Planning Statement

Flood Lighting at Outdoor Netball Courts
Drill Hall Common

Date: 27th August 2019

Contents

1. Purpose of Planning Statement

The purpose of this statement is to provide a detailed description of the proposed 'action' to take place within the Sydney Harbour Federation Trust (SHFT).

Action is defined in the *Environmental Protection and Biodiversity Act 1999* (EPBC Act) and includes a project, a development, an undertaking, an activity, or a series of activities.

The SHFT is the Consent Authority for most actions proposed on its land and requires a formal application as part of the approval process. This planning statement forms part of the application for this action.

2. Introduction

The proposed 'action' relates to the site known as the Drill Hall Common, Lot 2 in DP 541799, Cross Street, Mosman.

This Planning Statement has been prepared as supporting documentation for the application to install flood lighting to the existing three outdoor hardstand netball courts at this site.

The Planning Statement should be read in conjunction with:

- Netball Court Lighting Report, prepared by Webb Australia Group Pty Ltd, dated 4th January 2018 (Appendix 1).

3. Description of Action

The aim of the 'Action' is to provide floodlighting to the three existing outdoor hardstand netball courts located at Drill Hall Common, consisting of the following:

- Twelve (12) 8m poles, four (4) per court, with LED floodlights to each pole; and
- Lighting designed for training purposes (AS2560.2.4 'Lighting for outdoor netball and basketball') and with minimum light spill in accordance with AS 4282 'Control of the obtrusive effects of outdoor lighting'.

The intended hours of use for floodlights would be:
- February to September: Mondays to Thursdays 4:30pm to 8.30pm
- October to January: Tuesdays to Thursdays 6:30pm to 8.30pm

The proposal would allow existing players more time to train on the existing outdoor hardstand netball courts.

The outcome of the 'action' is to improve the facility so that Mosman Netball Club has more time available for training, allowing all teams better access to full courts. This would help to achieve the NSW Governments *Her Sport Her Way 2019-23* objective to *invest in the provision of sport facilities that support women and girls*.

4. Background Information

Why is the project needed?

Providing lighting to outdoor hardstand netball courts at Drill Hall Common was identified as part of the *Future Needs of Sport 2015* study undertaken by the Office of NSW Sport and Recreation. The project is also supported by the *Mosman Open Space Recreational Needs Assessment, 2015* prepared by @leisure on behalf of Mosman Council.

The Mosman Drill Hall Common is managed by Mosman Council under a lease agreement with the Sydney Harbour Federation Trust which is the owner and consent authority for the site including the three outdoor hardstand netball courts.

Mosman Netball Club currently use the three outdoor hardstand netball courts from 3.30-5.30 pm Monday to Thursday from early March to early September. They also utilise the Marie Bashir Sports Centre between the hours of 3.30-7.30 pm Monday to Thursday. The

club caters to a range of age groups from junior players through to senior players and for the 2017 season had 450 players, an increase of 80 players since 2012.

At present the outdoor hardstand netball courts are limited to day-time use under the SHFT *Management Plan for the Mosman Drill Hall* precinct, development approval conditions, and the terms of the lease for the site.

Mosman Netball Club has advised that this limitation means that each team in the club has only nine minutes in which to train on a full court per week. If floodlighting was installed this would extend the time available to the Club's teams to use the courts. The proposal would therefore significantly improve the facilities available to Mosman Netball Club and help facilitate women's participation in sport, the key objective of the NSW governments Women in Sport Strategy; *Her Sport Her Way 2019-23.* This objective is reflected in both the Federal Governments National Sports Plan (*Sport 2030*) and the *Mosman Open Space Recreational Needs Assessment, 2015*

The needs of the Mosman Netball Club align with the objectives of the SHFT as outlined in the Trust's Comprehensive Plan in which one of the priorities is to maximise public access.

Funding

On 30 June 2017 Council was advised by the office for the Minister for Sport that it would receive $150,000 for the installation of lights at the Drill Hall Common Netball courts. Council lodged the grant through the NSW Government 2016/17 Community Facility Funding.

At its meeting on 4 July 2017, Council endorsed the recommendation and actions described in the Mayoral Minute and resolved:

i. Acceptance of the grant
ii. Community consultation on the installation of lighting
iii. Progress the lodgement of a Development Application with the Trust

Consultation and Evidence of Community and Council Support

In November and December 2017, Council undertook public consultation. A design for the lights was issued to the community for comments and feedback. A letter was issued to local residents and key stakeholders. The consultation included an electronic survey.

In regards to the survey, Council received 185 responses to its survey with the majority from respondents having an association with Mosman Netball Club. A report generated from the survey tool showed that 87.6% of respondents support the proposal to install floodlights at the three hard court netball courts at Drill Hal Common (Appendix 2).

The majority of comments indicated:

- Overdue project which will meet the high demand to play netball in the Mosman area
- Will provide better utilisation of a much needed community facility and allow Mosman Netball to run its training schedule
- Currently it is dark at 5pm and installation of floodlights will allow current teams to train after its gets dark which is usually the time senior players can get to the site after work. Currently we are forced to share the indoor sports centre and with floodlights we will have a further three courts to utilise
- Lights would provide extended training hours, meaning less cars parking in the area after school in daylight hours

- Women's sports are not prioritised by Council and we need safe 'well lit' training areas. It seems that the male dominated sports have many options but no single option for women's sport. It is a question of equality
- Netball is a fantastic sport that promotes teamwork, social skills and an active lifestyle
- Gives hundreds of local residents a sense of belonging and purpose in the community
- Improves connectedness amongst girls and improves self esteem

In regards to specific feedback, Council received four written submissions during the consultation period. Of the four submission, three where in support of the project and one was an objection.

The one objection was received from Cross Street residents, their concerns include:

- Light pollution and light spill.
  Comment: The light design has been undertaken by a lighting engineer to minimise light spill and glare complying with Australian Standards.
- The lease of the site put in place in 2006 between Mosman Council and Sydney Harbour Federation Trust contained provisions to prevent the expanded use of the netball courts
  Comment: Lease conditions are able to be revised and changed to accommodate increased usage requirements.
- Cross Street and the area already has excessive traffic and parking issues and is exposed to speeding cars.
  Comment: Initial traffic investigations found that this street is no different to other streets where ovals and sporting facilities are located. Improvements have been made to traffic and parking arrangements.
- Over intensification of the facility and changes would lead to competition games at the site.
  Comment: It is not proposed to use this facility for competition games.

The results were presented to Council in February 2018 (Appendix 3), where Council resolved the following:

1. *Council note the outcomes of the consultation and the strong support for the installation of floodlights at the three outdoor netball courts at Drill Hall Common.*

2. *Council seek approval from the Sydney Federation Trust to lodge a Development Application for the works.*

3. *Subject to approval of (2) Council seek the required amendment to the lease for the site and changes to the Plan of Management for the site.*

4. *The General Manager be delegated authority to arrange the work required to undertake (2)-(3) above.*

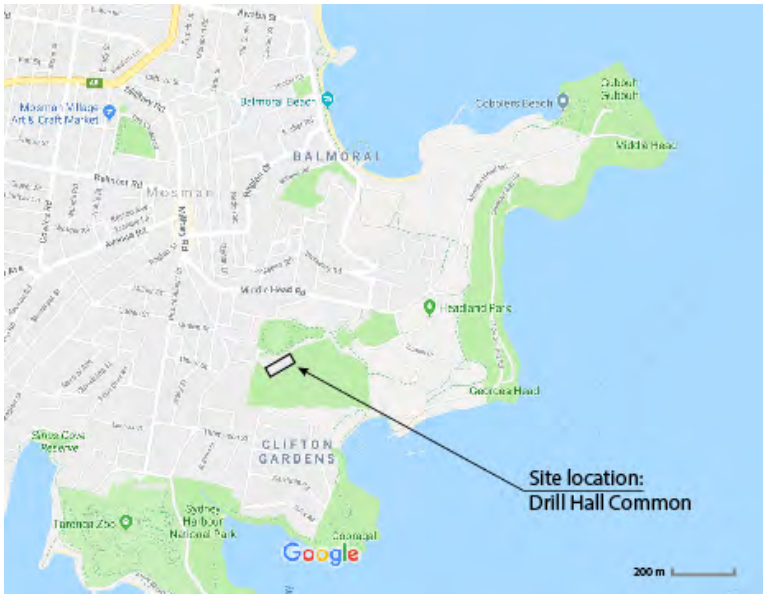
At the Council Meeting on 13th November 2018, Council resolved to delegate authority to the General Manager, Mayor and Councillor Willoughby to respond to and resolve any issues raised by SHFT, Council also reiterated its support for the installation for lights at the Drill Hall Common Netball Courts (Appendix 4).

Site Description

The Drill Hall Common is approximately 1ha and is located on the ridge of Middle Head, one of the three headlands that define the entrance to Sydney Harbour. The site sits directly upslope from Clifton Gardens and is positioned at the end of Cross Street, Mosman and a

no-through residential street that provides the only vehicular access to the site. The site is bound by residential properties on the west, Rawson Park (Crown Land managed by Mosman Council) to the north and the National Park to the south and east.

Access to the site is predominantly by vehicle via Cross Street. There is a carpark adjoining the Drill Hall, a carpark associated with Rawson Oval and on street parking along Cross Street, Alexander Avenue and Croquet Lane. Council's management of the land is covered under the Drill Hall Operations Plan (Appendix 5).



Location of Drill Hall Common and netball courts

Context

The Drill Hall Common is currently a highly used facility that includes three outdoor hardstand netball courts, the Marie Bashir Indoor Sports Centre (opening hours are 7am to 10pm) and the Drill Hall building, which is Council operated, providing Before and After School Care and Vacation Care Programs that run from 7.30am to 9am and 3pm to 6pm Monday to Friday during school term. During school holidays vacation programs are run 8am to 6pm Monday to Friday.

The broader precinct, commonly known as Rawson Park, is historically significant as a result of its links with the development of the Mosman community, and as one of the first parks established in Mosman. Rawson Park is made up of Rawson Oval and Park, Bradley Bushland Reserve, Mosman Croquet Club and Rawson Park Tennis Centre.

This precinct caters for a wide range of uses including, but not limited to, dog walking, bushwalking, tennis, croquet, cricket, and rugby as well as general active and passive recreation activities. It is generally considered that the winter season is the busiest for organised sport with both rugby and netball clubs utilising the prescient.

Mosman Netball Club currently uses the three outdoor hardstand netball courts from 3.30-5.30 pm Monday to Thursday from early March to early September. They also utilise the Marie Bashir Sports Centre between the hours of 3.30-7.30 pm Monday to Thursday.

Mosman Rugby Club hirers Rawson Oval for training and match purposes during the winter season, April to September. Training takes place on Tuesday, Thursday and Friday evenings from 3.30 - 9pm. Floodlights at Rawson Oval are turned off by 9.15pm on these

nights. The Croquet and Tennis Club operates throughout the year. The tennis courts are used in the evening with lights for all courts being turned off by 9.30pm.

The parking across all carparks in the area provide suitable capacity for the current uses of the area. Recent upgrades to the carpark at Rawson Oval (off Cross Street) have made vehicle circulation more efficient and pick-up / drop-off activity safer here.

The Mosman Open Space Recreational Needs Assessment (adopted by Mosman Council in October 2015) identifies netball as a high demand sport and recommends managing capacity to improve facilities for women's participation. The courts at the Drill Hall Common are currently the only public accessed netball facilities in Mosman's Local Government Area.

Alternative Locations in Mosman

Mosman High School is the only other site in the Mosman area with similar facilities and capacity (two outdoor hardcourts used for basketball, netball and futsal). These courts do not have lights and are not available during daylight hours. The courts are currently used at full capacity outside of school hours (7:45am - 9am and 3:30pm - 5pm).

Council, at its meeting in December 2018 requested a report on possible locations for new netball courts. Woolacotts Consulting Engineers were engaged to investigate possible new locations and provided a report for Council. The report found that all other possible sites are unsuitable due to existing uses, limited space and large set-up and ongoing maintenance. The report indicated Spit West Reserve could be investigated as suitable location to establish new grass netball courts with the possibility of installing floodlights.

Spit West Reserve has a high demand from other sporting groups and as such is not suitable for the provision of a hard court surface. The grass area is currently used for junior soccer and rugby in winter and junior cricket in summer. Council has resolved to establish four grass netball courts and these courts can only be provided with temporary line marking and portable goal posts in order to allow current usage requirements from sporting groups and passive recreation. Accordingly, the provision of netball facilities at Spit West Reserve would not overcome the need for the provision of lighting to allow better usage of the existing courts at the Drill Hall Common.

At the Council Meeting in December 2018; Council resolved to pursue the installation of lighting at the Drill Hall Common outdoor netball hardcourts and undertake consultation on the option of new courts and lighting at Spit West (Appendix 6).

5. Installation and Operation

The design of lighting scheme has been undertaken by a lighting engineer WEBB Australia for outdoor netball to meet AS2560.2.4 and to minimise light spill and glare in accordance with AS4282. Refer to Appendix 1 for design scheme showing plans of floodlights and light levels noting that the 355W LED 8 metre 4 pole per court option is better suited to the site and is preferred by Council.

Extent of Works

The work will be limited to a two metre perimeter around the existing hardcourts. Work will include:

- Excavation and installation of concrete footings to support the light poles;

- Trenching and installation of underground cabling, connecting lights to an electrical connection located near the Marie Bashir Centre; and
- Fitting of poles and lights.

Impacts to existing trees will be minimised, refer to Tree Protection below. Other issues associated with the construction, such as dust, site access, underground services and disruption will be minimised. These issues will be addressed in a works plan following approval of the 'Action'

Operation

Lights will be turned on when required with normal time expected to be 4:30pm and use of courts will not be permitted after 8:30pm. The extended training times will be supported by the existing associated facilities including the Marie Bashir Centre and the Drill Hall amenities block. The management of which falls under the Drill Hall Common Operations Plan (Appendix. 5).

It is proposed that lights would be left on until 8:30pm for pack up and departure purposes. The system will be controlled by E-State automation system. This will allow the lights to be programmed by Council so that lights are turned on when required and turned off at 8:30pm. Council will also allow Mosman Netball to turn off lights if training is cancelled, however the automation system will not allow Mosman Netball to turn lights on or extend the period of lighting.

The following training schedule will also be initiated in conjunction with the floodlights to ensure there are no disruptions to the normal traffic conditions.

- Providing a short break between training times so there is less training sessions overlapping.
- Staggering the start times for each netball court (and potentially each rugby training session) so there is less sessions overlapping at the same time.
- Changing the netball training times not to overlap with the Drill Hall after school care program finishing time.
- Encourage rugby players to park on Alexander Avenue and avoiding overlaps in netball and rugby training start and finish times.

6. Sydney Harbour Federation Trust Plans, Policies and Leases

As stated above the outdoor hardstand netball courts are located on lands owned by the SHFT. The vision for all sites owned by SHFT is:

> *"To provide a lasting legacy for the people of Australia by helping to create one of the finest foreshore parks in the world and provide places that will greatly enrich the cultural life of the city and the nation."*

A series of plans and policies provide guidelines and regulations, have been prepared to implement the Trust's vision and how sites, such as the Drill Hall Common, are managed. The proposed Action would not contravene the following documents:

- Sydney Harbour Federation Trust Act 2001;
- SHFT Comprehensive Plan;
- The Trust's draft Access policy;

- The Trust's Leasing policy; and
- The Trust's Policy for the Leasing of Land and Buildings to Community Users;

The proposed 'Action' is in line with objectives of the SHFT however it may influence some the existing plans and agreements. Below is a short summary of how the proposed Action aligns or differs from the relevant documents.

Comprehensive Plan

The plan expresses the vision, core values and objectives of the Harbour Trust, identifies land-use and provides a framework for implementation through detailed policies, site management plans and guidelines.

The Harbour Trust Act sets out the objectives which the proposed 'Action' must abide by, these are discussed below:

Object of the Act	Discussion
(a) to ensure that management of Trust land contributes to enhancing the amenity of the Sydney Harbour region;	*The netball lights will allow additional access to the area increasing its desirability and use as a facility.*
(b) to protect, conserve and interpret the environmental and heritage values of Trust land;	*Controls will be put in place to ensure works do not impact the heritage and environment.*
(c) to maximise public access to Trust land;	*The additional training hours, as a result of the netball lights, will maximise public access to the area.*
(d) to establish and manage suitable Trust land as a park on behalf of the Commonwealth as the national government;	*The area will continue to be used as a park irrespective of the netball lights.*
(e) to co-operate with other Commonwealth bodies that have a connection with any Harbour land in managing that land; to co-operate with New South Wales, affected councils and the community in furthering the above objects.	*This project is one undertaken by Mosman Council. The area will continue to be managed by Mosman Council in accordance with the values and objectives of the Harbour Trust.*

The proposed 'Action' is consistent with the Trust's Comprehensive Plan and aligns with the following objectives:

Group	Objective	Complies
Open Space and Recreation	*Ensure that the recreational facilities are available to the broad community of Sydney while still contributing to some of the needs of the local community.*	✔
	Promote co-operative management between the Trust and adjoining open space owners and managers.	✔
	Ensure that organised group activities are managed to avoid conflicts and environmental impacts.	✔
Sporting Facilities	*Have minimal negative visual, heritage and environmental impact*	✔
	Provide equity of access to all appropriate user groups	✔
	Are co-located, where possible, to allow for shared use of essential *services such as parking and amenities*	✔

The proposed Action is also consistent with the following statement from the Comprehensive Plan:

> *"In some cases, new or upgraded sporting facilities may be suitable to achieve the objective of maximising public access, providing a diversity of activities, or may have considerable community benefits. Public access may be maximised by providing sporting facilities in addition to those that already exist*."

The following objectives and policies have also been addressed during the planning of the proposed Action:

- Ecologically Sustainable Development (ESD) and Biodiversity Conservation – the proposal is designed to use efficient LED light fittings reducing power consumption and switch controls that allow efficient management and limiting lit hours. Best practice construction methods will ensure minimal impact during installation. There will be no adverse impact to the natural biodiversity of the area, refer to *Flora and Fauna* discussion below.

- Transport Management and Air Quality – The proposal seeks to minimise transport impact through a series of infrastructure improvements and management measures. Council has already implemented physical improvements to traffic conditions and car parking located at adjacent Rawson Park, refer to *Transport* discussion below.

- Bushfire Management – The proposal complies with the aim and objectives of *Planning for Bush Fire Protection 2006* (PBP) and is not considered a bushfire risk, refer to report prepared by Travers Bushfire and Ecology.(Appendix 7)

- Contamination – Numerous environmental site investigations have been undertaken at the Drill Hall Common, which indicate that historical activities at the site have led to contamination. Polycyclic aromatic hydrocarbons (PAHs), inorganic compounds and asbestos fibres may contaminate soils on site. Any excavation required for the installation of flood lights would be carried out in accordance to the 'Risk and Control Measures' outlined in Environmental Management Plan prepared by URS.

- Aboriginal Heritage – From previous studies conducted in the immediate area, no aboriginal heritage items are located at the site. There are sites of significance located nearby at Clifton Gardens and Middle Head, which would suggest that the site has some potential for significant heritage items. However it is highly unexpected as the areas proposed for work have previously been excavated and filled during the construction of the netball hardcourts.

  Mosman Council has a stop work procedure for works if potential heritage items are uncovered during excavation. This procedure will be part of construction contract documents. If potential heritage items are uncovered during excavation, work will cease and the local Aboriginal Heritage Office notified.

- Cultural Heritage – Impacts to heritage have been assessed by Council's Heritage Advisor, refer to *Heritage* discussion below.

- Design Approach – The proposal recognises the unique characteristics and heritage of the site, the design has no adverse impacts on these.

- Access – The provision of lighting will dramatically improve public access to this Trust site, which is a fundamental objective of the Trust's Act. Improvements to transport, car

parking and pedestrian links will also improve access to the site, refer to *Transport* discussion below.

- Consultation and Communications - Details of community and stakeholder consultation and the proceeding Council resolutions are discussed in *Consultation and Support* above.

Management Plan (Mosman No.6, Mosman Drill Hall Precinct)

The application for this Action is in conjunction with proposed amendments to the SHFT Management Plan (Mosman No.6, Mosman Drill Hall Precinct) that includes changes to allow floodlighting at the Drill Hall Common.

Lease

Mosman Council is in a lease arrangement with SHFT for the Drill Hall Common which includes the outdoor hardstand netball courts. Conditions contained in the original lease, commenced on 6th September 2006, would remain the same with the exception of:

2. Outdoor Lighting
   The Lessee must not install or use any outdoor lighting for netball courts at any time.

8. Outdoor Courts
(d) The formal use of the Courts is limited to daylight hours only.

These conditions would require to be changed in accordance with any consent.

Bushfire Management Plan, Headland Park

The Drill Hall Precinct is classified as an Asset Protection Zone (APZ), Mosman Council is responsible to minimise the risk of unplanned bushfires to spread onto and from *Headland Park.* Therefore minor pruning works to vegetation to ensure adequate clearances for light poles will be required as a result of this 'Action'.

NPWS are responsible for the bushland directly adjacent to the site and manage the area for bushfire through the Mosman, North Sydney Willoughby Bushfire Management Committee.

7. Identification of Potential Impacts and Mitigation

The netball training is one of many activities located within the immediate and broader precinct, as described above. The potential impacts of this 'action' are considered to be minimal. The discussion below addresses any perceived concerns over the potential impacts of floodlights at the three outdoor hardstand netball courts.

Transport and Traffic

The main mode of transport for visitors to the Drill Hall Common is by private vehicle. The changes in traffic as a result of the installation of lights will be minimal. Investigations by Council's Traffic Engineers are summarised below:

As the Rawson Oval facilities operate concurrently during existing hours, the peak hourly traffic generation is not expected to change as a result of installing the lights at the netball courts.

A comprehensive Transport Impact Assessment was prepared by GTA Consultants for the SHFT, dated 24th August 2018, it stated that:

The proposed installation of floodlighting would not result in an increase in visitors to the Precinct, but rather distribute existing visitation numbers to later in the weekday afternoon / night.

The extended weekday training periods would occur outside of the typical weekday evening commuter peak periods and as such would result in improved conditions for the Precinct and broader external road network.

Council has implemented management measures, recommended by GTA, that improve traffic, pedestrian and parking conditions. These measures include:

- Enforcement of one-way clockwise circulation around the Rawson Oval car park;
- Provision of two pick-up/ drop-off bays on the northern side of the Rawson Oval car park;
- Provision of lighting at the stairs connecting Rawson Oval with Alexander Avenue; and
- Provision of stairs linking Rawson Oval car park with the Drill Hall.

A follow up analysis by GTA Consultants dated 2nd May 2019 (Appendix 8), concluded that these management measures '*have benefited the Precinct in making vehicle circulation of the Rawson Oval car park more efficient and pick-up/drop-off activity safer'*.

If floodlighting where to be installed, Council would implement mitigation measures, recommended by GTA, to minimise impact from the extended hours of usage due to floodlighting. These mitigation measures include:

- Providing a short break between training times so there is less training sessions overlapping.
- Staggering the start times for each netball court (and potentially each rugby training session) so there is less sessions overlapping at the same time.
- Changing the netball training times not to overlap with the Drill Hall after school care program finishing time.
- Encourage rugby players to park on Alexander Avenue and avoiding overlaps in netball and rugby training start and finish times.

In addition, a letter prepared by The Australian Road Research Board (ARRB), on behalf of the Cross Street residents was submitted to Council (Appendix 9). The letter contains comments and recommendations for the transport and traffic in the area. Council has reviewed the letter and noted that it is only a cursory review of the existing environment and excludes the level of detail and assessment undertaken by GTA. The management measures undertaken by Council have addressed the relevant concerns raised in this letter.

Heritage

The Drill Hall Common is located on Commonwealth Land and includes items from the Commonwealth Heritage list including:

- Defence site - Georges Heights and Middle Head, Middle Head Rd, Georges Heights - Place ID 105541; and
- Headquarters 8th Brigade Precinct - Place ID 105574

These heritage items are covered under the Environment Protection and Biodiversity Conservation Act 1999.

Impacts to heritage were assessed by Council's Heritage Advisor. It was considered that there would be no adverse impact to the heritage items located at Drill Hall Common if floodlights were installed at the site (Appendix 10).

Flora and Fauna

Council engaged specialist consultant Ecosure to assess the impact of floodlights to the flora and fauna in the vicinity of the outdoor hardstand netball courts. The recommendation dated August 2018 was that:

Due to the limited footprint of the lighting, the minimal light spill and the amount of time the lights are expected to be switched on, it is unlikely the proposal will have any significant impact on listed threatened species identified as potentially occurring at the site, or on any native flora and fauna (Appendix 11).

This planning proposal was provided to the Commonwealth Department of Environment and Energy, whose initial advice was that a referral is not warranted as the assessment of potential impacts of the action, provided by Council, concluded that no significant impacts are likely.

Tree Protection

The impacts to existing trees and tree canopy have been considered and are minimal. All trenching and excavation, associated with the installation of floodlighting will initially avoid treed areas. Where this is not possible and is required under a tree canopy Council will ensure non-invasive methods, such as hand excavation is implemented. All roots over 50mm diameter that require pruning will complete under the supervision of an AQF level 5 qualified arborist.

There are seven trees that are in close proximity to the proposed floodlight poles. Minor pruning (less than 10% of each tree canopy) is required to provide appropriate clearances.

Visual Impact

The visual impact of the proposed lighting considers both (a) the impact lighting has on the site when viewed from the harbour (under the Scenic Protection Area provision) and (b) the effect of light spill from the floodlights to neighbouring properties.

(a) Impact on the site when viewed from the harbour

The proposal does not detract from the Scenic Protection Area because the height of the poles will be limited to 8 metres, which is below the height of the canopy trees in the adjoining bushland to the south-east. The canopy trees range in height from 8 to 14 metres and form a continuous dense screen that will conceal any poles and light when viewed from Sydney Harbour.

(b) Impact of light spill on neighbouring properties

There will be no light spill to surrounding properties as the design of lighting scheme complies with Australian Standards AS 4282 'Control of the obtrusive effects of outdoor lighting'. The design of the poles and LED lights is such that all light is directed over the courts with minimal light spill to areas directly adjacent to courts.

Noise Impact

A Noise Impact Assessment was prepared by Benbow Environmental, dated August 2018, (Appendix 12). The assessment modelled the predicated noise levels as a result of the proposed installation of flood lighting.

The predicted noise levels were found to comply with the relevant noise guidelines from the NSW Environmental Protection Authority:

- NSW Noise Policy for Industry (EPA, 2017); and
- NSW Road Noise Policy (RNP) (DECCW, 2011).

Although the predicted noise levels comply with relevant noise guidelines the assessment did provide possible mitigation measures which could be incorporated to reduce any increase in noise levels. Some of these that are considered practical and not already implemented and will meet the requirements of the expected user groups include:

- The Drill Hall precinct and car park is not recommended to be used after 10pm. The Drill Hall, Marie Bashir Indoor Centre and Netball courts are recommended to finish use at 9:30pm to enable cars to leave the carpark before 10pm;
- Outdoor netball activities are recommended to take place between 7am and 8:30pm. Preference is recommended to be given to conduct activities on the eastern courts. i.e. if only one court is used, the eastern court is used (Court 3). If two courts are used, the eastern court and the central court are recommended to be used (Courts 2 and 3). The western court is recommended to be used only when all three courts are simultaneously required (Courts 1, 2 and 3);
- Signs are recommended to be erected to encourage quiet behaviour when leaving the site, and to encourage patrons to leave the car park before 10pm.

It should be noted Council has no control of vehicles using the carpark after 10pm and no plans to limit access in this regard.

8. Conclusion

Based on Councils extensive investigations and consultation with the community, as detailed in this Planning Statement, the provision of lighting to the existing netball courts will provide a positive public benefit by allowing better use of this existing facility. The proposal will not create any unreasonable impacts given that light spill, traffic, parking and noise issues can be mitigated. Accordingly it is recommended that the application for lighting of the existing courts be approved.

Including the installation of twelve 8m light posts with floodlights for use at the following times:

- February to September: Mondays to Thursdays 4:30pm to 8.30pm
- October to January: Tuesday to Thursday 6:30pm to 8.30pm

Figure 1. Artist impression of floodlights

Figure 2. 3D render of proposed floodlights

9. Appendix

1. Netball Court Lighting Report, prepared by Webb Australia, dated 4th January 2018
2. Survey Project Report prepared by Engagement HQ, December 2017
3. Council Resolution – Drill Hall Common Netball Court Lighting Proposal, February 2018
4. Council Resolution – Drill Hall Common Netball Court Lighting Proposal Update, November 2018
5. Drill Hall Operations Plan, Mosman Council
6. Council Resolution – Netball Grounds and Facilities Response, March 2019
7. Bushfire Assessment prepared by Travers Bushfire and Ecology, August 2019
8. Mosman Drill Hall Precinct – Transport Assessment Addendum, prepared by GTA Consultants, dated 2nd May 2019
9. Letter from ARRB, dated 25th September 2018
10. Heritage Letter, prepared by NBRS, dated 17th July 2019
11. Flora and Fauna Impact Statement prepared by Ecosure, dated August 2018
12. Draft Noise Impact Assessment, prepared by Benbow Environmental, dated August 2018

Appendix 1.

DRILL HALL COMMON
MIDDLE HEAD
MOSMAN

NETBALL COURT LIGHTING REPORT

PREPARED BY:

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BRISBANE CANBERRA GOLD COAST MELBOURNE SUNSHINE COAST SYDNEY

M252BREP001.DOCX ISSUE C

DRILL HALL COMMON
MIDDLE HEAD
MOSMAN

NETBALL COURT LIGHTING REPORT

Issued For:	INFORMATION	x
	TENDER	
	CONSTRUCTION	

Authorised By: KEN DOUGLAS

Date: 23 OCT 2017

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1 INTRODUCTION

The Mosman Municipal Council has engaged the services of Webb Australia Group (NSW) Pty Ltd to produce this report outlining the recommended lighting provisions for the Netball Courts at Drill Hall Common.

The report shall consider the following items;

- Review of existing
- Lighting Levels
- Switching Arrangements
- Supply Provisions
- Spill Lighting

2 SUMMARY RECOMMENDATIONS

It is recommended the Lighting for the Netball Courts at Drill Hall Common consist of the following;

- 322W LED Full cut-off floodlights with four(4) poles per court, each pole at 8m high
- This configuration complies with AS2560.2.4 level "Recreation or training and competition with few spectators" being 100lux and complies with AS4282.
- Each court shall be individually switched using the E-State Automation SMS control system

3 STANDARDS

The Australian Standards that specifically addresses the lighting requirement, and referenced in this report, are:

AS2560.2.4 - 1986	Guide to sports lighting Part 2.4: Lighting for outdoor netball and basketball
AS4282 - 1997	Control of the obtrusive effects of outdoor lighting

4 SITE INSPECTION

A physical inspection of the site was held on the 1st and again on the 17th July 2015, to assess the existing site conditions at Drill Hall Common, Cross Street, Mosman. The Drill Hall Common is owned by the Sydney Harbour Federation Trust (SHFT) and sits within the Management Plan – Mosman No. 6 Mosman Drill Hall Precinct.

The inspection was made during the day. No inspections or light measurements have been undertaken at night.

Drill Hall Common consists of three (3) existing bitumen netball courts.

The Common is bound by residential properties on the west, Rawson Park Oval to the north and the National Park to the south and east.

Figure 4-1 – Drill Hall Common

The Common houses the Drill Hall Building and Marie Bashir Sports Centre along with the netball courts.

Figure 4-2 – Netball Courts – View from Court 1 steps looking east

Figure 4-3 – Court 3 - View from the entry steps to Marie Bashir Sports Centre

Figure 4-4 – Marie Bashir Sports Centre adjacent Court 2 & 3.

Figure 4-5 – Netball courts looking west towards Cross St.

5 PROPOSED LIGHTING INSTALLATION

5.1 LIGHTING CRITERIA

Table 1 of AS2560.2.4 outlines the lighting criteria for netball courts;

Level of play	Minimum service illuminance	Minimum uniformity ratio	Minimum CIE general colour rendering index	Recommended types of floodlight	
				Type	Beam classification
Competition with large spectator galleries	200	0.66	65	B or C	H6-7 V5-6
Recreation or training and competition with few spectators	100	0.5	65	B or C	H6-7 V5-6

The Level of play to be used in the Drill Hall Common shall be Recreation or training and competition with few spectators.

5.2 LIGHTING POLE CONFIGURATION

According to Table 2 of AS2560.2.4, the minimum mounting height for floodlights on a single court two-pole configuration shall be ten (10) metres and for a single court four-pole configuration it shall be eight (8) metres. This is because in a two-pole configuration the two fittings per pole are used thereby increasing the 'per pole' output.

MINIMUM MOUNTING HEIGHTS FOR FLOODLIGHTS

Lamp luminous flux (initial) installed per pole and aimed generally in the same direction lm	Minimum mounting height, m	
	Single court	Double court
≤ 50 000 > 50 000 ≤ 200 000 > 200 000	B or C	H6-7 V5-6

The two pole per court arrangement is more cost effective however as highlighted above, higher poles are required, increasing the possible visual impact.

It is recommended the Drill Hall Common use the four (4) x 8m high pole per single court configuration as per AS2560.2.4 as shown below;

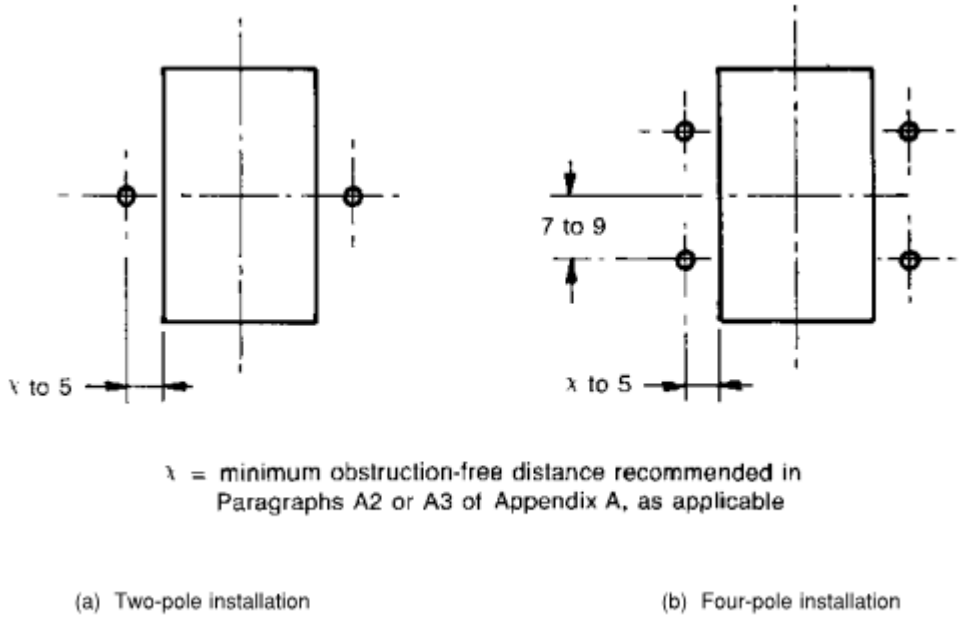


Figure 5-1 Single Court Pole configurations

5.3 LUMINAIRES

The luminaire used shall be a flat glass asymmetrical type C fitting as per AS2560.1.

5.4 DISCHARGE LAMP OPTION

A suitable discharge lamp fitting would be a Sylvania Siteco A3 Maxi. This type of fitting greatly reduces the amount of spill light and glare to the surrounding area.

Figure 5-2 Sylvania Siteco A3 Maxi

These fittings use a 1000W Metal Halide lamp. The total current load for the installation would be in the order of 18 amps per phase (or 12.6kW)
Similar fittings to the A3 Maxi that can be considered for the project include;

- Philips Optivision
- Thorn Champion
- Pierlite Olympic

5.5 LED OPTION

A suitable LED source fitting would be the Pierlite Quantum as shown below;

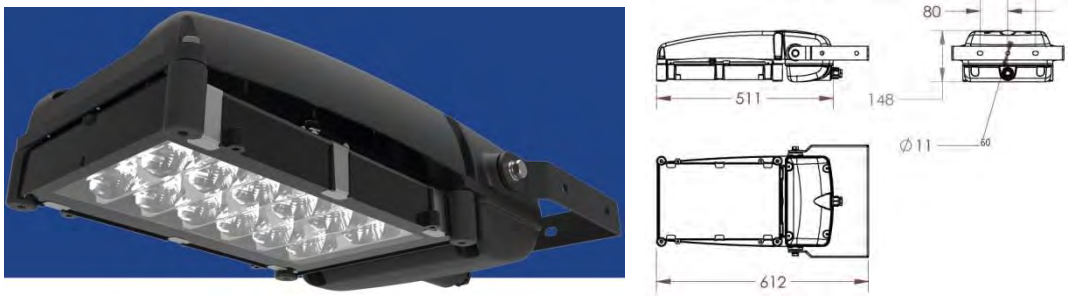


Figure 5-3 Pierlite Quantum (Single Module)

The fitting comes with variety of beam distributions. The fitting shown uses a 322W single module. Compliance is achieved using single & double module luminaires. This results in a total current load for the installation in the order of 7 amps per phase (or 5.12kW)

Similar fittings to the Pierlite Quantum that can be considered for the project include;

- Philips Optivision LED
- BetaLED Edge
- LumaLED AAA-Lux
- Pierlite LUX Flood

Benefits of LED sources include longer stated life, lower power consumption, "instant-on", and the ability to dim. All of which should be considered against the higher capital costs.

It is recommended the Drill Hall Common utilise the 332W Quantum LED fixture in the design.

6 SWITCHING

The trend in legislation is to dictate smaller switching banks for installations, thereby allowing sections of an installation to be turned off when not in use to encourage energy saving. This approach can be considered at Drill Hall Common however it should be reviewed in light of the usage by the organisation using the facility.

Technically, each court can be switched separately, but if all courts are used each time the facility is used, the complexity and cost of implementing this is without purpose.

We would recommend that the courts be wired to allow individual switching.

If the LED option is implemented flexibility is available via dimming.

The netball club should be consulted in this matter and a scheme approved prior to proceeding.

The overall control strategy must be considered in designing the installation. Many councils are implementing control systems which incorporate automatic, time-clock, manual override, and remote control capability. Time clock control is required to turn the lights off at curfew time, regardless of the control system used. Daylight sensors can be used to turn the lights on at dusk or at low light conditions, however this will turn the lights on every day, even if not in use.

A 7-day time clock can be used in conjunction with sensors to turn the lights on only days when it is know the courts are in use. This can be inflexible as the time clock must be changed if the booking schedule of the courts is changed. Occupancy sensors are a possible alternative to switch the lights off if not in use.

An option popular with councils is the remote control via mobile phone. This allows council officers to remotely switch the court lighting on or off by sending an SMS command to a number corresponding to a GSM receiver at the court. A system typical of this is the E State Automation, which Mosman Council has installed on all of its sports field floodlighting.

6.1 RETICULATION

To be confirmed during detail design stage.

7 SPILL LIGHT

The lighting for the netball courts shall comply with the requirements of AS4282. The site is adjacent to residential properties on the southern side.

Figure 7-1 Spill Lighting calculation plane

As such, the installation shall be classified as being in a residential area for the purposes of AS4282 and hence the light technical parameters shall be as follows;

Light Technical Parameter	Recommended maximum values
Illuminance in vertical plane	10 lx
Maximum luminous intensity per luminaire	7 500 cd

Only the pre-curfew parameters are being considered as it is assumed the installation shall be switched off post curfew hours.
Any spill light calculations being considered shall be based on initial lumens without any maintenance factor applied.

Calculations for the preferred options have been included in Appendices B & C. These include spill lighting calculations both of which comply with the requirements of AS4282 as described above.

Summary of spill lighting compliance as follows;

Summary of Drill Hall Common Spill Lighting Calculations (Refer Appendices B & C)

Arrangement	Vertical Illuminance at boundary	Luminous Intensity	Result
4 poles per court (8m)	0.3 lx	2033 cd	Complies
2 poles per court (10m)	0.4 lx	1441 cd	Complies

8 ELECTRICITY SUPPLY

To be confirmed during detail design stage.

9 COST BREAKDOWN

Cost analysis has been carried out for the following compliant options;

- 1kW Metal Halide Floodlights 2 poles per court option
- 322W and 635W LED Floodlight 2 poles per court option
- 322W LED Floodlight 4 poles per court option

Estimated costs for the works as follows;

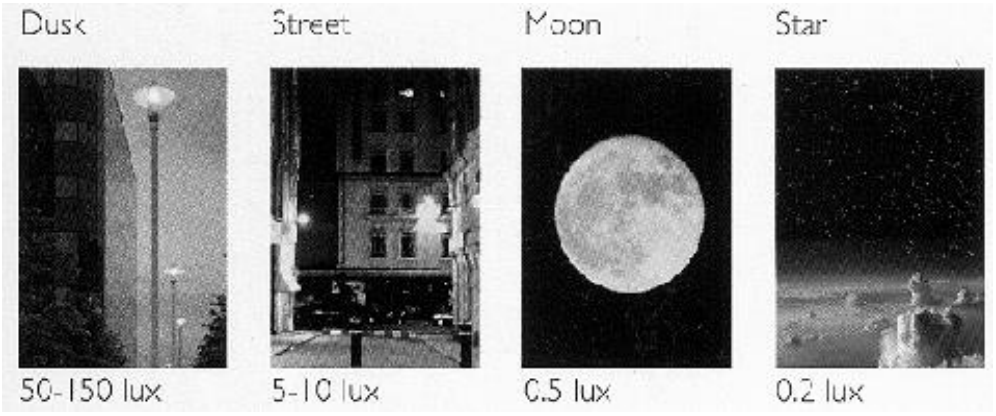
	1kW MH 2 pole option	322W+635W LED 2 pole option	322W LED 4 pole option
Distribution Boards	$10,000.00	$10,000.00	$10,000.00
Masts & Footings	$16,500.00	$17,500.00	$33,000.00
Floodlights	$14,400.00	$28,000.00	$18,480.00
Cabling	$1,950.00	$1,950.00	$3,900.00
Conduits & Trenching	$7,950.00	$7,950.00	$15,900.00
SMS remote control	$7,000.00	$7,000.00	$7,000.00
Total	**$57,800.00**	**$72,400.00**	**$88,280.00**

10 APPENDIX A - LIGHTING BACKGROUND

To assist with the interpretation of this report, some basic information about lighting should be explained.

10.1 ILLUMINANCE (lux)

This is the light that reaches an area or a surface. It is measured in lux. It is this lighting that would tend to light up the sports field or adjacent roadway. Illuminance reduces significantly with distance from the source. The illustrations below provide an indication of various lux levels that occur in normal exterior situations.



Minimum illuminance (*E*min)—the lowest value of illuminance in a horizontal plane at ground level, within a specified area.

Illuminance uniformity (UV)—a measure of the uniformity of the illuminance within a defined area of the carriageway or road reserve, as follows:

10.2 LUMINOUS INTENSITY (cd)

This is a representation of the brightness or glaring effect of a light. It is measured in candela. Glare can be caused by a direct view of a powerful lamp and its associated reflector. This effect does not significantly reduce with distance.

The eye has a characteristic called the phototropic reflex. This is the involuntary action of the eye to seek out and investigate the brightest object in the field of view. A view of a bright source of light can be annoying, as it tends to continually attract attention. If lights are too bright, the attention is taken away from the night environment and concentrated on the light fittings.

Luminous intensity can only be accurately assessed based on the photometric data for the luminaires and their aiming and the exact geometry to the point of interest, i.e. the exact location of the neighbouring viewpoint has to be defined to find the luminous intensity in that direction.

10.3 MAINTENANCE FACTOR FOR METAL HALIDE LAMPS

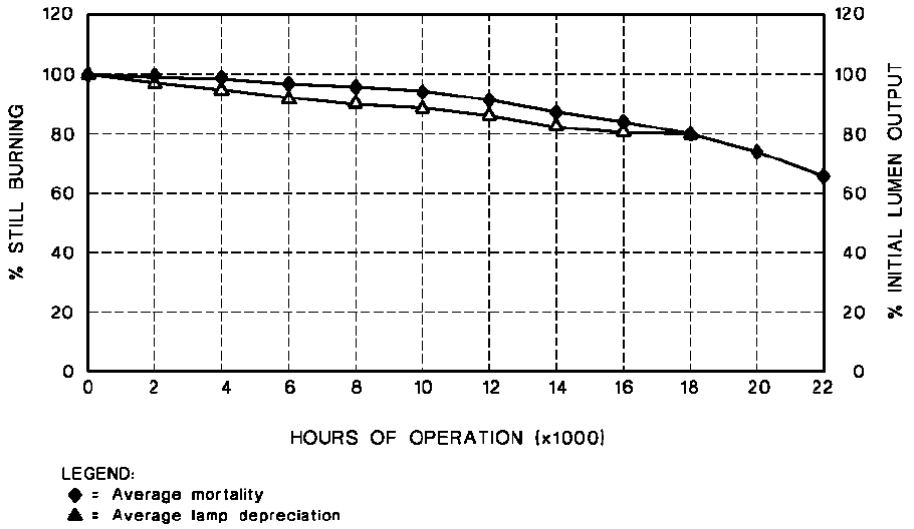
Maintenance factor (light loss factor)—a factor applied to lighting design calculations, to take account of light losses resulting from the depreciation in lamp lumen output due to ageing and the accumulation of dirt on the optical surfaces of the luminaire, during the interval between scheduled maintenance of the lighting system.
NOTE: The factor does not take account of the effect of the failure of individual luminaires within the group of luminaires involved in the calculation.

Allowances for lamp and luminaire depreciation

The maintenance factor selected to allow for the combined light loss should be taken as the product of the following:
(a) *Luminaire maintenance factor* — the factor selected from Table 14.3 applicable for the pollution category and luminaire cleaning interval.
(b) *Lamp lumen depreciation factor* — the lamp luminous flux available at the end of the nominated maintenance period, as a proportion of the initial lamp luminous flux, expressed as a decimal fraction.

Lamp lumen depreciation – During the life of a lamp there is a gradual deterioration in light output, or lamp lumen depreciation, caused by the ageing process and influenced by manufacturing tolerances, environmental factors and operating conditions.

It will be observed that different rates of depreciation are obtained for different lamp types, and the serviceable burning hours will be dictated by the allowable depreciation having regard to the required initial output and the allowable luminaire depreciation.



Luminaire depreciation – Luminaires age and deteriorate due to dirt and dust collecting on reflecting surfaces, the ingress of insects and moisture through the failure of seals, the loss of transparency of the refractor bowl through corrosion and discoloration caused by sunlight, heat and the effects of ultra violet light from the lamp itself.
The severity of fouling will depend on the design of the luminaire and the amount of pollution present in the atmosphere.
Luminaire cleaning will usually regain the light output lost due to luminaire depreciation, apart from the gradual depreciation in reflectivity of reflectors and the transparency of refractors which will eventually determine the life of the luminaire.
Cleaning intervals should be determined based upon site conditions; although, for economic reasons, cleaning may be carried out in conjunction with lamp replacement, provided the overall lumen output of the lamp/luminaire combination does not fall below that necessary to ensure compliance with the applicable maintained values of $\bar{L}$ and Emin

TABLE 14.3

TYPICAL LUMINAIRE MAINTENANCE FACTORS

Cleaning interval months	Typical luminaire maintenance factors (Notes 1 and 2)		
	Pollution category (Note 3)		
	High	Medium	Low
12	0.89	0.90	0.92
18	0.87	0.88	0.91
24	0.84	0.86	0.90
36	0.76	0.82	0.88
48	0.66	0.76	0.86

NOTES:

1 The effects of lamp lumen depreciation are not included in the luminaire maintenance factors.

2 The typical luminaire maintenance factors are based on an ingress protection rating of IP54 in accordance with AS 1939 for the lamp chamber, as required by AS 3771.

3 High pollution applies for the centres of large urban areas and for heavy industrial areas. Medium pollution applies for semi-urban, residential and light industrial areas. Low pollution applies for rural areas.

For the purpose of the calculations the Maintenance Factor was calculated as follows:

Luminaire Depreciation = 0.82 (based on medium pollution & 36 month cleaning intervals – approx 12000 burning hours)

Lamp Lumen Depreciation = 0.85 (based on 12000 burning hours)

Total Maintenance Factor = 0.82 * 0.85 = 0.697 ≈ 0.7 (FOR METAL HALIDE)

11 APPENDIX B – LIGHTING CALCULATIONS

Compliance calculations using Quantum LED floodlight in four (4) pole per court arrangement.

3 x A3 pages.

3 x Single Netball

Lighting for Recreation, Training and Low Level Competition = 100 Lux

12 x 8m Lighting Columns

12 x QUANTUM 322W LED Floodlights

PROJECT	DRAWING	REVISION	DATE	PAGE	
M252B Netball Courts Drill Hall Common Wollongong	Netball Lighting Recreation, Training and Low Level Competition 100 Lux	A	28 08 2017 AM	Page 1 of 3	

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EMAIL sydney@webbaustralia.com.au

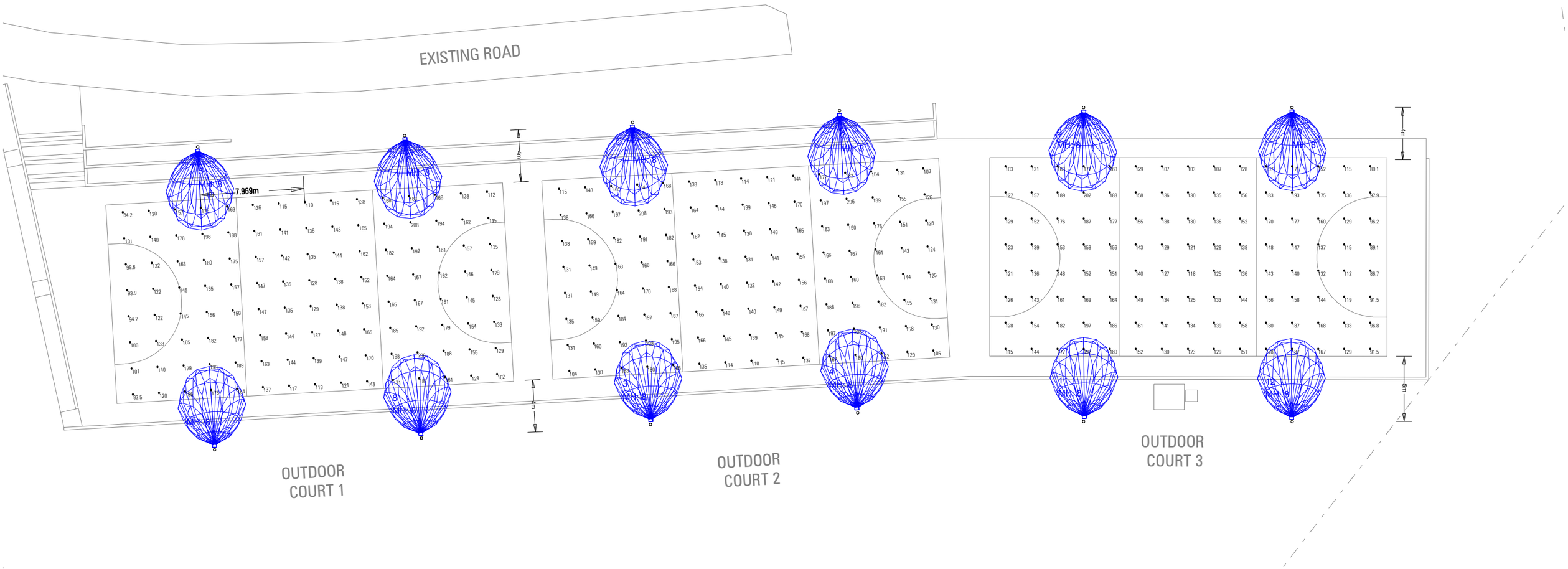
WEBB AUSTRALIA

3 x Single Netball

Lighting for Recreation, Training and Low Level Competition = 100 Lux

12 x 8m Lighting Columns

12 x QUANTUM 322W LED Floodlights



PROJECT	DRAWING	REVISION	DATE	PAGE		CONSULTING ELECTRICAL ENGINEERS LIGHTING CONSULTANTS TECHNOLOGY CONSULTANTS
M252B Netball Courts Drill Hall Common Mosman	Netball Lighting Recreation, Training and Low Level Competition 100 Lux	A	28 08 2017 AM	Page 2 of 3		WEBB AUSTRALIA GROUP (NSW) PTY LIMITED ABN 40 050 056 712 LEVEL 4, 828 PACIFIC HIGHWAY GORDON NSW 2072 AUSTRALIA TELEPHONE 02 9418 1444 FACSIMILE 02 9418 1191 EMAIL sydney@webbaustralia.com.au

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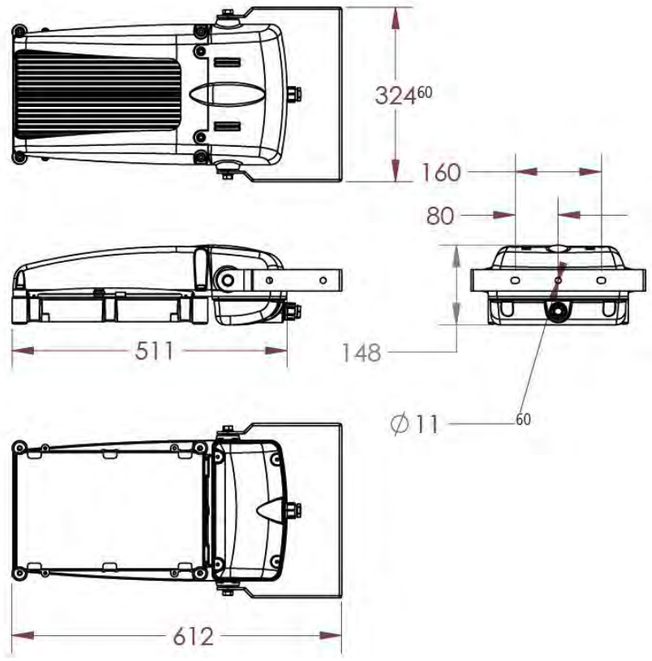

Calculation Summary							
Project: Court Lighting							
Label	**Units**	**Avg**	**Min/Avg**	**Min**	**Max**	**PtSpcLr**	**PtSpcTb**
Court 1 Eh 0m AGL	Lux	150.16	0.56	83.5	208	2	2
Court 2 Eh 0m AGL	Lux	156.52	0.66	103	208	2	2
Court 3 Eh 0m AGL	Lux	144.16	0.56	80.1	202	2	2

Netball Courts
30m x 15m
12 x 8m Columns

Luminaire Schedule						
Symbol	**Qty**	**Label**	**LLF**	**Description**	**Lum. Watts**	**Lum. Lumens**
	12	PPH1A5757ET-1MOD Quantum 322W	0.800	PPH1A5740ET FLAT GLASS 1 MODULE 757	322	33603

Luminaire Location Summary				
LumNo	**Label**	**Z**	**Orient**	**Tilt**
1	PPH1A5757ET-1MOD Quantum 322W	8	271.886	10
2	PPH1A5757ET-1MOD Quantum 322W	8	273.017	10
3	PPH1A5757ET-1MOD Quantum 322W	8	93.847	10
4	PPH1A5757ET-1MOD Quantum 322W	8	93.541	10
5	PPH1A5757ET-1MOD Quantum 322W	8	272.951	10
6	PPH1A5757ET-1MOD Quantum 322W	8	274.19	10
7	PPH1A5757ET-1MOD Quantum 322W	8	93.725	10
8	PPH1A5757ET-1MOD Quantum 322W	8	94.87	10
9	PPH1A5757ET-1MOD Quantum 322W	8	268.584	10
10	PPH1A5757ET-1MOD Quantum 322W	8	270.471	10
11	PPH1A5757ET-1MOD Quantum 322W	8	90.657	10
12	PPH1A5757ET-1MOD Quantum 322W	8	90.433	10

Calculation Summary		
Project: Spill Light		
Label	**Units**	**Max**
Spill Light Residents Boundary_Cd_Seg1	N.A.	11
Spill Light Residents Boundary_Cd_Seg2	N.A.	0
Spill Light Residents Boundary_Cd_Seg3	N.A.	1441
Spill Light Residents Boundary_Ill_Seg1	Lux	0.0
Spill Light Residents Boundary_Ill_Seg2	Lux	0.0
Spill Light Residents Boundary_Ill_Seg3	Lux	0.3

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12 APPENDIX C – LIGHTING CALCULATIONS

Compliance calculations using Quantum LED floodlight in two (2) pole per court arrangement.

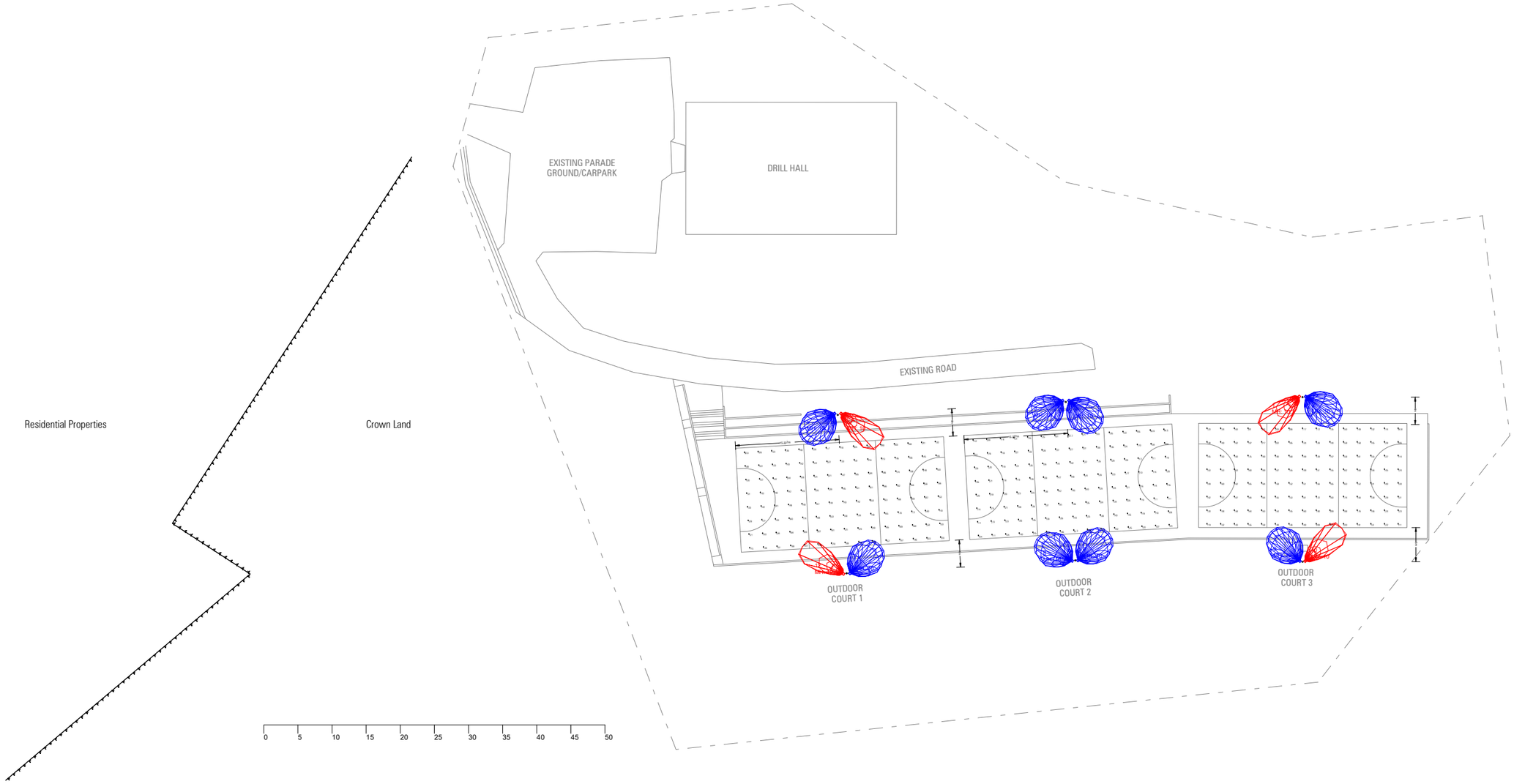
3 x A3 pages.

3 x Single Netball

Lighting for Recreation, Training and Low Level Competition = 100 Lux

6 x 10m Lighting Columns

8 x QUANTUM 322W + 4 x QUANTUM 635W LED Floodlights



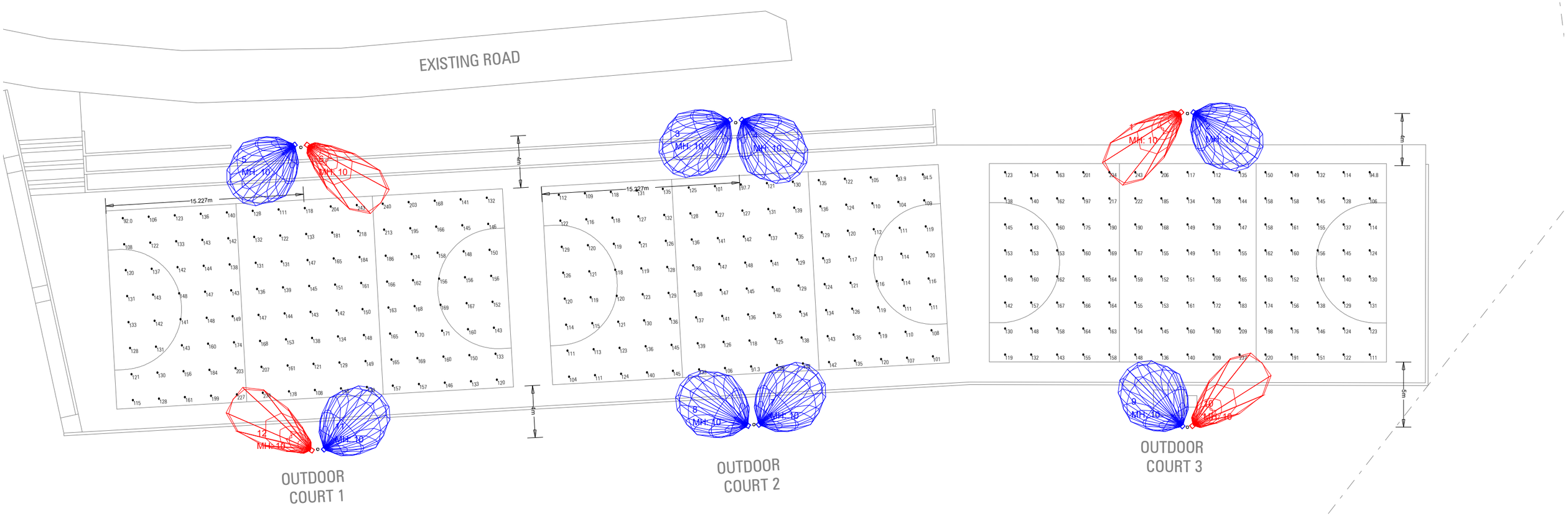
PROJECT	DRAWING	REVISION	DATE	PAGE		CONSULTING ELECTRICAL ENGINEERS LIGHTING CONSULTANTS TECHNOLOGY CONSULTANTS
M252B Netball Courts Drill Hall Common Wollongong	Netball Lighting Recreation, Training and Low Level Competition 100 Lux	A	21 08 2017 AM	Page 1 of 3		WEBB AUSTRALIA GROUP (NSW) PTY LIMITED ABN 40 050 056 712 LEVEL 4, 828 PACIFIC HIGHWAY GORDON NSW 2072 AUSTRALIA TELEPHONE 02 9418 1444 FACSIMILE 02 9418 1191 EMAIL sydney@webbaustralia.com.au

3 x Single Netball

Lighting for Recreation, Training and Low Level Competition = 100 Lux

6 x 10m Lighting Columns

8 x QUANTUM 322W +
4 x QUANTUM 635W
LED Floodlights



PROJECT	DRAWING	REVISION	DATE	PAGE
M252B Netball Courts Drill Hall Common Mosman	Netball Lighting Recreation, Training and Low Level Competition 100 Lux	A	21 08 2017 AM	Page 2 of 3

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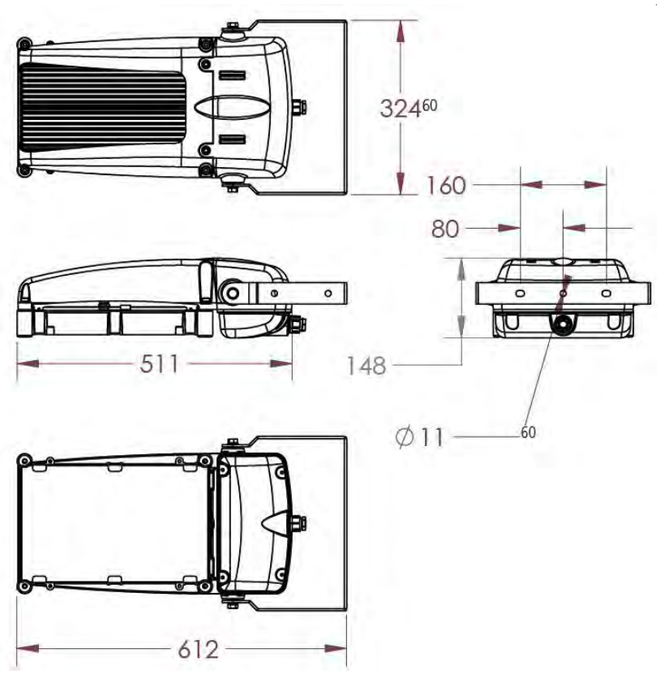

Calculation Summary							
Project: Court Lighting							
Label	**Units**	**Avg**	**Min/Avg**	**Min**	**Max**	**PtSpcLr**	**PtSpcTb**
Court 1 Eh 0m AGL	Lux	152.32	0.60	92.0	243	2	2
Court 2 Eh 0m AGL	Lux	123.88	0.74	91.3	148	2	2
Court 3 Eh 0m AGL	Lux	156.04	0.61	94.8	243	2	2

Netball Courts
30m x 15m
6 x 10m Columns

Luminaire Schedule						
Symbol	**Qty**	**Label**	**LLF**	**Description**	**Lum. Watts**	**Lum. Lumens**
	4	SR4H757A2-2MOD Quantum 635W NB	0.800	SR4H757A2 FLAT GLASS 2 MODULE 757	635	67043
	8	PPH1A5757ET-1MOD Quantum 322W	0.800	PPH1A5740ET FLAT GLASS 1 MODULE 757	322	33603

Luminaire Location Summary				
LumNo	**Label**	**Z**	**Orient**	**Tilt**
1	SR4H757A2-2MOD Quantum 635W NB	10	222	5
2	PPH1A5757ET-1MOD Quantum 322W	10	324	10
3	PPH1A5757ET-1MOD Quantum 322W	10	214	10
4	PPH1A5757ET-1MOD Quantum 322W	10	317	10
5	PPH1A5757ET-1MOD Quantum 322W	10	219	10
6	SR4H757A2-2MOD Quantum 635W NB	10	322	5
7	PPH1A5757ET-1MOD Quantum 322W	10	41	10
8	PPH1A5757ET-1MOD Quantum 322W	10	149	10
9	PPH1A5757ET-1MOD Quantum 322W	10	134	10
10	SR4H757A2-2MOD Quantum 635W NB	10	42	5
11	PPH1A5757ET-1MOD Quantum 322W	10	43	10
12	SR4H757A2-2MOD Quantum 635W NB	10	147	5

Calculation Summary		
Project: Spill Light		
Label	**Units**	**Max**
Spill Light Residents Boundary_Cd_Seg1	N.A.	1035
Spill Light Residents Boundary_Cd_Seg2	N.A.	1048
Spill Light Residents Boundary_Cd_Seg3	N.A.	2033
Spill Light Residents Boundary_Ill_Seg1	Lux	0.1
Spill Light Residents Boundary_Ill_Seg2	Lux	0.2
Spill Light Residents Boundary_Ill_Seg3	Lux	0.4

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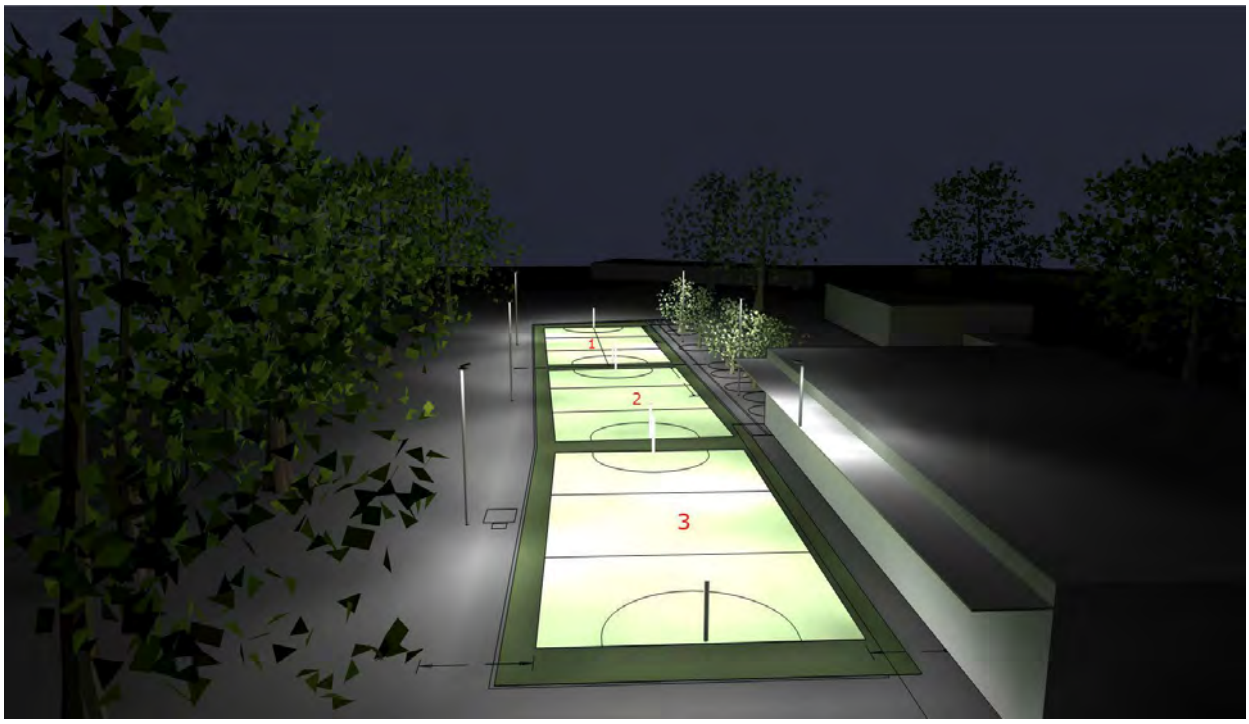
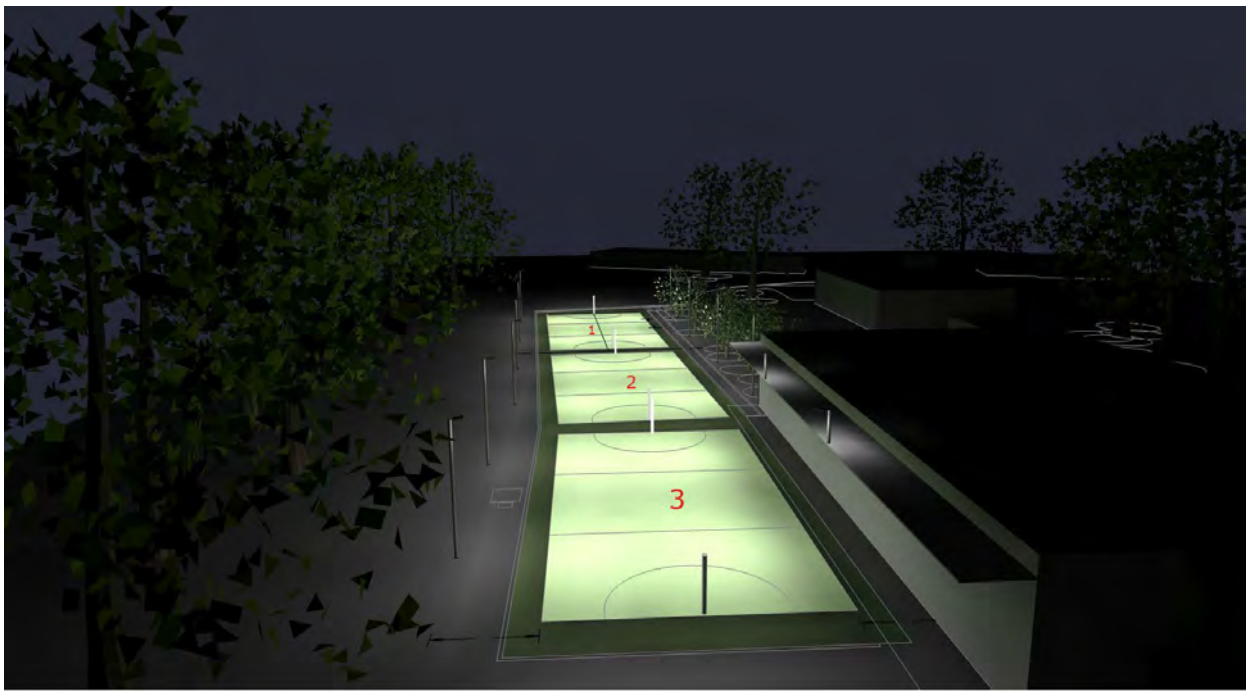
Document Set ID: 5350548
Version: 1, Version Date: 04/01/2018

13 APPENDIX D – LIGHTING CALCULATION RENDERINGS



Computer simulation showing two(2) poles per court at 10m high



Computer simulation showing four(4) poles per court at 8m high

14 APPENDIX E – LIGHTING POLE MONTAGES

Montage showing two(2) poles per court at 10m high.

Montage showing four(4) poles per court at 8m high.

Appendix 2.

Project Report

13 October 2014 - 26 December 2017

Have your say Mosman

Mosman Drill Hall Common - Netball Court Lighting Concept - Preliminary Community Consultation

Visitors Summary

Highlights

TOTAL VISITS	MAX VISITORS PER DAY	NEW REGISTRATIONS
314	68	1

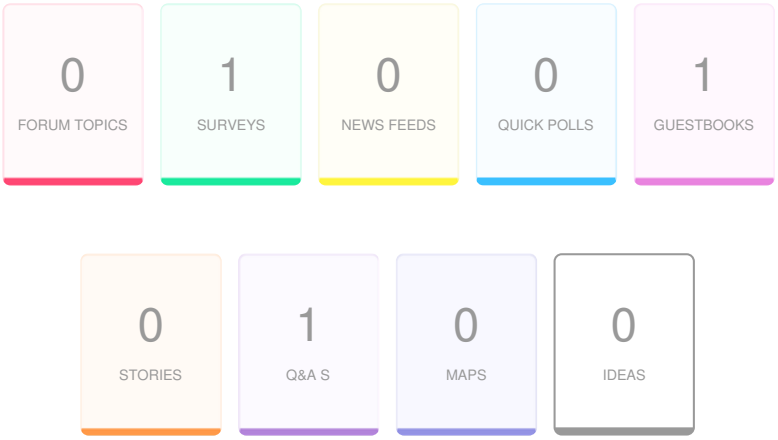
ENGAGED VISITORS	INFORMED VISITORS	AWARE VISITORS
172	194	258

Aware Participants	258
Aware Actions Performed	Participants
Visited a Project or Tool Page	258

Informed Participants	194
Informed Actions Performed	Participants
Viewed a video	0
Viewed a photo	0
Downloaded a document	18
Visited the Key Dates page	4
Visited an FAQ list Page	0
Visited Instagram Page	0
Visited Multiple Project Pages	27
Contributed to a tool (engaged)	172

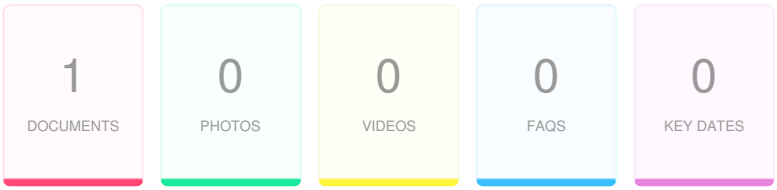
Engaged	172		
Engaged Actions Performed	Registered	Unverified	Anonymous
Contributed on Forums	0	0	0
Participated in Surveys	1	0	171
Contributed to Newsfeeds	0	0	0
Participated in Quick Polls	0	0	0
Posted on Guestbooks	0	0	0
Contributed to Stories	0	0	0
Asked Questions	0	0	0
Placed Pins on Maps	0	0	0
Contributed to Ideas	0	0	0

ENGAGEMENT TOOLS SUMMARY



Tool Type	Engagement Tool Name	Tool Status	Visitors	Contributors		
				Registered	Unverified	Anonymous
Survey Tool	Drill Hall Common Netball Court Lighting Proposal	Published	224	1	0	171

INFORMATION WIDGET SUMMARY



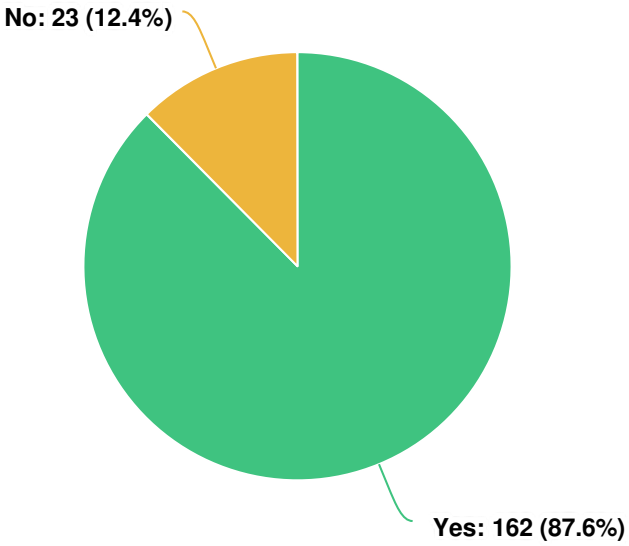
Widget Type	Engagement Tool Name	Visitors	Views/Downloads
Document	Drill Hall Common Netball Court Lighting Proposal	18	19
Key Dates	Key Date	4	4

ENGAGEMENT TOOL: SURVEY TOOL

Drill Hall Common Netball Court Lighting Proposal

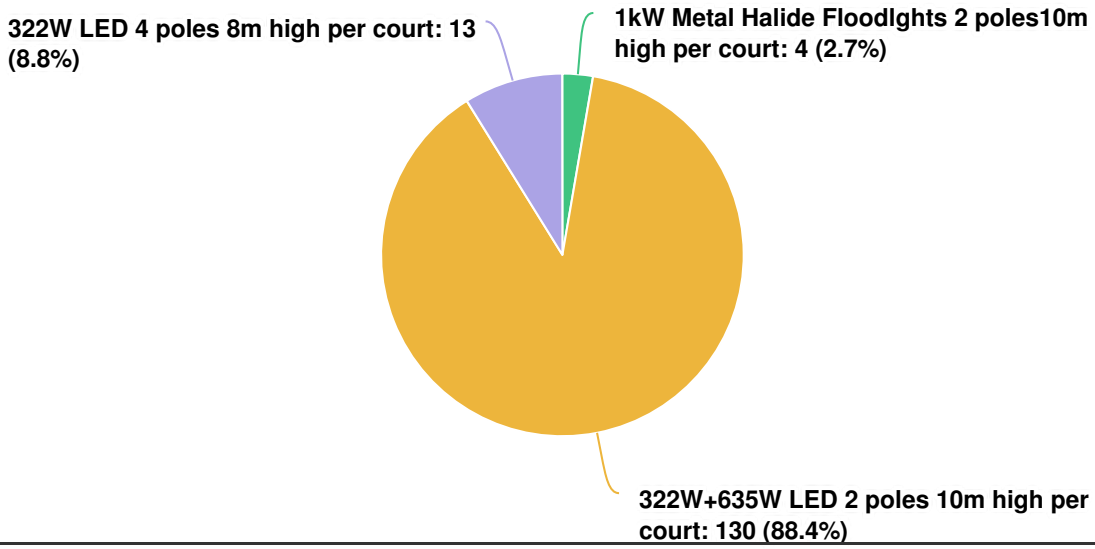
VISITORS 224	CONTRIBUTORS 172	CONTRIBUTIONS 185

Do you support the proposal to install flood lights at the three hard court netball courts at Drill Hall Common?



(185 responses, 0 skipped)

If yes, which do you prefer?



Optional question (147 responses, 38 skipped)

Appendix 3.

Agenda Report

EP/2: Drill Hall Common Netball Court Lighting Proposal (EP)

RESPONSIBLE OFFICER: Manager Environment and Open Space

EXECUTIVE SUMMARY

In November and December 2017 Council undertook public consultation on the installation of floodlights at three outdoor netball courts at Drill Hall Common. This report details the outcomes of this consultation.

The results show high level of support for the proposal however there is opposition from some surrounding residents. It is proposed to approach the Trust and seek approval to lodge a Development Application and subject to approval seek amendment to their Plan Of Management and the lease condition of the site.

OFFICER'S RECOMMENDATION

The Manager Environment and Open Space recommends that:

1. Council note the outcomes of the consultation and the strong support for the installation of floodlights at the three outdoor netball courts at Drill Hall Common.

2. Council seek approval from the Sydney Federation Trust to lodge a Development Application for the works.

3. Subject to approval of (2) Council seek the required amendment to the lease for the site and changes to the Plan Of Management for the site.

4. The General Manager be delegated authority to arrange the work required to undertake (2)-(3) above.

Background

On 30 June 2017 Council was advised by the office for the Minister for Sport that it would receive $150,000 for the installation of lights at the Drill Hall Common Netball courts. The grant was made through the NSW Government 2016/17 Community Facility Funding Program.

A Mayoral Minute was in drafted for the installation of lights at the three outdoor netball courts at Drill Hall Common in response to a 30 June 2017 grant offer of $150,000 and Council at its meeting on 4 July 2017, resolved inter alia "*That Council endorse the recommendation and the actions described in the Mayoral Minute".* The recommendations and actions included:

i) Acceptance of the grant
ii) Community consultation on the installation of lighting
iii) Progress the lodgement of a Development Application with the Trust

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Current Position

The Drill Hall Common is currently a highly used facility that includes three outdoor netball courts, the Marie Bashir Indoor Sports Centre (opening hours are 7 am to 10 pm) and a Council run After School Care Program. The area is also directly adjacent to Rawson Oval and has residential properties on its western edge.
The Mosman Drill Hall Common is managed by Mosman Council under an agreement with the Sydney Harbour Federation Trust which is the owner and consent authority for the three Netball courts and site.

Mosman Netball Club currently uses the three outdoor netball courts from 3.30-5.30 pm Monday to Thursday from early March to early September. They also utilise the Marie Bashir Sports Centre between the hours of 3.30-7.30 pm Monday to Thursday. The club caters to a range of age groups from junior players through to senior players and for the 2017 season had 450 players, an increase of 80 players since 2012.

The proposal to install floodlights at the three hard court netball courts at Drill Hall Common was identified as part of the *Future Needs of Sport* study undertaken by the Office of NSW Sport and Recreation. The project is also supported by the *2015 Open Space Recreational Needs and Assessment Report.*

At present the courts are limited to day-time use under the SHFT *Management Plan for the Mosman Drill Hall* precinct, development approval conditions, and the terms of the lease for the site. Mosman Netball Club has advised that this limitation means that each team in the club has only nine minutes in which to train on a full court per week. If floodlighting was installed this would extend the time available to the Club's teams to use the courts. The proposal would help also support increased women's participation in sport.

Mosman Netball Club has indicated that if the floodlights were to be installed the intended hours of use would be:

- February to September: Mondays to Thursdays until 8.30pm
- October to February: 2-3 evenings per week until 8.30pm

Consultation

Consultation material was advertised as follows:

- Council's website
- Mosman Daily

The consultation included a Netball Court Lighting Report prepared by a lighting consultant which contained three lighting options, a short survey of two questions with question three allowing other comments. Written submissions were also accepted.

Key stakeholders including local sporting clubs, National Parks and Wildlife Service, Sydney Harbour Federation Trust and residents within Cross Street and nearby properties were advised directly in writing.

The consultation period was opened on the 22 November 2017 and closed on 22 December 2017.

Consultation Results

Council received 185 responses to its survey with the majority from respondents having an association with Mosman Netball Club.

A report generated from the survey tool (attached as an appendix to this report) showed that 87.6% of respondents support the proposal to install floodlights at the three hard court netball courts at Drill Hal Common. There was also strong support for the 322W+635W LED 2 poles 10m high per court lighting option.

In addition to the 185 electric survey submissions Council also received four written submissions.

Financial Implications

Council has received $150,000 from the NSW Government 2016/17 Community Facility Funding Program for the installation of floodlights at the netball courts at Drill Hall Common. The cost of supply and installation of floodlights including preparation of a Development Application is expected to be within this budget.

If approved, once constructed, a fee would be charged to use the lights as is the standard practice at all Council sporting ovals with lights. This fee is currently $25.50 per hour.

Relationship with MOSPLAN

The installation of floodlights in the three hard court netball courts at Drill Hall Common meets many strategies within MOSPLAN. These include Community Wellbeing Strategy 6 - *Maximise opportunities for residents to connect with and participate in community life* and Community Spaces Strategy 2 - *Manage parklands, sporting fields and recreational facilities in a manner that is well maintained, well equipped and encourages active lifestyles*.

Comment

Council has indicated that it supports this proposal and this is replicated by the feedback. However it should be noted that the majority of the feedback is from those with some association with Mosman Netball. The majority of comments indicated:

- Overdue project which will meet the high demand to play netball in the Mosman area
- Will provide better utilisation of a much needed community facility and allow Mosman Netball to run its training schedule
- Currently it is dark at 5pm and installation of floodlights will allow current teams to train after its gets dark which is usually the time senior players can get to the site after work. Currently we are forced to share the indoor sports centre and with floodlights we will have a further three courts to utilise
- Lights would provide extended training hours, meaning less cars parking in the area after school in daylight hours
- Women's sports are not prioritised by Council and we need safe 'well lit' training areas. It seems that the male dominated sports have many options but no single option for women's sport. It is a question of equality
- Netball is a fantastic sport that promotes teamwork, social skills and an active lifestyle
- Gives hundreds of local residents a sense of belonging and purpose in the community
- Improves connectedness amongst girls and improves self esteem

The small number of objections received are from Cross Street residents. Their concerns are:

- Light pollution and light spill.
  Comment: The light design has been undertaken by a lighting engineer and complies with Australian Standards.
- The lease of the site put in place in 2006 between Mosman Council and Sydney Harbour Federation Trust contained provisions to prevent the expanded use of the netball courts
  Comment: Lease conditions are able to be revised and changed to accommodate. increased usage requirements.
- Cross Street and the area already has excessive traffic and parking issues and is exposed to speeding cars.
  Comment: Initial traffic investigations found that this street is no different to other streets where ovals and sporting facilities are located.
- Over intensification of the facility and changes would lead to competition games at the site.
  Comment: The use with the lights is considered acceptable and not excessive for a facility like this.

The proposed times of use as provided by Mosman Netball Club if floodlights are to be installed would not extend the traffic issues and noise at Rawson Oval as the Oval is currently utilised until 9pm on most weekdays throughout the winter months by other local sporting groups. Further, the extended use of the courts may actually reduce traffic congestion and parking intensity especially from 3:30-5:30 pm as training use on the courts could be extended and therefore evenly spread across the afternoon and evening.

The consultation showed strong support for the 322W+635W LED 2 poles 10m high per court lighting option. Although all lighting options have very little light spill predicted on adjoining properties staff believe that the 355W LED 8 metre 4 pole option per court is better suited to the site. This would ensure there is no visual intrusion into the Sydney foreshore.

Recommended Action

It is considered that the lights would improve accessibility to a training facility for Mosman Netball Club and provide greater opportunity for women in sport.

It is recommended that a Development Application be prepared and presented to the Sydney Harbour Federation Trust and a request be made to alter the various leases and Plans of Management. Further the General Manager be delegated authority to manage these applications.

Recommendation endorsed by Director Environment and Planning.

ATTACHMENTS

Circulations

- Drill Hall Common Netball Court Lighting Report
- Project Report from Survey Tool for proposal to install floodlights at the outdoor netball courts Drill Hall Common

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COUNCIL RESOLUTION

The Deputy Mayor read out and tabled a letter from Ms Felicity Wilson, Member for North Shore, providing support for this item which was read at the Council meeting and is attached to these minutes.

Motion Willoughby/Bendall
That the Officer's Recommendation be adopted subject to amendment of (2) to:

Council seek the required amendment to the lease for the site and changes to the Plan of Management for the site to make provision for competition matches and provision for a future Club House facility at the site.

Amendment Menzies/Moline
That the Officer's Recommendation be adopted.
CARRIED

For: Cook, Menzies, Moline

Against: Bendall, Willoughby

and on being put as the Motion CARRIED UNANIMOUSLY

Appendix 4.

Agenda Report

Council Resolution Item

Action is required from the Council Meeting on **13 November 2018** as per the Resolution outlined below.

EP/61 (EP)	**Drill Hall Common Netball Court Lighting Proposal Update**
EP/61:	**Drill Hall Common Netball Court Lighting Proposal Update (EP)**
RESPONSIBLE OFFICER:	**Manager Environment and Open Space**

EXECUTIVE SUMMARY

The Sydney Harbour Federation Trust (Trust) Board have advised that they will not be reviewing the Drill Hall Common Plan of Management (in order to allow floodlighting of netball courts) at this time. This is largely due to traffic management concerns related to sporting use of the courts and the surrounding site. They have requested additional information and have provided recommendations in this area in order to reconsider the matter.

The recommendations provided by the Trust have financial implications for Council and will have impacts on the way sporting groups use the site. Further, the delay in consideration of this matter may impact the grant Council has received for the lights.

It is recommended that in the first instance, consultation with Mosman Netball and Rugby be undertaken prior to making any determination on this matter. It is further recommended that the General Manager and Mayor be delegated authority to resolve this matter.

OFFICER'S RECOMMENDATION

The Manager Environment and Open Space recommends that:

1. Council reiterates its support for Mosman Netball and the installation of the lights at the Drill Hall Common Netball Courts.

2. Council undertakes consultation with Mosman Netball and Mosman Rugby regarding the recommendations suggested by the Trust.

3. The Mayor and General Manger be delegated authority to respond to the Trust once this consultation occurs and should additional expenditure be required the matter be reported back to Council.

Background

On 30 June 2017, Council received a $150K grant from the NSW Department of Sport and Recreation for installation of lights at the Drill Hall Common Netball Courts. At its meeting on 6 February 2018 Council considered report EP/2: Drill Hall Common Netball Court Lighting Proposal and resolved the following:

1. *Council note the outcomes of the consultation and the strong support for the installation of floodlights at the three outdoor netball courts at Drill Hall Common.*

2. *Council seek approval from the Sydney Federation Trust to lodge a Development Application for the works.*

3. *Subject to approval of (2) Council seek the required amendment to the lease for the site and changes to the Plan Of Management for the site.*

4. *The General Manager be delegated authority to arrange the work required to undertake (2)-(3) above.*

Staff prepared a relevant lighting study and planning proposal for the work and this was ready for submission to the Trust for review.

As this work was not in accordance with the Drill Hall Common Plan of Management, an amendment to the Plan is required. To successfully install the lights, the following process needs to be followed:

1. The Trust agree to and amend the Plan of Management for the site.
2. The Trust agree to receive an application for the works (unlike a normal development application, the Trust can choose whether to accept an application or not).
3. The Trust consider and approve the application.

To consider item 1, the Trust undertook their own investigation which included a light and traffic study. The Trust Board met in October 2018 and has advised Council that it will not be reviewing the Drill Hall Common Plan of Management until Council completes a traffic management plan for the site and this is reviewed in six months' time.

The traffic management plan makes several recommendations that will impact the operation of Mosman Netball as well as Council. Further it will require additional expenditure and may have an impact on the Grant. There is no guarantee at the end of this work that an application would be approved let alone be received.

In regards to the grant, Council has already spent some monies on consultancy work and has now written to the NSW Department of Sport and Recreation requesting an extension.

Report

The additional requirements of the Trust are listed in the following table. These have not been costed, investigated, nor has formal consultation with Mosman Netball occurred. It is considered on initial review, many conditions may not be supported by Mosman Netball as efficiencies gained by the lights may be off-set by new operational conditions.

Mitigation Measure or Improvement from Sydney Harbour Federation Trust	Staff Comments	Recommended Action
Providing a short break between training times so there is less training sessions overlapping.	May not be feasible	Consultation with Netball Club
Staggering the start times for each netball court (and potentially each rugby training session) so there are less sessions overlapping at the same time.	May not be feasible	Consultation with Netball and Rugby Club
Changing the netball training times so as to not overlap with the Drill Hall outside of school hours (OSH) care finishing time.	OOSH is unable to change times and may not be feasible	Consultation with Netball Club
Implementing time restrictions on the car	May not be	Consultation with Rugby Club

parking supply to the south of Rawson Oval to reduce the number of long-stay vehicles (staying over two-hours).	supported by Clubs	with Netball Club
Install lighting along the pedestrian connections between Rawson Oval and Alexander Avenue to increase safety at night.	There is no funding for this work and work could be significant	No further action at this time
Relocate the bollards on the internal access road within the precinct to the western end of the road to increase pedestrian safety.	Likely conflict with waste services accessing bins	Council to investigate
Provide stairs between the Rawson Oval car park and the precinct.	There is no funding for this work and work could be significant	Council to investigate
Change the circulation of the Rawson Oval car park to one-way clockwise to improve operation. This would require six spaces to be signed as rear to kerb only.	May have implications on the number of available spaces	Council to investigate
Provide a pick-up and drop-off bay along the northern edge of the Rawson Oval car park.	May have implications on the number of available spaces	Council to investigate feasibility
Provide give-way line marking at the Rawson Oval car park access to ensure pedestrians and cyclists are given priority.	Agreed	Council to implement

***Table 1**: Transport Impact Assessment recommended mitigation measures, staff comments and recommended actions.*

Consultation

The Office of Sport (the organisation responsible for the administration of the grant), State MP Felicity Wilson and Mosman Netball Club have been advised in writing by Council of the response by the Trust. The Trust have advised all other stakeholders including surrounding properties.

Financial Implications

Council has not yet received a response from the Office of Sport at this stage. The additional works as described on top of the lights could be in excess of $100,000.

Relationship with MOSPLAN

The installation of flood lights for netball courts at Drill Hall Common falls under *Strategic Direction 7 – A Healthy and Active Village Lifestyle.*

Comment

There are concerns that the recommendations suggested by the Trust in order to reconsider the matter are excessive. Additionally, they may impact the operation of Mosman Netball and any efficiencies gained from the lights may be lost. Even if Council implements all the recommendations, there is no guarantee that the Trust will amend the Plan of Management for the site to allow an application to install the lights.

In order to respond to the Trust, detailed discussions with Mosman Netball and Mosman Rugby are required.

It is suggested in the first instance and in order to streamline the process, the Mayor and General Manger be delegated authority to respond to the Trust once this consultation occurs, and should additional expenditure be required the matter be reported back to Council.

Recommended Action

That Council reiterates its support for Mosman Netball and the installation of the lights at the Drill Hall Common Netball Courts. Further Council undertakes consultation with Mosman Netball and Rugby and the Mayor and General Manger be delegated authority to respond to the Trust. Should additional expenditure be required the matter be reported back to Council.

Recommendation endorsed by Director Environment and Planning.

ATTACHMENTS

Circulations

Letter to Mayor of Mosman from SHFT regarding Mosman Drill Hall Flood Lights

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COUNCIL RESOLUTION

Motion Willoughby/Sherlock
That the Officer's Recommendation be adopted and further that Council investigate other options for additional courts and alternate sites. It is further recommended that the General Manager, Mayor and Councillor Willoughby be delegated authority to resolve this matter.
CARRIED UNANIMOUSLY

Appendix 5.

DRILL HALL COMMON OPERATIONS PLAN

Contents

Purpose

The purpose of this plan is to outline Council's management of the Drill Hall Common ensuring that all facilities contained are asfe, fit for purpose and well maintained. All areas are owned by the Sydney Harbour Federation Trust and leased and subsequently maintained and upgraded by Council.

Objectives

Mosman Council is committed to providing high quality community assets and services within allocated budgets. Assets and services are managed through Council and associated service contracts.

Scope

This operations plan is for the management of the Drill Hall Common, which is made up of three main facilities;

- The Drill Hall
- Marie Bashir Indoor Sports Centre; and
- Outdoor netball courts.

The facilities are shown in Figure 1. The plan details the day to day activities required by Council to provide well maintained facilities for local user groups and the general public. The plan also outlines the procedure for booking each facility, their current usage and user fees.

Figure 1. Facilities at the Drill Hall Common.

Maintenance

Council has service contracts for the cleaning and maintenance of all facilities at the Drill Hall Common, these include:

- Outdoor cleaning and maintenance which includes:
    - Lawn and gardens maintenance under Council's Parks and Sports Field Management contract;
    - Litter bin and reserve cleaning under Council's Beach and Reserve Cleaning contract; and
    - Roads, carpark cleaning under, outdoor netball courts and goal posts under Council's Street and Gutter Cleaning contract.
- Building cleaning which includes:
    - Internal cleaning under Council's Building Cleaning and Indoor Plant Hire contract; and
    - External cleaning under Councils Graffiti Management and Outdoor Cleaning contract.
- Building maintenance, falls under the Services for Buildings Management – General Services Contract and includes a range of associated building trades.

An asset inventory including condition of each asset covered under this plan is attached as Appendix. 1.

Current Usage

The use of facilities at Drill Hall Common are determined through bookings following the Venue Hire Policy and Procedures for each facility (see Appendix. 2 and 3). A detailed example of schedule of bookings for July - August 2018 is attached as Appendix 4 and 5.

A summary of the usage for each facility are detailed in tables below:

<table>
<tr><th>Drill Hall - Main Hall</th><th>Weekdays (school term only)</th><th>Weekdays (school holidays)</th><th>Weekends</th><th>Public Holidays</th></tr>
<tr><td>7:00am – 6:30pm</td><td>Before School and After School Care</td><td></td><td rowspan="2">Available for group or private bookings (up to 10pm)</td><td rowspan="2">Closed</td></tr>
<tr><td>8:00am – 6:00pm</td><td></td><td>Vacation Care</td></tr>
</table>

Table 1. Priority and usage for the Main Hall (Drill Hall).

The Marie Bashir Indoor Sports Centre is available for a range of uses between the hours of 7am and 10pm seven days a week, closed on Public Holidays. Bookings are made throughout the year based around the school term calendar.

Marie Bashir Indoor Sports Centre	Weekdays	Weekends	Public Holidays
7:00am – 3:30pm	Children groups and school bookings	Netball, Basketball, Indoor Hockey and Futsal	Closed
3:30pm – 10:00pm	Netball, Basketball, Indoor Hockey and Futsal		

Table 2. Summary of usage for the Marie Bashir Indoor Sports Centre.

The three outdoor netball courts are available for hire throughout the year; priority is given to Mosman Netball Club during pre-season and winter. Casual use of the outdoor netball courts is available outside of booked times.

Drill Hall – Netball Courts 1,2 & 3	Weekdays - February to September	Weekends - February to September	October to March
7:00am – 3:30pm	School or group bookings	Mosman Netball Club	School or group bookings
3:30pm – 5:00pm	Mosman Netball Club	School or group bookings	School or group bookings

Table 2. Summary of usage for the Outdoor Netball Courts.

Usage Fees

Fees and Charges are updated annually as per Council's Pricing Policy and can be found on Council's website at http://www.mosman.nsw.gov.au/council/policies-forms/policies/. The Policy is reviewed and put out to public consultation April of each year and Council reviews and finalises each June.

Booking Procedures

Procedure for booking each facility is as per Council's Venue Hire Policy and Procedures for the Marie Bashir Sports Centre and Drill Hall (both are attached as an Appendix 2 and 3). The Outdoor netball courts fall under the Drill Hall Venue Hire Policy and Procedures.

User groups are required to complete an application form for seasonal booking requests so Council is able to allocate time for each user group. Priority is generally given to local sporting groups that enable larger group of participants. Casual use of the outdoor netball courts does not require booking but users must not inhibit user groups that have booked.

Contact

Enquiries should be directed to the Manager Environment and Open Space on 9978 4025.

Appendix

1. Drill Hall Common Assets list
2. Marie Bashir Sports Centre, Drill Hall Common – Venue Hire Policy and Procedures
3. Mosman Drill Hall – Venue Hire Policy and Procedures
4. Current 2019 Weekly Bookings for Marie Bashir

Appendix 6.

Agenda Report

Council Resolution Item

Action is required from the Council Meeting on **05 March 2019** as per the Resolution outlined below.

EP/4 **Netball Grounds and Facilities Response (EP)**

EP/4: **Netball Grounds and Facilities Response (EP)**

RESPONSIBLE OFFICER: **Manager Environment and Open Space**

EXECUTIVE SUMMARY

To report on an investigation of additional netball courts within the Mosman Local Government Area.

OFFICER'S RECOMMENDATION

The Manager Environment and Open Space recommends that the report be received and noted.

Background

At its meeting on the 4 December 2019 in response to Notice of Motion: Netball Grounds and Facilities (NM/19) Council resolved the following;

That Council:

1. *Notes the acute need for more locally based sporting facilities while recognising a chronic undersupply of land on which to build them.*

2. *Notes the inequity between sexes as more facilities are available for sports played predominantly by males.*

3. *Press for the installation of lights at Cross Street and seek letters of support from Federal and State members including support from stakeholders such as Headland Preservation Group and Mosman Parks and Bushlands should it be forthcoming*

4. *Staff bring back a report on locations for new netball courts to the March 2019 Council Meeting where consideration is given to all possibilities.*

5. *That the impacts on existing user groups be minimised as much as practicable.*

6. *The use of the Drill Hall and Marie Bashir Mosman Sports Centre also be considered in the above report.*

This report directly addresses items 4, 5 and 6.

Current Position

Additional Netball Courts

Council currently provides three outdoor netball hardcourts at Drill Hall Common and netball is the priority use of this facility The courts are currently unlit and use is restricted to daylight hours. In winter use is generally limited to 3.30- 5.30 pm during weekdays.

At its meeting in December 2018 Council requested a report on locations for new netball courts and as such staff engaged an engineering consultancy firm to investigate suitable sites within the Mosman LGA. The report is attached and a summary of potential options Council may wish to pursue are provided below in Table 1. Sites were assessed in regards to availability of parking, hydrology, land zoning and existing site use. Note that apart from Rawson Oval no sites are currently lit and costs for lighting and ongoing site maintenance are not included.

Site	No. of additional courts	Cost	Timeframe	Pro's	Con's
Rawson Oval	2	$6,000	2 months	Currently lit and grass surface is ready. Close proximity to existing netball facilities.	Only available on Wednesday's. No potential to convert grass surface to hardcourt.
Rawson Park	2	$80,000	12+ months	Close proximity to existing netball facilities. Possible conversation of grass surface to hardcourts in future.	Requires extensive works to get grass surface ready. Consultation with existing user group required.
Spit West	4	$30,000	12+ months	Site could accommodate four courts and site is currently used for junior sports.	Requires works to get grass surface ready. Site has been identified as construction site for Beaches Link Tunnel project. Limited potential to convert grass surface to hardcourt.
SHFT lands	4	Unknown	24+ months	No disruption/ displacement of existing user groups. Plenty of space available. Remote locations	Land not owned/ managed by Council. Consultation to amend POM's required.

				so no disturbance to adjacent areas.	Extensive civil works required to build either grass or hardcourts.

Table 1: Summary of potential sites that Council could pursue for increased netball courts within the Mosman LGA.

Although not listed within the attached report staff also assessed school facilities within the LGA. Mosman High School was the only site with suitable facilities and capacity (two outdoor courts used for basketball, netball and futsal). These courts do not have lights and are currently not available during daylight hours.

Drill Hall

As previously reported to Council, the use of the Drill Hall at present is significantly dedicated to the provision of before and after school care. Due to the timing of the current after school care arrangements which conclude at 6 pm it is incompatible with Mosman Netball using the single internal court on weekdays. A review on the before and after school service is presented to Council in a separate report for consideration, noting that Mosman Primary has recently commenced its own after school care service. Initial analysis suggests that neither service, even if fully subscribed, could meet the total after school demand on their own (Council provides 75 places, Mosman Public's number of spaces vary on different days).

Marie Bashir Sports Centre

The Marie Bashir Sports Centre has one indoor hardcourt and the use of the Marie Bashir Sports Centre has also been contemplated previously by Council. The Centre is used by a wide variety of sporting entities ranging from children's activity groups and schools to Netball, Futsal, Hockey and Basketball associations. The current venue hire policy for the Centre states as follows:

1. Booking Priorities

    - Council's lease with the Sydney Harbour Federation Trust stipulates that sporting activities, recreation and community use will be given priority. Other priority usage will be to address the gender imbalance of sporting facilities for women and for the disabled.
    - The greater the number of people per booking using the facility for sport or active recreation, particularly young people, the higher the priority of the booking.

2. Access to the Marie Bashir Mosman Sports Centre

    - Council will not permit the Sports Centre to be used exclusively by any group or individual, in order to facilitate accessibility of the Venue to all users
    - Use of the Venue will be approved for no more than twelve months. Bookings will be reviewed every twelve months to ensure that the distribution of bookings is equitable.

Consultation

Consultation has occurred with Mosman junior and senior rugby in regards to shared use of Rawson Oval. It is also noted that at a recent Sporting Fields Advisory Group biannual meeting there was strong support for the lighting of the outdoor Drill Hall Common netball courts and further exploration of SHFT lands.

Extensive consultation excluding Rawson Oval would be required if Council chose to explore the options outlined within Table 1.

Financial Implications

No option as listed in Table 1 is currently funded.

Relationship with MOSPLAN
The investigation of additional sites for netball courts falls under *Strategic Direction 7 – A Healthy and Active Village Lifestyle.*

Comment

Additional Netball Courts

There are three possible solutions for Council consideration that could provide additional grass netball courts within two to twelve plus months on land under the control of Mosman Council. Rawson Oval is able to provide two additional grass courts within two months that could be used on Wednesday's up to 9 pm. Rawson Park could also provide two grass courts however significant funds for turf preparation works are required and timeframe for installation is estimated at greater than twelve months. Both sites at Rawson have the additional benefit of being in close proximity to existing netball court facilities. Any impacts to existing user groups is difficult to determine and therefore extensive consultation is required for Rawson Park. The park is an existing off leash dog park and this use is generally not compatible with netball court use and further infrastructure (not costed in Table 1) such as fencing would most likely be required.

Spit West grass netball courts could be established by the start of next year's netball season and would generate four courts in total. The site is currently used by other junior sports which require a grass playing surface for weekend use. Long-term use is subject to the development of the Beaches Link Tunnel as some land may be required for construction activities.

Whilst Council could resolve to progress the above sites, lands managed by the SHFT are most suitable to accommodate additional netball courts within the Mosman LGA. There is ample spare land and conversion would not disrupt existing user groups. It is however noted that no site currently is able to be easily converted to netball courts and any potential site would require significant community consultation and amendment to existing POM's. The exact process of same is strictly a matter for the SHFT but it is estimated that a minimum of two years is required to establish the courts. The netball club is encouraged to continue to pursue such a facility with the SHFT directly with Council support.

Drill Hall

Whilst Council could resolve to close or move its current before and after school care service, (such a decision would require lead time to allow the affected families to make other arrangements but could be implemented as early as 2020), to provide access to Mosman Netball, it should be noted that there is no appropriate alternative location readily available to the Council and that the benefit provided to Mosman Netball is not a fulsome solution as there is only one undersized indoor netball court as its curtilage is heavily compromised. The Drill Hall, however does provide a useful all-weather space for drills, exercises, and non-match practice as well as a meeting space for parents and club officials.

As Mosman Netball has indicated a need for a clubhouse one option that also could be considered is the installation of a small demountable cabin near the courts which would enable the after school care service to continue and provide a secure, dedicated space for Mosman Netball. This would be subject to SHFT approval.

Marie Bashir Sports Centre

Mosman Netball already have access to the centre and account for about 11% of bookings. Mosman Netball wrote to Council in November 2018 seeking to extend their access at that time from March to August 2019 from the hours of 3.30 to 8 pm. Council was unable to

accede to this request as other users had already been locked in for 2019, however there is the potential for greater access in 2020. Whilst access could be increased to some degree, providing continuity for other deserving groups is also a factor, as is the potential for the Centre being unoccupied after 8 pm as it is too late for many sporting activities to commence. If council wish to give preference to Mosman Netball over other user groups it would need to resolve as such, and as a consequence amend the current hire policy to reflect this decision.

Recommended Action

That there are several possible short and longer term solutions to provide additional netball courts and facilities within the Mosman LGA. If Council wishes to pursue additional courts and facilities for netball in Mosman it can choose from the options below;

Short-term

- Establish two grass courts on Rawson Oval
- Revise the use of Marie Bashir Sports Centre giving priority to women's sports
- Commit to pursuing with the SHFT the installation of lighting of the Drill Hall Common outdoor netball hardcourts
- Installation of a modest demountable cabin to use as a clubhouse adjacent to the outdoor courts at Cross Street subject to SHFT approval.

Medium to Long-term

- Establish grass courts at Spit West or Rawson Park to be ready by the start of the 2020 netball season
- Liaise with SHFT to ascertain the possibility of using their land to install grass or hardstand netball courts.

Recommendation endorsed by Director Environment and Planning.

ATTACHMENTS

Minute Book Attachments

- Consultant Report - Potential locations for additional Netball Courts in the Mosman LGA

COUNCIL RESOLUTION

Motion Willoughby/Bendall
That Council:

1. Revise the use of Marie Bashir Sports Centre giving priority to women's sports.
2. Commit to pursuing with the SHFT the installation of lighting of the Drill Hall Common outdoor netball hardcourts.
3. Install a modest demountable cabin to use as a clubhouse adjacent to the outdoor courts at Cross Street subject to SHFT approval.
4. Establish grass courts at Spit West to be ready by the start of the 2020 netball season.
5. Liaise with SHFT to ascertain the possibility of using their land to install grass or hardstand netball courts.
6. Begin a consultation process after the State elections for installation of lights at Spit West without incurring significant expenditure with a further report to come back to Council.

CARRIED

For: Bendall, Cook, Corrigan, Moline, Sherlock, Willoughby

Against: Menzies

Appendix 7.

Our Ref: 18MOSM03:NvD

13 August 2019

Mosman Council
Civic Centre
Mosman Square
SPIT JUNCTION NSW 2088

Attention: Mr A Webster

Dear Adrian

Re: Bushfire assessment
Drill Hall Common, Headland Park, 1A Cross Street, Mosman

Travers bushfire & ecology has been requested to undertake a bushfire assessment for the proposed installation of floodlights at the three (3) outdoor netball courts located at the Drill Hall Common at the above address.

As part of this application Mosman Council would like to assess the new floodlights (preferred option being four poles per court) in the context of the Bushfire Management Plan for Headland Park prepared by *Travers bushfire & ecology*.

Proposed development

The proposed lighting for the three (3) bitumen netball courts will consist of the following:

- 322W LED full cut-off floodlights with four (4) poles per court, each pole 8m high
- each court shall be individually switched using the E-State Automation SMS control system.

The Drill Hall Common is owned by the *Sydney Harbour Federation Trust (SHFT)* and sits within the Management Plan – Mosman No. 6 Mosman Drill Hall Precinct.

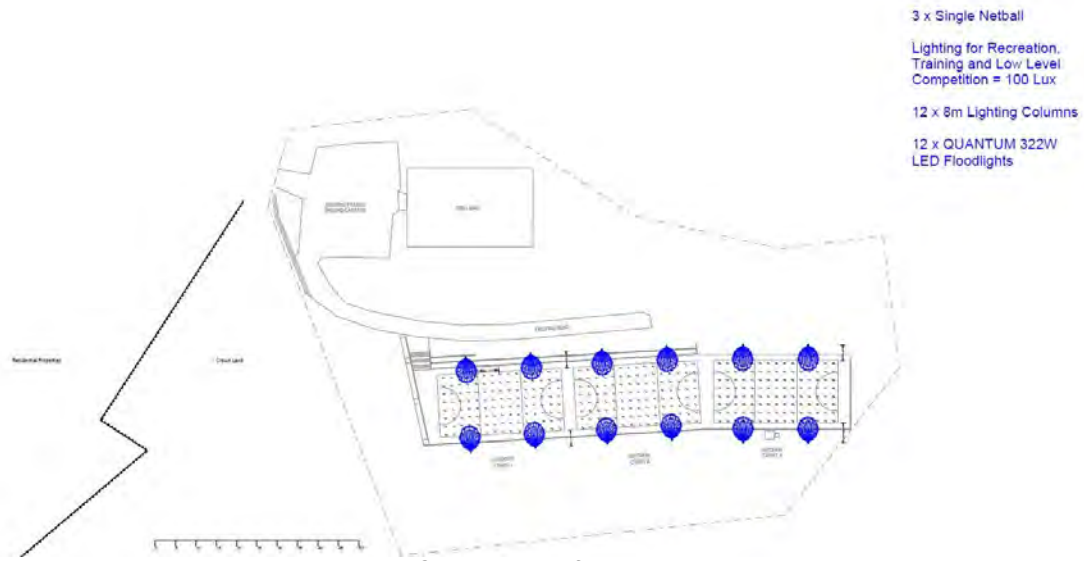


Figure 1 – Site plan with floodlighting location
(source: Webb Australia, project M252B, 21/8/2017)

TBE Environmental Pty Ltd
ABN 85 624 419 870
PO Box 7138
Kariong NSW 2250

38A The Avenue
Mt Penang Parklands
Central Coast Highway
Kariong NSW 2250

t: 02 4340 5331
e: info@traversecology.com.au
www.traversecology.com.au

Figure 2 – Aerial location
(source: *NearMap*, July 2019)

Bushfire assessment

We can advise that the Drill Hall Common is located on land mapped by Mosman Council as being bushfire prone. As a result, Section 4.14 of the *Environmental Planning and Assessment Act 1979* triggers an assessment against *Planning for Bush Fire Protection (PBP)* for any development application associated with the site.

Whilst *PBP* mainly focuses on development applications associated with subdivisions, special fire protection purpose developments and infill development, the document lists the following general objectives that must be achieved for all development;

1. Afford occupants of any building adequate protection from exposure to a bushfire.
2. Provide for a defendable space to be located around buildings.
3. Provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent direct flame contact and material ignition.
4. Ensure that safe operational access and egress for emergency service personnel and residents is available.
5. Provide for ongoing management and maintenance of bushfire protection measures, including fuel loads in the asset protection zone (APZ).
6. Ensure that utility services are adequate to meet the needs of fire fighters (and others who may assist in bushfire fighting).

The proposed flood lights are not a building. They are classified as a Class 10b structure under the *National Construction Code (NCC)*. Under *PBP* there are no bushfire protection requirements for Class 10b structures located more than 6m from a dwelling in bushfire prone areas. Where a Class 10b structure is located within 6m of a dwelling it must be constructed in accordance with the *NCC*.

Travers bushfire & ecology was engaged by *Sydney Harbour Federation Trust to* prepare a bushfire management plan for the broader Headland Park in August 2016. The following figure, which depicts the existing and recommended asset protection zone adjacent to the drill hall and sports facility, has been extracted from this plan.

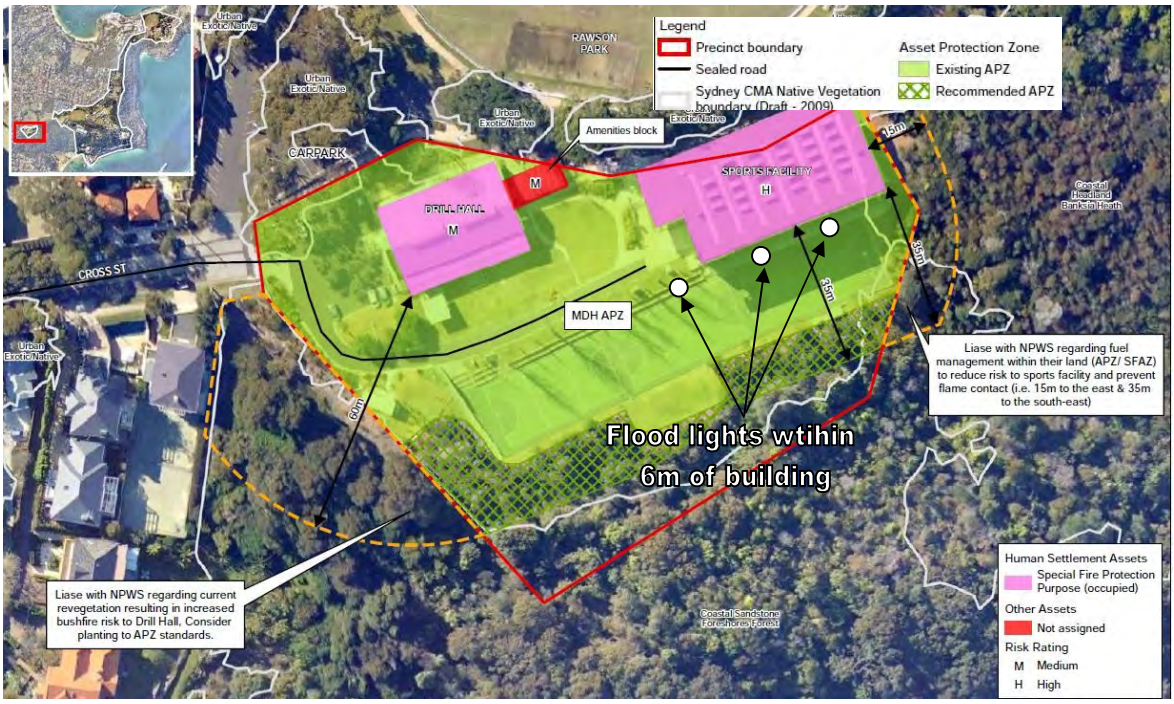


Figure 3 – Mosman Drill Hall Precinct
(source: Bushfire Management Plan, prepared by *Travers bushfire & ecology*, August 2016)

The proposed floodlights are located within the existing asset protection zone and adjacent to the bitumen netball courts. Whilst the majority of the lights are located over 6m from buildings there will be three (3) lights (white dots in Figure 3) located within 6m of the sports facility.

These three (3) floodlights will be constructed with non-combustible material and are provided with an adequate cleared area (i.e. APZ) of at least 15m from unmanaged vegetation to the east.

Accordingly, *Travers bushfire & ecology* can confirm that the proposed development complies with the aims and objectives of *Planning for Bush Fire Protection 2006* with the provision of adequate defendable space and appropriate construction material so as not to pose a bushfire risk to the sporting facility.

Should you require further assistance please contact the undersigned on 02 4340 5331 or at info@traversecology.com.au.

Yours faithfully

Nicole van Dorst
BA Sc. / Grad Dip / BPAD-Level 3-23610 (FPA)
Manager, Bushfire Services – ***Travers bushfire & ecology***

John Travers and Nicole van Dorst are BPAD consultants. Both are certified by the Fire Protection Association. FPA Australia administers the Bushfire Planning and Design (BPAD) Accreditation Scheme. The Scheme accredits consultants who offer bushfire assessment, planning, design and advice services. It accredits practitioners who meet criteria based on specific accreditation and competency requirements, including a detailed knowledge of the relevant planning, development and building legislation for each State and Territory. Through the Accreditation Scheme, BPAD Accredited Practitioners are recognised by industry, regulators, fire agencies, end-users and the community as providers of professional bushfire assessment, planning, design and advice services. The Scheme provides an enhanced level of confidence for government and the community that practitioners are accredited by a suitably robust scheme that is administered by the peak national body for fire safety. Note: L3 is the highest level and L1 is the lowest level.

Appendix 8.

LETTER

Transport Engineering

REF: N156061

DATE: 2 May 2019

Mosman Municipal Council
Civic Centre, Mosman Square
SPIT JUNCTION NSW 2088

Attention: Mr Christopher Saunders

Dear Christopher,

RE: MOSMAN DRILL HALL PRECINCT – TRANSPORT ASSESSMENT ADDENDUM

The Sydney Harbour Federation Trust (Harbour Trust) owns the Mosman Drill Hall Precinct (Precinct), approximately one-hectare of land located on the ridge of Middle Head in Mosman, formally known as Lot 2 in DP 541799. GTA Consultants (GTA) completed a transport impact assessment (Attachment 1) for the Precinct in August 2018 with the purpose of informing an update of the Management Plan of the Precinct which was previously adopted in May 2006. The transport impact assessment was required due to transport and parking conditions and activities surrounding the Precinct having changed, with three outdoor hardcourts and an indoor multipurpose sports hall (Marie Bashir Sports Centre) now located in the Precinct. The Drill Hall is now also used for out of school hours care, private functions and community facilities. The transport assessment also outlined the anticipated traffic and parking impact of a proposal by Mosman Municipal Council (Council) to install floodlights for the outdoor netball courts, allowing netball training to extend into the evening, while also recommending mitigation measures to reduce the impact of the proposal.

Council has now implemented some of the management measures recommended in the original transport assessment and has engaged GTA to a prepare a subsequent transport and parking assessment to understand the impact that the management measures have had. The following measures have been implemented around the Precinct:

- Enforcement of one-way clockwise circulation around the Rawson Oval car park (Figure 1)
- Provision of two pick-up/ drop-off bays on the northern side of the Rawson Oval car park (Figure 2)
- Provision of lighting at the stairs connecting Rawson Oval with Alexander Avenue.

Figure 1: One-way circulation through Rawson Oval car park

VIC | NSW | QLD | SA | WA
Level 16, 207 Kent Street
SYDNEY NSW 2000
t// +612 8448 1800
ABN 31 131 369 376
www.gta.com.au

Figure 2: Pickup/ drop-off area in Rawson Oval car park

Development Proposal

It was previously understood that the extension in training hours as a result of installation of the new floodlights would allow for more training sessions to be held between 5:30pm and 8:30pm. Council has since advised that the number of people would not increase under the proposal, but rather allow for the length of each training session to be increased to 1.5 hours long from the existing 45 minute sessions. By having training up until 8:30pm, it would also allow training sessions to be offset by 15 minutes to reduce the overlap with teams arriving and departing at the same time.

An indicative schedule under the proposal is provided in Table 1.

Table 1: Indicative training schedule

Session	Start	End
Session 1	3:30pm	5:00pm
Session 2	5:15pm	6:45pm
Session 3	7:00pm	8:30pm

Car Parking Assessment

Consistent with the original transport assessment, it is estimated that the courts generate a parking demand of 10 spaces per court. With the staggering of training sessions by 15 minutes, each session would be expected to generate a parking demand of 30 vehicles. This is compared to the 60 spaces that was previously estimated which assumed training sessions would run sequentially after each other without a break in between, causing an overlap in parking demand between people arriving before the previous team departs.

Considering the number of vacant car parking spaces captured in the weekday parking surveys completed in July 2018, it was estimated that a minimum 37 spaces would be available in the Rawson Oval and Precinct car parks and on-street along Cross Street during the evening period after the existing netball activity subsides. It is understood that five spaces have been removed from the Rawson Oval car park as a result of improving circulation through the car park. Considering this, the anticipated demand of 30 parking spaces per session could still be accommodated within the available car parking supply during the extended training hours.

It is noted that with the extension of training sessions from 45 mins to 1.5 hours long, it is likely that parking demand could potentially decrease below the 10 car parking spaces per court per session, with more parents/ carers likely to drop off children and come back at the end of the session to pick up rather than staying for the whole session. As such, the estimated demand of 30 car parking spaces is considered conservative.

Traffic Impact Assessment

It is expected that the netball courts would generate up to 60 vehicles parking per hour (30 parked vehicles leaving after a session and 30 vehicles arriving for the next session in the 15 minute offset) during the weekday evening periods when training is extended to 8:30pm. During the surveyed period in July 2018, 35 users were seen to be dropped off without parking over a two-hour period between 3:30pm and 5:30pm on a weekday evening. These drop offs usually involved more than one person being dropped off per vehicle, with up to four people seen getting out of one car. Conservatively assuming an occupancy rate of 1.5 people getting dropped off per car, this equates to approximately 12 vehicles per hour. Based on the above, it is anticipated that up to 72 vehicles (84 vehicle movements) per hour could be expected during the extended training hours, with 60 vehicles parking (60 movements) and 12 vehicles dropping passengers off (24 vehicle movements) per hour. This is consistent with the original transport assessment, however noting that the proposed offset between training sessions would assist in distributing the peak traffic demand over a 15 minute period as opposed existing conditions where one session finishes as the next one starts.

It is worth noting that these trips would not cause an increase in the existing peak traffic generated by the netball courts. Rather, the proposed lighting of the courts would distribute the existing netball related traffic over a longer period of time, therefore reducing peak hour traffic and increasing traffic after 6pm. As the extended weekday training periods would occur outside of the typical weekday evening commuter peak periods the conditions for the Precinct and broader external road network would improve. This is confirmed by traffic counts that indicated that traffic volumes along surrounding roads reduce significantly after 6pm.

The anticipated additional traffic generated (after 6pm) from the netball courts has been used to assess the environmental capacity of the surrounding road network later in the evening. It has been assumed all vehicles associated with the netball courts will travel along Cross Street and Bradleys Head Road only.

The environmental capacity assessment is shown in Error! Reference source not found.

Table 2: Environmental capacity assessment (after 6pm)

Road	Classification	Environmental threshold (veh/h)	Average weekday peak traffic volume after 6pm (veh/h)	Additional traffic from netball courts (movements/h)	Total future weekday peak traffic volume (veh/h)
Cross Street	Residential local street	300	79	+84	163
Bradleys Head Road	Residential collector street	500	285	+84	369

As shown in Table 2, Cross Street is expected to remain within the environmental goal of 200 vehicles per hour and well within the maximum threshold of 300 vehicles per hour. Bradleys Head Road is expected to slightly exceed the environmental goal of 300 vehicles per hour however remain within the maximum threshold of 500 vehicles per hour.

Based on the above, it is expected that the surrounding roads are expected to remain within their maximum environmental capacities with the redistribution of existing netball traffic to later in the afternoon/ night. Traffic on Cross Street and Bradleys Head Road will likely decrease in the afternoon period prior to 6pm as a result of some teams now training after this period under the proposal.

Management Measures

As mentioned previously, physical management measures have been implemented by Council including the provision of two drop off/ pick up bays in the northern section of the Rawson Oval car park as well as provision of linemarking in the Rawson Oval car park to enforce one-way clockwise circulation around the car park. To accommodate the one-way circulation, some of the angled parking spaces in the centre of the car park were re-marked to allow easy entry to clockwise circulating vehicles. It is understood that the angled spaces in the car park were also widened in line with AS/NZS 2890.1:2004. These modifications resulted in a loss of five car parking spaces, while two new motorcycle spaces have been provided. Lighting has also been installed on the stairs that link Rawson Oval to Alexander Avenue.

GTA completed a site visit on 30 April 2018 to observe the benefit of the implemented management measures. The Rawson Oval car park was observed to operate more efficiently, with less conflicts between vehicles circulating the car park. The two drop-off/ pick-up bays were found to be highly utilised particularly during changeover times between training sessions, with many children being dropped off in this location choosing to walk down to the netball courts via the footpaths along the northern and eastern sides of the Drill Hall building, a much more desired outcome than walking through the car park and along Cross Street. The new linemarking also allows for vehicles to easily re-circulate around the car park again if drivers aren't able to find a vacant space on the first lap around the car park rather than holding up traffic. This is demonstrated in Figure 3.

Figure 3: Linemarking allows for drivers to recirculate the car park

During the site visit, there was also some junior rugby training activity that commenced around 6pm. Although the number of people training on Rawson Oval was limited, it is likely that the implemented lighting at the stairs on the northern side of Rawson Oval will help encourage more users of Rawson Oval to park on Alexander Avenue if they drive to the Precinct, alleviating parking demand to the south of the oval.

The following management measures could be implemented to further improve the transport and parking arrangement in the Precinct under the proposal:

- advise the Rugby Club to encourage players to park on Alexander Avenue when driving to the site
- advise the Rugby Club to hold their training sessions on the northern side of Rawson Oval, to encourage players to park on Alexander Avenue
- coordinating netball and rugby sessions to not start and finish at the same time where possible.

Conclusion

Based on the analysis and discussions presented within this report, the following conclusions are made:

1. The proposed installation of floodlighting would not result in an increase in visitors to the Precinct, but rather distribute existing visitation numbers to later in the weekday afternoon/ night.
2. Physical management measures have been implemented since GTA's previous assessment including enforcement of one-way circulation of the Rawson Oval car park, provision of two drop-off/ pick-up spaces in the Rawson Oval car park and installation of lighting on the stairs linking Rawson Oval to Alexander Avenue.

3. The proposal will result in an anticipated parking demand of 30 spaces per session displaced to later in the afternoon/ night, with this to be accommodated within the available car parking supply south of Rawson Oval.
4. Cross Street and Bradleys Head Road will likely experience less traffic before 6pm as a result of the extension to training hours, and an increase in traffic on these roads after 6pm however will remain within the relevant environmental thresholds for these roads.
5. The management measures that have been implemented following GTA's previous assessment have benefited the Precinct in making vehicle circulation of the Rawson Oval car park more efficient and pick-up/ drop-off activity safer.
6. The extended weekday training periods would occur outside of the typical weekday evening commuter peak periods and as such would result in improved conditions for the Precinct and broader external road network.
7. The proposed extension to netball training times to 8:30pm is supported from a transport and parking perspective with the provision of a 15 minute offset between training sessions.
8. Further management measures post implementation of the increased training hours could further improve the transport and parking arrangement in the area, including encouraging rugby players to park on Alexander Avenue and avoiding overlaps in netball and rugby training start and finish times.

I trust the above assessment provides the necessary information. Should you have any questions or require any further information, please do not hesitate to contact me on (02) 8448 1800.

Yours sincerely

GTA CONSULTANTS

Karen McNatty
Associate Director

encl.
Attachment 1 - Mosman Drill Hall Precinct Transport Impact Assessment (GTA, August 2018)

ATTACHMENT 1

Mosman Drill Hall Precinct Transport Impact Assessment (GTA, August 2018)

Mosman Drill Hall Precinct
Transport Impact Assessment

Client //	Sydney Harbour Federation Trust
Office //	NSW
Reference //	N156060
Date //	30/08/18

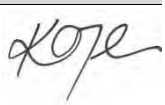
Mosman Drill Hall Precinct

Transport Impact Assessment

Issue: A 30/08/18

Client: Sydney Harbour Federation Trust
Reference: N156060
GTA Consultants Office: NSW

Quality Record

Issue	Date	Description	Prepared By	Checked By	Approved By	Signed
A	30/08/18	Final	Mackenzie Brinums	Karen McNatty	Karen McNatty	

GTAconsultants
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Canberra | Adelaide | Perth

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Appendices

Figures

Tables

1. Introduction

1.1 Background

The Sydney Harbour Federation Trust (Harbour Trust) owns the Mosman Drill Hall Precinct (Precinct), an approximately one-hectare piece of land located on the ridge of Middle Head in Mosman, formally known as Lot 2 in DP 541799. In 2006, a Management Plan was prepared for the Precinct with the aim of facilitating the adaptive re-use of the former Drill Hall for appropriate uses and the relocation of netball courts from Rawson Park. The Management Plan was adopted by the Harbour Trust on 24 May 2006.

Since 2006, much of the transport and parking conditions and activities surrounding the Precinct has changed. The six grass netball courts that were located to the east of Rawson Oval have now been removed and replaced in the form of three outdoor hardcourts and an indoor multipurpose sports hall (Marie Bashir Sports Centre) in the Precinct. The Drill Hall is now also used for out of school hours care, private functions and community facilities.

Given the changes to the site and surrounding area, the Harbour Trust are seeking to update the Management Plan for the Precinct. It is understood that the Harbour Trust are also looking to understand the traffic and parking impact of a proposal by Mosman Council to install floodlights for the outdoor netball courts, allowing netball training to extend into the evening.

The Harbour Trust engaged GTA Consultants (GTA) to prepare a transport and parking assessment to inform the updated Management Plan and assess the impact of the increased netball training times. Given the proximity of the outdoor netball courts to the surrounding sporting facilities, in particularly Rawson Oval which is managed by Mosman Council, a holistic approach was taken by assessing the wider area to identify opportunities for coordinated traffic and parking management between the facilities.

1.2 Purpose of this Report

This report sets out an assessment of the anticipated transport implications of the proposed lighting of the outdoor courts, including consideration of the following:

i existing traffic and parking conditions surrounding the site
ii suitability of the current parking supply
iii the traffic generating characteristics of the extended netball training times
iv suitability of the access arrangements for the site
v the transport impact of the extended netball training times on the surrounding road network.

1.3 References

In preparing this report, reference has been made to the following:

- an inspection of the site and its surrounds
- traffic and car parking surveys undertaken by Matrix as referenced in the context of this report
- other documents and data as referenced in this report.

2. Existing Conditions

The site (Lot 2 in DP 541799) is located at the end of Cross Street in Mosman and is owned by the Harbour Trust however is leased by Mosman Council on a long-term basis. It is located within a surrounding sporting precinct catchment, with Rawson Oval, the Mosman Croquet Club and Rawson Park Tennis Centre located adjacent to the north of the site.

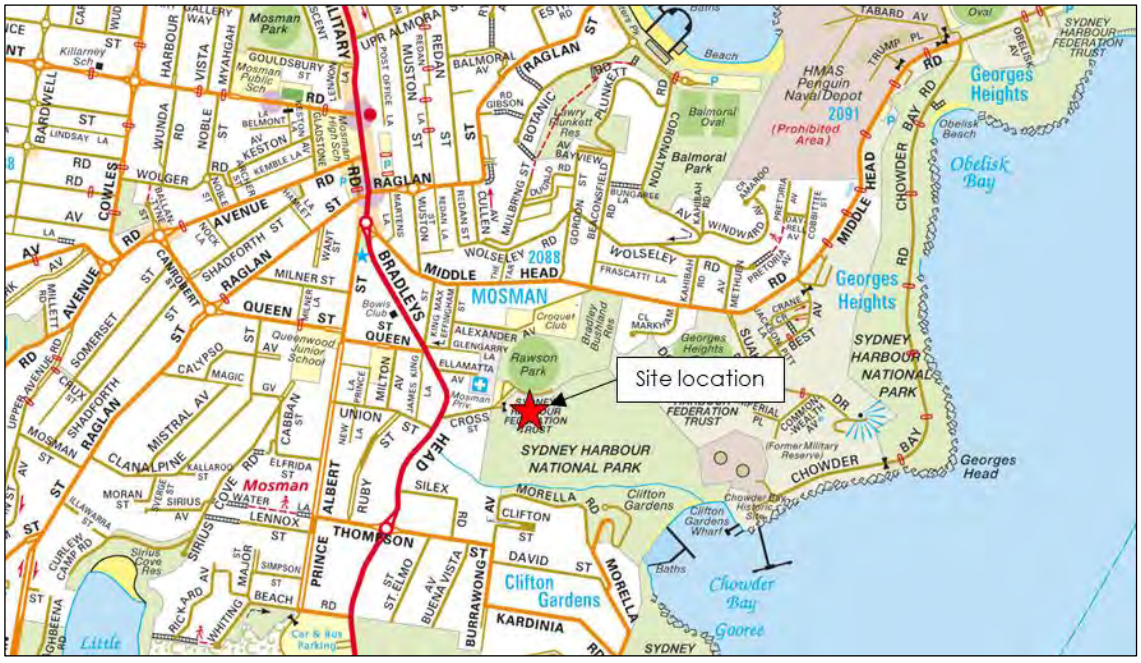
The Precinct's outdoor netball courts are likely to experience peak usage during the middle of the year, as the main netball season is over the winter season. During the summer season, it is not expected that the proposed introduction of lighting would result in any change in evening usage of the outdoor courts, given that the courts would already be usable due to the extended hours of daylight during summer. During the winter period, other activities within and surrounding the Precinct that occur on weekday afternoons generally include the following:

- outside-of-school hours care in the Drill Hall building
- indoor sports within the Marie Bashir Sports Centre
- both junior and senior rugby training and rugby at Rawson Oval
- walkers and runners in Rawson Park
- croquet at Mosman Croquet Club
- tennis at Rawson Park Tennis Centre.

Other surrounding properties predominantly include low density residential uses. Mosman Private Hospital is also located northeast of the site.

The location of the subject site and its surrounding environs is shown in Figure 2.1.

Figure 2.1: Subject site and its environs



Base image source: Sydway

2.1 Road Network

2.1.1 Road Hierarchy

Roads are classified according to the functions they perform. The main purpose of defining a road's functional class is to provide a basis for establishing the policies which guide the management of the road according to their intended service or qualities.

In terms of functional road classification, State roads are strategically important as they form the primary network used for the movement of people and goods between regions, and throughout the State. Roads and Maritime Services (Roads and Maritime) is responsible for funding, prioritising and carrying out works on State roads. State roads generally include roads classified as freeways, state highways, and main roads under the Roads Act 1993, and the regulation to manage the road system is stated in the Australian Road Rules, most recently amended on 19 March 2018.

Roads and Maritime defines four levels in a typical functional road hierarchy, ranking from high mobility and low accessibility, to high accessibility and low mobility. These road classes are:

Arterial Roads – Controlled by Roads and Maritime, typically no limit in flow and designed to carry vehicles long distance between regional centres.

Sub-Arterial Roads – Managed by either Council or Roads and Maritime under a joint agreement. Typically, their operating capacity ranges between 10,000 and 20,000 vehicles per day, and their aim is to carry through traffic between specific areas in a sub region or provide connectivity from arterial road routes (regional links).

Collector Roads – Provide connectivity between local sites and the sub-arterial road network, and typically carry between 2,000 and 10,000 vehicles per day.

Local Roads – Provide direct access to properties and the collector road system and typically carry between 500 and 4,000 vehicles per day.

2.1.2 Surrounding Road Network

Cross Street

Cross Street functions as a local road and is aligned in an east-west direction, connected with the site on its western boundary. It is a two-way road with one lane in each direction, set within a carriageway of around 12-metres and a 20-metre wide road reserve.

Unrestricted kerbside parking is permitted on both sides of the road. Cross Street is sign posted as 50 kilometres per hour and has bicycle markings to advise of mixed users.

Cross Street is shown in Figure 2.2 and carries approximately 900 vehicles per day. The Precinct site access from Cross Street is shown in Figure 2.3.

Figure 2.2: Cross Street (looking west)

Figure 2.3: Mosman Drill Hall Precinct Access

Bradleys Head Road

Bradleys Head Road is a State controlled regional road that functions as a collector road and is aligned in a north-south direction to the west of the site. It is a two-way road with one lane in each direction, set within a carriageway of around 12-metres and 20-metre wide road reserve.

Unrestricted kerbside parking is permitted on both sides of the road. Bradleys Head Road is sign posted as 50 kilometres per hour and near the site has a separated bicycle lane on the western side of the road while the southbound traffic lane has bicycle line marking.

Bradleys Head Road carries around 5,900 vehicles per day.

Alexander Avenue

Alexander Avenue functions as a local road and is aligned in an east-west direction to the north of the site adjacent to Rawson Oval. It is a two-way road with one lane in each direction, set within a carriageway of around seven metres.

Unrestricted kerbside parking is generally only permitted on the southern side of the road, with 16 90-degree angled parking spaces also provided at the western end of Alexander Avenue near the croquet club and tennis courts. Alexander Avenue has a sign posted speed limit of 50 kilometres per hour.

Alexander Avenue is shown in Figure 2.4 and Figure 2.5 and carries approximately 400 vehicles per day.

Figure 2.4: Alexander Avenue (looking east)

Figure 2.5: Alexander Avenue (looking west)

Croquet Lane

Croquet Lane functions as a local road and is generally aligned in an east-west direction to the north and between the croquet fields. It is a two-way road with one lane in each direction, set within a carriageway of around six metres.

Unrestricted kerbside parking is only permitted on the northern side of the road to the north of the croquet fields, with 17 90-degree angled parking spaces also provided on the western side of the road between the fields. Croquet Lane has a sign posted speed limit of 50 kilometres per hour.

Croquet Lane is shown in Figure 2.6 and carries approximately 200 vehicles per day.

Figure 2.6: Croquet Lane

2.2 Traffic Volumes

GTA commissioned seven-day Automatic Traffic Counters (ATCs) a typical week[1] to understand traffic volumes on key roads surrounding the Precinct.

The location of where the ATCs were placed are shown in Figure 2.7, while a summary of the daily traffic volumes at these locations is provided in Figure 2.8.

[1] Cross Street, Alexander Avenue and Croquet Lane surveys were completed from 30 July 2018 to 5 August 2018. Bradleys Head Road surveys were completed from 8 August 2018 to 13 August 2018.

Figure 2.7: ATC locations

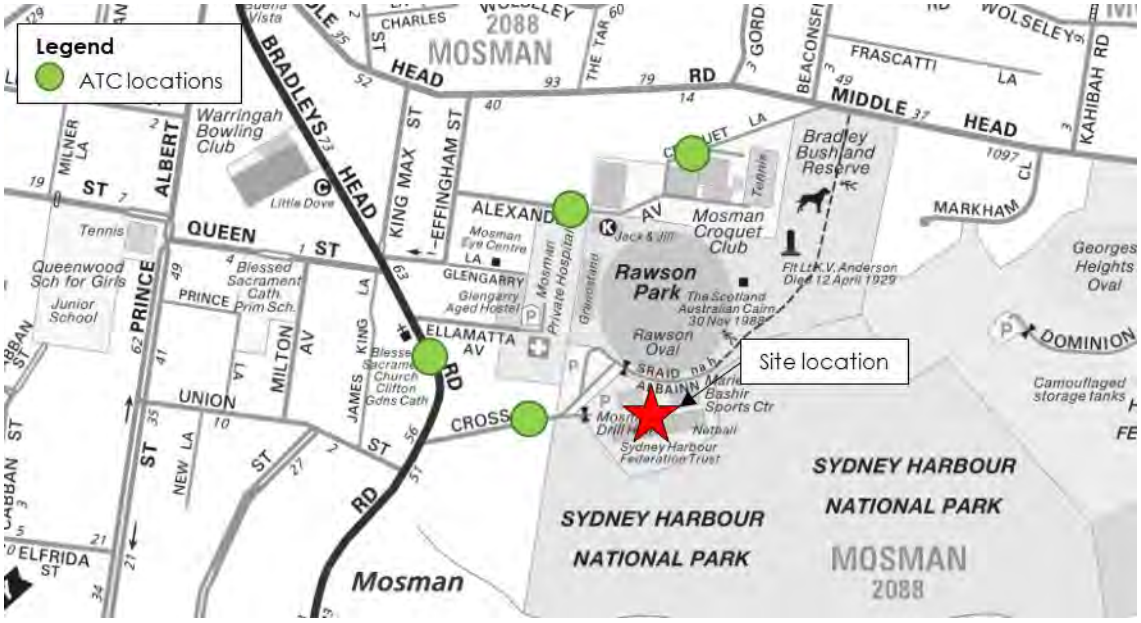
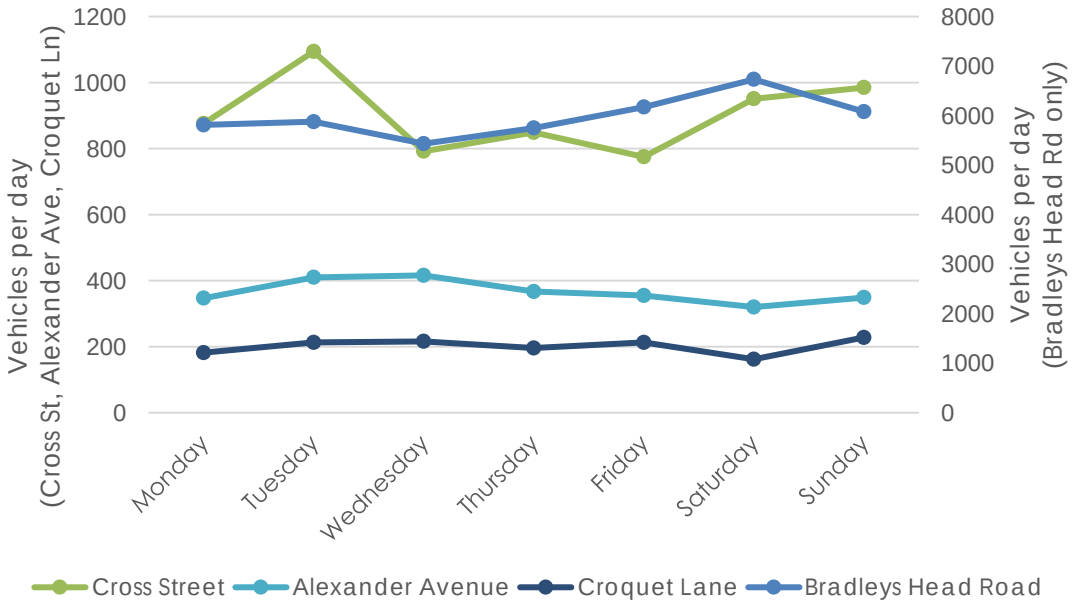


Figure 2.8: ATC daily traffic volumes



2.2.1 Environmental Capacity

The Roads and Maritime Guide to Traffic Generating Developments (Guide) 2002 details Environmental Capacity as the performance standard to assess residential streets which are summarised in Table 2.1.

Table 2.1: Environmental capacity performance standards on residential street

Road class	Road type	Maximum speed (km/h)[1]	Maximum peak hour volumes (veh/h)
Local	Access way	25	100
	Street	40	200 environmental goal
			300 maximum
Collector	Street	50	300 environmental goal
			500 maximum

[1] Maximum speed relates to the 85th percentile speed in existing areas.

The surveyed roads have been assessed against the Guide's performance standards, as shown in Table 2.2.

Table 2.2: Environmental capacity assessment

Road	Classification	85th percentile speed (km/h)	Environmental threshold (veh/h)	Weekday average peak traffic volumes (veh/h)	Weekend average peak traffic volumes (veh/h)
Cross Street	Residential local street	37	300	154	104
Alexander Avenue	Residential local street	31	300	44	50
Croquet Lane	Residential local street	38	300	22	28
Bradleys Head Road	Residential collector street	50	500	471	596

Table 2.2 shows Cross Street, Alexander Avenue and Croquet Lane are all below the environmental goal of 200 vehicles per hour and well below the maximum of 300 vehicles per hour. Bradleys Head Road is within the maximum threshold during the weekday peak period, however exceeds the limit by around 100 vehicles per hour during the weekend peak period.

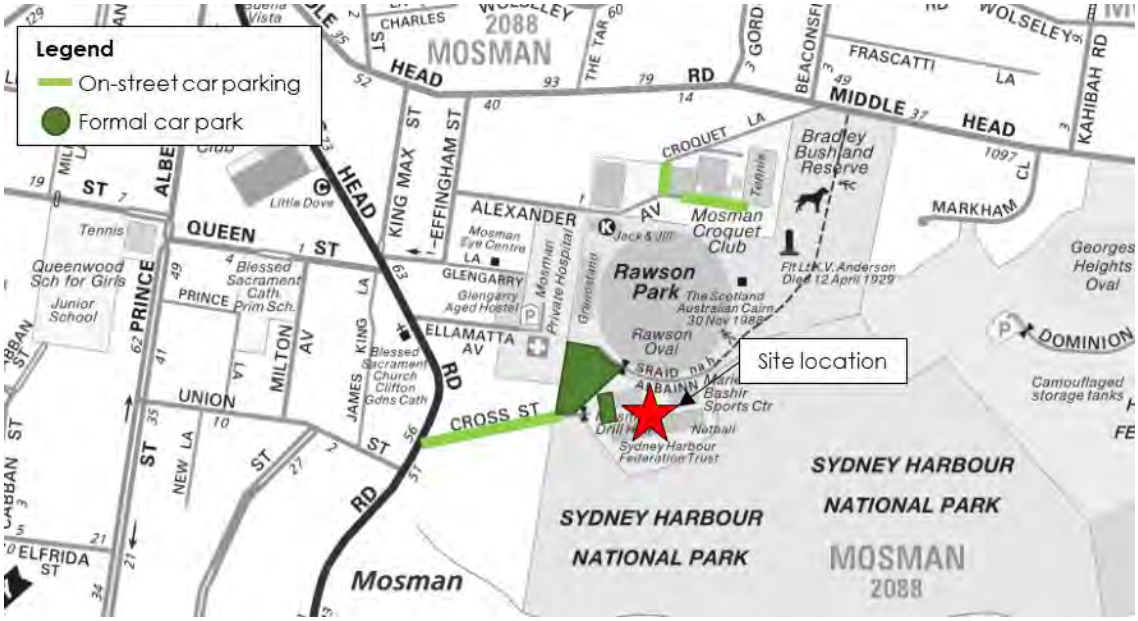
The full ATC results are presented in Appendix A of this report.

2.3 Car Parking

2.3.1 Supply

GTA compiled an inventory of car parking supply surrounding the site. The survey specifically identified the car parking supply which is easily accessible and likely to be used by visitors of the Precinct. The surveyed locations have been separated into two parking areas; parking to the south of Rawson Oval which is closer and requires less walking to the Precinct, and the 90-degree parking spaces north of Rawson Oval which is still within walking distance of the Precinct however is more likely to be used by the tennis/ croquet clubs and users of Rawson Oval. The surveyed locations are shown in Figure 2.9, while a summary of the traffic volumes at these locations is provided in Table 2.3.

Figure 2.9: Extent of parking study



Base image source: Sydway

Table 2.3: Surrounding car parking supply and restrictions

Location	Description	Restrictions	Car parking supply
South of Rawson Oval	Drill Hall car park	No restrictions	15
		Accessible	1
	Rawson Oval car park	No restrictions	39
		Accessible	1
	Cross Street	No restrictions	30
		Subtotal	86
North of Rawson Oval	Alexander Avenue	No restrictions	16
	Croquet Lane	No restrictions	17
		Subtotal	33
		Total	119

The Drill Hall and Rawson Oval car parks are the two main off-street car parks that provide parking to the Precinct and Rawson Oval, combining to provide a total of 56 spaces. The Drill Hall car park is configured with one-way clockwise circulation, with an internal access road connecting with the south of the car park currently functioning as a drop-off area for passengers arriving to the Precinct by car. The Rawson Oval car park is configured with two-way circulation despite its narrow circulation width. Pick-up and drop-off activity also often occurs within this car park, with drivers observed to use the circulation aisle around the car park or the entrance into the access road aligned along the northern boundary of the Precinct to pick-up and drop-off passengers. Drivers stopping in the circulation aisles were observed to cause internal congestion due to the narrow width of the aisles.

It should be noted that the 2006 Management Plan proposed to allow parking on the grassed area to the south of the Drill Hall building for occasional special events. The Trust have since advised that this is no longer considered appropriate as this area is now a high pedestrian area within the Precinct and is best managed as a pedestrian-only zone. This area has therefore not been considered as part of the surrounding car parking supply.

The full inventory of the car parking supply is presented in Appendix B of this report.

2.3.2 Demand

Car parking surveys were completed on Tuesday 31 July 2018 between 3pm and 10pm and on Saturday 4 August 2018 between 8am and 6pm for the studied area.

The full parking demand surveys are presented in Appendix B of this report.

Occupancy

The parking occupancy results are detailed in Table 2.4 to Table 2.7. The parking occupancy results are also shown indicatively in Figure 2.10 to Figure 2.13.

Table 2.4: Tuesday 31 July 2018 car parking demands south of Rawson Oval

Location	Car parking supply	3pm	4pm	5pm	6pm	7pm	8pm	9pm	10pm
Drill Hall car park	16	15	15	15	13	13	13	11	10
Rawson Oval car park	40	33	37	33	37	14	14	17	9
Cross Street	30	21	18	18	21	22	16	16	17
Total	86	69	70	66	71	49	43	44	36

Table 2.5: Tuesday 31 July 2018 car parking demands north of Rawson Oval

Location	Car parking supply	3pm	4pm	5pm	6pm	7pm	8pm	9pm	10pm
Alexander Avenue	16	12	11	12	10	8	10	5	0
Croquet Lane	17	11	10	13	6	6	5	5	5
Total	33	23	21	25	16	14	15	10	5

Table 2.6: Saturday 4 August 2018 car parking demands south of Rawson Oval

Location	Car parking supply	8am	9am	10am	11am	12pm	1pm	2pm	3pm	4pm	5pm	6pm
Drill Hall car park	16	6	16	16	2	4	10	15	15	15	13	9
Rawson Oval car park	40	11	34	34	6	7	15	28	33	33	32	18
Cross Street	30	17	27	27	15	15	23	27	27	25	24	18
Total	86	34	77	77	23	26	48	70	75	73	69	45

Table 2.7: Saturday 4 August 2018 car parking demands north of Rawson Oval

Location	Car parking supply	8am	9am	10am	11am	12pm	1pm	2pm	3pm	4pm	5pm	6pm
Alexander Avenue	16	8	10	8	11	7	8	12	13	14	9	3
Croquet Lane	17	3	6	4	4	4	7	10	14	16	11	4
Total	33	11	16	12	15	11	15	22	27	30	20	7

Figure 2.10: Tuesday 31 July 2018 car parking demands south of Rawson Oval

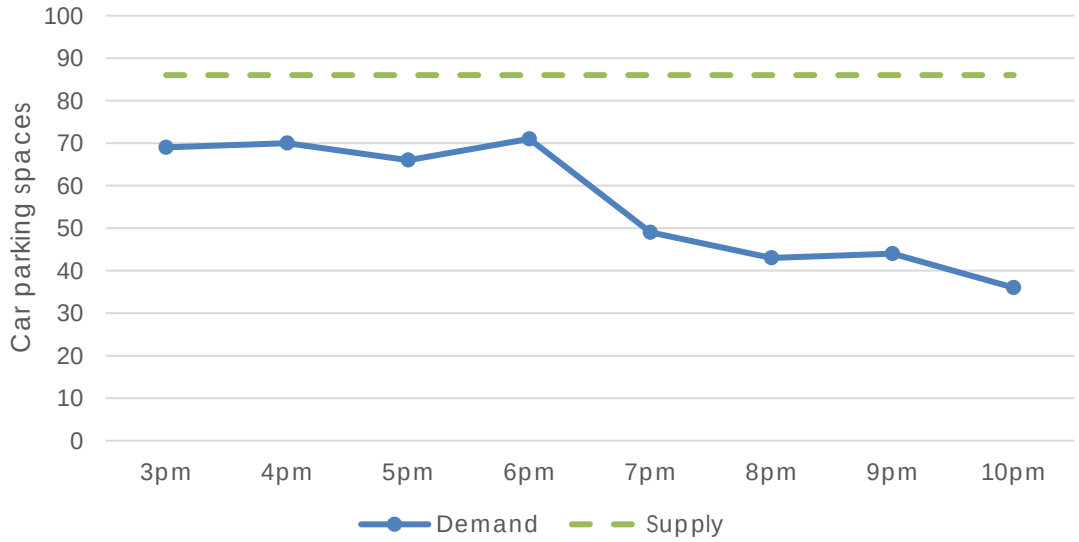


Figure 2.11: Tuesday 31 July 2018 car parking demands north of Rawson Oval

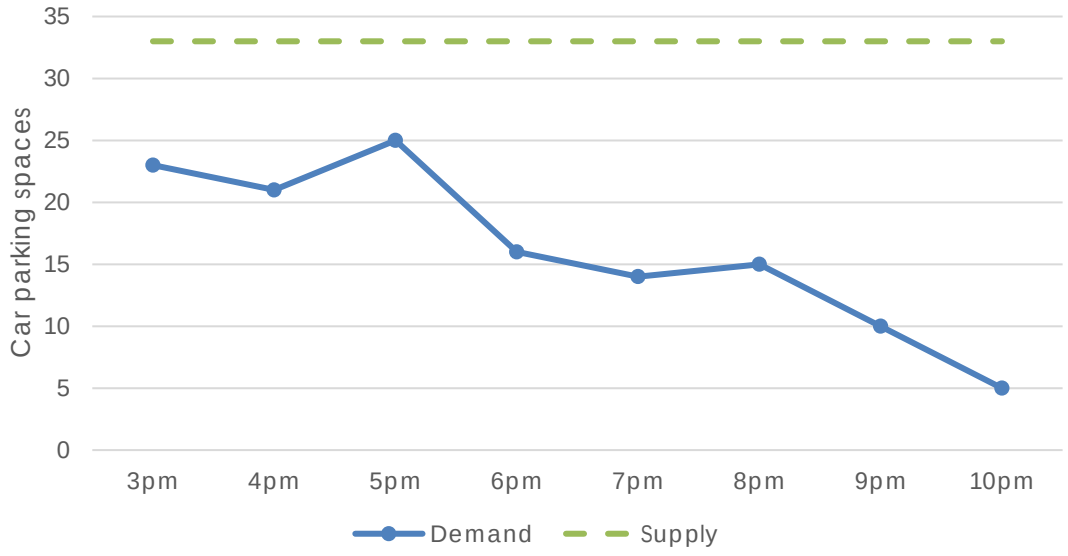


Figure 2.12: Saturday 4 August 2018 car parking demands south of Rawson Oval

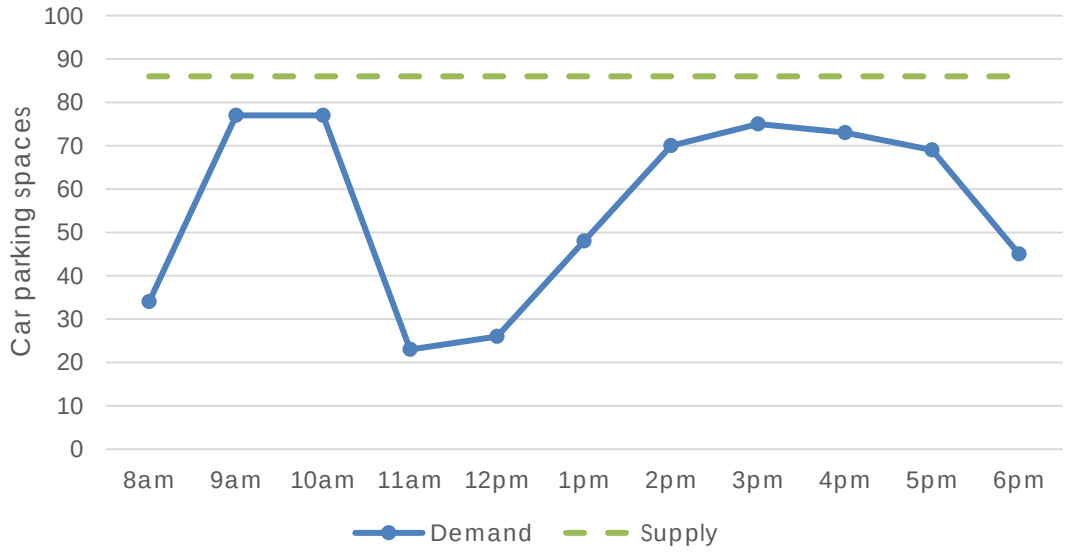
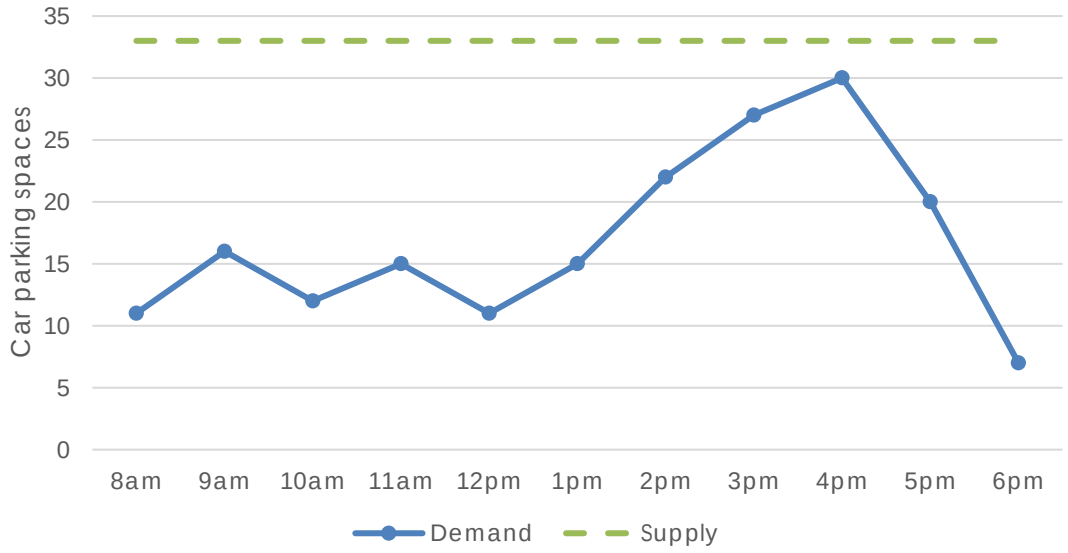


Figure 2.13: Saturday 4 August 2018 car parking demands north of Rawson Oval



The surveys indicate that the parking demands on a typical Tuesday are moderate, with the peak occupancy of the car parking supply south of Rawson Oval resulting in a minimum of 15 vacant spaces (83 per cent occupied), occurring at 6pm and corresponding to the Drill Hall outside of school hours care and sporting activity pickup. Once the Drill Hall outside of school hours care finishes at 6pm, parking demand was observed to decline. Peak occupancy for the car parking supply to the north of Rawson Oval occurred at 5pm and resulted in a minimum of eight vacant spaces (76 per cent occupied).

Parking demands on the Saturday to the south of Rawson Oval was observed to be high, with peak occupancy occurring between 9am and 10am resulting in nine vacancies (90 per cent occupied). Parking demand on the Saturday in the car parking supply to the north of Rawson Oval was observed to be moderate throughout most of the day, with peak demand occurring at 4pm resulting in a minimum of three vacant spaces (91 per cent occupied).

It should be noted that although the car parking demand surveys do not indicate the Drill Hall and Rawson Oval car parks reaching capacity, on-site observations indicate that these car parks were operating over capacity during crossovers between sports training sessions, with drivers seen to double park or circulate the car park while waiting for car parking spaces to become vacant.

Duration of Stay

In addition to car parking demand surveys, parking turnover/ duration of stay surveys were also undertaken. These surveys help understand whether on-street car parking demands are short-stay (parked for under two-hours) or long-stay (parked for over two-hours) demands. A summary of the duration of stay of parked vehicles in the surveyed parking areas around the Precinct on Tuesday 31 July 2018 and Saturday 4 August 2018 is shown in Figure 2.14 and Figure 2.15 respectively.

Figure 2.14: Tuesday 31 July 2018 car parking duration of stay

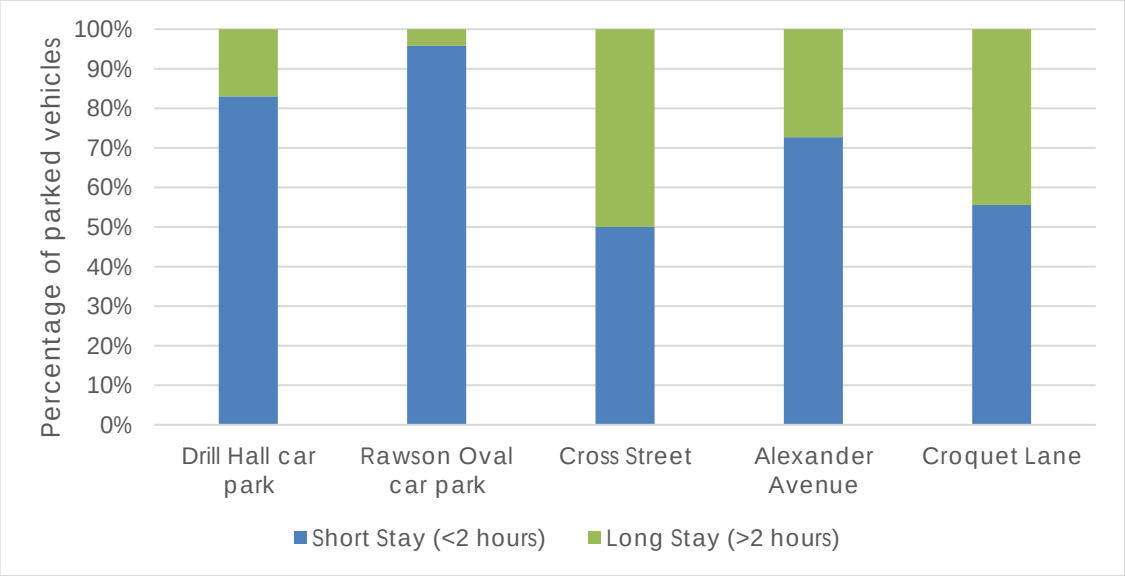
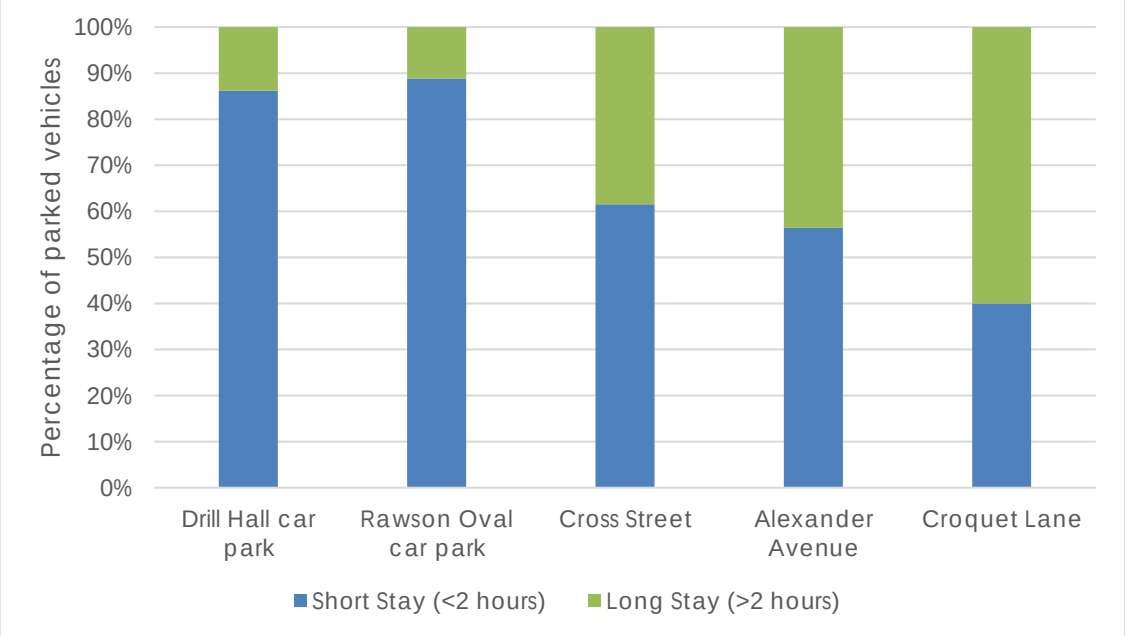


Figure 2.15: Saturday 4 August 2018 car parking duration of stay



The results indicate that most vehicles parking in the Precinct and Rawson Oval car parks are only short stay parking, whereas roads further away from the Precinct identified more long-stay parking, most likely related to the residential parking. Overall, 89 per cent and 87 per cent of off-street parking demands on the Tuesday and Saturday respectively were short-stay parking. In comparison, 59 per cent and 53 per cent of on-street parking demands on the Tuesday and Saturday respectively were short-stay parking.

2.4 Public Transport

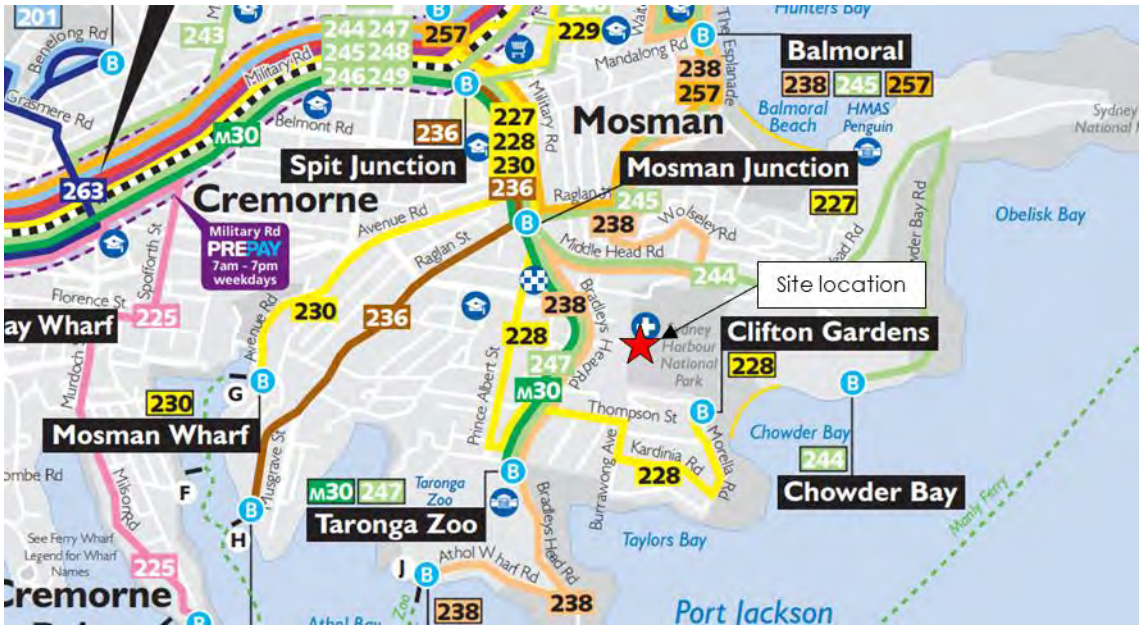
The site is serviced by the local bus network, with frequent buses provided in the peak hours. Buses servicing nearby roads to the site were generally found to stop at around 8pm.

A review of the public transport available near the site is summarised in Table 2.8.

Table 2.8: Public transport provision

Service	Route #	Route description	Location of stop	Distance to nearest stop	Frequency on/off peak
Bus	238	Taronga Zoo Wharf to Balmoral	Bradleys Head Road at Cross Street	200m	30 mins peak and off peak
	244	Chowder Bay Mosman to City Wynyard	Middle Head Road at Croquet Lane	300m	30 mins peak/ hourly off peak
	247	Taronga Zoo to City Wynyard via Mosman Junction	Bradleys Head Road at Cross Street (before 8am and after 8:30pm only) or Military Road at Raglan Street	200m or 650m	10-30 mins peak/ 30 mins off peak
	M30	Sydenham to Taronga Zoo	Bradleys Head Road at Cross Street	200m	10 mins peak/ 15 mins off peak

Figure 2.16: Surrounding public transport network



Source: https://transportnsw.info/document/1695/region-guide-sydney-northern-beaches-lower-north-shore.pdf, accessed 3 August 2018

2.5 Pedestrian Infrastructure

Well-established pedestrian paths are generally provided on both sides of the roads which link with the Precinct, with the exception of Alexander Avenue and Croquet Lane. A shared path is located between Rawson Oval and the Precinct starting from Cross Street and provides connection to other destinations in Middle Head, while also linking to other walking tracks to Chowder Bay and Balmoral.

Pedestrian connections between the Precinct and car parking along Alexander Avenue and Croquet Lane are provided along the northern and western sides of Rawson Oval. The northern connection is provided as an informal path and stairs, connecting to the angled car parking spaces at the eastern end of Alexander Avenue. The western connection is provided in the form of a concrete path and stairs which connects to Alexander Avenue, requiring all pedestrians to walk within the road carriageway. Both connections from Rawson Oval to Alexander Avenue do not provide any lighting and therefore do not provide good amenity to pedestrians at night.

The connections from Rawson Oval to Alexander Avenue are shown in Figure 2.17 and Figure 2.18.

Figure 2.17: Northern connection from Rawson Oval to Alexander Avenue

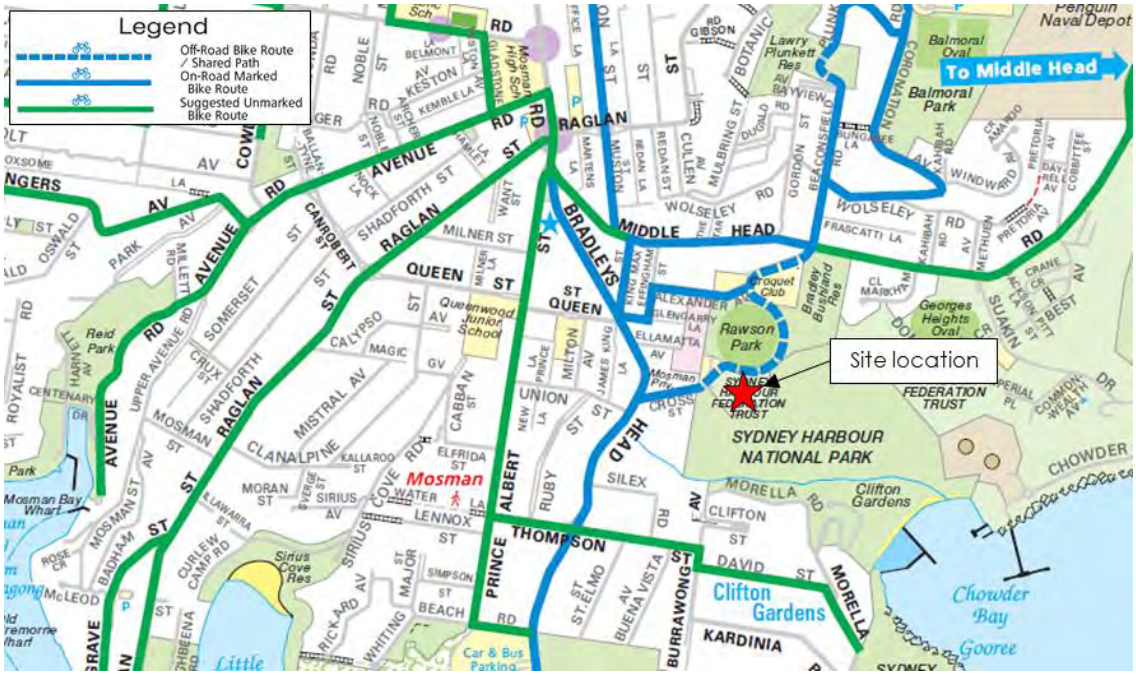
Figure 2.18: Western connection from Rawson Oval to Alexander Avenue

2.6 Cycle Infrastructure

The site is well serviced by cycling infrastructure, with many of the surrounding roads line marked with bicycle markings to inform drivers of cyclists. Roads surrounding the site that are marked as bicycle friendly roads include Cross Street, Alexander Avenue, a portion of Middle Head Road, Muston Road and Bradleys Head Road, which provides further connection to Sydney Harbour National Park and Taronga Zoo to the south. A shared path is also provided to the north of the Precinct adjacent to Rawson Oval.

The surrounding bicycle network is shown in Figure 2.19.

Figure 2.19: Surrounding bicycle network



Source: Northern Sydney Cycling Map, Mosman Council, accessed 3 August 2018

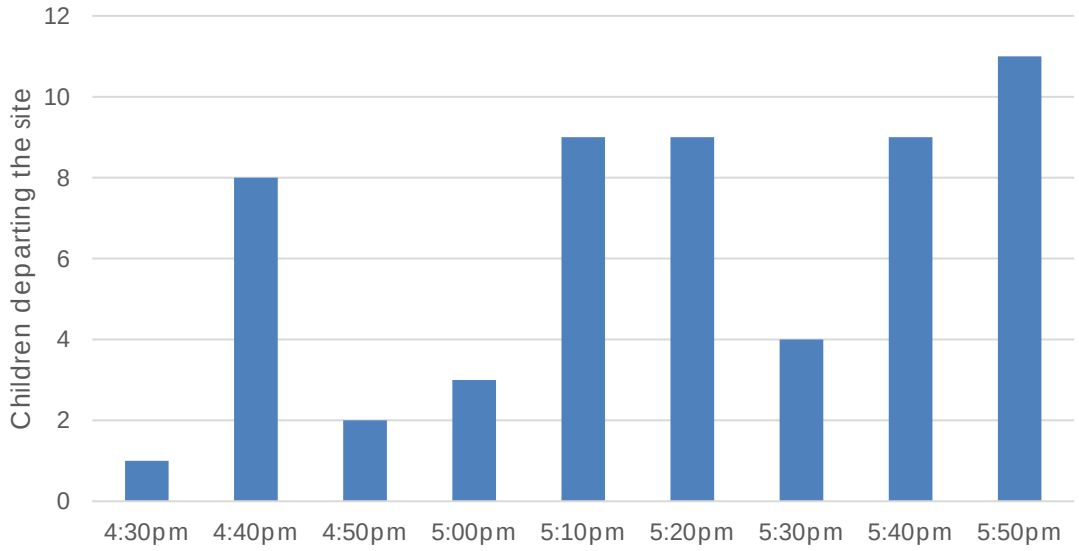
There are several Class 3 bicycle racks provided around the Precinct for visitors to the site, some of which are shown in Figure 2.20.

Figure 2.20: Class 3 bicycle racks outside Marie Bashir Mosman Sports Centre

2.7 Drill Hall Out of School Hours Care

The Drill Hall building within the Precinct is currently used for out of school hours care, specifically after school which operates to 6pm on weeknights. GTA was provided with a logbook of pick-up times for Tuesday 31 July 2018, with the profile of the number of children being picked-up shown in Figure 2.21.

Figure 2.21: Drill Hall out of school hours care pick-up profile for Tuesday 31 July 2018



As shown in Figure 2.21, the peak pick-up activity occurred in the 10-minute period between 5:50pm and 6pm with 11 children being collected, however the profile shows that pick-up activity is fairly consistent between 5:10pm and 6pm.

Further to this, the out of school hours care staff departures were also provided and are summarised in Table 2.9.

Table 2.9: Drill Hall out of school hours care staff departure times

Departure time	Number of staff
5:00pm-5:30pm	1
5:30pm-6:00pm	1
6:00pm-6:30pm	4
Total	6

Based on Table 2.9, peak staff departure times occur after 6pm. Combining both staff and children, the peak is identified as 12 people in a 10-minute period.

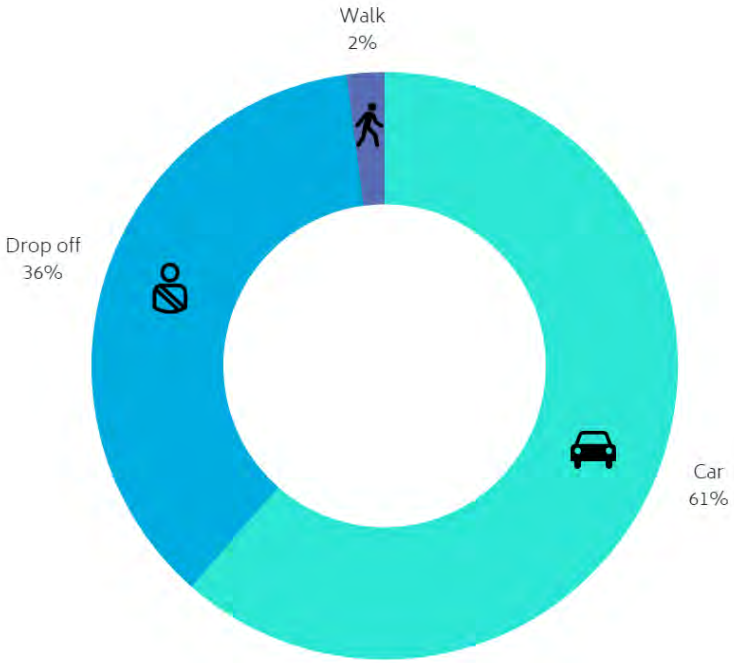
2.8 Mode Choice

Mode split interview surveys for the users of the outdoor netball courts were undertaken by GTA on Tuesday 31 July 2018, between 3pm and 6pm. The interview survey was conducted to understand the current travel modes for the netball courts on a training night.

Figure 2.22 indicates that travelling to the netball courts by private vehicle is the most popular mode choice of the 96 court users interviewed which accounts for 98 per cent, including 36 per cent being dropped off. The remaining two per cent accounts for users walking to the netball courts. It is expected that with the installation of floodlights for the netball courts to allow training

to continue later into the night, private vehicles will continue to remain as the most popular mode choice.

Figure 2.22: Travel modes by users to the existing netball courts



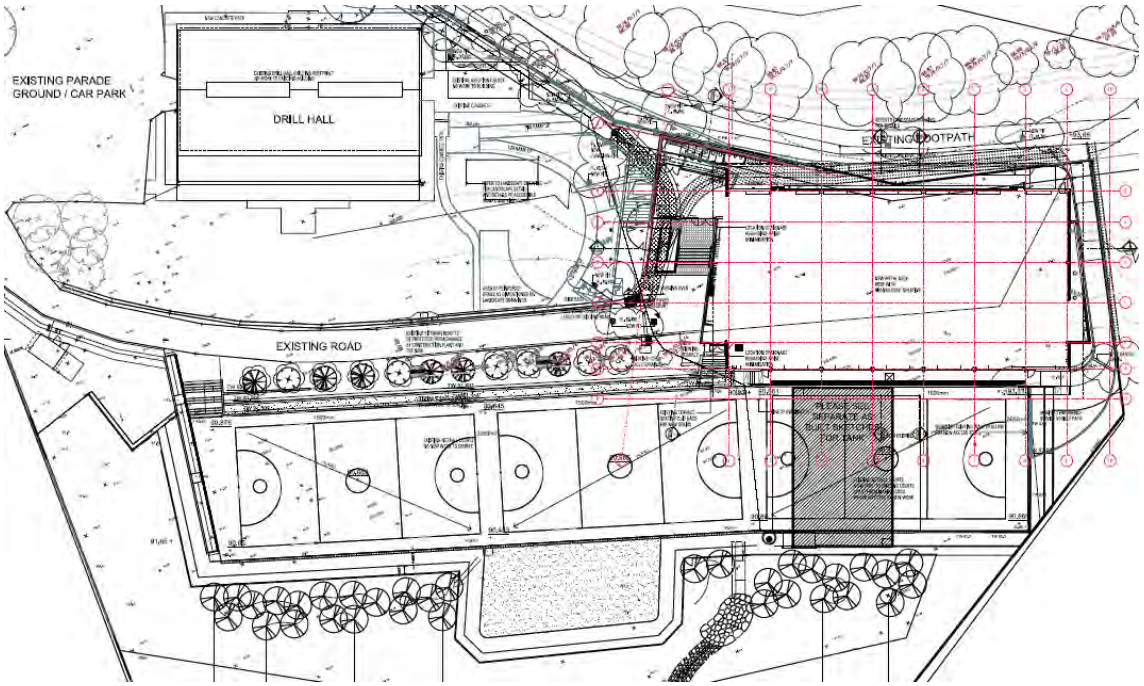
The majority of users of the netball courts that drove to site were recorded as parking in the Rawson Oval car park (44 per cent), with slightly less parking in the Drill Hall car park (37 per cent) and the remaining parking along Cross Street (19 per cent).

3. Proposal

The Harbour Trust are looking to understand the impact of installing floodlights for the outdoor netball courts located at the Precinct. The new floodlights would permit netball training to continue up to 8:30pm, with the current arrangement only allowing training up to 5:30pm. The netball courts are currently only used for training and would continue to only be used for training under the new arrangement.

The outdoor netball courts subject to the proposal are shown in Figure 3.1.

Figure 3.1: Outdoor netball courts at the Mosman Drill Hall Precinct



Source: Mode Design, Sports Building at Drill Hall Common – Site Plan, dated 28 February 2011

3.1 Car Parking Assessment

3.1.1 Car Parking Requirements

As mentioned previously, the parking surveys that were undertaken during the weekday evening period indicate parking demand in the Rawson Oval and Precinct car parks and along Cross Street declines after 6pm coinciding with when the Drill Hall outside of school hours care finishes. The peak activity for the surrounding facilities including Rawson Oval and Park and the croquet and tennis clubs were generally found to occur between 3pm and 6pm. As such, a car parking assessment has been undertaken to identify if the potential additional car parking capacity near the Precinct after 6pm is adequate to meet the demand generate by the netball courts.

The separate parking and mode split interview surveys indicate a parking rate for the three netball courts of around 30 spaces (or 10 spaces per court) per hour during the weekday evening peak hour. That is, each court is estimated to generate demand for 10 parking spaces per hour.

This rate is consistent with historical data collected for similar facilities (on a per game basis), detailed as follows:

- Richard Murden Reserve, 10 vehicles per court (GTA, 2017)
- Willoughby Leisure Centre: 19 vehicles per court (GTA, 2012)
- Throsby Playing Fields, Canberra: 11 vehicles per court (AECOM, July 2011)
- Bungarribee Parklands, Blacktown: 9 vehicles per court (Maunsell AECOM, August 2007)
- Meadowbank Park Netball Courts, Ryde: 10 vehicles per court parking demand (Ryde Council, December 2009)
- Woodward Park Complex, Liverpool: 10 vehicles per court parking demand
- John Fisher Park, Warringah: 20 vehicles per court
- Canoon Road, Ku-ring-gai: peak parking demand of 30 vehicles per court (KMC, November 2005).

A review of the above sites and their proximity to public transport, surrounding residential areas and metropolitan Sydney indicates a parking rate of approximately 10 spaces per court per game/ training session could be expected.

A conservative approach has been taken by adopting a higher rate of 60 spaces per hour and takes into consideration the localised parking peak due to changeover of use of the courts. For the purposes of this assessment, the parking rate is considered appropriate for planning and parking management purposes.

It should be noted that the demand for 60 car parking spaces is in addition to the parking demand of surrounding activities however would only occur during training time overlaps which would only be for a short period of time (i.e. approximately 10 minutes). During each training session, the parking demand is only expected to be approximately 30 spaces. This is representative of the car parking demand during existing training times, with the Drill Hall and Rawson Oval car parks currently operating over capacity during training time overlaps requiring drivers to circulate or double park while waiting for vacant spaces to become available.

It is noted that the above rate is based on a '*per hour*' basis and that the netball courts are proposed for training purposes only during weekday evenings. The installation of new floodlighting to allow training up to 8:30pm could therefore be expected to generate an additional demand of up to 60 parking spaces per hour for during the evening period (i.e. 5:30pm to 8:30pm).

Considering the number of vacant car parking spaces captured in the parking surveys after the existing netball activity subsides, it is estimated that a minimum 37 spaces would be available in the Rawson Oval and Precinct car parks and on-street along Cross Street during the evening period. Without implementation of some of the recommended mitigation measures described in Section 3.1.2, this would not be sufficient to accommodate the estimated additional demand of the 60 car parking spaces.

With the implementation of the recommended mitigation measures in Section 3.1.2, it is expected that sufficient parking will be available to accommodate the use of the netball courts during the evening training periods. Implementation of these measures would also help to improve existing traffic and parking conditions in the 3pm to 6pm period.

3.1.2 Car Parking Impact Mitigation Measures

The following mitigation measures and recommendations have been identified to lessen the car parking impact surrounding the Precinct and improve the existing car parking supply. These mitigation measures also consider the benefit of Mosman Council's role of managing activities both at Rawson Oval and within the Precinct, which includes the outdoor netball courts, Drill Hall building and Marie Bashir Sports Centre. Where possible, recommendations have been identified

to improve not only the traffic and parking conditions associated with the outdoor netball courts, but also improve the wider precinct area.

Offset/ Staggered Training Times

A review of the existing netball court training schedules indicates that as one training session finishes, another starts. A way of mitigating the car parking impact of the extended training times would be to offset the start and finish times of training sessions to allow for a 10-minute break between training groups. The gap between the training groups would likely result in the first group leaving before the second group begins, and further reducing the car parking demand from 60 vehicles to 30 vehicles per hour. Based on the observed vacant car parking spaces during the proposed extended training hours, the parking demand for 30 spaces could be accommodated in the car parking supply south of Rawson Oval alone.

An alternative approach may include staggering the training start times to distribute the car parking demand and traffic generation of the Precinct more evenly over the hour. Considering the three outdoor netball courts and the multi-use court in the Marie Bashir Sports Centre, session times on each court could be staggered to start every 15 minutes. For example, this might mean training sessions on Court 1 commencing on the hour; on Court 2 at 15 minutes-past-the-hour; on Court 3 at 30-past; and on the indoor Court at 45-past. This would allow the car parking demand from the extended training hours to be accommodated in the car parking supply south of Rawson Oval. This approach would have the added benefit compared to offset training times by minimising the amount of 'wasted time' between each training session. Staggered training times could also be implemented for rugby training at Rawson Oval to further reduce the parking and traffic impact of surrounding facilities.

Netball training times could also be altered to avoid having a changeover between training occurring at the same time as peak out of school hours care pick-up activity which occurs around 6pm. The extended training hours would allow for more flexibility in avoiding conflict between netball training finishing at the same time as the out of school hours care.

Implementing Car Parking Time Restrictions

The car parking surveys that were undertaken on Tuesday 31 July 2018 indicated that 17 per cent of the vehicles parked in the Precinct car park were parked for over two hours. Further to this, there were seven cars that were parked in the Precinct or Rawson Oval car parks for over four hours on the Tuesday night, which suggests that these car parks are potentially being used by residents and employees in the surrounding area.

A potential mitigation measure to avoid long-stay car parking would be to implement two-hour time restrictions in the Precinct and Rawson Oval car parks. This would encourage turnover and increase parking availability in these more sought-after car parks.

3.2 Traffic Impact Assessment

As mentioned previously, it is expected that the netball courts would generate 60 vehicles per hour during the weekday evening periods when training is being extended to 8:30pm. In addition, during the surveyed period, 35 users were seen to be dropped off without parking over a two-hour period between 3:30pm and 5:30pm on a weekday evening. These drop offs usually involved more than one person being dropped off per vehicle, with up to four people seen getting out of one car. Conservatively assuming an occupancy rate of 1.5 people getting dropped off per car, this equates to approximately 12 additional vehicles per hour.

Overall, it is expected that up to an additional 72 vehicles (84 vehicle movements) per hour could be associated with the netball courts, with 60 vehicles parking (60 movements) and 12 vehicles dropping passengers off (24 vehicle movements) per hour.

It is worth noting that these trips would not cause increase in the existing peak traffic generated by the netball courts. Rather, the proposed lighting of the courts would cause an extension of their traffic generation into the evening. Also, the extended weekday training periods would occur outside of the typical weekday evening commuter peak periods. The traffic counts indicated that traffic volumes along surrounding roads reduce significantly after 6pm.

As such, the traffic associated with the extended training hours is able to be adequately accommodated in the surrounding road network.

The anticipated traffic generated from the netball courts has been used to assess the environmental capacity of the surrounding road network. Given the additional traffic movements would only occur from around 5:30pm onwards, the traffic volumes at 5pm on the surrounding road network have been used for the base traffic for a conservative assessment. It has also been assumed all vehicles associated with the netball courts will travel along Cross Street and Bradleys Head Road only.

The environmental capacity assessment is shown in Table 3.1.

Table 3.1: Environmental capacity assessment

Road	Classification	Environmental threshold (veh/h)	Average 5pm weekday peak traffic volume (veh/h)	Additional traffic from netball courts (movements/h)	Total future weekday peak traffic volume (veh/h)
Cross Street	Residential local street	300	154	+84	238
Bradleys Head Road	Residential collector street	500	429	+84	513

As shown in Table 3.1, Cross Street is expected to exceed the environmental goal of 200 vehicles per hour however remains within the maximum threshold of 300 vehicles per hour. Bradleys Head Road is expected to slightly exceed the maximum threshold of 500 vehicles per hour, however it should be noted that this is already exceeded on weekends. It is also important to note that the 5pm traffic volumes that were used as the base traffic volumes would already account for a portion of the netball traffic and therefore the above assessment is considered conservative.

As such, it is expected that the surrounding roads are expected to remain within their maximum environmental capacities with the additional netball traffic. Notwithstanding this, the mitigation measures detailed in Section 3.1.2 should be considered to reduce the number of vehicle trips per hour and the ensure the surrounding roads remain within their environmental capacities.

3.3 General Recommendations for Precinct Surrounds

The following recommendations should be considered to improve the amenity for drivers, cyclists and pedestrians that use the surrounding area.

Improved Lighting

Lighting along the pedestrian connections from Rawson Oval to Alexander Avenue should be installed to encourage walkers and users of Rawson Oval to park along Alexander Avenue and Croquet Lane instead of in the car parking supply to the south of Rawson Oval. This would not only have the potential of reducing the demand on the car parking supply to the south of

Rawson Oval and therefore provide more vacant spaces for users of the Precinct, but would also improve pedestrian safety at night.

Improved Pedestrian Amenity

The pedestrian path along the southern side of Cross Street was further extended in early 2018 to connect with the internal road within the Precinct. These works were undertaken to improve pedestrian safety for the site, with pedestrians previously having to walk on the Cross Street carriageway to access the site. The upgrades to the Cross Street footpath are shown in Figure 3.2 and Figure 3.3.

Figure 3.2: Cross Street footpath before upgrades (aerial taken 18 January 2018

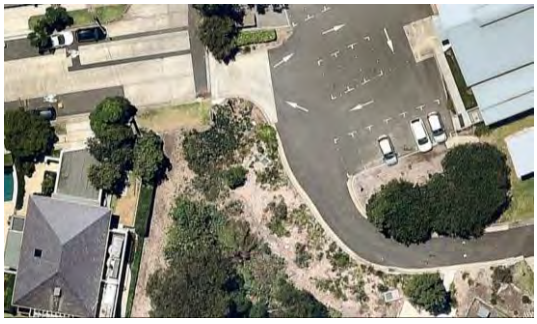


Figure 3.3: Cross Street footpath before upgrades (aerial taken 15 April 2018

Source: Nearmap

Bollards are located further along the internal access road restricting vehicle access into the site for all unauthorised vehicles. To increase pedestrian safety for the Precinct, it is recommended that the bollards be relocated north towards the start of the internal access road to protect pedestrians when they enter the site.

On-site observations indicated that much of the short-term parking activity associated with the Precinct occurred in the spaces along the south of the Rawson Oval car park. As such, improved connection between the Precinct and the Rawson Oval car park could be provided in the form of stairs linking with the existing pedestrian path outside the Drill Hall building.

The existing bollards and their recommended new location, along with the recommended new pedestrian connection between the Rawson Oval car park and the Precinct are shown in Figure 3.4.

Figure 3.4: Recommended new stairs and relocation of bollards

Base image source: Nearmap

Due to the relocated bollards being located at the start of the access road, visitors may tend to park in front of the bollards and block access for authorised vehicles. To avoid this, line marking and/or signage could be implemented to identify this area as no parking to allow emergency vehicles to still access the Precinct. The no parking area would have the added benefit of improving circulation of the Precinct car park by allowing drivers who are dropping off passengers to pull into this area rather than blocking the circulation aisle.

Improved Vehicle Circulation

It is recommended that the circulation around the Rawson Oval car park be converted to one-way in a clockwise direction due to the narrow width of the circulation aisle. Due to some of the angled car parking not being perpendicular with the circulation aisle, some spaces would have to be marked as "rear to kerb only".

It is also recommended that give-way line marking be implemented in the Rawson Oval car park prior to the footpath to ensure pedestrians and cyclists have right-of-way when connecting from Cross Street to the shared path around Rawson Oval.

A pick-up and drop-off bay could also be implemented on the northern edge of the Rawson Oval car park. This would allow drivers to pull into the bay without blocking circulation within the car park. Considering the narrow width of the circulation aisle, the car park carriageway may need to be slightly widened to the north to allow for the pick-up and drop-off bay.

A mark-up of general recommendations for the area surrounding the Precinct is shown in Figure 3.5.

Figure 3.5: Recommendations for improved vehicle circulation and pedestrian safety

Base image source: Nearmap

4. Conclusion

Based on the analysis and discussions presented within this report, the proposal to install floodlights to allow for extending netball training times to 8:30pm is expected to generate an additional parking demand of 60 vehicles per hour between 5:30pm and 8:30pm on weeknights.

This demand can adequately be accommodated within the total surrounding car parking supply, subject to the implementation of management measures accommodate the demand purely in the car parking supply to the south of Rawson Oval. These measures will also help to improve existing traffic and parking conditions.

The following conclusions are also made:

i Peak parking occupancy in the car parking supply to the south of Rawson Oval was found to be 83 per cent and 90 per cent occupied in the Tuesday and Saturday peak parking periods respectively.

ii Peak parking occupancy in the car parking supply to the north of Rawson Oval was found to be 76 per cent and 91 per cent occupied in the Tuesday and Saturday peak parking periods respectively.

iii Approximately 89 per cent and 87 per cent of off-street car parking were short-stay (under two hours) during the Tuesday and Saturday survey periods respectively.

iv Around 59 per cent and 53 per cent of on-street car parking were short-stay (under two hours) during the Tuesday and Saturday survey periods respectively.

v Private vehicle is the most popular mode of travel to the outdoor netball courts, making up 98 per cent of travel.

vi On-site observations indicate the Drill Hall and Rawson Oval car parks currently operate over capacity during the overlaps between training sessions, with drivers seen to double park or block the circulation aisles while waiting for car parking spaces to become vacant.

vii There is anticipated to be approximately 72 additional vehicles per hour associated with extending the netball court usage. This is expected to occur outside the road network peak and can be accommodated within the surrounding road network.

viii The following mitigation measures could be implemented to better manage the surrounding car parking supply and/or reduce the peak car parking demand traffic generation of the netball courts:

- Providing a short break between training times so there is less training sessions overlapping.
- Staggering the start times for each netball court (and potentially each rugby training session) so there is less sessions overlapping at the same time.
- Changing the netball training times so as to not overlap with the Drill Hall outside of school hours care finishing time.
- Implementing time restrictions on the car parking supply to the south of Rawson Oval to reduce the number of long-stay vehicles (staying over two-hours).

ix General recommendations for the area surrounding the Precinct include the following:

- Install lighting along the pedestrian connections between Rawson Oval and Alexander Avenue to increase safety at night.
- Relocate the bollards on the internal access road within the Precinct to the western end of the road to increase pedestrian safety.
- Provide stairs between the Rawson Oval car park and the Precinct.

- Change the circulation of the Rawson Oval car park to one-way clockwise to improve operation. This would require six spaces to be signed as rear to kerb only.
- Provide a pick-up and drop-off bay along the northern edge of the Rawson Oval car park.
- Provide give-way linemarking at the Rawson Oval car park access to ensure pedestrians and cyclists are given priority.

Appendix A

Automatic Traffic Counter (ATC) Results

Job No	N4378 - Mosman
Client	GTA
Site	Cross St (wk 1)
Location	Mosman
Site No	2
Start Date	28-Jul-18
Description	Volume Summary
Direction	Combined

Hour Starting	Day of Week							W'Day Ave	7 Day Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	30-Jul	31-Jul	1-Aug	2-Aug	3-Aug	28-Jul	29-Jul		
AM Peak	63	79	70	124	69	91	107		
PM Peak	154	225	154	126	111	143	78	**877**	**907**
0:00	1	1	1	0	3	0	1	1	1
1:00	0	1	0	2	2	0	2	1	1
2:00	0	0	0	0	0	0	0	0	0
3:00	0	1	1	0	2	1	1	1	1
4:00	5	4	1	2	2	6	4	3	3
5:00	14	15	13	11	18	14	1	14	12
6:00	27	29	32	28	44	13	13	32	27
7:00	63	79	70	124	69	26	22	81	65
8:00	63	61	47	79	45	57	60	59	59
9:00	35	50	40	51	52	82	57	46	52
10:00	36	42	29	52	51	91	107	42	58
11:00	60	40	41	42	41	91	41	45	51
12:00	24	27	21	21	36	132	76	26	48
13:00	33	18	24	24	31	117	32	26	40
14:00	29	44	25	29	27	135	32	31	46
15:00	61	79	51	37	58	143	54	57	69
16:00	115	131	74	55	92	108	78	93	93
17:00	154	225	154	126	111	101	47	154	131
18:00	88	121	61	71	52	60	7	79	66
19:00	48	45	77	51	12	44	23	47	43
20:00	18	41	14	30	6	27	4	22	20
21:00	2	31	12	12	14	21	17	14	16
22:00	0	8	2	0	2	8	1	2	3
23:00	0	1	2	2	5	6	0	2	2
Total	876	1094	792	849	775	1283	680	877	907

7-19	761	917	637	711	665	1143	613	738	778
6-22	856	1063	772	832	741	1248	670	853	883
6-24	856	1072	776	834	748	1262	671	857	888
0-24	876	1094	792	849	775	1283	680	877	907

Job No	N4378 - Mosman
Client	GTA
Site	Cross St (wk 2)
Location	Mosman
Site No	2
Start Date	4-Aug-18
Description	Volume Summary
Direction	Combined

Hour Starting	Day of Week							W'Day Ave	7 Day Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug	4-Aug	5-Aug		
AM Peak	67	0	0	0	0	78	146		
PM Peak	132	0	0	0	0	105	111	**174**	**401**
0:00	0	0	0	0	0	3	6	0	1
1:00	0	0	0	0	0	2	7	0	1
2:00	0	0	0	0	0	0	4	0	1
3:00	0	0	0	0	0	1	0	0	0
4:00	2	0	0	0	0	4	5	0	2
5:00	14	0	0	0	0	8	1	3	3
6:00	29	0	0	0	0	9	12	6	7
7:00	59	0	0	0	0	19	24	12	15
8:00	67	0	0	0	0	66	56	13	27
9:00	47	0	0	0	0	78	79	9	29
10:00	47	0	0	0	0	76	146	9	38
11:00	24	0	0	0	0	29	117	5	24
12:00	37	0	0	0	0	46	87	7	24
13:00	24	0	0	0	0	77	111	5	30
14:00	34	0	0	0	0	93	88	7	31
15:00	49	0	0	0	0	105	99	10	36
16:00	123	0	0	0	0	102	63	25	41
17:00	132	0	0	0	0	51	38	26	32
18:00	78	0	0	0	0	56	12	16	21
19:00	52	0	0	0	0	54	8	10	16
20:00	22	0	0	0	0	23	7	4	7
21:00	26	0	0	0	0	23	14	5	9
22:00	1	0	0	0	0	23	1	0	4
23:00	1	0	0	0	0	3	0	0	1
Total	868	0	0	0	0	951	985	174	401

7-19	721	0	0	0	0	798	920	144	348
6-22	850	0	0	0	0	907	961	170	388
6-24	852	0	0	0	0	933	962	170	392
0-24	868	0	0	0	0	951	985	174	401

Job No	N4378 - Mosman
Client	GTA
Site	Alexander Ave (wk 1)
Location	Mosman
Site No	3
Start Date	28-Jul-18
Description	Volume Summary
Direction	Combined

Hour Starting	Day of Week							W'Day Ave	7 Day Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	30-Jul	31-Jul	1-Aug	2-Aug	3-Aug	28-Jul	29-Jul		
AM Peak	34	37	43	41	32	59	39		
PM Peak	40	53	56	44	38	60	39	**379**	**380**
0:00	0	0	0	0	0	0	0	0	0
1:00	0	0	0	0	0	0	0	0	0
2:00	0	0	0	1	0	0	0	0	0
3:00	0	2	0	0	0	0	1	0	0
4:00	0	0	0	0	0	0	0	0	0
5:00	3	4	4	5	0	3	2	3	3
6:00	14	16	18	20	11	7	2	16	13
7:00	32	28	24	24	25	9	13	27	22
8:00	34	37	39	29	32	25	13	34	30
9:00	33	36	43	41	25	39	24	36	34
10:00	20	26	23	16	26	51	39	22	29
11:00	20	17	29	32	29	59	24	25	30
12:00	19	21	19	19	29	37	31	21	25
13:00	18	25	21	16	23	34	24	21	23
14:00	13	19	21	23	24	46	23	20	24
15:00	23	42	35	20	31	60	39	30	36
16:00	37	53	46	43	30	41	26	42	39
17:00	40	44	56	44	38	30	30	44	40
18:00	16	13	17	15	12	12	2	15	12
19:00	15	14	11	8	1	3	2	10	8
20:00	6	5	3	7	8	2	1	6	5
21:00	4	7	6	4	3	6	3	5	5
22:00	0	0	1	0	2	2	0	1	1
23:00	0	1	0	0	6	0	0	1	1
Total	347	410	416	367	355	466	299	379	380

7-19	305	361	373	322	324	443	288	337	345
6-22	344	403	411	361	347	461	296	373	375
6-24	344	404	412	361	355	463	296	375	376
0-24	347	410	416	367	355	466	299	379	380

Job No	N4378 - Mosman
Client	GTA
Site	Alexander Ave (wk 2)
Location	Mosman
Site No	3
Start Date	4-Aug-18
Description	Volume Summary
Direction	Combined

Hour Starting	Day of Week							W'Day Ave	7 Day Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug	4-Aug	5-Aug		
AM Peak	44	1	0	0	0	23	49		
PM Peak	37	0	0	0	0	42	40	**64**	**141**
0:00	0	0	0	0	0	1	1	0	0
1:00	0	0	0	0	0	1	0	0	0
2:00	0	0	0	0	0	1	1	0	0
3:00	0	1	0	0	0	0	2	0	0
4:00	0	0	0	0	0	0	0	0	0
5:00	4	0	0	0	0	0	1	1	1
6:00	13	0	0	0	0	6	1	3	3
7:00	15	0	0	0	0	17	14	3	7
8:00	44	0	0	0	0	22	32	9	14
9:00	32	0	0	0	0	23	30	6	12
10:00	29	0	0	0	0	17	22	6	10
11:00	8	0	0	0	0	22	49	2	11
12:00	16	0	0	0	0	28	34	3	11
13:00	14	0	0	0	0	36	40	3	13
14:00	13	0	0	0	0	30	22	3	9
15:00	26	0	0	0	0	35	28	5	13
16:00	37	0	0	0	0	42	35	7	16
17:00	36	0	0	0	0	15	19	7	10
18:00	12	0	0	0	0	12	11	2	5
19:00	9	0	0	0	0	4	2	2	2
20:00	5	0	0	0	0	1	3	1	1
21:00	2	0	0	0	0	3	1	0	1
22:00	1	0	0	0	0	3	1	0	1
23:00	1	0	0	0	0	1	0	0	0
Total	317	1	0	0	0	320	349	64	141

7-19	282	0	0	0	0	299	336	56	131
6-22	311	0	0	0	0	313	343	62	138
6-24	313	0	0	0	0	317	344	63	139
0-24	317	1	0	0	0	320	349	64	141

Job No	N4378 - Mosman
Client	GTA
Site	Croquet Lane (wk 1)
Location	Mosman
Site No	4
Start Date	28-Jul-18
Description	Volume Summary
Direction	Combined

Hour Starting	Day of Week							W'Day Ave	7 Day Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	30-Jul	31-Jul	1-Aug	2-Aug	3-Aug	28-Jul	29-Jul		
AM Peak	20	29	28	18	21	31	23		
PM Peak	21	26	21	24	24	28	28	**204**	**210**
0:00	0	0	0	0	0	0	0	0	0
1:00	0	0	0	0	0	0	0	0	0
2:00	0	0	0	1	0	0	0	0	0
3:00	0	0	0	0	0	0	1	0	0
4:00	0	0	0	0	0	0	0	0	0
5:00	0	3	0	2	0	0	0	1	1
6:00	10	12	12	14	14	4	2	12	10
7:00	16	18	28	18	19	6	10	20	16
8:00	19	29	20	9	17	15	7	19	17
9:00	19	13	17	10	12	16	16	14	15
10:00	14	18	16	14	21	21	23	17	18
11:00	20	11	17	15	17	31	18	16	18
12:00	7	6	11	22	14	28	21	12	16
13:00	4	10	10	9	13	18	19	9	12
14:00	9	10	12	11	9	28	16	10	14
15:00	12	21	19	9	17	27	19	16	18
16:00	21	21	18	19	17	28	28	19	22
17:00	16	26	21	24	24	17	11	22	20
18:00	7	3	6	9	4	5	3	6	5
19:00	7	6	2	7	4	2	2	5	4
20:00	0	3	3	2	5	1	1	3	2
21:00	1	2	2	1	2	3	0	2	2
22:00	0	0	2	0	2	2	0	1	1
23:00	0	1	0	0	2	0	0	1	0
Total	182	213	216	196	213	252	197	204	210

7-19	164	186	195	169	184	240	191	180	190
6-22	182	209	214	193	209	250	196	201	208
6-24	182	210	216	193	213	252	196	203	209
0-24	182	213	216	196	213	252	197	204	210

Job No	N4378 - Mosman
Client	GTA
Site	Croquet Lane (wk 2)
Location	Mosman
Site No	4
Start Date	4-Aug-18
Description	Volume Summary
Direction	Combined

Hour Starting	Day of Week							W'Day Ave	7 Day Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug	4-Aug	5-Aug		
AM Peak	22	0	0	0	0	15	24		
PM Peak	19	0	0	0	0	18	25	**30**	**77**
0:00	0	0	0	0	0	1	0	0	0
1:00	0	0	0	0	0	1	0	0	0
2:00	0	0	0	0	0	1	1	0	0
3:00	0	0	0	0	0	0	0	0	0
4:00	0	0	0	0	0	0	0	0	0
5:00	1	0	0	0	0	0	1	0	0
6:00	9	0	0	0	0	2	2	2	2
7:00	10	0	0	0	0	8	10	2	4
8:00	22	0	0	0	0	12	18	4	7
9:00	13	0	0	0	0	15	19	3	7
10:00	7	0	0	0	0	12	24	1	6
11:00	6	0	0	0	0	9	20	1	5
12:00	7	0	0	0	0	15	15	1	5
13:00	8	0	0	0	0	13	25	2	7
14:00	6	0	0	0	0	14	22	1	6
15:00	9	0	0	0	0	18	22	2	7
16:00	15	0	0	0	0	15	25	3	8
17:00	19	0	0	0	0	7	8	4	5
18:00	6	0	0	0	0	7	9	1	3
19:00	8	0	0	0	0	3	2	2	2
20:00	2	0	0	0	0	1	3	0	1
21:00	2	0	0	0	0	4	2	0	1
22:00	1	0	0	0	0	1	0	0	0
23:00	1	0	0	0	0	3	0	0	1
Total	152	0	0	0	0	162	228	30	77

7-19	128	0	0	0	0	145	217	26	70
6-22	149	0	0	0	0	155	226	30	76
6-24	151	0	0	0	0	159	226	30	77
0-24	152	0	0	0	0	162	228	30	77

Appendix B

Parking Survey Results

Capacity and Restrictions

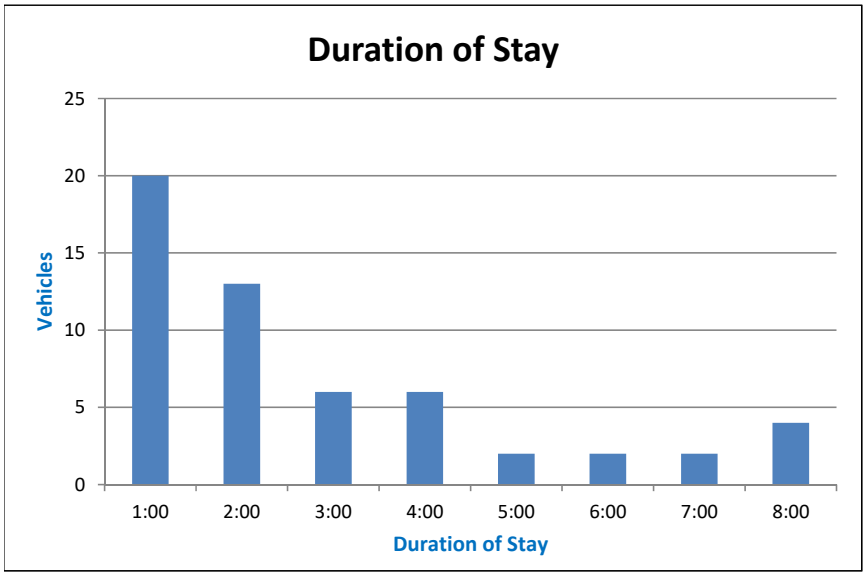
Street	Side	Between	Parking_Restriction	Time_Restrictions	Capacity
On-Street Parking					
Alexander Ave	North	btwn Effingham St & Croquet Ln	No Restriction		8
			No Stopping		
		btwn Croquet Ln & Rawson Park Tennis Centre	No Stopping		
			No Parking		
	South	btwn Rawson Park Tennis Centre & Effingham St	No Restriction	90' Angle Parking Front or Rear to Kerb	16
			No Restriction		10
			P 10mins	7:30am-10am & 3pm-6pm Mon-Fri	2
			No Stopping	7:30am-10:30am & 3pm-6pm Mon-Fri	1
			P 10mins	7:30am-10am & 3pm-6pm Mon-Fri	2
			No Restriction		16
Croquet Ln	North	btwn Alexander Ave & Middle Head Rd	No Restriction	90' Angle Parking	17
			No Restriction		25
	South	btwn Middle Head Rd & Alexander Ave	No Stopping		
			No Parking		
			No Stopping		
Cross St	North	btwn Bradleys Head Rd & 1 Cross St	No Restriction		15
	South	btwn 2 Cross St & Bradleys Head Rd	No Stopping		
			No Restriction		15
Off-Street Parking					
A. Car Park	Off-St	North of Cross St	No Restriction		38
			Disabled	Authorised Disabled Persons Vehicles Excepted	1
			No Restriction		1
B. Car Park	Off-St	South of Cross St	No Restriction		15
			Disabled		1

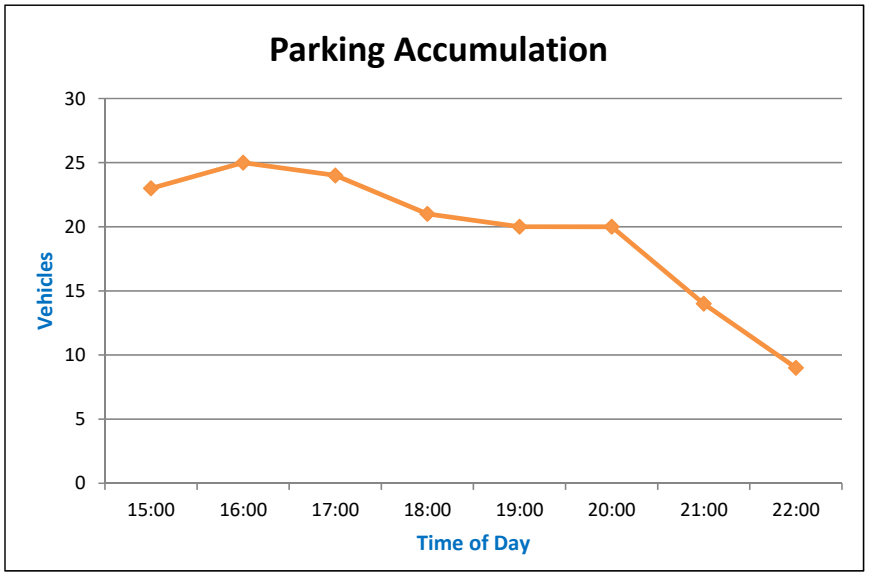
Client	GTA
Location	**Total - Alexander Ave
Date	Tue, 31st Jul 2018 (15:00-22:00 inclusive)
Description	Mosman Parking Survey

MATRIX Traffic and Transport Data

Site	****Total - Alexander Ave**	**Peak demand**	25
Total Parking Spaces	55	**Peak Demand %**	45%
		Ave Duration of Stay(h:mm)	2:50
Time Restriction	-	**Total Vehicles**	55

Total	20	13	6	6	2	2	2	4			
	Duration of Stay										
Time	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	Total	Accumulation	% Capacity
15:00	5	8	1	1	2	2		4	23	23	42%
16:00	4		1				2		7	25	45%
17:00	10	1							11	24	44%
18:00		2	3	3					8	21	38%
19:00				2					2	20	36%
20:00	1	2	1						4	20	36%
21:00									0	14	25%
22:00									0	9	16%



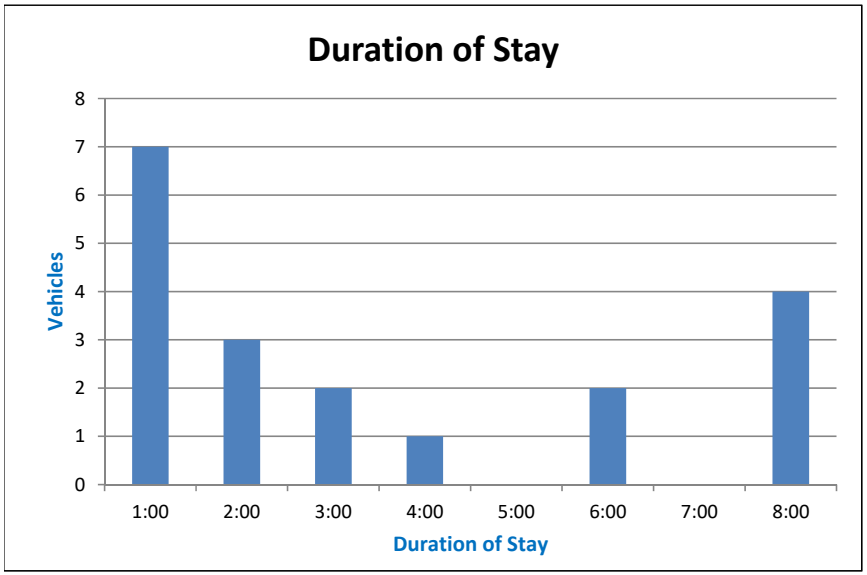


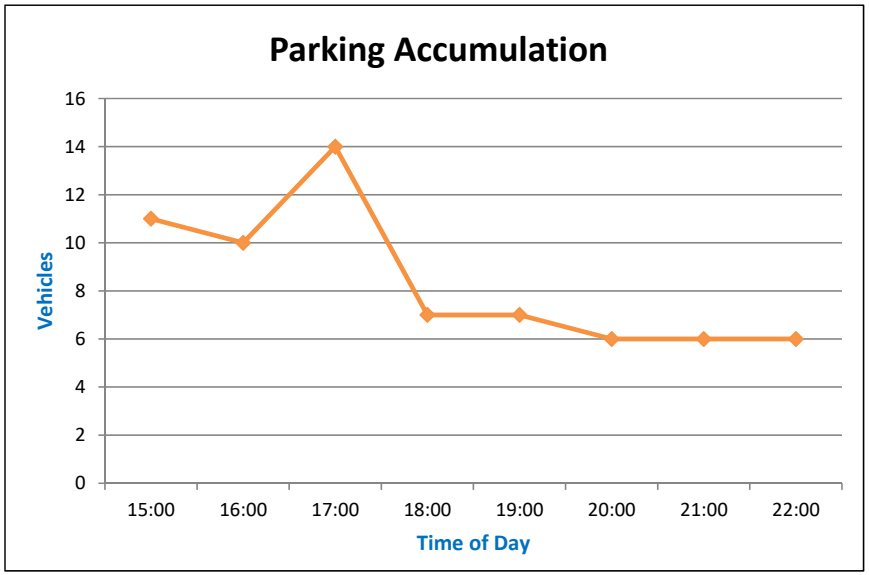
Client	GTA
Location	**Total - Croquet Ln
Date	Tue, 31st Jul 2018 (15:00-22:00 inclusive)
Description	Mosman Parking Survey

MATRIX Traffic and Transport Data

Site	**Total - Croquet Ln	**Peak demand**	14
Total Parking Spaces	42	**Peak Demand %**	33%
		Ave Duration of Stay(h:mm)	3:31
Time Restriction	-	**Total Vehicles**	19

Total	7	3	2	1	0	2	0	4			
	Duration of Stay										
Time	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	Total	Accumulation	% Capacity
15:00	3	1	2	1				4	11	11	26%
16:00		2							2	10	24%
17:00	3					2			5	14	33%
18:00									0	7	17%
19:00	1								1	7	17%
20:00									0	6	14%
21:00									0	6	14%
22:00									0	6	14%



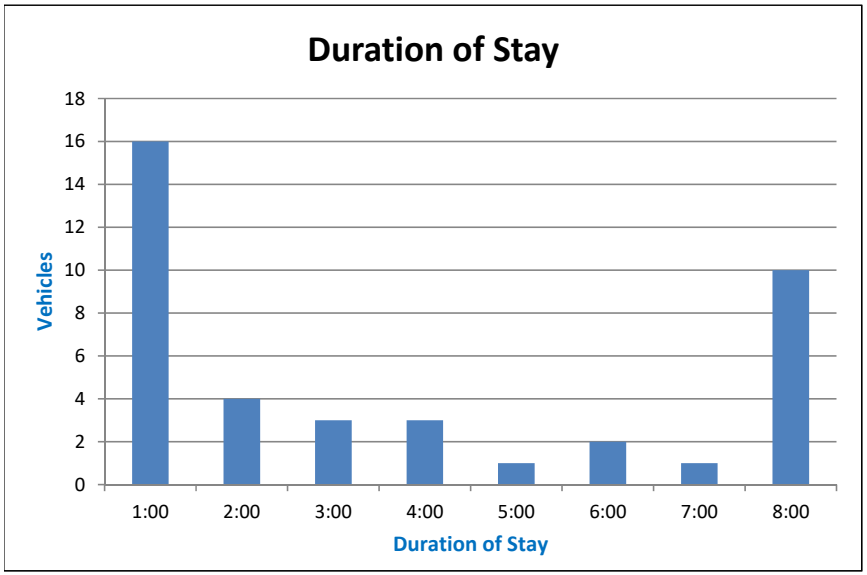


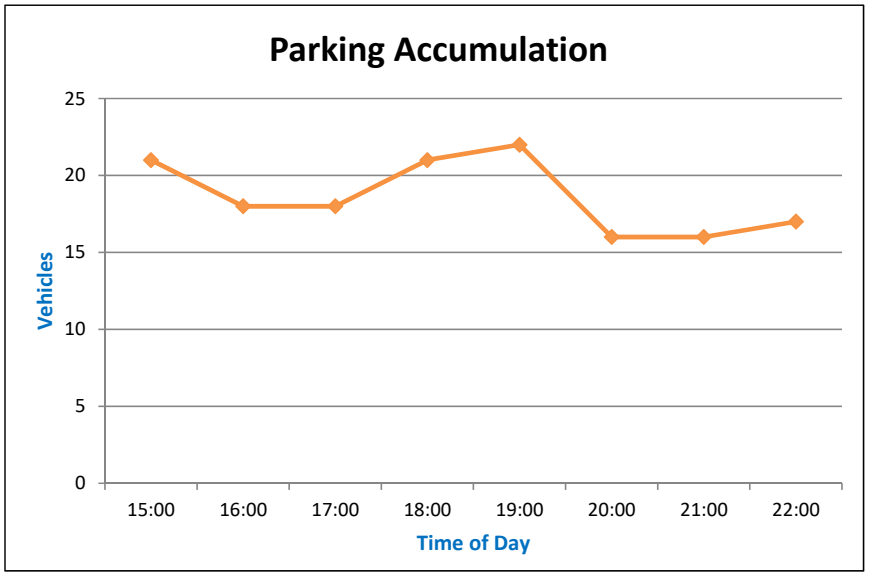
Client	GTA
Location	**Total - Cross St
Date	Tue, 31st Jul 2018 (15:00-22:00 inclusive)
Description	Mosman Parking Survey

MATRIX Traffic and Transport Data

Site	**Total - Cross St	**Peak demand**	22
Total Parking Spaces	30	**Peak Demand %**	73%
		Ave Duration of Stay(h:mm)	3:43
Time Restriction	-	**Total Vehicles**	40

Total	16	4	3	3	1	2	1	10			
	Duration of Stay										
Time	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	Total	Accumulation	% Capacity
15:00	8	1	1	1				10	21	21	70%
16:00	4						1		5	18	60%
17:00		1	2			2			5	18	60%
18:00	1	2			1				4	21	70%
19:00	2			2					4	22	73%
20:00									0	16	53%
21:00									0	16	53%
22:00	1								1	17	57%



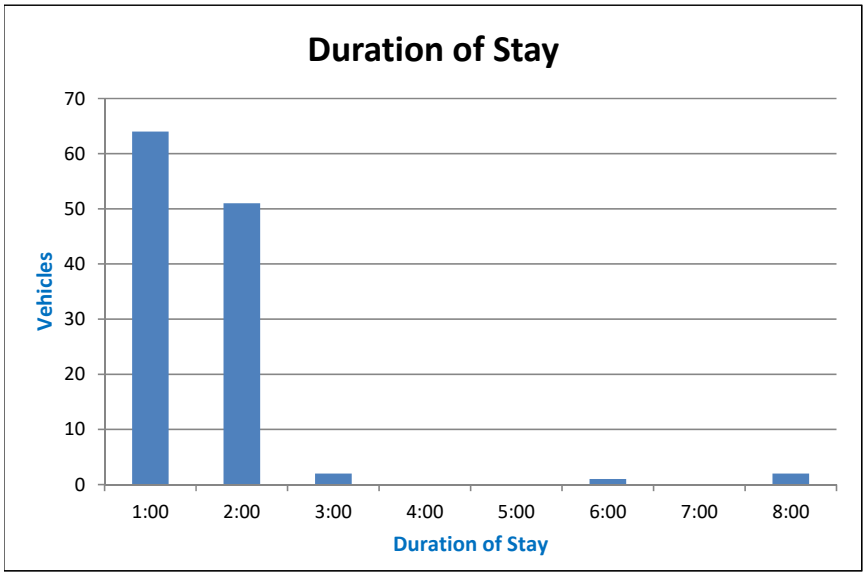


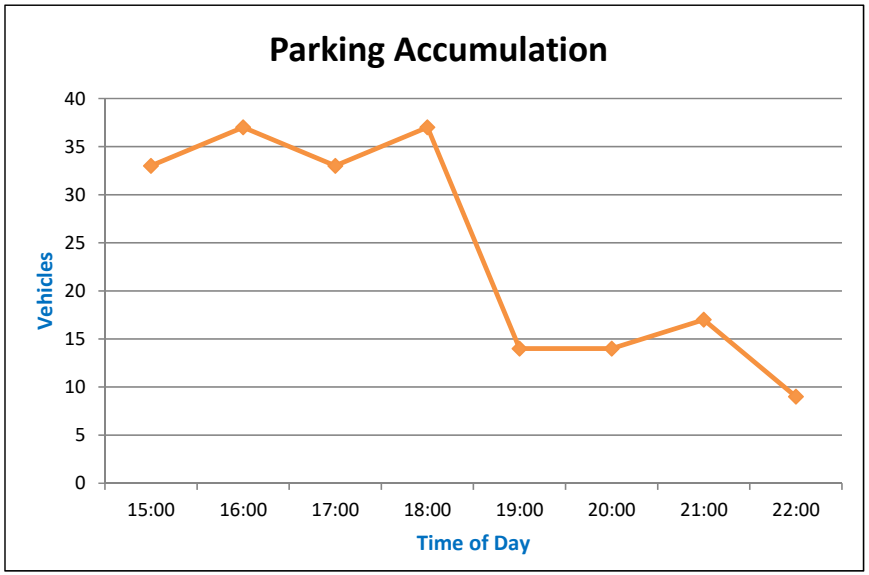
Client	GTA
Location	**Total - A. Car Park
Date	Tue, 31st Jul 2018 (15:00-22:00 inclusive)
Description	Mosman Parking Survey

MATRIX Traffic and Transport Data

Site	**Total - A. Car Park	**Peak demand**	37
Total Parking Spaces	40	**Peak Demand %**	93%
		Ave Duration of Stay(h:mm)	1:37
Time Restriction	-	**Total Vehicles**	120

Total	64	51	2	0	0	1	0	2			
	Duration of Stay										
Time	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	Total	Accumulation	% Capacity
15:00	9	20	2					2	33	33	83%
16:00	5	8							13	37	93%
17:00	17	3				1			21	33	83%
18:00	25	6							31	37	93%
19:00	5								5	14	35%
20:00	3	8							11	14	35%
21:00		6							6	17	43%
22:00									0	9	23%



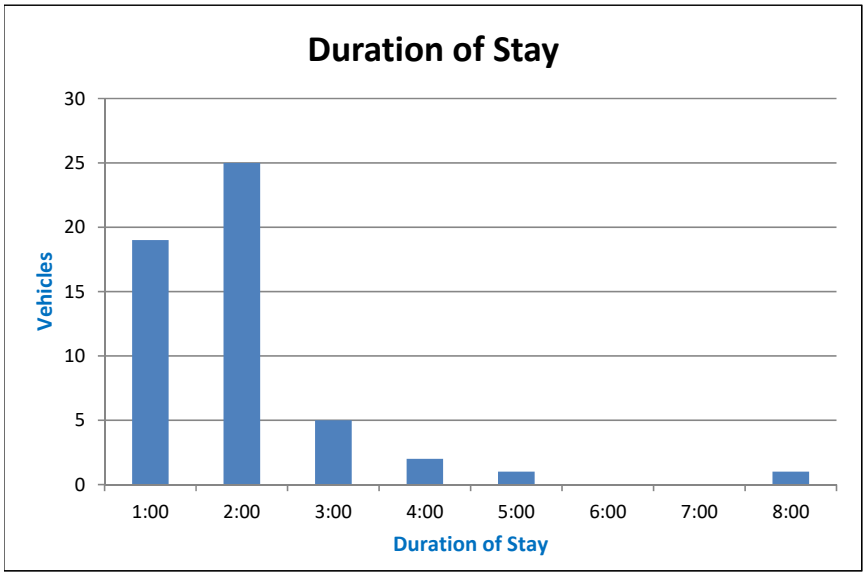


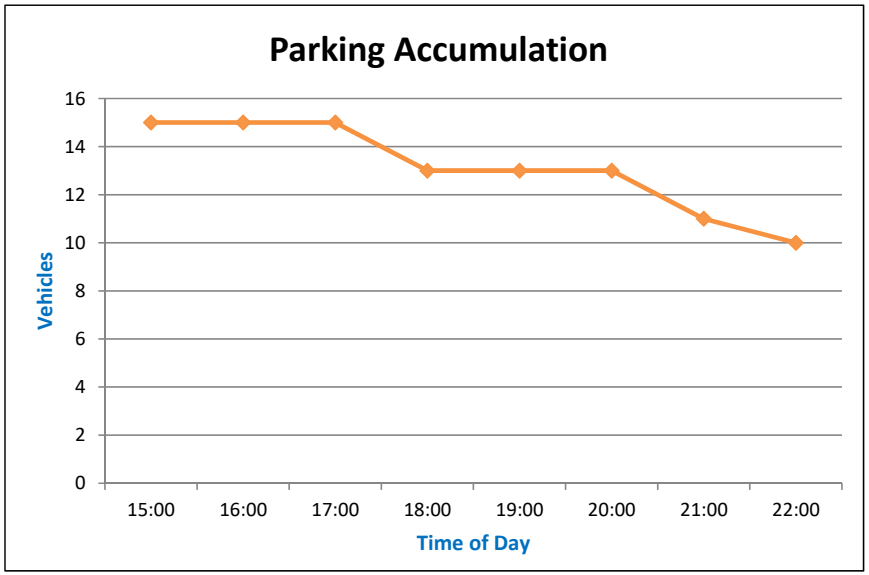
Client	GTA
Location	**Total - B. Car Park
Date	Tue, 31st Jul 2018 (15:00-22:00 inclusive)
Description	Mosman Parking Survey

MATRIX Traffic and Transport Data

Site	**Total - B. Car Park	**Peak demand**	15
Total Parking Spaces	16	**Peak Demand %**	94%
		Ave Duration of Stay(h:mm)	1:58
Time Restriction	-	**Total Vehicles**	53

Total	19	25	5	2	1	0	0	1			
	Duration of Stay										
Time	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	Total	Accumulation	% Capacity
15:00		9	4	1				1	15	15	94%
16:00									0	15	94%
17:00	9								9	15	94%
18:00	5	5			1				11	13	81%
19:00		4	1	1					6	13	81%
20:00	3	2							5	13	81%
21:00		5							5	11	69%
22:00	2								2	10	63%





Client	GTA
Location	Mosman
Date	Tue, 31st Jul 2018 (15:00-22:00 inclusive)
Description	Mosman Parking Survey

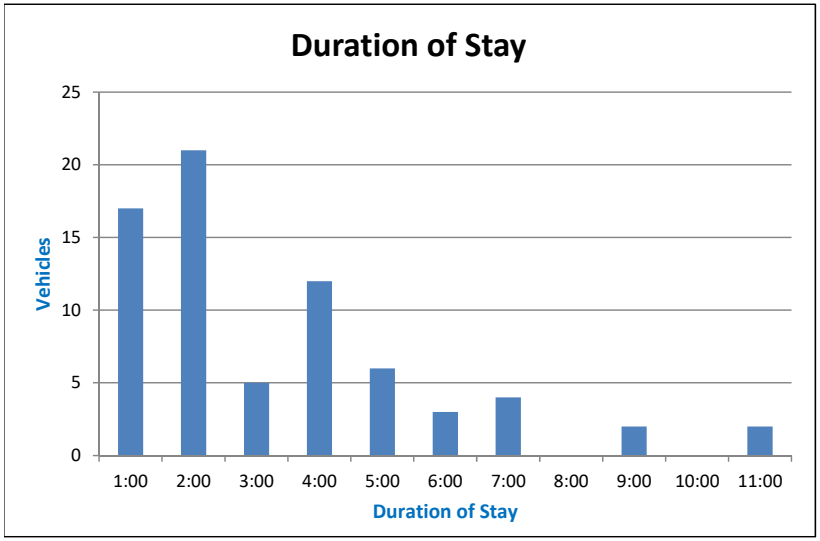
Street	Side	Between	Parking_Restriction	Time_Restrictions	Capacity	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00
On-Street Parking													
Alexander Ave	North	btwn Effingham St & Croquet Ln	No Restriction		8	5	5	4	5	5	4	3	3
			No Stopping			0	0	0	0	0	0	0	0
		btwn Croquet Ln & Rawson Park Tennis Centre	No Stopping			0	0	0	0	0	0	0	0
			No Parking			0	0	0	0	0	0	0	0
	South	btwn Rawson Park Tennis Centre & Effingham St	No Restriction	90' Angle Parking Front or Rear to Kerb	16	12	11	12	10	8	10	5	0
			No Restriction		10	0	0	2	0	0	0	0	0
			P 10mins	7:30am-10am & 3pm-6pm Mon-Fri	2	0	2	0	0	0	0	0	0
			No Stopping	7:30am-10:30am & 3pm-6pm Mon-Fri	1	0	0	0	0	0	0	0	0
			P 10mins	7:30am-10am & 3pm-6pm Mon-Fri	2	0	0	0	0	0	0	0	0
			No Restriction		16	6	7	6	6	7	6	6	6
Total					**55**	**23**	**25**	**24**	**21**	**20**	**20**	**14**	**9**
% Capacity						**42%**	**45%**	**44%**	**38%**	**36%**	**36%**	**25%**	**16%**
Croquet Ln	North	btwn Alexander Ave & Middle Head Rd	No Restriction	90' Angle Parking	17	11	10	13	6	6	5	5	5
			No Restriction		25	0	0	1	1	1	1	1	1
	South	btwn Middle Head Rd & Alexander Ave	No Stopping			0	0	0	0	0	0	0	0
			No Parking			0	0	0	0	0	0	0	0
			No Stopping			0	0	0	0	0	0	0	0
Total					**42**	**11**	**10**	**14**	**7**	**7**	**6**	**6**	**6**
% Capacity						**26%**	**24%**	**33%**	**17%**	**17%**	**14%**	**14%**	**14%**
Cross St	North	btwn Bradleys Head Rd & 1 Cross St	No Restriction		15	10	11	11	11	12	9	9	10
	South	btwn 2 Cross St & Bradleys Head Rd	No Stopping			0	0	0	0	0	0	0	0
			No Restriction		15	11	7	7	10	10	7	7	7
Total					**30**	**21**	**18**	**18**	**21**	**22**	**16**	**16**	**17**
% Capacity						**70%**	**60%**	**60%**	**70%**	**73%**	**53%**	**53%**	**57%**
Off-Street Parking													
A. Car Park	Off-St	North of Cross St	No Restriction		38	32	36	31	36	14	14	17	9
			Disabled	Authorised Disabled Persons Vehicles Excepted	1	0	0	1	0	0	0	0	0
			No Restriction		1	1	1	1	1	0	0	0	0
Total					**40**	**33**	**37**	**33**	**37**	**14**	**14**	**17**	**9**
% Capacity						**83%**	**93%**	**83%**	**93%**	**35%**	**35%**	**43%**	**23%**
B. Car Park	Off-St	South of Cross St	No Restriction		15	15	15	15	13	13	13	11	10
			Disabled		1	0	0	0	0	0	0	0	0
Total					**16**	**15**	**15**	**15**	**13**	**13**	**13**	**11**	**10**
% Capacity						**94%**	**94%**	**94%**	**81%**	**81%**	**81%**	**69%**	**63%**

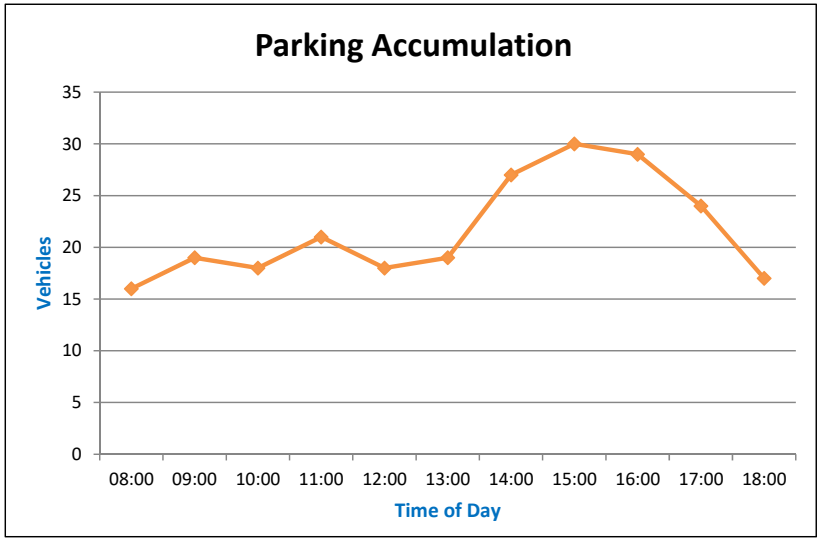
Client	GTA
Location	**Total - Alexander Ave
Date	Sat, 4th Aug 2018 (8:00-18:00 inclusive)
Description	Mosman Parking Survey

MATRIX Traffic and Transport Data

Site	**Total - Alexander Ave	**Peak demand**	30
Total Parking Spaces	55	**Peak Demand %**	55%
		Ave Duration of Stay(h:mm)	3:18
Time Restriction	-	**Total Vehicles**	72

Total	17	21	5	12	6	3	4	0	2	0	2			
	Duration of Stay													
Time	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	Total	Accumulation	% Capacity
08:00		4		3	3	2			2		2	16	16	29%
09:00	1	1				1						3	19	35%
10:00	1	2					1					4	18	33%
11:00	4						1					5	21	38%
12:00	1	1	2				2					6	18	33%
13:00		2		3								5	19	35%
14:00		1	3	4	3							11	27	49%
15:00	3	3		2								8	30	55%
16:00	1	2										3	29	53%
17:00	3	5										8	24	44%
18:00	3											3	17	31%





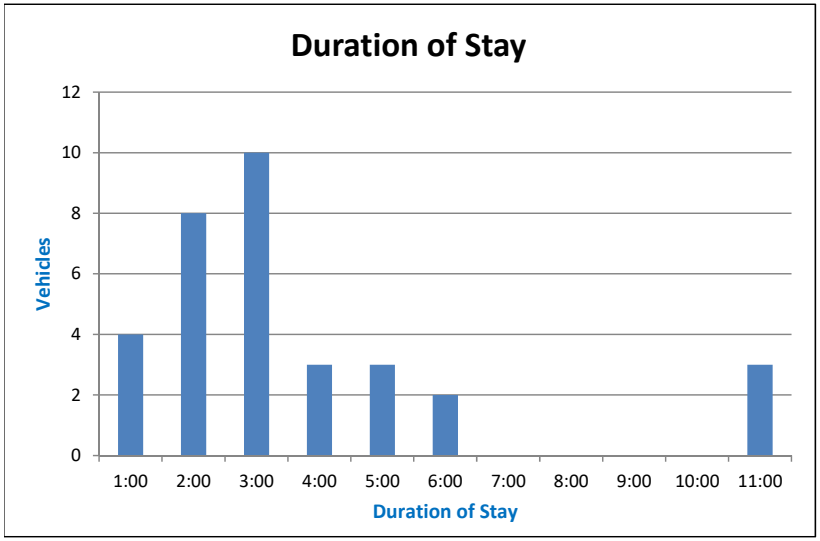
Client	GTA
Location	**Total - Croquet Ln
Date	Sat, 4th Aug 2018 (8:00-18:00 inclusive)
Description	Mosman Parking Survey

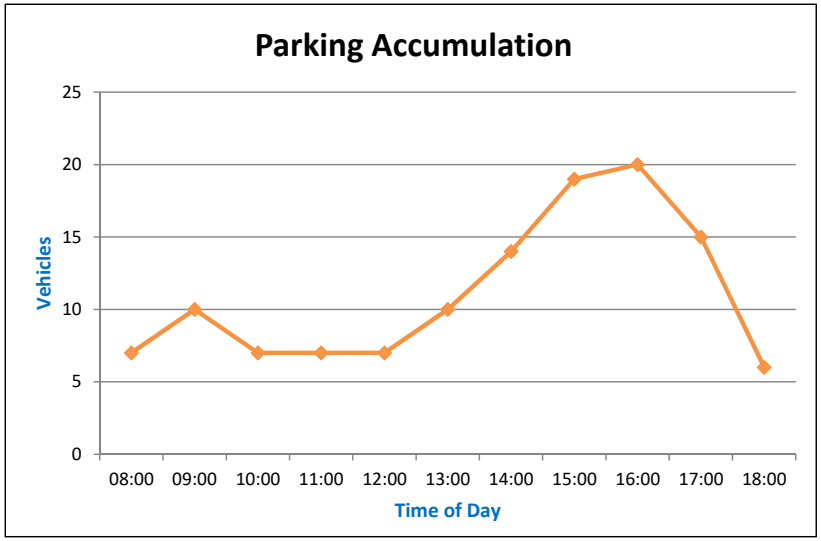
MATRIX Traffic and Transport Data

Site **Total - Croquet Ln
Total Parking Spaces 42
Time Restriction -

Peak demand 20
Peak Demand % 48%
Ave Duration of Stay(h:mm) 3:41
Total Vehicles 33

Total	4	8	10	3	3	2	0	0	0	0	3			
	Duration of Stay													
Time	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	Total	Accumulation	% Capacity
08:00		2			1	1					3	7	7	17%
09:00	1		1		1							3	10	24%
10:00												0	7	17%
11:00												0	7	17%
12:00			1									1	7	17%
13:00			1	2		1						4	10	24%
14:00		1	3	1	1							6	14	33%
15:00		3	3									6	19	45%
16:00		2	1									3	20	48%
17:00	3											3	15	36%
18:00												0	6	14%



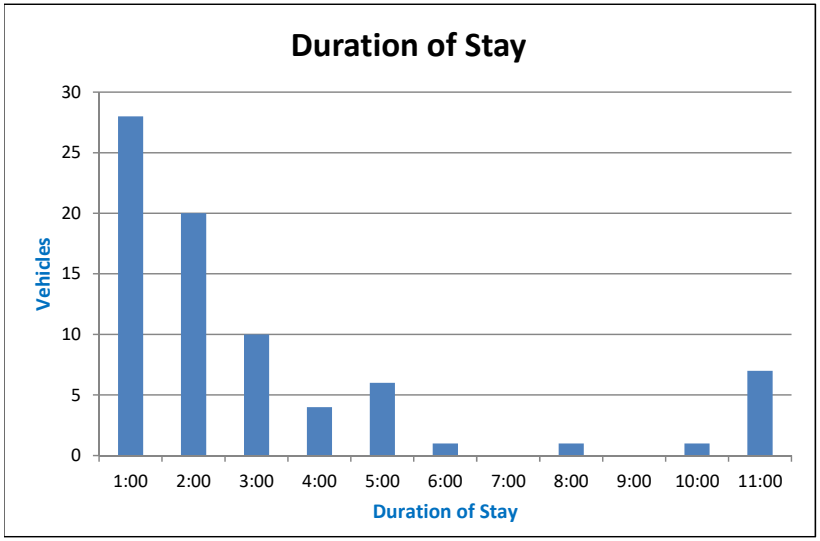


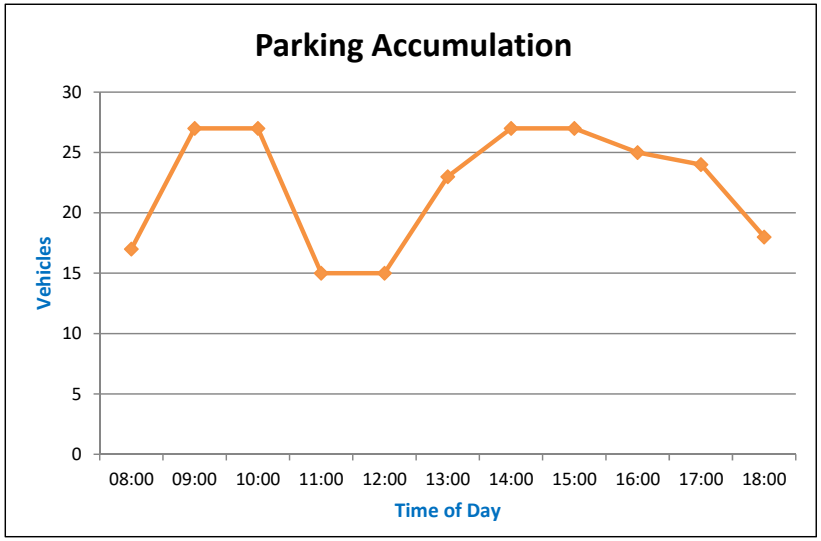
Client	GTA
Location	**Total - Cross St
Date	Sat, 4th Aug 2018 (8:00-18:00 inclusive)
Description	Mosman Parking Survey

MATRIX Traffic and Transport Data

Site	**Total - Cross St	**Peak demand**	27
Total Parking Spaces	30	**Peak Demand %**	90%
		Ave Duration of Stay(h:mm)	3:08
Time Restriction	-	**Total Vehicles**	78

Total	28	20	10	4	6	1	0	1	0	1	7			
	Duration of Stay													
Time	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	Total	Accumulation	% Capacity
08:00	2	2	1	2	3						7	17	17	57%
09:00		11								1		12	27	90%
10:00	2											2	27	90%
11:00			1					1				2	15	50%
12:00	1					1						2	15	50%
13:00	4		6		2							12	23	77%
14:00	3	3	1	1	1							9	27	90%
15:00	1	1		1								3	27	90%
16:00	4	3	1									8	25	83%
17:00	5											5	24	80%
18:00	6											6	18	60%



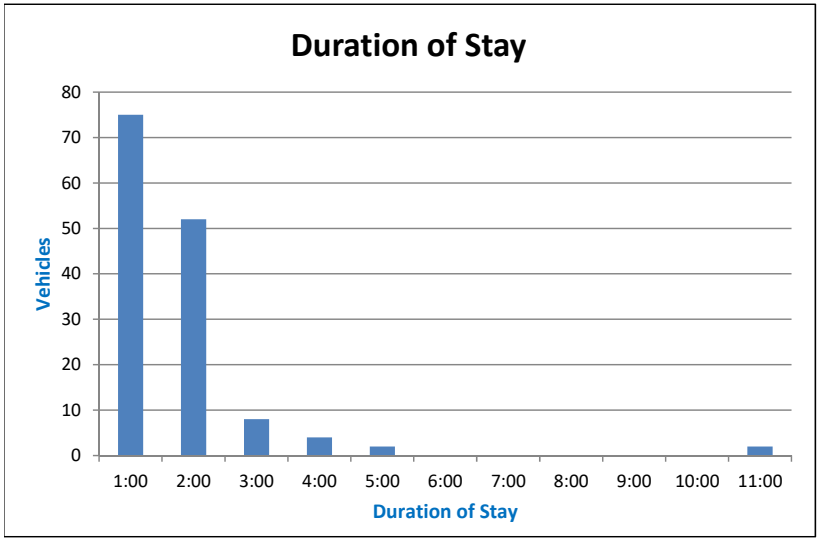


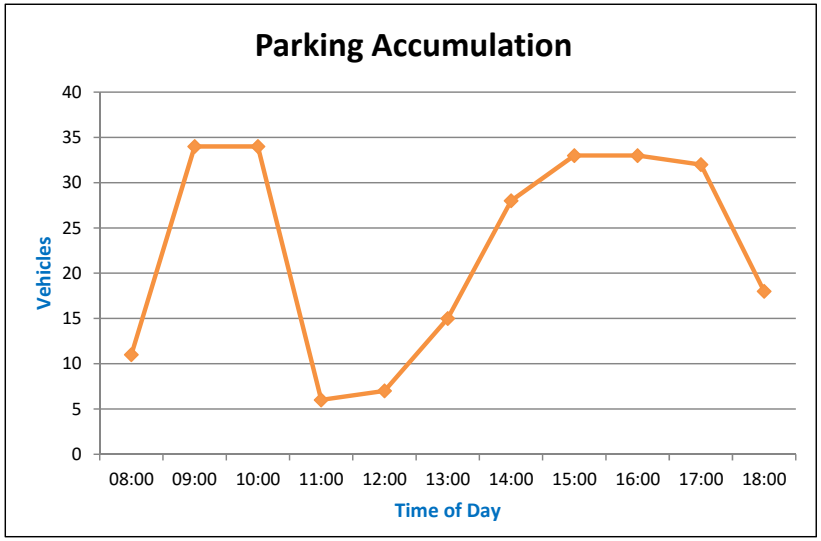
Client	GTA
Location	**Total - A. Car Park
Date	Sat, 4th Aug 2018 (8:00-18:00 inclusive)
Description	Mosman Parking Survey

MATRIX Traffic and Transport Data

Site	**Total - A. Car Park	**Peak demand**	34
Total Parking Spaces	40	**Peak Demand %**	85%
		Ave Duration of Stay(h:mm)	1:45
Time Restriction	-	**Total Vehicles**	143

Total	75	52	8	4	2	0	0	0	0	0	2			
	Duration of Stay													
Time	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	Total	Accumulation	% Capacity
08:00	4	2	3								2	11	11	28%
09:00	6	21										27	34	85%
10:00	8											8	34	85%
11:00	3	1										4	6	15%
12:00	4											4	7	18%
13:00	9	1	2		1							13	15	38%
14:00	5	11	1	4	1							22	28	70%
15:00	8	2	1									11	33	83%
16:00	9	11	1									21	33	83%
17:00	8	3										11	32	80%
18:00	11											11	18	45%



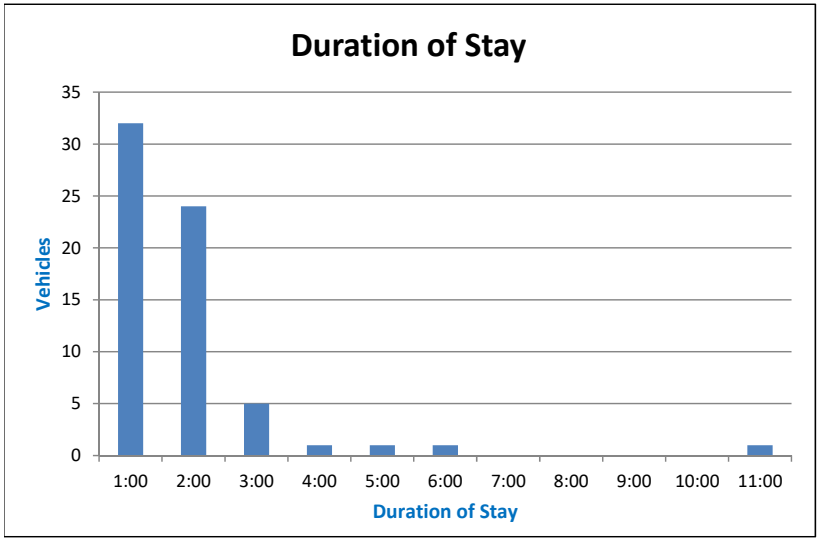


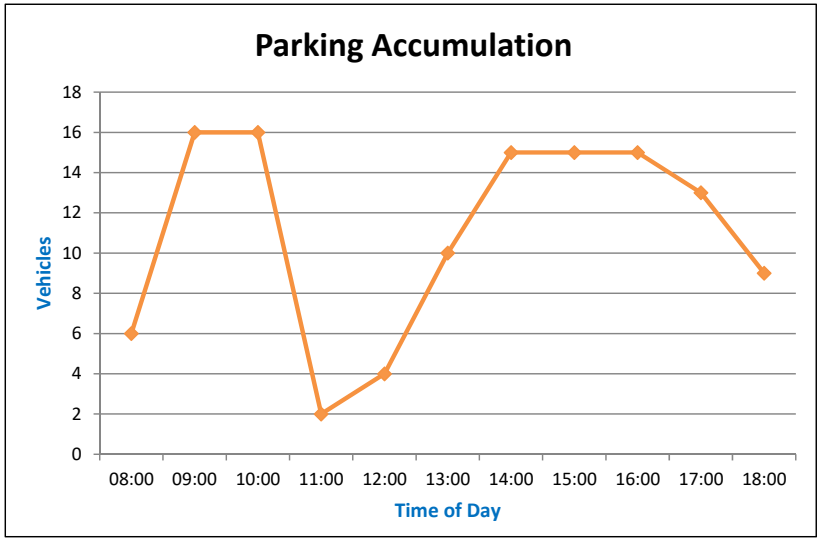
Client	GTA
Location	**Total - B. Car Park
Date	Sat, 4th Aug 2018 (8:00-18:00 inclusive)
Description	Mosman Parking Survey

MATRIX Traffic and Transport Data

Site	**Total - B. Car Park	**Peak demand**	16
Total Parking Spaces	16	**Peak Demand %**	100%
		Ave Duration of Stay(h:mm)	1:51
Time Restriction	-	**Total Vehicles**	65

Total	32	24	5	1	1	1	0	0	0	0	1			
	Duration of Stay													
Time	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	Total	Accumulation	% Capacity
08:00	4		1								1	6	6	38%
09:00	1	13										14	16	100%
10:00	1											1	16	100%
11:00	1											1	2	13%
12:00	3											3	4	25%
13:00	6		1		1	1						9	10	63%
14:00	2	6	2	1								11	15	94%
15:00	1		1									2	15	94%
16:00	4	4										8	15	94%
17:00	3	1										4	13	81%
18:00	6											6	9	56%





Client	GTA
Location	Mosman
Date	Sat, 4th Aug 2018 (8:00-18:00 inclusive)
Description	Mosman Parking Survey

Street	Side	Between	Parking_Restriction	Time_Restrictions	Capacity	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00
On-Street Parking																
Alexander Ave	North	btwn Effingham St & Croquet Ln	No Restriction		8	3	3	3	3	3	3	4	5	3	2	3
			No Stopping			0	0	0	0	0	0	0	0	0	0	0
		btwn Croquet Ln & Rawson Park Tennis Centre	No Stopping			0	0	0	0	0	0	0	0	0	0	0
			No Parking			0	0	0	0	0	0	0	0	0	0	0
	South	btwn Rawson Park Tennis Centre & Effingham St	No Restriction	90' Angle Parking Front or Rear to Kerb	16	8	10	8	11	7	8	12	13	14	9	3
			No Restriction		10	0	1	1	0	0	1	2	1	2	2	1
			P 10mins	7:30am-10am & 3pm-6pm Mon-Fri	2	0	0	0	0	0	0	1	1	0	0	0
			No Stopping	7:30am-10:30am & 3pm-6pm Mon-Fri	1	0	0	0	0	0	0	0	0	0	0	0
			P 10mins	7:30am-10am & 3pm-6pm Mon-Fri	2	0	0	0	1	1	1	1	1	1	1	0
			No Restriction		16	5	5	6	6	7	6	7	9	9	10	10
Total					**55**	**16**	**19**	**18**	**21**	**18**	**19**	**27**	**30**	**29**	**24**	**17**
% Capacity						**29%**	**35%**	**33%**	**38%**	**33%**	**35%**	**49%**	**55%**	**53%**	**44%**	**31%**
Croquet Ln	North	btwn Alexander Ave & Middle Head Rd	No Restriction	90' Angle Parking	17	3	6	4	4	4	7	10	14	16	11	4
			No Restriction		25	4	4	3	3	3	3	4	5	4	4	2
	South	btwn Middle Head Rd & Alexander Ave	No Stopping			0	0	0	0	0	0	0	0	0	0	0
			No Parking			0	0	0	0	0	0	0	0	0	0	0
			No Stopping			0	0	0	0	0	0	0	0	0	0	0
Total					**42**	**7**	**10**	**7**	**7**	**7**	**10**	**14**	**19**	**20**	**15**	**6**
% Capacity						**17%**	**24%**	**17%**	**17%**	**17%**	**24%**	**33%**	**45%**	**48%**	**36%**	**14%**
Cross St	North	btwn Bradleys Head Rd & 1 Cross St	No Restriction		15	12	13	13	11	10	12	14	15	13	14	12
	South	btwn 2 Cross St & Bradleys Head Rd	No Stopping			0	0	0	0	0	0	0	0	0	0	0
			No Restriction		15	5	14	14	4	5	11	13	12	12	10	6
Total					**30**	**17**	**27**	**27**	**15**	**15**	**23**	**27**	**27**	**25**	**24**	**18**
% Capacity						**57%**	**90%**	**90%**	**50%**	**50%**	**77%**	**90%**	**90%**	**83%**	**80%**	**60%**
Off-Street Parking																
A. Car Park	Off-St	North of Cross St	No Restriction		38	9	32	33	6	7	15	27	32	32	30	16
			Disabled	Authorised Disabled Persons Vehicles Excepted	1	1	1	0	0	0	0	0	0	0	1	1
			No Restriction		1	1	1	1	0	0	0	1	1	1	1	1
Total					**40**	**11**	**34**	**34**	**6**	**7**	**15**	**28**	**33**	**33**	**32**	**18**
% Capacity						**28%**	**85%**	**85%**	**15%**	**18%**	**38%**	**70%**	**83%**	**83%**	**80%**	**45%**
B. Car Park	Off-St	South of Cross St	No Restriction		15	6	15	15	2	4	10	15	15	15	13	9
			Disabled		1	0	1	1	0	0	0	0	0	0	0	0
Total					**16**	**6**	**16**	**16**	**2**	**4**	**10**	**15**	**15**	**15**	**13**	**9**
% Capacity						**38%**	**100%**	**100%**	**13%**	**25%**	**63%**	**94%**	**94%**	**94%**	**81%**	**56%**

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Appendix 9.

SHAPING OUR TRANSPORT FUTURE

25 September 2018

[redacted]
[redacted]
Mosman NSW 2088

Dear [redacted]

OFF-STREET PARKING ACCESSED FROM CROSS STREET, MOSMAN

In response to your email request and our subsequent site meeting, we provide our initial comments for your consideration.

BACKGROUND

The site includes two at grade parking areas which are commonly known as Rawson Park and the Drill Hall. The Rawson Park parking area consists of 39 standard bays and 1 disability bay with the Drill Hall providing 15 bays and 1 disability bay giving a combined capacity of 56 bays. Separate access to each is provided from Cross Street, Mosman, which is a local residential street. Cross Street on-street parking is unrestricted.

The car parks are physically separated by a retaining wall and pedestrian thoroughfare. They provide parking for Rawson Oval, a meeting hall, the Marie Bashir sporting complex and three netball training courts. Additionally, pedestrian access to the Georges Heights,- Headland Park dog park, walking tracks, lookout, playing fields as well as Mosman Private Hospital can also be gained via the car parks.

The Rawson Park parking area is owned and operated by Mosman Council ('Council'). The Drill Hall parking area is owned by the Harbour Trust and operated under a lease agreement by Council. A copy of the Lease has been provided to ARRB.

INTRODUCTION TO ARRB PARKING

The Australian Road Research Board (ARRB) was established in 1960 and has been providing specialist parking advice for more than 20 years. At ARRB, we're helping to solve today's most pressing transport problems. We're also firmly focused on building the knowledge to identify and overcome the challenges we'll face in future decades. These solutions will make our activity centres and infrastructure, smarter, cleaner, greener, safer, more efficient and more productive.

ARRB's resources include personnel with expertise in car parking operations, management, audit, technology, design and safety.

MITIGATION OF RISK

A number of recent accidents occurring in Council operated car parks which serve community centres and sporting facilities received extensive media coverage. As a consequence, the potential safety risks associated with operating parking infrastructure has been highlighted to Local Governments, insurers as well as the community.

Once identified, many Councils are taking positive steps to mitigate these risks.

VIC | 80a Turner St, Port Melbourne, 3207 VIC, Australia | +61 3 9881 1555 | arrb.com.au | ABN 68 004 620 651
NSW | 2-14 Mountain St, Ultimo, NSW 2007, Australia | +61 2 9282 4444
QLD | 21 McLachlan St, Fortitude Valley, QLD 4006, Australia | +61 7 3260 3500
SA | PO Box 31, Rundle Mall, Adelaide, SA 5000, Australia | +61 8 8235 3300
WA | 191 Carr Place, Leederville, WA 6007, Australia | +61 8 9227 3000

INITIAL REVIEW

ARRB have conducted a cursory review of the car parks and confirm the following findings:

Competing Demands and Supply

The parking supply provided by both parking areas does not satisfy current competing demand from the various generators within the precinct during peak periods. This deficiency in capacity is causing parking overspill in surrounding residential streets.

We note there is a proposal to upgrade the netball courts with the installation of lighting to encourage evening utilisation of the facility. The resultant impact on parking demand should be investigated.

Current Enforcement and Management

Council are not managing the car parks in accordance with standard practice as well as the Management Plan and associated obligations contained in the Lease. The Rawson Park car park is not operating as designed due to the absence of clear directional pavement markings and informational signage.

There is no signage erected displaying the terms and conditions of parking or rules and regulations for entry and use. As a minimum, parkers are required to comply with the Roads and Maritime Services Road Rules as they apply which should be incorporated in Council's general regulations. However, given the highlevel of utilisation during peak periods, current non-compliance and to increase public awareness, it is advisable appropriate signage is installed

Due to minimal enforcement being undertaken by Council, vehicles are parking across two designated bays and not within the linemarking. This impacts the availability of the existing limited parking supply.

Additionally, sub-standard maintenance has led to several rocks detaching from the retaining wall located between the car parks falling onto parking bays in the Drill Hall car park.

Design Compliance

The size of some of the parking bays in the Rawson Park car park appear non-compliant with the Australian Standards for Off Street Parking Facilities AS 2890.1:2004 when taking into account the curent use and aisle dimensions. This warrants further investigation.

Potential Safety and Other Risks

The potential risk to safety arising from vehicle/vehicle and vehicle/pedestrian conflict is of concern and exists due to the following:

- Escalating demand and utilisation.
- Minimal enforcement of the rules and regulations by Council.
- No clearly defined and marked pedestrian thoroughfares within the car parks and across the access ways.
- Non-compliant car park design.
- The absence of pavement marked directional arrows and supporting signage in the Rawson Park car park leading to conflicting traffic flows.

- Council garbage trucks, tractors and other heavy vehicles using the access as a thoroughfare as well as a parking area.
- Vehcles parking adjacent to the Rawson Park car park access impacting the line of sight of exiting drivers.
- The lack of parking availability during peak periods causing drivers to drop passengers off at the entrances and aisles of the car parks.
- The failure to properly repair and maintain the retaining wall.

Futhermore, the failure to display adequate terms and conditions or rules and regulations enhances the risk of non-compliance and is an impediment to enforcement. It also creates uncertainty regarding liability for damage and loss incurred while using the car parks.

MOVING FORWARD

Moving forward, ARRB recommend the following:

Current and Forecast Demand

A survey should be undertaken to determine current demand and utilisation of the car parks as well as the Cross Street on-street parking, especially during peak periods.

An analysis of the expected impact on parking demand arising from the proposed installation of additional lighting for the netball courts is also required.

Car Park Design

The design of each car park, including the points of access should be examined to consider:

- Compliance with Australian Standards for Off Street Parking Facilities AS 2890.1:2004.
- The user experience.
- Mitigation of vehicle and pedestrian safety risks.
- Efficiency of bay layout.
- Traffic flow, speed management and traffic calming.
- Optimum capacity.

Options and Tools Available

Alternative options and available parking management tools should then be examined to improve the customer experience and operational performance as well as mitigate safety risk and alleviate community concerns. This will include consideration of lessons learned by other Councils when implementing solutions in similar circumstances.

Operational Plan

An operational plan should then be developed in agreement with all key stakeholders which will address parking management requirements and obligations specific to:

- Car park design including bay layout, designated pedestrian thoroughfares, drop off zones, signage and pavement markings.
- Enforcement.
- Maintenance.
- Restriction on parking use.
- Parking overspill during peak times and protecting residential on-street parking amenity.
- Future disruptors and the impact on parking demand of future development.

Stakeholder Meeting

We are available to meet with the residents or the Harbour Trust to discuss all of the issues and outline the services we can provide which will assist in a successful resolution of this matter for all parties concerned. These services include a risk assessment of the current parking infrastrucure as well as the proposed intensified use.

We trust our preliminary advice assists.

Yours sincerely,

Michael Moses
Principal Technology Leader
Future Transport Infrastructure

Appendix 10.

Tuesday, 27 August 2019

Mr Adrian Webster
Mosman Municipal Council
PO Box 211
Spit Junction NSW 2088

Dear Mr Webster,

RE: Flood Lighting the Netball Courts Near Mosman Drill Hall — Heritage Advice

This letter discusses the heritage impact of the proposed flood lighting of the three netball courts at the Mosman Drill Hall Common. The site is listed on the Commonwealth Heritage List as part of the Headquarters 8th Brigade Precinct, Cross St, Clifton Gardens, NSW (Commonwealth Place Identifier 105541). This Commonwealth Heritage Listed site for ID 105541 comprises the whole of Lot 2 in DP 541799, which fully encloses the subject netball courts. The subject place ID 105541 is within a separate, larger Commonwealth Heritage listing for 'Defence site — Georges Heights and Middle Head, Middle Head Road, Georges Heights', (same Commonwealth Place Identifier 105541).

The site is close to Rawson Oval, which is a heritage item (I349) and the C1 Conservation Area. (see Figure 1 below)

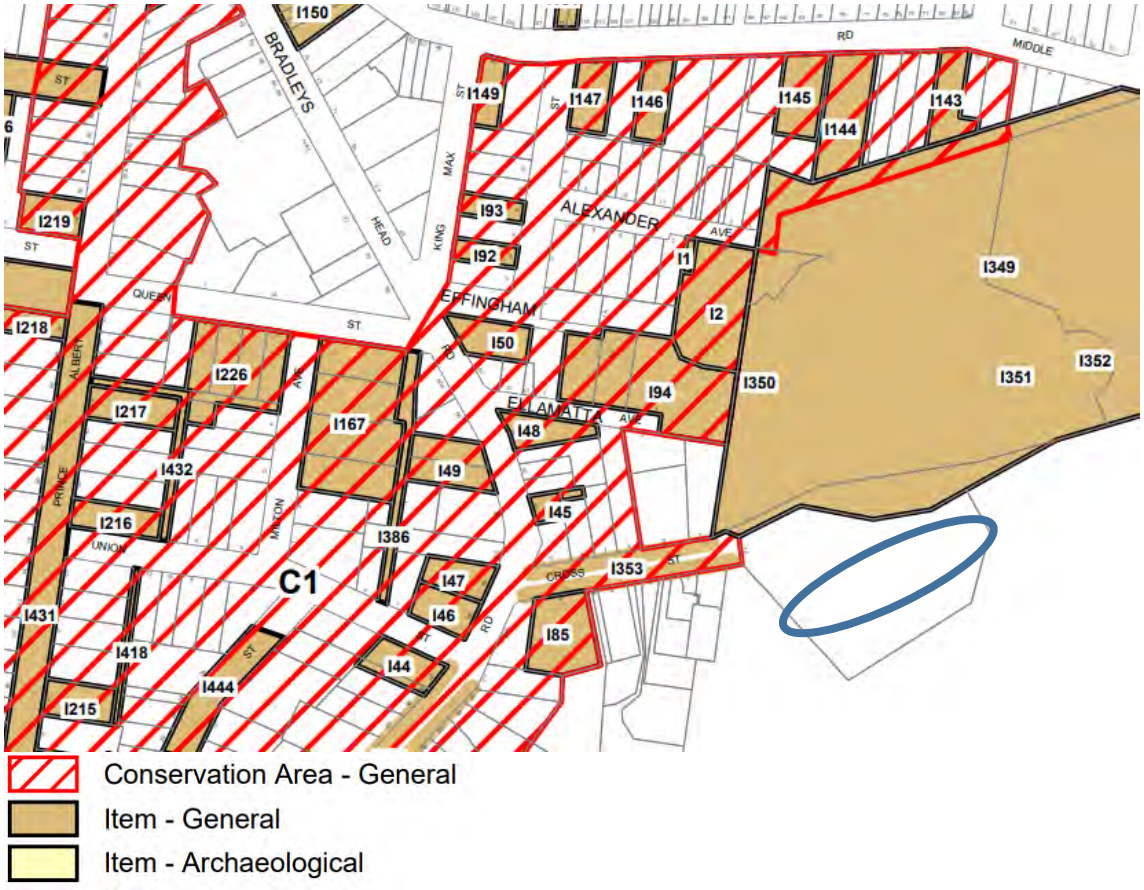

Figure 1 — extract from Heritage Map 002 in the Mosman Local Environmental Plan 2012. The site of the subject three netball courts is circled in blue, which is part of the allotment of Lot 2 in DP 541799, on the Commonwealth Heritage List.

1.1 SIGNIFICANCE OF THE SUBJECT SITE

The Headquarters 8th Brigade Precinct (including the Mosman Drill Hall) has the following official Commonwealth heritage values:

Criterion A Processes

The Headquarters 8th Brigade Precinct is one of a number of places that are part of the larger Middle Head-Georges Heights defence site. The site is historically significant as the location of major defence works for Sydney Harbour and Port Jackson during the nineteenth and twentieth centuries and provides an appropriate setting for the former Mosman Drill Hall.

The Mosman Drill Hall, under erection in October 1913 as one of 5 new drill halls in Sydney, was one of the earliest erected in New South Wales by the Commonwealth Government. Until 1901 Defence had been the responsibility of each colony. The passing of the Defence Act in December 1909 introduced a universal training scheme based on the Swiss model which provided for the compulsory training of Junior and Senior cadets from the age of twelve to eighteen and for adult training. Drill halls for militia training were implemented in 1913 to four standard plans prepared by the Commonwealth Architect's office under J S Murdoch.

Attributes: The architectural form and fabric of the whole building.

Criterion B Rarity

The building is unusual in the use of steel framing throughout in contrast to the standard stud framed construction.

Attributes: The building's steel-framed construction.

Criterion D Characteristic values

The Drill Hall is important as an excellent example of a Type-2 drill hall designed by the Commonwealth Architects office. The drill hall location at the junction of Cross Street and Bradleys Head Road illustrates the characteristic prominent siting employed to promote public access, the northern boundary of the site defining the alignment of the military road of 1871.

Attributes: The architectural form and fabric of the whole building, including plan, elevations, architectural details, setting and address to the road.

Summary Statement of Significance

The Headquarters 8th Brigade Precinct is one of a number of places that are part of the larger Middle Head-Georges Heights defence site (see Register No.102619). The site is historically significant as the location of major defence works for Sydney Harbour and Port Jackson during the nineteenth and twentieth centuries and provides an appropriate setting for the former Mosman Drill Hall.

The Mosman Drill Hall, under erection in October 1913 as one of 5 new drill halls in Sydney, was one of the earliest erected in New South Wales by the Commonwealth Government. Until 1901 Defence had been the responsibility of each colony. The passing of the Defence Act in December 1909 introduced a universal training scheme based on the Swiss model which provided for the compulsory training of Junior and Senior cadets from the age of twelve to eighteen and for adult training. Drill halls for militia training were implemented in 1913 to four standard plans prepared by the Commonwealth Architect's office under J S Murdoch. (Criterion A.4) (Historic Themes: 7.4 Federating Australia; and 7.7 Defending Australia)

The Drill Hall is important as an excellent example of a Type-2 drill hall designed by the Commonwealth Architects office. The drill hall location at the junction of Cross Street and Bradleys Head Road illustrates the characteristic prominent siting employed to promote public access, the northern boundary of the site defining the alignment of the military road of 1871. The building is unusual in the use of steel framing throughout in contrast to the standard stud framed construction. (Criteria B.2 and D.2)

1.2 PROPOSED WORKS

Design options for lighting the netball courts have been prepared by Webb Australia, Consulting Engineers. Among the two lighting options, Council has selected the option for four lighting poles 8m tall for each of the three courts.

The 1943 aerial photograph of the subject site shows the drill hall in place, and the alignment of the existing roadway adjacent to the netball courts, which was a dirt track at that time. The site of the netball courts had been cleared of the larger trees at that time, but was occupied by scrub and grassland. The netball court site had a grid of army tents on it then. The site of the netball courts is unlikely to have any European archaeological significance. The site is highly disturbed and is unlikely to contain stratified relics of any type.

The lighting poles would be slender steel posts and their 8m height is well under the canopy of the nearby trees. The light poles would not have a physical impact on any fabric of heritage significance. The lighting works would not diminish view views towards a heritage item. The lighting poles are consistent with the traditional use of the netball courts and wider area for community sports. The night-time light from the poles may have an amenity impact, but this is not a heritage issue and will be assessed separately by others.

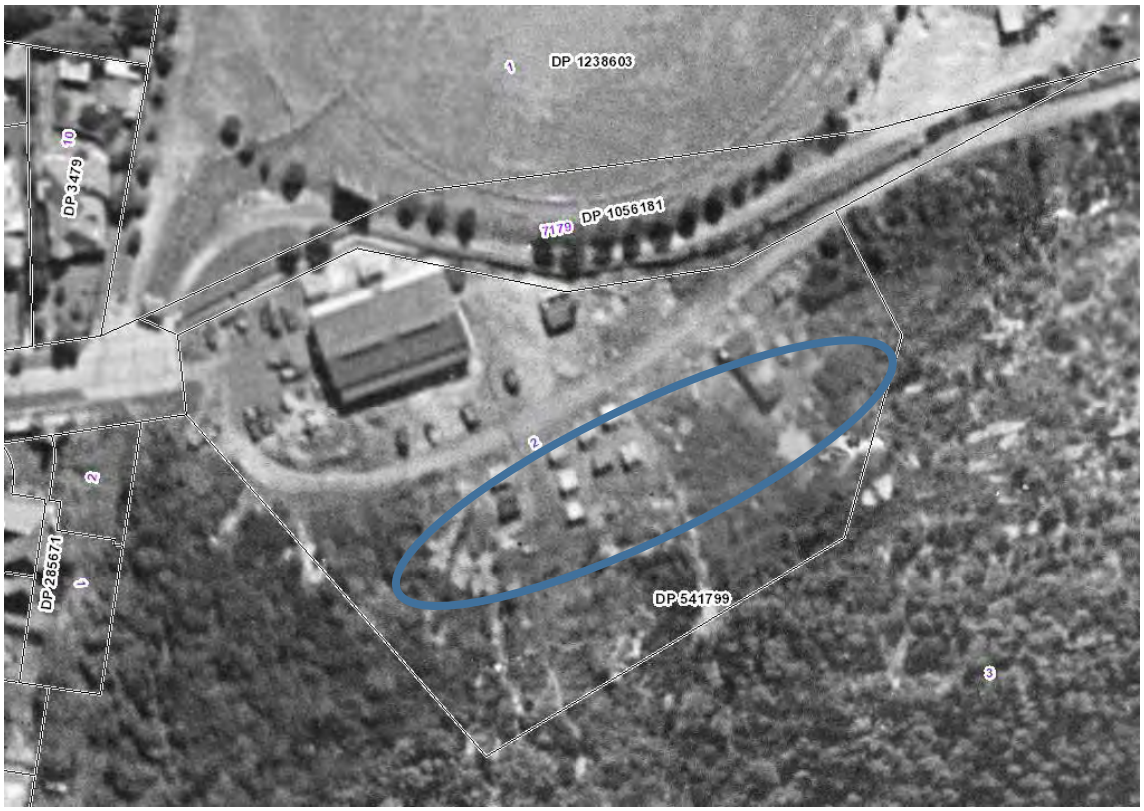

Figure 2 — extract from the 1943 aerial photograph of Sydney (source: NSW Spatial Information Exchange) The site of the subject three netball courts is circled in blue.

1.3 EVALUATION OF IMPACTS ON COMMONWEALTH HERITAGE VALUES

This assessment of heritage impact against Commonwealth Heritage Values addresses the more specific listing of the Headquarters 8th Brigade Precinct.

Headquarters 8th Brigade Precinct: Commonwealth Heritage Value	Potential Heritage Impact
Criterion A Processes	The proposed lighting will have no impact on the site as a defense site. Sporting facilities are complementary to the setting of a drill hall, since cadets were intended to be fit. The works will have no physical impact on the form or fabric of the drill hall.
Criterion B Rarity	The lighting works will have no physical impact on the steel framing of the drill hall.
Criterion D Characteristic values	The works will have no adverse impact on the building as a Type-2 drill hall designed by the Commonwealth Architects office, nor will there be any adverse impact on the characteristic prominent siting of the drill hall.

The Commonwealth heritage listing of the Headquarters 8th Brigade Precinct is within the broader Commonwealth heritage listing of the Defence site — Georges Heights and Middle Head, Middle Head Rd, Georges Heights. The broader listing of the Georges Heights sites includes a recognition of the development of colonial and national defence policy and military training in Australia from the Napoleonic Wars until the 1960s, the remnant natural vegetation, and social/community values. Without quoting the criteria (available at http://www.environment.gov.au/cgi-bin/ahdb/search.pl?mode=place_detail;search=state%3DNSW%3Blist_code%3DCHL%3Blegal_status%3D35%3Bkeyword_PD%3D0%3Bkeyword_SS%3D0%3Bkeyword_PH%3D0;place_id=105541), the following assessment is made against the Commonwealth criteria for the Defence site — Georges Heights and Middle Head, Middle Head Rd, Georges Heights.

Commonwealth Heritage Value	Potential Heritage Impact
Criterion A Processes	The proposed lighting will have no impact on the demonstrated development of colonial and national defence policy and military training in Australia from the Napoleonic Wars until the 1960s, no impact on military technology, no adverse impact on the cultural or natural landscape. The lighting is compatible with the universal training scheme which followed the *1909 Defence Act,* and the growth of leisure and recreation in the early twentieth century.
Criterion B Rarity	The lighting works will have no impact on the remnant natural vegetation of the precinct or the character of the harbor foreshore, since the light poles are very unlikely to be visible from sea level.
Criterion C Research	The 1943 aerial photograph shows land clearing as the only development to have taken place on the netball courts site, so the minor excavation to install electrical wiring is very unlikely to uncover European era archaeological artefacts.

Criterion D Characteristic values	The lighting works will have no adverse impact on nineteenth-century military development or the natural vegetation around Sydney Harbour.
Criterion E Aesthetic characteristics	The lighting works will have no adverse impact on the natural and scenic values of Sydney Harbour's foreshore, or interfere with public views.
Criterion F Technical achievement	The lighting works will have no adverse impact on the precinct's demonstration of technical innovation in the early use of concrete.
Criterion G Social value	The proposed lighting complements the precinct's associations with recreational use, which began in the nineteenth century.
Criterion H Significant people	The lighting works will have no impact on the works of Lt Colonel J Gordon, Colonial Architect James Barnet, General Sir William Jervois RE or Lt Colonel Peter Scratchley.
Criterion I Indigenous tradition	While Indigenous cultural values are not assessed at the site on the Commonwealth Heritage Register, the small amount of excavation at this disturbed site is unlikely to reveal stratified Aboriginal artefacts of state significance. Should any Aboriginal objects be identified during excavation at this site, works must cease and the area containing the objects be made secure (any artefacts must be left in situ). The Office of Environment and Heritage (formerly National Parks and Wildlife Service) Aboriginal Cultural Heritage Unit must be notified of any such find. An archaeologist must be called in at this time to assess the site and provide management recommendations in conjunction with the Local Aboriginal Land Council, any other identified Aboriginal Stakeholders and the Office of Environment and Heritage.

1.4 CONCLUSION

The proposed lighting of the three netball courts in the Drill Hall Common would have no adverse heritage impact on the Commonwealth heritage values of the Headquarters 8th Brigade Precinct. No formal referral should be made to the Commonwealth Department of the Environment and Energy under the EPBC Act.

These works will also have no adverse heritage impact on Rawson Park, the various listed features within Rawson Park, or the Bradleys Head Road Heritage Conservation Area (C1), each of which is nearby.

Yours Faithfully,
NBRSARCHITECTURE**.**

Brad Vale
Senior Heritage Consultant

Appendix 11.

ecosure

Flora and Fauna Impact Statement

Drill Hall Common
Report
August 2018

Mosman Municipal Council

ecology / vegetation / wildlife / aquatic ecology / GIS

Executive summary

This Flora and Fauna Impact Statement is for Lot 2 DP 541799 on Cross Street, Mosman, known as Drill Hall Common. This Statement addresses the potential impacts in relation to the installation of flood lighting at three existing netball courts. There are two threatened species known to occur on or within the vicinity of the site.

Following a review of relevant databases and documents, as well as a site assessment, the proposed activity was found to have no significant impact on threatened species or other native fauna and flora occurring at or within the vicinity of Drill Hall Common.

Glossary, acronyms and abbreviations

BC Act	*Biodiversity Conservation Act 2016*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
MMC	Mosman Municipal Council

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1 Introduction

1.1 Overview

Mosman Municipal Council (MMC) has engaged Ecosure Pty Ltd (Ecosure) to undertake a flora and fauna impact statement to address potential impacts in relation to the installation of flood lighting at three existing netball courts located at Drill Hall Common, Mosman (see Appendix 1 for lighting footprint). The lighting will extend the hours of operation of the courts to include:

- 5.30 – 8.30 pm Mondays to Thursdays (February to September)
- 5.30 – 8.30 pm for 2-3 evenings per week (October to February).

The scope of work includes:

- A desktop assessment including:
  - Literature review of relevant databases, reports, documents and planning policies
  - Determination of potential impacts on flora and fauna, and mitigation options, associated with construction and operation of the floodlights
- Review of construction and future flood lighting impacts on threatened species or Threatened Ecological Communities
- Two tests of significance (5 part tests) on threatened species likely or known to occur in the vicinity of the site under the *Biodiversity Conservation Act 2016*
- Summary report of findings from the desktop assessment, site visit, tests of significance and recommendations.

1.2 Site description

Drill Hall Common is located on the ridge of Middle Head at the end of Cross Street off Bradleys Head Road, Mosman. The site is approximately one hectare in area, and consists of the heritage-listed Drill Hall and surrounding lawn and garden area, the Marie Bashir Mosman Sports Centre, three netball courts, and a linear strip of vegetation to the south. The site is adjacent to Rawson Oval and Park to the north and bounds Sydney Harbour National Park to the south, which is directly upslope from Clifton Gardens (Figure 1).

The linear strip of vegetation adjacent to the netball courts is the focus of this statement. It consists of a revegetation area along with emergent vegetation, and scattered remnant trees. The majority of understorey vegetation consists of introduced species. A fence has been erected approximately one metre from the artificial surface along the majority of the site with the exception of a grassed open space where the fence is set back approximately six metres from the netball court surface.

Figure 1: Site location

Mosman Municipal Council

Flora and fauna impact assessment

Site

Property boundary

ecosure

Job number: PR3760
Revision: 0
Author: KF
Date: 22/08/2018

0 25.5 51 76.5 102 m

GCS GDA 1994
Datum: GDA 1994
Units: Degree

2 Methods

2.1 Literature review

The Mosman Flora and Fauna Survey (Ecosure 2016) audited 25 bushland reserves and 30 unmade road reserves in the MMC area. Within the vicinity of Drill Hall Common are Bradley's Bushland Reserve and Rawson Park to the north, and Morella Road and Clifton Gardens bushland reserves to the south.

The Grey-headed Flying-fox was recorded at Bradley's Bushland Reserve, Rawson Park and Morella Road bushland reserves (Ecosure 2016). This species is listed as Vulnerable under both the *Biodiversity Conservation Act 2016* and *Environment Protection and Biodiversity Conservation Act 1999.*

Two threatened flora species were also recorded at nearby reserves. The magenta lilly pilly (*Syzygium paniculatum*) was recorded at Clifton Gardens (Ecosure 2016), and the Sunshine Wattle (*Acacia terminalis* ssp. *terminalis*) was previously recorded at Bradley's Bushland Reserve (Total Earth Care 2007). Both these threatened species were returned in the NSW BioNet Survey.

2.1.1 NSW BioNet Survey and EPBC Act Protected Matters Search Tool

A search of NSW BioNet records within 1.5 km of the site returned 18 species listed as threatened under the BC Act 2016 (Table 1). An EPBC Act Protected Matters Search returned three listed Threatened Ecological Communities, 66 threatened species and 54 migratory species as potentially occurring (see Appendix 2).

Table 1 NSW BioNet records of threatened species within 1.5 km of Drill Hall Common, Mosman

Kingdom	Class	Family Name	Scientific Name	Common Name	*NSW Status (BC Act)	*Comm Status (EPBC Act)
Animalia	Amphibia	Myobatrachidae	*Pseudophryne australis*	red-crowned toadlet	V	Not listed
	Aves	Accipitridae	*Haliaeetus leucogaster*	white-bellied sea eagle	V	C
		Accipitridae	*Hieraaetus morphnoides*	little eagle	V	Not listed
		Columbidae	*Ptilinopus superbus*	superb fruit-dove	V	Not listed
		Procellariidae	*Pterodroma leucoptera leucoptera*	Gould's petrel	V	E
		Laridae	*Onychoprion fuscata*	sooty tern	V	Not listed
		Psittacidae	*Lathamus discolour*	swift parrot	E1	CE
		Psittacidae	*Glossopsitta pusilla*	little lorikeet	V	Not listed
		Strigidae	*Ninox strenua*	powerful owl	V	Not listed
		Neosittidae	*Daphoenositta chrysoptera*	varied sittella	V	Not listed
	Mammalia	Petauridae	*Petaurus norfolcensis*	squirrel glider	V	Not listed
		Pteropodidae	*Pteropus poliocephalus*	grey-headed flying-fox	V	V
		Vespertilionidae	*Miniopterus schreibersii oceanensis*	Eastern bentwing bat	V	Not listed
		Vespertilionidae	*Myotis macropus*	Southern myotis	V	Not listed

Kingdom	Class	Family Name	Scientific Name	Common Name	*NSW Status (BC Act)	*Comm Status (EPBC Act)
Plantae	Flora	Fabaceae (Mimosoideae)	*Acacia terminalis* subsp. *terminalis*	sunshine wattle	E1	E
		Myrtaceae	*Eucalyptus camfieldii*	Camfield's stringybark	V	V
		Myrtaceae	*Melaleuca biconvex*	biconvex paperbark	V	V
		Myrtaceae	*Syzygium paniculatum*	magenta lilly pilly	E1	V

*E1 Endangered, V Vulnerable, CE Critically Endangered (Comm), E Endangered (Comm), C CAMBA (Comm – migratory bird agreement)

2.1.2 Site visit

A site visit to Drill Hall Common was conducted on 18 July 2018 from 7 am to 9 am where a full habitat assessment was completed. Data was collected using Fulcrum software which enabled a range of features to be recorded on the site including details about soil, disturbance level, vegetation type and habitat. A flora and fauna list is provided in Section 3 of the results.

3 Results

3.1 Site assessment

A site assessment conducted on 18 July 2018 identified flora and fauna occurring adjacent to the netball courts (Table 2 and 3). The site visit was conducted during the day over a period of two hours, therefore the fauna list is limited by birds present on site at the time of survey. Nocturnal species such as flying-foxes and arboreal marsupials potentially occur on site but were not surveyed.

The site is comprised of a mixture of revegetation, remnant and invasive plant species. Much of the site appears to be regrowth with very few large trees and no visible hollows. Habitat features recorded within a 50 x 20 metre plot included small logs, small and large rocks, as well as bark, and leaf litter. Shrub density was greater than 50%, nectar abundance scored 11-50%, and fruiting plant abundance scored 1-10%.

A low level of human-induced disturbance was evident. While the adjacent vegetation is fenced, a section has been removed resulting in disturbance such as trampling and littering. A storm water outlet that directs runoff from the site is also present within the adjoining vegetation. Hard landscaping works using rock and concrete substrates have been undertaken to reduce the impacts of high water flow.

3.1.1 Flora

Revegetation in the area adjacent to the netball courts has been conducted in the past so it was difficult to quantify the exact area of remnant vegetation. Revegetation appeared appropriate in terms of use of species and density that supported local fauna species, particularly birds. A number of representatives of original vegetation from the area still exist within the immediate vicinity including a large coastal banksia (*Banksia integrifolia*) and a number of small trees and shrubs including cheese tree (*Glochidion fernandii*), brush cherry (*Syzyigium australe*) and grasses such as blue flax-lily (*Dianella caerulea*).

Invasive weeds are established at the site. Woody species such as lantana (*Lantana camara*), large-leaved privet (*Ligustrum lucidium*) and Mickey mouse plant (*Ochna serrulata*) comprise a considerable area of understorey vegetation. Sweet pittosporum (*Pittosporum undulatum*) occurs frequently and while native, it has become an opportunistic invader of bushland in the Sydney region. Its invasive nature is likely exacerbated by the presence of increased nutrients as a result of water run-off from the surrounding area.

The magenta lilly pilly (*Syzyigium paniculatum*) was not recorded in the immediate vicinity of the netball courts. However, it could potentially occur nearby or downslope of the adjacent vegetation. As a precaution, Ecosure has undertaken a test of significance to ensure that any potential impacts are addressed (Table 4).

3.1.2 Fauna

A bird survey conducted during the site assessment recorded 15 species of birds including five species of honeyeater which were utilising a large flowering coastal banksia (see bird list provided in Table 3). Food sources for the grey-headed flying-fox are found on the site including coastal banksia, brush cherry, Port Jackson fig (*Ficus rubiginosa*) and sweet pittosporum (Eby and Law 2008). Grey-headed flying-foxes have been recorded nearby and it's highly likely that the species would utilise any suitable food resource available on the site depending on its seasonal availability.

Due to the likelihood of the grey-headed flying-fox utilising resources within or near the site, Ecosure has undertaken a test of significance (Table 5).

Table 2 Plant species recorded at Drill Hall Common Mosman

Scientific Name	Common Name	Form	Dominance	Weed
Lophostemon confertus	brush box	Tree	Frequent	
Acacia implexa	hickory	Tree	Frequent	
Banksia integrifolia subsp. *integrifolia*	coastal banksia	Tree	Occassional	
Ficus rubiginosa	Port Jackson fig	Tree	Occassional	
Glochidion ferdinandi	cheese tree	Tree	Occassional	
Corymbia maculata	spotted gum	Tree	Occassional	
Melaleuca quinquenervia	broad-leaved paperbark	Tree	Frequent	
Eucalyptus piperita	Sydney peppermint	Tree	Occassional	
Syzygium australe	brush cherry	Tree	Occassional	
Olea europaea	common olive	Tree	Occassional	Yes
Ligustrum lucidum	large-leaf privet	Tree	Frequent	Yes
Pittosporum undulatum	sweet pittosporum	Shrub	Abundant	Opportunistic
Callistemon linearis	narrow-leaved bottlebrush	Shrub	Occassional	
Grevillea sericea	pink spider flower	Shrub	Occassional	
Homalanthus populifolius	bleeding heart	Shrub	Occassional	
Kunzea ambigua	tick bush	Shrub	Occassional	

Scientific Name	Common Name	Form	Dominance	Weed
Ochna serrulata	Mickey mouse plant	Shrub	Frequent	Yes
Lantana camara	lantana	Scrambler	Frequent	Yes
Dianella caerulea var. *caerulea*	blue flax lily	Grass	Frequent	
Lomandra longifolia	spiny-headed mat rush	Grass	Frequent	
Ehrharta erecta	panic veldtgrass	Grass	Frequent	Yes
Ipomoea purpurea	common morning glory	Climber	Frequent	Yes
Asparagus aethiopicus	asparagus fern	Groundcover	Frequent	Yes

Table 3 Bird species list for Drill Hall Common Mosman (Incidental = flying overhead)

Scientific name	Common name	On site	Incidental
Acanthorhynchus tenuirostris	Eastern spinebill	✓	
Lichenostomus chrysops	yellow-faced honeyeater	✓	
Anthochaera chrysoptera	little wattlebird	✓	
Anthochaera carunculata	red wattlebird	✓	
Phylidonyris niger	white-cheeked honeyeater	✓	
Pardalotus striatus	striated pardalote	✓	
Pardalotus punctatus	spotted pardalote	✓	
Rhipidura leucophrys	willie wagtail	✓	
Psophodes olivaceus	Eastern whipbird	✓	
Cacatua galerita	sulfur-crested cockatoo		✓
Zosterops lateralis	silvereye	✓	
Trichoglossus haematodus	rainbow lorikeet		✓
Hirundo neoxena	welcome swallow	✓	
Sturnis tristis	common myna		✓
Manorina melanocephala	noisy miner	✓	

Table 4 Test of Significance (5 part test) for the magenta lilly pilly (*Syzyigium paniculatum)*

Criteria	Assessment
a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The magenta lilly pilly is a medium sized rainforest tree found only in NSW in a narrow, linear coastal strip centred roughly around Sydney and Newcastle. The species has been recorded nearby the subject site in bushland reserves. The proposed action is unlikely to have an adverse effect on the local population as the lighting footprint is not within the area where the species potentially occurs.
b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	n/a
c) In relation to the habitat of a threatened species or ecological community: i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or ii) Is likely to substantially and adversely modify the	The proposed action is unlikely to have an adverse effect on the extent of habit of the species.

Criteria	Assessment
composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	
d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),	The proposed lighting footprint is not within the area where the species potentially occurs.
e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process	n/a

Table 5. Test of Significance (5 part test) for the Grey-headed Flying-fox (*Pteropus poliocephalus*)

Criteria	Assessment
a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	**Viable local population** Grey-headed flying-foxes are generally found within 200 km of the east coast of Australia. They occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, as wells as heaths, swamps, urban gardens and fruit crops. There have been 169 records of 435 individuals of this species recorded within 5 km of the subject site (BioNet 2018). The Sydney harbour area and wider region supports suitable habitat that enable a viable population to persist. **Life cycle factors** The site is not within the vicinity of any roosting camps where mating, giving birth and rearing young takes place. The nearest camp is located to the south of the subject site and it is therefore unlikely to have any impact on the species life cycle. **Assessment** The most likely utilisation of the site is scattered food trees adjacent to the netball courts. The proposed lighting has a limited footprint that is projected onto the netball courts and is unlikely to have an impact on the foraging ability of the species.
b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	n/a
c) In relation to the habitat of a threatened species or ecological community: i) Is likely to have an adverse effect on the extent of the	n/a

Criteria	Assessment
ecological community such that its local occurrence is likely to be placed at risk of extinction, or ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	
d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),	The proposed lighting footprint is not within the area where foraging habitat occurs for this species.
e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process	n/a

4 Discussion

The grey-headed flying-fox was not recorded during the site assessment due to their nocturnal behaviour. However, the vegetation within the adjacent area to the netball courts supports suitable foraging habitat and it is likely that they would utilise available resources in the vicinity at any given time. The magenta lilly pilly was not recorded in the area, however it could potentially occur nearby as it has been recorded in surrounding bushland reserves. As a precaution, Ecosure has completed tests of significance for both threatened species. No other threatened species were recorded during the site assessment.

The proposed flood lighting for the netball courts at Drill Hall Common is expected to extend playing hours until 8.30 pm for up to four nights per week, which during the winter months is approximately three hours after sunset. During summer, this is approximately half an hour after sunset. The lighting is proposed to be projected directly onto the courts and expected to have a limited beam footprint. It is therefore unlikely to have a significant impact on fauna in the surrounding area. Construction is also not expected to encroach on any adjacent vegetation.

5 Conclusion

The results of this impact statement identify that while there is a level of disturbance through weed encroachment, water run-off and previous clearing, the vegetation at Drill Hall Common still exhibits a degree of resilience demonstrated by the good health of the remnant trees, particularly *Banksia* species. The site continues to support a variety of native birdlife and would likely respond well to bush regeneration and weed control methods.

The proposed flood lighting to be installed on netball courts at Drill Hall Common is unlikely to have any significant impact on listed threatened species identified as potentially occurring at the site, or on any other native flora and fauna. This is due to the limited footprint of the lighting, the amount of time the lights are expected to be switched on, and the negligible potential impacts on native flora and fauna.

References

Australian Government. Department of the Environment and Energy. Protected Matters Search Tool. Accessed on 12 August 2018. http://www.environment.gov.au/epbc/pmst/index.html

Eby, P. and Law, B. 2008, Ranking the feeding habitats of Grey-headed Flying-foxes for conservation management. A report for The Department of Environment and Climate Change (NSW).

Ecosure 2016, Flora and Fauna Assessment. Volume 2 – Bushland Reserves. Report to Mosman Municipal Council.

NSW Government. Office of Enivironment and Heritage NSW BioNet Species Sighting Search. Accessed on 12 August 2018. http://www.bionet.nsw.gov.au/.

Total Earth Care 2007, *Flora and Fauna Survey - Mosman Municipal Council* (Volumes 1-4). Report to Mosman Municipal Council.

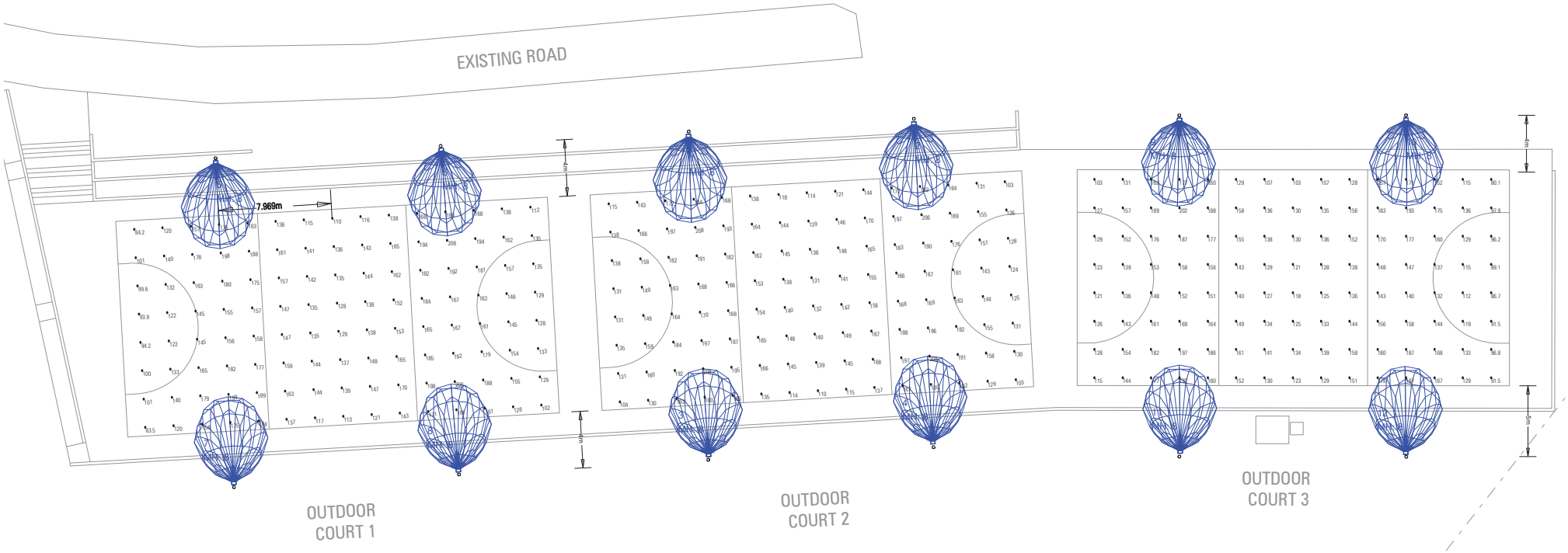
Appendix 1 Proposed flood lighting footprint

3 x Single Netball

Lighting for Recreation, Training and Low Level Competition = 100 Lux

12 x 8m Lighting Columns

12 x QUANTUM 322W LED Floodlights



PROJECT	DRAWING	REVISION	DATE	PAGE		CONSULTING ELECTRICAL ENGINEERS LIGHTING CONSULTANTS TECHNOLOGY CONSULTANTS
M252B Netball Courts Drill Hall Common Mosman	Netball Lighting Recreation, Training and Low Level Competition 100 Lux	A	28 08 2017 AM	Page 2 of 3		WEBB AUSTRALIA GROUP (NSW) PTY LIMITED ABN 40 050 056 712 LEVEL 4, 828 PACIFIC HIGHWAY GORDON NSW 2072 AUSTRALIA TELEPHONE 02 9418 1444 FACSIMILE 02 9418 1191 EMAIL sydney@webbaustralia.com.au

Appendix 2 EPBC Protected Matters Search

Australian Government
Department of the Environment and Energy

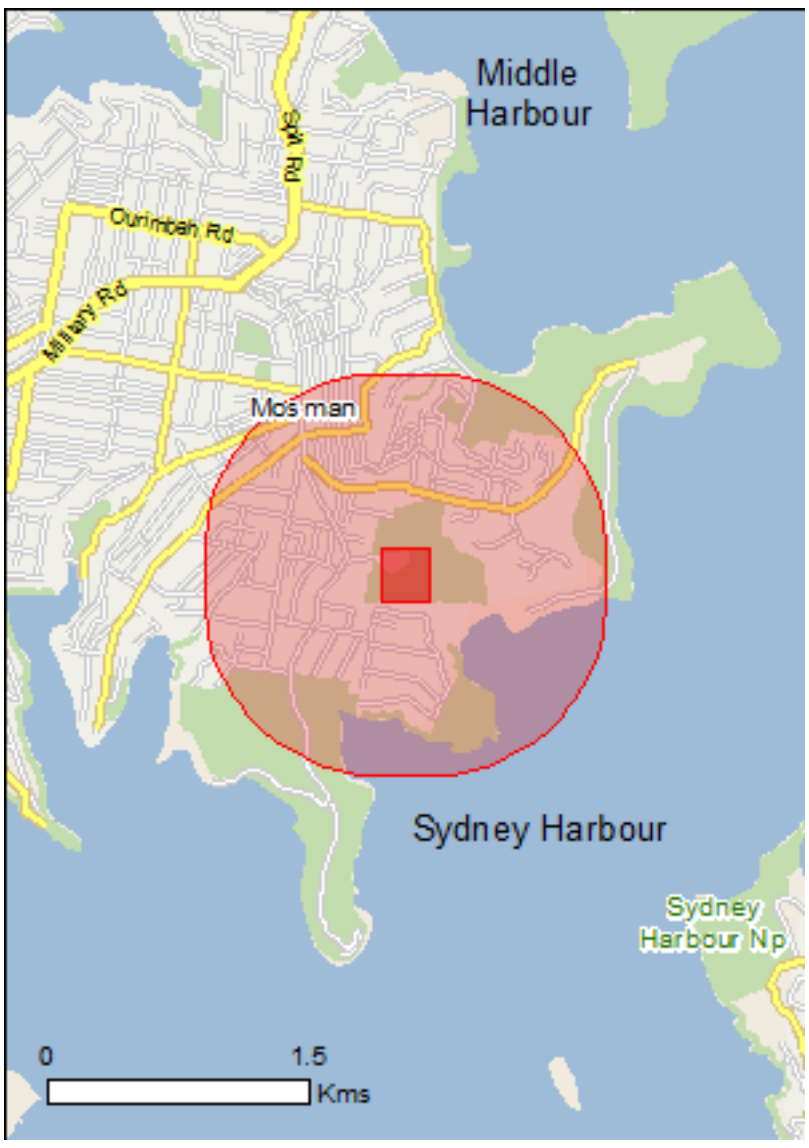
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

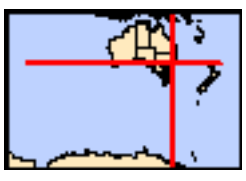
Report created: 06/08/18 14:14:32



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates

Buffer: 1.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	66
Listed Migratory Species:	54

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	6
Commonwealth Heritage Places:	13
Listed Marine Species:	75
Whales and Other Cetaceans:	11
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	46
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community may occur within area
Coastal Upland Swamps in the Sydney Basin Bioregion	Endangered	Community may occur within area
Posidonia australis seagrass meadows of the Manning-Hawkesbury ecoregion	Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat likely to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or

Name	Status	Type of Presence
		related behaviour likely to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
Pterodroma neglecta neglecta Kermadec Petrel (western) [64450]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area

Name	Status	Type of Presence
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Fish		
Epinephelus daemelii		
Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Macquaria australasica		
Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area
Prototroctes maraena		
Australian Grayling [26179]	Vulnerable	Species or species habitat likely to occur within area
Frogs		
Heleioporus australiacus		
Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat may occur within area
Litoria aurea		
Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Balaenoptera musculus		
Blue Whale [36]	Endangered	Species or species habitat may occur within area
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Isoodon obesulus obesulus		
Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat likely to occur within area
Pseudomys novaehollandiae		
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or

Name	Status	Type of Presence
		related behaviour known to occur within area
Plants		
Acacia terminalis subsp. terminalis MS Sunshine Wattle (Sydney region) [88882]	Endangered	Species or species habitat known to occur within area
Asterolasia elegans [56780]	Endangered	Species or species habitat may occur within area
Caladenia tessellata Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat likely to occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area
Genoplesium baueri Yellow Gnat-orchid [7528]	Endangered	Species or species habitat likely to occur within area
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat may occur within area
Pelargonium sp. Striatellum (G.W.Carr 10345) Omeo Stork's-bill [84065]	Endangered	Species or species habitat may occur within area
Persoonia hirsuta Hairy Geebung, Hairy Persoonia [19006]	Endangered	Species or species habitat likely to occur within area
Pimelea curviflora var. curviflora [4182]	Vulnerable	Species or species habitat likely to occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat known to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hoplocephalus bungaroides Broad-headed Snake [1182]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		

Name	Status	Type of Presence
Carcharias taurus (east coast population)		
Grey Nurse Shark (east coast population) [68751]	Critically Endangered	Species or species habitat likely to occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Calonectris leucomelas		
Streaked Shearwater [1077]		Species or species habitat known to occur within area
Diomedea antipodensis		
Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora		
Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans		
Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi		
Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel		
Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor		
Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli		
Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Sternula albifrons		
Little Tern [82849]		Species or species habitat may occur within area
Thalassarche bulleri		
Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Thalassarche cauta		
Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita		
Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis		
Southern Right Whale [75529]	Endangered*	Species or species habitat likely to occur within area
Balaenoptera edeni		
Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Species or species habitat may occur within area
Caperea marginata		
Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Lagenorhynchus obscurus		
Dusky Dolphin [43]		Species or species habitat may occur within area
Lamna nasus		
Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Manta alfredi		
Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Limosa lapponica		
Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Australian Postal Commission
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Defence Housing Authority
Defence - HMAS PENGUIN
Defence - NFI CHOWDER BAY (fuel depot)

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Historic		
Batteries A83 and C9A	NSW	Listed place
Battery B42	NSW	Listed place
Battery for Five Guns	NSW	Listed place
Chowder Bay Barracks Group	NSW	Listed place
Commonwealth Avenue Defence Housing	NSW	Listed place
Defence site - Georges Heights and Middle Head	NSW	Listed place
HMAS Penguin	NSW	Listed place
Headquarters 8th Brigade Precinct	NSW	Listed place
Headquarters Training Command Precinct	NSW	Listed place
Military Road Framework - Defence Land	NSW	Listed place
Navy Refuelling Depot and Caretakers House	NSW	Listed place
Officers Mess, HQ Training Command	NSW	Listed place
Thirty Terminal Squadron Precinct	NSW	Listed place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Cuculus saturatus Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Sterna albifrons Little Tern [813]		Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
Acentronura tentaculata Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]		Species or species habitat may occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Solenostomus paradoxus Ornate Ghostpipefish, Harlequin Ghost Pipefish, Ornate Ghost Pipefish [66184]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within

Name	Threatened	Type of Presence area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Sydney Harbour	NSW

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Carduelis chloris European Greenfinch [404]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Asparagus scandens Asparagus Fern, Climbing Asparagus Fern [23255]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom,		Species or species

Name	Status	Type of Presence
Common Broom, French Broom, Soft Broom [20126]		habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-33.83581 151.24828,-33.83581 151.25086,-33.83798 151.25086,-33.83798 151.24828,-33.83581 151.24828

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix 3 Site images

Plate 1 View of netball courts showing adjacent linear strip of vegetation

Plate 2 Revegetation site and remnant vegetation adjacent to the netball courts

Revision History

Revision No.	Revision date	Details	Prepared by	Reviewed by	Approved by
00	22/08/2018	Flora and Fauna Impact Statement	Vanessa Cain, Scientist	Nigel Cotsell, Senior Ecologist	Heather Richards, Regional Manager

Distribution List

Copy #	Date	Type	Issued to	Name
1	24/08/2018	Electronic	Mosman Municipal Council	Adrian Webster
2	24/08/2018	Electronic	Ecosure	Administration

Citation: Ecosure, 2018, *Flora and Fauna Impact Statement*, Report to Mosman Municipal Council. Publication Location – Coffs Harbour

Report compiled by Ecosure Pty Ltd

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PR3760-RE.Flora and Fauna Impact Statement

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Appendix 12.

NOISE IMPACT ASSESSMENT
FOR SYDNEY HARBOUR FEDERATION TRUST
MOSMAN DRILL HALL PRECINCT, MOSMAN

Prepared for: Daniel Sealey, Senior Manager, Sydney Harbour Federation Trust
Kathryn Werner, Senior Planner, Sydney Harbour Federation Trust

Prepared by: Peter Gangemi, Senior Acoustic Engineer
R T Benbow, Principal Consultant

Report No: 181121_NIA_Rev2
August 2018
(Released: 30 August 2018)

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R T Benbow	Principal Consultant		30 August 2018

DOCUMENT REVISION RECORD

Revision	Date	Description	Checked	Approved
1	22-8-2018	Draft/Rev1	R T Benbow	R T Benbow
2	30-8-2018	Draft/Rev2	R T Benbow	R T Benbow

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1	22-8-2018	Sydney Harbour Federation Trust	Benbow Environmental
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Attachments

Attachment 1: Noise Terminology
Attachment 2: Calibration Certificates
Attachment 3: QA/QC Procedures
Attachment 4: Daily Noise Logger Charts

1. INTRODUCTION

Benbow Environmental has been engaged by the Sydney Harbour Federation Trust to prepare a noise impact assessment for the Mosman Drill Hall Precinct, at 1A Cross Street, Mosman, Lot 2 in DP 541799, Mosman.

The Mosman Drill Hall Precinct includes the Drill Hall, Marie Bashir Sports Centre, outdoor netball courts and a 19 space car park. Uses within the precinct include the following activities:

- Mosman Drill Hall
  - Out of hours school care
  - Community centre
  - Private functions

- Marie Bashir Sports Centre
  - Indoor soccer
  - Indoor basketball

- Outdoor Netball Courts
  - Mosman Netball Club
  - Outdoor child care play area

A Management Plan for the Mosman Drill Hall Precinct was adopted by the Sydney Harbour Federation Trust on 24 May 2006. Benbow Environmental previously completed the Noise Impact Assessment (16015_rep (rev3)) that helped inform the Management Plan for the Mosman Drill Hall Precinct. In that Management Plan, outdoor netball court activities were recommended to finish during the day period.

Since the 2006 Management Plan, a number of projects have been undertaken at the site including:

- Re-use of the Drill Hall for out of school hours care, private functions and community facilities;
- Construction and use of three outdoor netball courts; and
- Construction and use of the Marie Bashir Sports Centre.

The Harbour Trust is looking to update the previous 2006 Management Plan to reflect the current use of the drill hall, sports centre and netball courts. Additionally, the possible evening time use of the outdoor netball courts before 8:30pm is to be investigated. This Noise Impact Assessment therefore will assess these activities and inform the new Management Plan.

The existing and potential noise impacts of activities and road traffic have been predicted in this report. The operational, construction and road traffic scenarios have been analysed utilising noise modelling software, SoundPlan (V7.3). This noise impact assessment has been prepared in accordance with the following guidelines and documents:

- NSW Noise Policy for Industry (EPA, 2017); and
- NSW Road Noise Policy (RNP) (DECCW, 2011).

1.1 SCOPE OF WORKS

This noise impact assessment has been limited to the following scope of works:

a) Review of proposed plans and operations;
b) Long term and short term ambient and background noise monitoring in accordance with relevant guidelines;
c) Establish project specific noise levels;
d) Determine all potential noise sources associated with the existing and proposed development;
e) Collect required noise source data, including attended noise measurements of existing noise generating activities;
f) Predict potential noise impacts at the nearest potentially affected receptors to the site;
g) Assess potential noise impacts against relevant legislation and guidelines;
h) Recommend control measures where required; and
i) Compile this report with concise statements of potential noise impact.

To aid in the review of this report, supporting documentation has been included within the Attachments. A glossary of terminology is included in Attachment 1.

2. SITE DETAILS

2.1 SITE LOCATION

The subject site is located at 1A Cross Street, Mosman, Lot 2 in DP 541799. The site is located at the end of Cross Street, a no-through road off Bradleys Head Road in Mosman. Figure 2-1 shows the location of the subject site.

Located in the vicinity of the Mosman Drill Hall Precinct is Rawson Oval, managed by Mosman Council. Access to Rawson Oval and the Drill Hall Precinct is gained through Cross Street, Mosman.

2.2 HOURS OF OPERATIONS

Currently, the Drill Hall and Sports Centre are utilised during the day and evening periods (7am to 10pm). The outdoor netball courts and grass areas outside the drill hall are used during the day period (7am to 6pm). This report investigates the use of the netball courts during the evening period from 6pm to 8:30pm.

2.3 SITE ACTIVITIES

The Mosman Hall Drill Hall Precinct consists of the Drill Hall, Marie Bashir Sports Centre and outdoor netball courts. Details of each use are shown below.

Mosman Drill Hall (Indoors)
- Out of hours school care
- Community centre
- Private functions

Marie Bashir Sports Centre (Indoors)
- Indoor soccer
- Indoor basketball
- Indoor netball

Netball Courts (Outdoors)
- Mosman Netball Club
- Outdoor child care play area

2.4 ACTIVITIES BY USE

This report assumes that the following netball activities currently take place.

2.4.1 Netball

Mondays
- Outdoor Courts: 3:30pm - 4:20pm, 3 × NetSetGo (NSG) groups. Note that a unit is approximately 9-10 players
- Outdoor Courts: 4:20pm - 5:10pm, 1 × U11 (under 11 year old division), 1 × U12, 1 × U15
- Marie Bashir Indoor Centre: 3:30pm - 4:30pm, 1 × U12

- Marie Bashir Indoor Centre: 4:30pm - 5:30pm, 1 × U11, 1 × U15
- Marie Bashir Indoor Centre: 5:30pm - 6:30pm, 1 × U11, 1 × Senior

Tuesdays
- Outdoor Courts: 3:30pm - 4:20pm, 2 × U10, 2 × NSG
- Outdoor Courts: 4:20pm - 5:10pm, 3 × NSG, 2 × U10
- Marie Bashir Indoor Centre: 3:30pm - 4:30pm, 2 × U11
- Marie Bashir Indoor Centre: 4:30pm - 5:30pm, 2 × U12
- Marie Bashir Indoor Centre: 5:30pm - 6:30pm, 1 × U10, 1 × U13

Wednesdays
- Outdoor Courts: 4:20pm - 5:10pm, 1 × NSG
- Marie Bashir Indoor Centre: 3:30pm - 4:30pm, 1 × U10
- Marie Bashir Indoor Centre: 5:30pm - 6:30pm, 1 × NSG
- Marie Bashir Indoor Centre: 6:30pm - 7:30pm, 1 × U10, 1 × U12

Thursdays
- Outdoor Courts: 3:30pm - 4:20pm, 1 × U10
- Outdoor Courts: 4:20pm - 5:10pm, 1 × NSG
- Marie Bashir Indoor Centre: 5pm – 6pm, 1 × U14

Fridays
- Outdoor Courts: 3:30pm - 4:20pm, 1 × NSG
- Outdoor Courts: 4:20pm - 5:10pm, 1 × NSG

Saturdays
- Outdoor Courts: 9am - 10am, NSG Skills (55 girls aged 5-7 years old)
- Marie Bashir Indoor Centre: 9am - 10am, NSG Skills (55 girls aged 5-7 years old)

This report also investigates the possible use of the netball courts during the evening period from 6pm to 8:30pm.

2.4.2 Rugby at Rawson Oval

This report assumes that the following rugby activities currently take place at Rawson Oval.

Friday the 27th July
- 6:30pm, 1 × U11 match, 12 players per team plus substitutes
- 7:20pm, 1 × U10 match, 12 players per team plus substitutes

Saturday the 28th July
- Senior club activity only

Sunday the 29th July
- 9:30am, 1 × U12 match, 15 players per team plus substitutes
- 10:30, 1 × U15 match, 15 players per team plus substitutes

Monday the 30th July
- 5:30pm – 7:30pm, Girls touch, approximately 40 players in total

Tuesday the 31st July

- 5:30pm – 6:30pm, U8/U9s training, approximately 60 kids in total
- 6:00pm – 7:30pm, U14s training, approximately 25 boys in total
- 6:00pm – 7:00pm, Women's Touch, approximately 10 adults in total

Wednesday the 1st August

- 5:30pm – 7:00pm, Training, U12s approximately 30 kids in total.
- 5:30pm – 7:00pm, Training, U15s approximately 15 kids in total.

Thursday the 2nd August

- 6:00pm – 7:00pm, Training, U13s approximately 20 kids in total.

Friday the 3rd August

- No Activity

Saturday the 4th August

- No Activity

Sunday the 5th August

- 9:00am – 3:30pm, 7 matches
  - 2 × U10s matches
  - 2 × U11 matches
  - 1 × U12 match
  - 1 × U13 match
  - 1 × U14 match

Monday the 6th August

- 5:30pm – 7:30pm, Girls touch, approximately 40 players in total.

2.4.3 Other Activities

Other activities considered in this report from the Drill Hall precinct and surrounding locality include:

- Community and Childcare activities inside the Drill Hall.
- Outdoor child care activities.
- Indoor activities inside the Marie Bashir Indoor Centre, including Basketball, Futsal and Taekwondo.
- On site car park use from the Drill Hall Precinct and Rawson Oval.
- Mosman croquet club activities. Activities typically finish by 4pm, or 5pm at the latest.
- Use of the Rawson Park Tennis Centre. Opening hours are 6:30am to 9:30pm during the week.
- Other users of Rawson Oval including Queenwood and Triathlon.

Figure 2-1: Site Location and Surrounding Precinct

↑N Not to scale	**Source:** SIX Maps 2018 **Legend**: Site Boundaries	Benbow Environmental 25-27 Sherwood Street, Northmead NSW 2152

2.5 Description of the Surrounding Area

The subject site is zoned as 'SP2 Infrastructure'. Rawson Oval immediately to the north is zoned as RE1 Public Recreation. The National Park to the east and south is zoned E1 National Parks and Nature Reserves. The residential properties to the west of the site on Cross Street, Ellamatta Avenue and Bradleys Head Road are zoned R2 Low Density Residential.

2.6 Nearest Sensitive Receptors

Table 2-1 lists the location of representative potentially affected receivers that are considered in this assessment. These are shown in Figure 2-2.

Table 2-1: Nearest Potentially Affected Receptors

Receptor ID	Address	Lot	DP	Separation distance	Type of receiver
R1	30A Morella Road, Mosman	3	583799	260 m	Residential
R2	46 Burrawong Road, Mosman	2	546439	180 m	Residential
R3	4A Cross Street, Mosman	2	843056	120 m	Residential
R4	2A Cross Street, Mosman	Y	344170	70 m	Residential
R5	1/2 Cross Street, Mosman	2	285671	15 m	Residential
R6	4 Cross Street, Mosman	3	843056	60 m	Residential
R7	3 Cross Street, Mosman	80	852643	35 m	Residential
R8	1 Cross Street, Mosman	10	3479	20 m	Residential
R9	1A Ellamatta Avenue, Mosman	111	884230	70 m	Residential
R10	1 Alexander Avenue, Mosman	B	341296	190 m	Residential
R11	18 Middle Head Road, Mosman	6	3395	230 m	Residential
R12	15 Markham Close, Mosman	104	1079507	220 m	Residential
R13	1109 Dominion Crescent, Mosman	202	1022020	300 m	Residential
R14	Alexander Avenue, Mosman	1	1238603	30 m	Active Recreation
R15	2C Alexander Avenue, Mosman	7178	1056180	140 m	School Classroom

Figure 2-2: Location of Nearest Potentially Affected Receptors

↑N Not to scale	**Source:** SIX Maps 2018 **Legend**: Site Boundaries	Benbow Environmental 25-27 Sherwood Street, Northmead NSW 2152

3. EXISTING ACOUSTIC ENVIRONMENT

The level of background noise varies over the course of any 24 hour period, typically from a minimum at 3.00am to a maximum during morning and afternoon traffic peak hours. Therefore the NSW EPA Noise Policy for Industry (2017) requires that the level of background and ambient noise be assessed separately for the daytime, evening and night time periods. The Noise Policy for Industry defines these periods as follows:

- **Day** – the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays;
- **Evening** – the period from 6pm to 10pm; and
- **Night** – the remaining periods.

3.1 NOISE MONITORING EQUIPMENT AND METHODOLOGY

Background noise level measurements were carried out using a Svantek SVAN 957 Precision Sound Level Meter (attended noise monitoring) and one (1) Acoustic Research Laboratories statistical Environmental Noise Logger, type Ngara (unattended noise monitoring). The instrument sets were calibrated by a NATA accredited laboratory within two years of the measurement period. Calibration certificates have been included in Attachment 2.

To ensure accuracy and reliability in the results, field reference checks were applied both before and after the measurement period with an acoustic calibrator. There were no excessive variances observed in the reference signal between the pre-measurement and post-measurement calibration. The instruments were set on A-weighted Fast response and noise levels were measured over 15-minute statistical intervals. QA/QC procedures applied for the measurement and analysis of noise levels have been presented in Attachment 3. The microphones were fitted with windsocks and were positioned between 1.2 metres and 1.5 metres above ground level.

In assessing the background noise levels, any data affected by adverse weather conditions has been discarded according to the requirements of the NSW EPA Noise Policy for Industry. The weather data was sourced from the Bureau of Meteorology from the Automatic Weather Station (AWS) located at Observatory Hill (ID 066062). Note that the wind data from this weather station is taken from Fort Denison.

3.2 MEASUREMENT LOCATION

Unattended long-term noise monitoring was undertaken from 1st August 2018 to 16th August 2018 at 1/2 Cross Street, Mosman. Attended noise monitoring was undertaken at 1/2 Cross Street Mosman and the subject site on 25th July 2018, 1st August 2018, 8th August 2018 and 16th August 2018. The attended and noise logging locations are shown in Figure 2-2. Noise Logger Charts are presented in Attachment 3.

3.3 MEASURED NOISE LEVELS

3.3.1 Long-Term Unattended Noise Monitoring Results

The data was analysed to determine a single assessment background level (ABL) for each day, evening and night time period, in accordance with the NSW EPA Noise Policy for Industry. That is, the ABL is established by determining the lowest tenth-percentile level of the L_{A90} noise data over each period of interest. The background noise level or rating background level (RBL) representing the day, evening and night assessment periods is based on the median of individual ABL's determined over the entire monitoring period. The results of the long-term unattended noise monitoring are displayed in Table 3-1. Daily noise logger graphs have been included in Attachment 3.

Weather data was sourced from the Bureau of Meteorology from the Automatic Weather Station (AWS) located at Sydney Observatory Hill AWS (ID 066062), with wind being measured from Fort Denison. In assessing the background noise levels, any data affected by adverse weather conditions has been broadly discarded according to the requirements of the NSW EPA Noise Policy for Industry. Section A4 of the Noise Policy for Industry states that *"data should be excluded when average wind speeds at microphone height are greater than 5 metres per second… exceptions to this rule are allowed provided the proponent is able to show that the wind-induced noise on the microphone… is at least 10 dB below the noise levels under investigation"*.

In this survey, a wind speed of 6.5 m/s instead of 5 m/s per second has been used in the discarding of data. The intent of the 5m/s limit is to ensure that wind-induced noise is at least 10 dB below the noise levels under investigation. The logger location was well shielded from wind due to local topography, and were located away from vegetation that would raise background noise levels under higher wind conditions.

Furthermore, the wind data in Figure 4-1 shows that higher wind speeds are characteristic of the Fort Denison locality. Observations from site show that on the mainland at Mosman, wind levels were well below the numerical measurements at Fort Denison on the water.

The 6.5 m/s limit therefore gives a representative value that recognises the higher wind speeds in from the Fort Denison station while not compromising the technical integrity of the data collection process as per the Noise Policy for Industry (EPA, 2017).

Table 3-1: Unattended Noise Monitoring Results at Logger Location A, dB(A)

Date	Average L_1			Average L_{10}			ABL (L_{90})			L_{eq}		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
1/08/2018	61	53	40	52	46	36	35	31	31	51	47	34
2/08/2018	62	58	44	54	50	38	37	38	31	52	51	43
3/08/2018	61	57	48	54	49	40	39	34	30	52	47	47
4/08/2018	-	53	48	-	47	40	-	36	28	-	47	43
5/08/2018	62	57	45	54	47	36	37	35	27	53	47	43
6/08/2018	-	58	-	-	52	-	-	37	-	-	53	-
7/08/2018	-	56	-	-	48	-	-	34	-	-	47	-
8/08/2018	62	57	44	52	48	38	35	33	29	53	47	43
9/08/2018	60	58	44	53	50	38	37	33	28	51	49	43
10/08/2018	63	-	44	55	-	38	38	-	29	53	-	43
11/08/2018	-	-	-	-	-	-	-	-	-	-	-	-
12/08/2018	-	-	49	-	-	42	-	-	26	-	-	43
13/08/2018	60	-	48	52	-	42	36	-	31	51	-	44
14/08/2018	62	54	48	54	46	41	36	33	31	53	48	45
15/08/2018	-	56	47	-	47	41	-	33	30	-	47	44
16/08/2018	-	-	-	-	-	-	-	-	-	-	-	-
Average	**61**	**56**	**46**	**53**	**48**	**39**	*	*	*	*	*	*
Median (RBL)	*	*	*	*	*	*	**37**	**34**	**30**	*	*	*
Logarithmic Average	*	*	*	*	*	*	*	*	*	**52**	**49**	**44**

Note: - indicates values that has not been considered due to adverse weather conditions.
* Indicates values that are not relevant to that noise descriptor.
Value in bold indicates relevant noise descriptor.

3.3.2 Short-Term Attended Noise Monitoring Results

Given that the results of the unattended noise monitoring are affected by all ambient noise sources such as local fauna, road traffic and industrial sources, it is not possible to determine with precision the exact existing industrial noise contribution based on unattended monitoring alone. Therefore, the attended noise monitoring allows for a more detailed understanding of the existing ambient noise characteristics and a more meaningful final analysis to be undertaken. The results of the short-term attended noise monitoring are displayed in Table 3-2.

The noise monitoring took place at the logger A location, which is one of the most sensitive receivers in this report (R5).

Table 3-2: Attended Noise Monitoring Results, dB(A)

Location / Time Period	Noise Descriptor				Comments
	L_{Aeq}	L_{A90}	L_{A10}	L_{A1}	
1/2 Cross Street 25/7/2018 16:27	50	42	53	60	*Cars arriving Rawson Oval <58 dB(A)* *Cars leaving Rawson Oval <62 dB(A)* *Cars arriving Drill Hall Precinct <57 dB(A)* *Cars leaving Drill Hall Precinct <56 dB(A)* *Childcare outdoor play, boy screams <66 dB(A)* *Door Slam <60 dB(A)* *Aircraft <61 dB(A)*

3.3.3 Existing Road Traffic Noise

Existing road traffic noise levels have been obtained from the unattended environmental noise logger. Table 3-3 shows the results of the long term unattended road traffic noise monitoring.

Table 3-3: Existing Road Traffic Noise Data

Date	Existing Road Traffic Noise – dB(A)			
	Daytime (7am to 10pm)		Night-time (10pm to 7am)	
	$L_{eq\ (15\ hour)}$	$L_{eq\ (1\ hour)}$	$L_{eq\ (9\ hour)}$	$L_{eq\ (1\ hour)}$
1/08/2018	-	-	35	35
2/08/2018	53	54	40	44
3/08/2018	52	52	44	47
4/08/2018	-	-	43	44
5/08/2018	54	55	39	43
6/08/2018	-	-	-	-
7/08/2018	-	-	-	-
8/08/2018	52	53	39	43
9/08/2018	51	51	40	44
10/08/2018	54	55	40	44
11/08/2018	-	-	-	-
12/08/2018	-	-	40	43
13/08/2018	-	-	41	44

Table 3-3: Existing Road Traffic Noise Data

Date	Existing Road Traffic Noise – dB(A)			
	Daytime (7am to 10pm)		Night-time (10pm to 7am)	
	$L_{eq\ (15\ hour)}$	$L_{eq\ (1\ hour)}$	$L_{eq\ (9\ hour)}$	$L_{eq\ (1\ hour)}$
14/08/2018	53	53	42	45
15/08/2018	-	-	41	45
16/08/2018	-	-	-	-
Overall	**53**	**53**	**41**	**44**
Road Traffic Noise Levels at the Residence R6	**53**	**53**	**41**	**44**

– Data excluded because adverse weather conditions were present.

4. CURRENT LEGISLATION AND GUIDELINES

4.1 NSW EPA NOISE POLICY FOR INDUSTRY

4.1.1 Introduction

The NSW Noise Policy for Industry was developed by the NSW EPA primarily for the assessment of noise emissions from industrial sites regulated by the NSW EPA.

The policy sets out two components that are used to assess potential site-related noise impacts. The intrusiveness noise level aims at controlling intrusive noise impacts in the short-term for residences. The amenity noise level aims at maintaining a suitable amenity for particular land uses including residences in the long-term. The more stringent of the intrusiveness or amenity level becomes the project noise trigger levels for the project.

4.1.2 Project Intrusiveness Noise Level

The project intrusiveness noise level is determined as follows:

$L_{Aeq,\ 15\ minute}$ = rating background noise level + 5 dB

Where the $L_{Aeq,(15minute)}$ is the predicted or measured L_{Aeq} from noise generated within the project site over a fifteen minute interval at the receptor.

This is to be assessed at the most affected point on or within the residential property boundary or if that is more than 30 m from the residence, at the most affected point within 30 m of the residential dwelling.

4.1.3 Amenity Noise Level

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.2 of the NSW Noise Policy for Industry 2017. The relevant recommended noise levels applicable are reproduced in Table 4-1. The suburban category has been selected for the residential noise amenity criteria, as per Table 2.3 of the Noise Policy for Industry, as the area has local traffic flows with a day RBL <45 dB(A), evening RBL <40 dB(A) and night RBL is <35 dB(A).

Table 4-1: Amenity noise levels.

Receiver	Noise Amenity Area	Time of Day	L_{Aeq} dB(A) Recommended amenity noise level
Residential	Suburban	Day	55
		Evening	45
		Night	40
School classroom	All	Noisiest 1-hour period when in use	Internal: 40[1]
			External: 50[2]
Active recreation	All	When in use	55

Note: 1) In the case where existing schools are affected by noise from existing sources, the acceptable L_{Aeq} noise level may be increased to L_{Aeq} 1 hour.
2) Where internal amenity noise levels are specified, they refer to the noise level at the centre of the habitable room that is most exposed to the noise and apply with windows opened sufficiently to provide adequate ventilation, except where alternative means of ventilation complying with the Building Code of Australia are provided. In cases where gaining internal access for monitoring is difficult, then external noise levels 10 dB(A) above the internal levels apply.

Source: Table 2.2 and Section 2.6, NSW Noise Policy for Industry

The project amenity noise level for industrial developments = recommended amenity noise level minus 5 dB(A)

The following exceptions to the above method to derive the project amenity noise levels apply:

1. *In areas with high traffic noise levels*
2. *In proposed developments in major industrial clusters*
3. *Where the resultant project amenity noise level is 10 dB or more lower than the existing industrial noise level. In this case the project amenity noise levels can be set at 10 dB below existing industrial noise levels if it can be demonstrated that existing industrial noise levels are unlikely to reduce over time.*
4. *Where cumulative industrial noise is not a necessary consideration because no other industries are present in the area, or likely to be introduced into the area in the future. In such cases the relevant amenity noise level is assigned as the project amenity noise level for development.*

This development is not considered to be captured by the above exceptions.

4.1.4 Sleep Disturbance Criteria

In accordance with the NSW EPA Noise Policy for Industry, the potential for sleep disturbance from maximum noise level events from premises during the night-time period needs to be considered. Sleep disturbance is considered to be both awakenings and disturbance to sleep stages.

Where the subject development/premises night-time noise levels at a residential location exceed:

- **$L_{Aeq,\ 15\ minute}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or**
- **L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,**

a detailed maximum noise level assessment should be undertaken.

4.1.5 Cumulative Criteria

Section 2.4 of the Noise Policy for Industry states "To limit continuing increases in noise levels from application of the intrusiveness level alone, the ambient noise level within an area from all industrial noise sources combined should remain below the recommended amenity noise levels specified in Table 2.2 where reasonable and feasible".

From Table 2.2 of the Noise Policy for Industry, for the suburban noise amenity area, the cumulative criteria over the period will be:

- Day period, 55 LAeq dB(A); and
- Evening period, 45 LAeq dB(A).

4.1.6 Project Noise Trigger Levels

The project noise trigger levels for the site have been established in accordance with the principles and methodologies of the NSW Noise Policy for Industry (EPA, 2017).

The table below presents the rating background level, project intrusive noise level, recommended amenity noise level, and project amenity noise level. The project noise trigger level is the lowest value of intrusiveness or project amenity noise level after conversion to $L_{Aeq\ 15\ minute}$, dB(A) equivalent level. Sleep disturbance trigger levels associated with operational activities are presented in Table 4-2.

Different time periods apply for the noise criteria as the intrusive criterion considers a 15 minute assessment period while the amenity criterion requires assessment over the total length of time that a site is operational within each day, evening or night period. In order to ensure compliance under all circumstances, a 15 minute period assessment has been considered for all receptors.

Table 4-2: Project Noise Trigger Levels (PNTL) for Operational Activities, dB(A)

Receiver	Type of Receptor	Time of day	Rating background noise level	Project intrusiveness noise level $L_{eq\ 15\ minute}$	Recommended amenity noise level $L_{Aeq\ period}$	Project amenity noise level $L_{Aeq\ 15\ minute}$[1]	PNTL $L_{Aeq\ 15\ minute}$	Sleep Disturbance L_{Amax}	Cumulative noise level $L_{Aeq\ 15\ minute}$[1]
R1-R13	Residential – Suburban	Day	37	**42**	55	53	**42**	-	**58**
		Evening	34	**39**	45	43	**39**	-	**48**
		Night	30	**35**	40	38	**35**	**52**	**43**
R14	Active Recreation	When in use	-	-	55	53	**53**	-	-
R15	School Classroom – External	Noisiest 1-hour period when in use	-	-	$L_{Aeq\ 1hr}$ = 50 (external)	50[2]	**50**	-	-

Notes:
1) These levels have been converted to $L_{Aeq\ 15\ minute}$ using the following: $L_{Aeq\ 15\ minute} = L_{Aeq\ period}$ + **3 dB** (NSW Noise Policy for Industry Section 2.2).
2) This value has been conservatively assumed that $L_{Aeq\ 15\ minute}$ is equivalent to $L_{Aeq\ 1hr}$.

4.1.7 Previous Noise Criteria

The noise criteria from the 2006 report 16015_rep (rev 3) is shown below in Table 4-3. In 2006 logging was conducted at three residential locations, 1/2 Cross Street, 5 Cross Street and 13 Clifton Street. In 2018, noise logging was conducted at a single location, 1/2 Cross Street. Logging was conducted at the single location as:

- 1/2 Cross Street and 5 Cross Street are located 50 m apart and represent the same catchment, as shown from the 2006 results; and
- 13 Clifton Street does not represent a "reasonably most or potentially most affected resident" as per Table A1 of the Noise Policy for Industry (2017, EPA).

Therefore, as per the Noise Policy for Industry, unattended logging was conducted at 1/2 Cross Street. Logging was conducted for 14 days to allow for at least seven days of data after weather data exclusions.

From Table 4-3, it can be seen that the noise criteria for residential receivers in 2018 is slightly below the noise criteria from the 2006 report. With the newer criteria being more representative of the current environment and more conservative at the closest receivers, the 2018 residential receiver criteria will be adopted in this report.

Table 4-3: 2006 and 2018 Residential Noise Criteria

Period	Day	Evening	Night
2006, 5 Cross Street	43	40	35
2006, 13 Clifton Street	39	38	35
2006, 1/2 Cross Street	44	41	36
2018, 1/2 Cross Street	42	39	35

4.2 NSW Road Noise Policy

The NSW Road Noise Policy (RNP) has been adopted to establish the noise criteria for the potential noise impact associated with additional traffic generated by the proposed development. The RNP was developed by the NSW EPA primarily to identify the strategies that address the issue of road traffic noise from:

- Existing roads;
- New road projects;
- Road redevelopment projects; and
- New traffic-generating developments.

4.2.1 Road Category

The subject site is located on Cross Street, a no-through road in Mosman. Residential receivers are located each side of Cross Street between Bradleys Head Road and the Mosman Drill Hall precinct.

Based on the RNP road classification description, Cross Street would be classified as a 'local road'.

4.2.2 Noise Assessment Criteria

Section 2.3 of the RNP outlines the criteria for assessing road traffic noise. The relevant sections of Table 3 of the RNP are shown in Table 4-4.

Table 4-4: Road Traffic Noise Assessment Criteria For Residential Land Uses, dB(A)

Road Category	Type of Project/Land Use	Assessment Criteria, dB(A)*	
		Day (7am-10pm)	Night (10pm-7am)
Local Roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq\ (1\ hour)}$ 55 dB	$L_{Aeq\ (1\ hour)}$ 50 dB

* Measured at 1 m from a building façade.

4.2.3 Assessment Locations for Existing Land Uses

Table 4-5: Assessment Locations for Existing Land Uses

Assessment Type	Assessment Location
External noise levels at residences	The noise level should be assessed at 1 metre from the façade and at a height of 1.5 metres from the floor. Separate noise criteria should be set and assessment carried out for each façade of a residence, except in straightforward situations where the residential façade most affected by road traffic noise can be readily identified. The residential noise level criterion includes an allowance for noise reflected from the façade ('façade correction'). Therefore, when taking a measurement in the free field where reflection during measurement is unlikely (as, for instance, when measuring open land before a residence is built), an appropriate correction – generally 2.5 dB – should be added to the measured value. The 'façade correction' should not be added to measurements taken 1 metre from the façade of an existing building. Free measurements should be taken at least 15 metres from any wall, building or other reflecting pavement surface on the opposite side of the roadway, and at least 3.5 metres from any wall, building or other pavement surface, behind or at the sides of the measurement point which would reflect the sound.
Noise levels at multi-level residential buildings	The external points of reference for measurement are the two floors of the building that are most exposed to traffic noise. On other floors, the internal noise level should be at least 10 dB less than the relevant external noise level on the basis of openable windows being opened sufficiently to provide adequate ventilation. (Refer to the Building Code of Australia (Australian Building Codes Board 2010) for additional information.)
Internal noise levels	Internal noise levels refer to the noise level at the centre of the habitable room that is most exposed to the traffic noise with openable windows being opened sufficiently to provide adequate ventilation. (Refer to the Building Code of Australia (Australian Building Codes Board 2010) for additional information.)
Open space – passive or active use	The noise level is to be assessed at the time(s) and location(s) regularly attended by people using the space. In this regard, 'regular' attendance at a location means at least once a week.

4.3 METEOROLOGICAL FACTORS

Wind and temperature inversions may affect the noise emissions from the site and are to be incorporated in the assessment when considered to be a feature of the area.

In this section, an analysis of the 2017 weather data has been conducted to establish whether significant winds are characteristic of the area.

4.3.1 Wind Effects

Wind is considered to be a feature where source-to-receiver wind speeds (at 10 m height) of 3 m/s or below occur for 30% or more of the time in any assessment period in any season.

4.3.2 Wind Rose Plots

Wind rose plots show the direction that the wind is coming from, with triangles known as "petals". The petals of the plots in the figures summarise wind direction data into 8 compass directions i.e. north, north-east, east, south-east, etc. The length of the triangles, or "petals", indicates the frequency that the wind blows from that direction. Longer petals for a given direction indicate a higher frequency of wind from that direction. Each petal is divided into segments, with each segment representing one of the six wind speed classes.

Thus, the segments of a petal show what proportion of wind for a given direction falls into each class. The proportion of time for which wind speed is less than 0.5 m/s, when speed is negligible, is referred to as calm hours or "calms". Calms are not shown on a wind rose as they have no direction, but the proportion of time consisting of the period under consideration is noted under each wind rose.

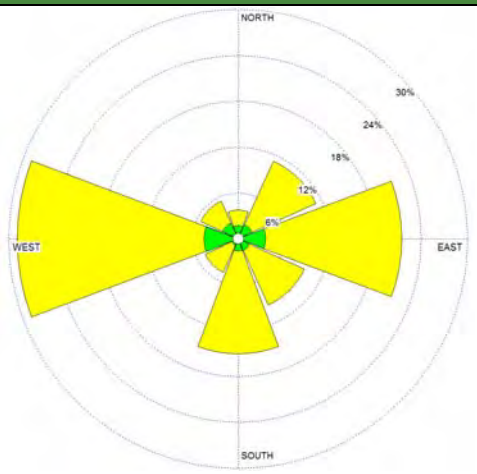
The concentric circles in each wind rose are the axis, which denote frequencies. In comparing the plots it should be noted that the axis varies between wind roses, although all wind roses are similar in size. The frequencies denoted on the axes are indicated beneath each wind rose.

4.3.3 Local Wind Trends

Seasonal wind rose plots for this site utilising Sydney Observatory Hill/Fort Denison AWS data have been included in Figure 4-1, Figure 4-2 and Figure 4-3 for day, evening and night periods respectively.

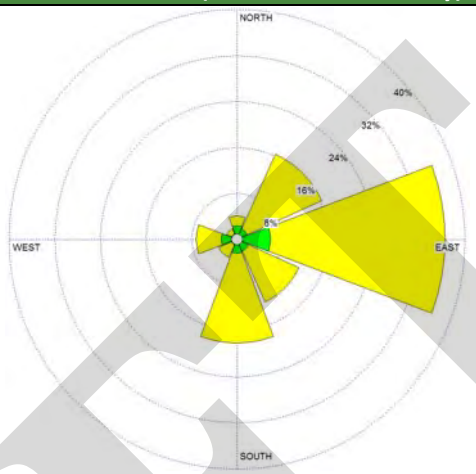
Figure 4-1: Wind Rose Plots– Bureau of Meteorology Fort Denison (2017) Daytime (7:00-18:00)

All Seasons



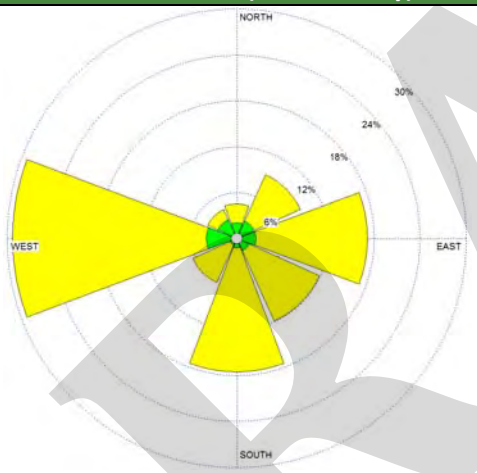
Average Wind Speed: 4.83 m/s
Axis Frequencies: 6%, 12%, 18%, 24%, 30%

Summer Season (December – February)



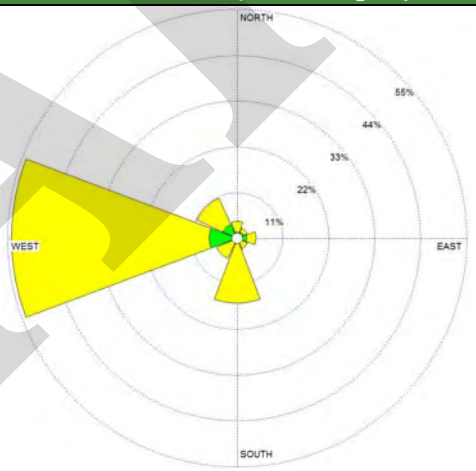
Average Wind Speed: 4.85 m/s
Axis Frequencies: 8%, 16%, 24%, 32%, 40%

Autumn Season (March – May)



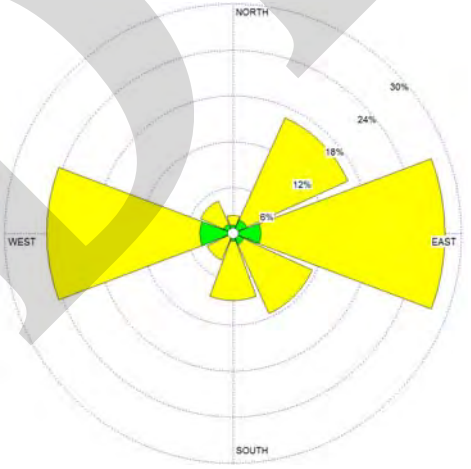
Average Wind Speed: 4.56 m/s
Axis Frequencies: 6%, 12%, 18%, 24%, 30%

Winter Season (June – August)



Average Wind Speed: 4.79 m/s
Axis Frequencies: 11%, 22%, 33%, 44%, 55%

Spring Season (September – November)



Average Wind Speed: 5.12 m/s
Axis Frequencies: 6%, 12%, 18%, 24%, 30%

Legend

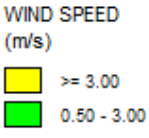


Figure 4-2: Wind Rose Plots– Bureau of Meteorology Fort Denison (2017) Evening (18:00-22:00)

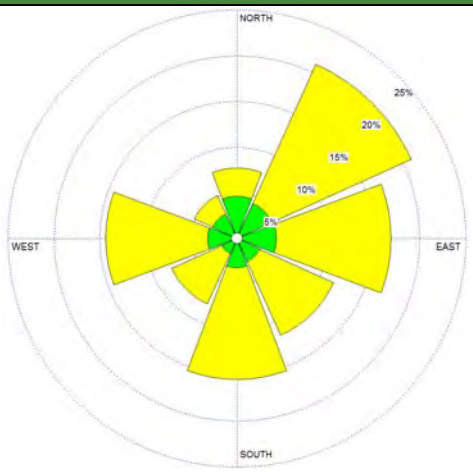
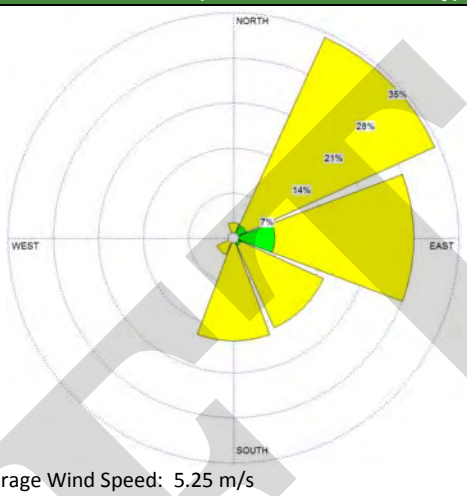
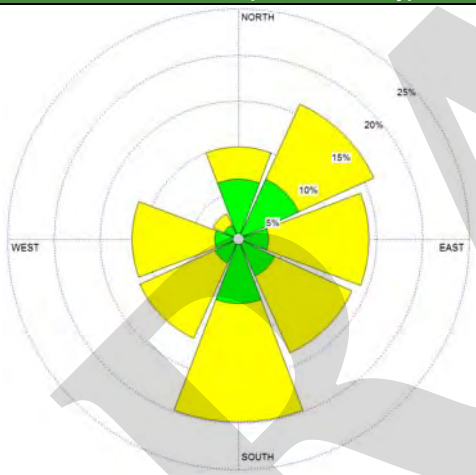
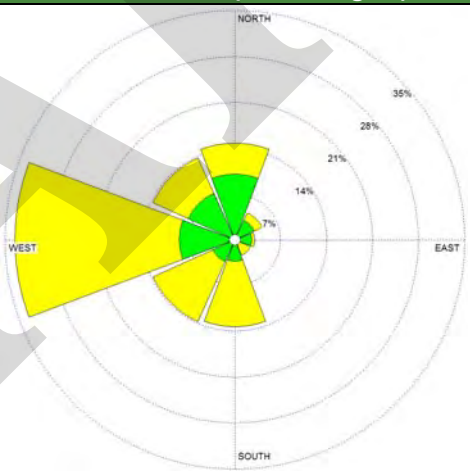
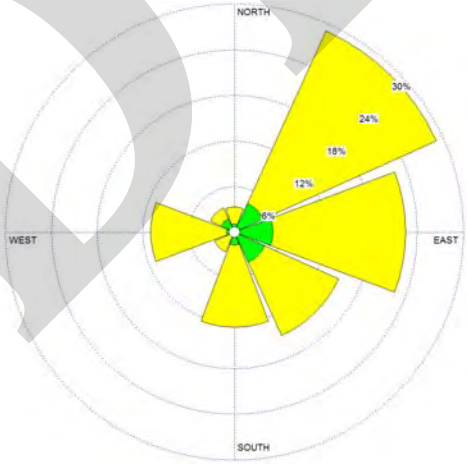
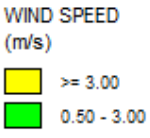
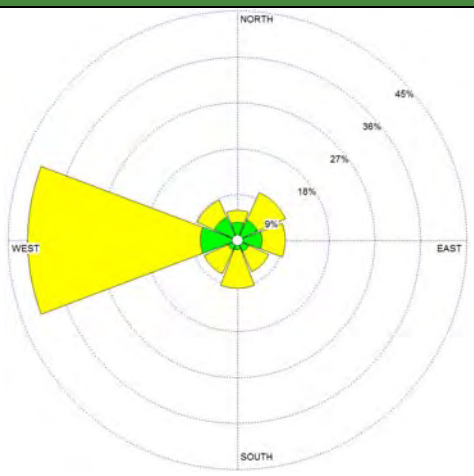
All Seasons	Summer Season (December – February)
	
Average Wind Speed: 4.35 m/s Axis Frequencies: 5%, 10%, 15%, 20%, 25%	Average Wind Speed: 5.25 m/s Axis Frequencies: 7%, 14%, 21%, 28%, 35%
Autumn Season (March – May)	**Winter Season (June – August)**
	
Average Wind Speed: 3.90 m/s Axis Frequencies: 5%, 10%, 15%, 20%, 25%	Average Wind Speed: 3.54 m/s Axis Frequencies: 7%, 14%, 21%, 28%, 35%
Spring Season (September – November)	**Legend**
	
Average Wind Speed: 4.75 m/s Axis Frequencies: 6%, 12%, 18%, 24%, 30%	

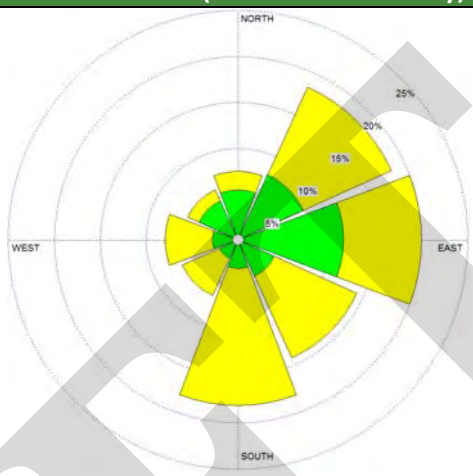
Figure 4-3: Wind Rose Plots– Bureau of Meteorology Fort Denison (2017) Night (22:00-07:00)

All Seasons



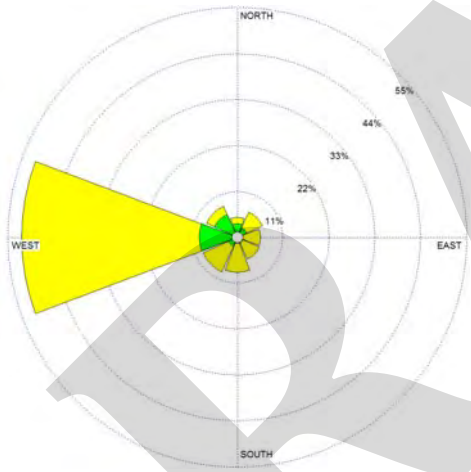
Average Wind Speed: 3.80 m/s
Axis Frequencies: 9%, 18%, 27%, 36%, 45%

Summer Season (December – February)



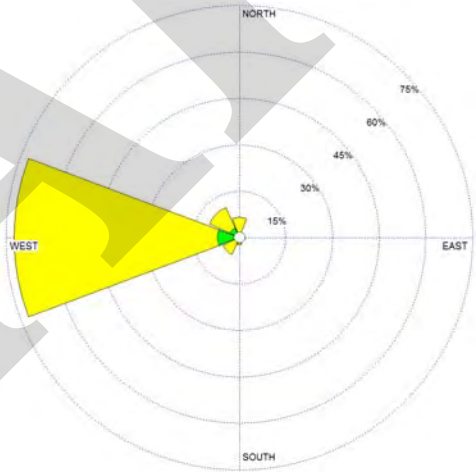
Average Wind Speed: 3.39 m/s
Axis Frequencies: 5%, 10%, 15%, 20%, 25%

Autumn Season (March – May)



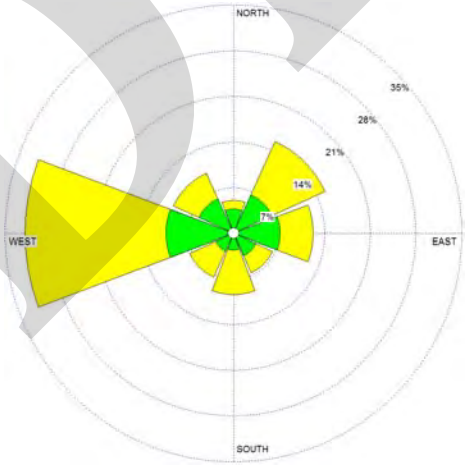
Average Wind Speed: 4.03 m/s
Axis Frequencies: 11%, 22%, 33%, 44%, 55%

Winter Season (June – August)



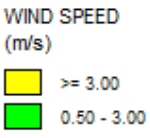
Average Wind Speed: 4.42 m/s
Axis Frequencies: 15%, 30%, 45%, 60%, 75%

Spring Season (September – November)



Average Wind Speed: 3.34 m/s
Axis Frequencies: 7%, 14%, 21%, 28%, 35%

Legend



Based on the information presented from the weather data, source-to receiver wind speeds of 3 m/s or below are not present for more than 30% of the time during any season, therefore wind effects have not been included in the assessment.

4.4 TEMPERATURE INVERSIONS

Temperature inversion is considered a feature where this occurs more than 30% of the nights in winter. Suitable data to determine temperature inversion was not available at Sydney Observatory or Fort Denison for 2017, therefore Sydney Harbour Wedding Cake West AWS was utilised being the next closest location.

Temperature inversion conditions would be best associated with F-class stability conditions – generally associated with still/light winds and clear skies during the night time or early morning period (these are referred to as stable atmospheric conditions).

The analysis conducted on the 2017 weather data highlighted that during winter 13.6% of the nights presented temperature inversion conditions, therefore these effects have not been included in the noise impact assessment.

4.4.1 Weather Conditions Considered in the Assessment

The following conditions will be considered in this noise impact assessment:

- Neutral Weather Conditions.

Details of the considered meteorological conditions have been displayed in Table 4-6.

Table 4-6: Meteorological Conditions Assessed in Noise Propagation Modelling

Classification	Ambient Temp.	Ambient Humidity	Wind Speed	Wind Direction (blowing from)	Temperature Inversion	Affected Receiver	Applicability
Neutral	10°C	70%	0 m/s	–	No	All	All periods

5. OPERATIONAL NOISE IMPACT ASSESSMENT

An outline of the predictive noise modelling methodology and operational noise modelling scenarios has been provided in this section of the report.

5.1 MODELLING METHODOLOGY

Predictive Noise Modelling was carried out using the ISO9613 algorithm within SoundPLAN v7.3. This model has been extensively utilised by Benbow Environmental for assessing noise emissions for numerous sites, and is recognised by regulatory authorities throughout Australia.

Inputs into the noise model include topographical features of the area, ground absorption, on site structures, surrounding buildings and predicted noise sources. Receivers were included to predict the noise emissions of the proposed development at the nearest potentially affected residences.

The modelling scenario has been carried out using the L_{Aeq} descriptor. Using the model, noise levels were predicted at the potentially most affected receivers to determine the noise impact against the project specific noise levels and other relevant noise criteria in accordance with the NSW Noise Policy for Industry (EPA, 2017).

5.2 NOISE SOURCES

The sound power levels for the identified noise sources associated with the operational activities have been taken from on-site attended measurements and audio data of existing activities at the Drill Hall Precinct, Rawson Oval, Mosman Croquet Club and Rawson Park Tennis Centre. Conversation levels and car manouvering, car door slam and car ignition have been sourced from Benbow Environmental's database.

A-weighted third octave band centre frequency sound power levels have been used and are presented in Table 5-1 below. The noise sources utilised as part of this assessment comprise of the primary noise generating activities associated with the existing and proposed development.

Table 5-1: A-weighted Sound Power Levels Associated with Operational Activities, dB(A)

Noise Source	Overall	Third Octave Band Centre Frequency (Hz)									
		25	31	40	50	63	80	100	125	160	200
		250	315	400	500	630	800	1000	1250	1600	2000
		2500	3150	4000	5000	6300	8000	10000	12500	16000	20000
Use of one netball court	85	47	52	53	54	59	62	63	63	65	66
		68	67	74	76	72	74	75	77	75	74
		71	69	65	62	57	54	50	46	42	43
Outdoor play child care centre	91	43	46	56	51	54	59	60	58	60	58
		58	59	59	64	59	71	74	80	81	88
		84	78	73	65	62	59	59	54	53	57
Use of the Drill Hall	86	36	41	45	50	57	59	64	62	63	64
		65	64	70	71	72	77	78	76	76	76
		74	76	73	70	64	61	60	55	51	54
Indoor Basketball	97	41	45	51	53	59	63	67	65	67	69
		69	70	79	79	81	86	88	86	90	90
		86	85	84	80	73	71	68	62	58	60
Tennis Activities	76	37	47	49	48	54	55	59	59	57	61
		58	57	59	62	64	64	65	68	67	67
		67	65	63	58	58	52	49	45	42	45
Croquet Activities	71	27	34	41	41	39	43	45	51	50	55
		58	56	59	62	63	60	59	60	60	60
		59	56	56	52	51	46	43	40	37	37
Rugby Union	86	49	54	59	63	68	72	73	72	72	73
		71	69	72	74	72	73	75	76	77	77
		76	71	67	63	59	56	54	51	48	51
Car Manouvering	81	38	55	46	51	51	54	59	64	65	63
		67	71	74	74	73	73	71	66	63	60
		57	55	56	49	49	46	46	43	40	37
Car Ignition	78	29	32	36	39	40	45	48	43	46	53
		54	49	52	60	65	63	64	67	70	71
		69	68	65	65	65	64	57	54	51	48
Car Door Slams	92	13	20	30	38	46	49	52	51	58	59
		62	70	75	81	81	80	84	87	85	78
		75	74	71	71	69	62	56	51	45	40
Four people in moderate conversation	80	29	34	44	46	36	42	43	54	55	61
		70	66	70	75	73	68	64	65	64	64
		63	60	62	58	55	52	50	47	44	42

5.2.1 Modelling Scenario

Five scenarios were modelled for operational noise emissions. The first scenario considers the current/proposed day activities, with all noise sources operating. The second scenario looks at the current evening activities, while the third scenario looks at the proposed evening activities. The fourth scenario looks at the cumulative day activities from other activities in the locality, while the fifth scenario examines cumulative locality evening activities. The details regarding the scenarios are presented in the following table.

Table 5-2: Modelled Noise Sources

Scenario	Description
Scenario 1: Drill Hall Precinct Operations (Current and Proposed Day period)	This scenario includes the following: • Outdoor use of three Drill Hall netball courts; • Drill Hall child care centre outdoor play area; • Indoor Basketball in the Marie Bashir Indoor Centre; • Indoor use of the Drill Hall; • Vehicles entering and exiting the Drill Hall Precinct car park; • Car door slams and engine start up noise; • Noise from people spectating; and • Noise from people in conversation in the car park.
Scenario 2: Drill Hall Precinct Operations (Current Evening period)	This scenario includes the following: • Indoor Basketball in the Marie Bashir Indoor Centre; • Indoor use of the Drill Hall; • Vehicles entering and exiting the Drill Hall Precinct car park; • Car door slams and engine start up noise; • Noise from people spectating; and • Noise from people in conversation in the car park.
Scenario 3: Drill Hall Precinct Operations (Proposed Evening period)	This scenario includes the following: • Outdoor use of three Drill Hall netball courts; • Indoor Basketball in the Marie Bashir Indoor Centre; • Indoor use of the Drill Hall; • Vehicles entering and exiting the Drill Hall Precinct car park; • Car door slams and engine start up noise; • Noise from people spectating; and • Noise from people in conversation in the car park.
Scenario 4: Cumulative Scenario (Current Day period)	This scenario includes the following: • Outdoor use of three Drill Hall netball courts; • Drill Hall child care centre outdoor play area; • Indoor Basketball in the Marie Bashir Indoor Centre; • Indoor use of the Drill Hall; • Operation of the Tennis Centre; • Activities at the Croquet Club; • Noise from Rawson Oval use; • Vehicles entering and exiting the Drill Hall Precinct and Rawson Oval car parks; • Car door slams and engine start up noise from the car parks; • Noise from people spectating; and • Noise from people in conversation in the car parks.

Table 5-2: Modelled Noise Sources

Scenario	Description
Scenario 5: Cumulative Scenario (Proposed Evening period)	This scenario includes the following: • Outdoor use of three Drill Hall netball courts; • Indoor Basketball in the Marie Bashir Indoor Centre; • Indoor use of the Drill Hall; • Operation of the Tennis Centre; • Noise from Rawson Oval use; • Vehicles entering and exiting the Drill Hall Precinct and Rawson Oval car parks; • Car door slams and engine start up noise from the car parks; • Noise from people spectating; and • Noise from people in conversation in the car parks.

Figure 5-1 to Figure 5-5 show the locations of the noise sources for the operational scenarios.

Figure 5-1: Scenario 1 – Current Day Activities

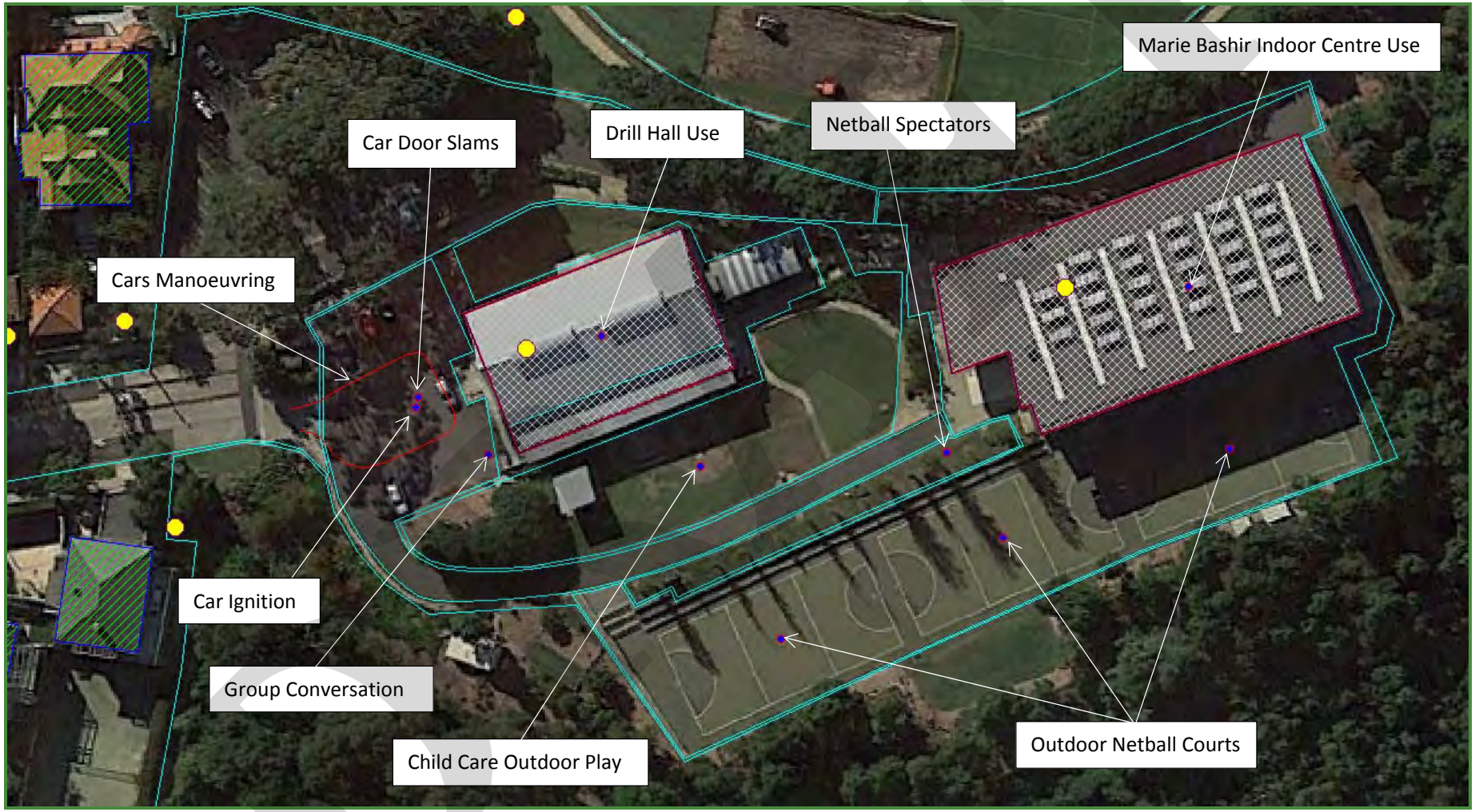


Figure 5-2: Scenario 2 – Current Evening Activities

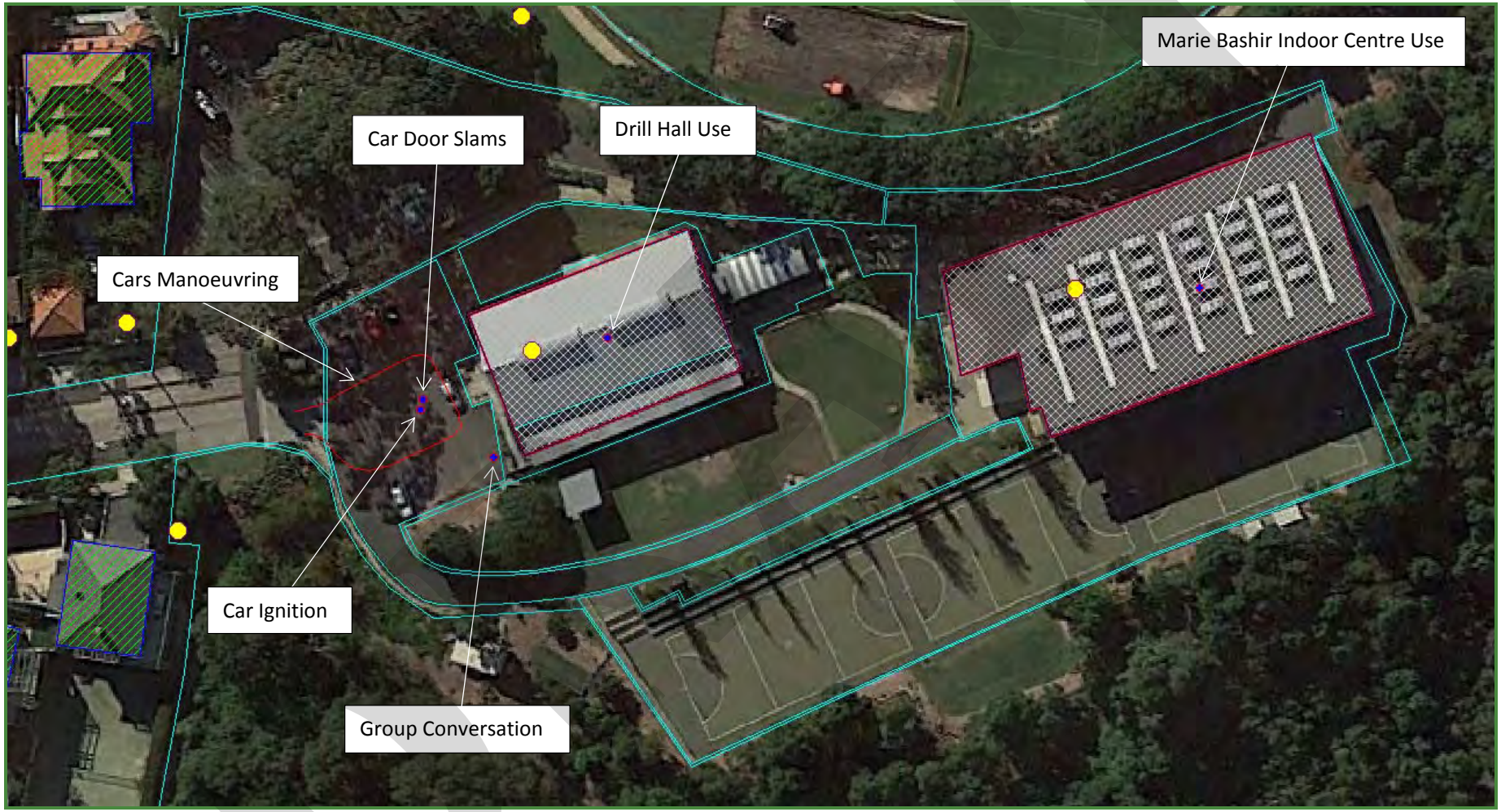


Figure 5-3: Scenario 3 – Proposed Evening Activities

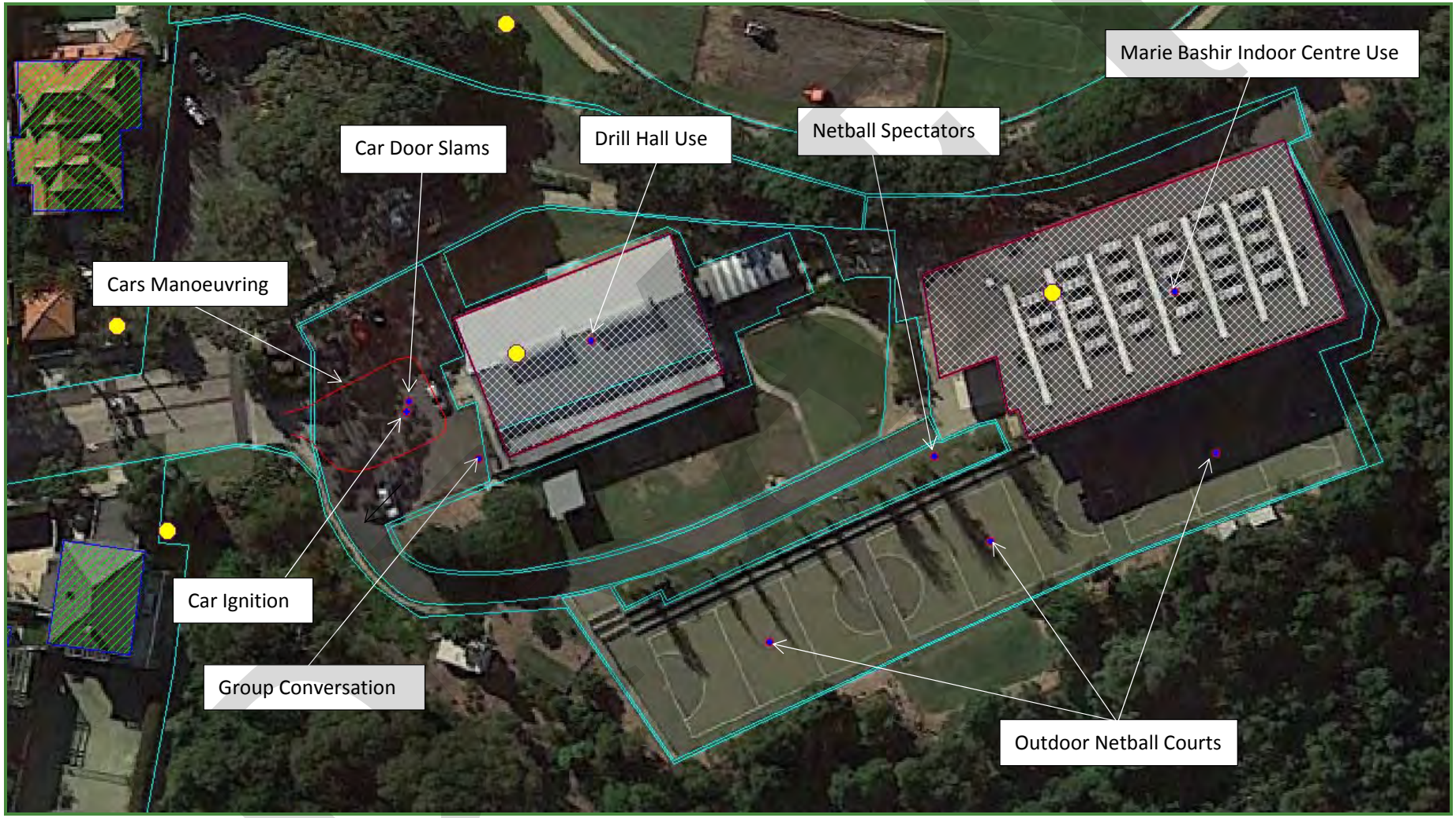


Figure 5-4: Scenario 4 – Day Cumulative Scenario

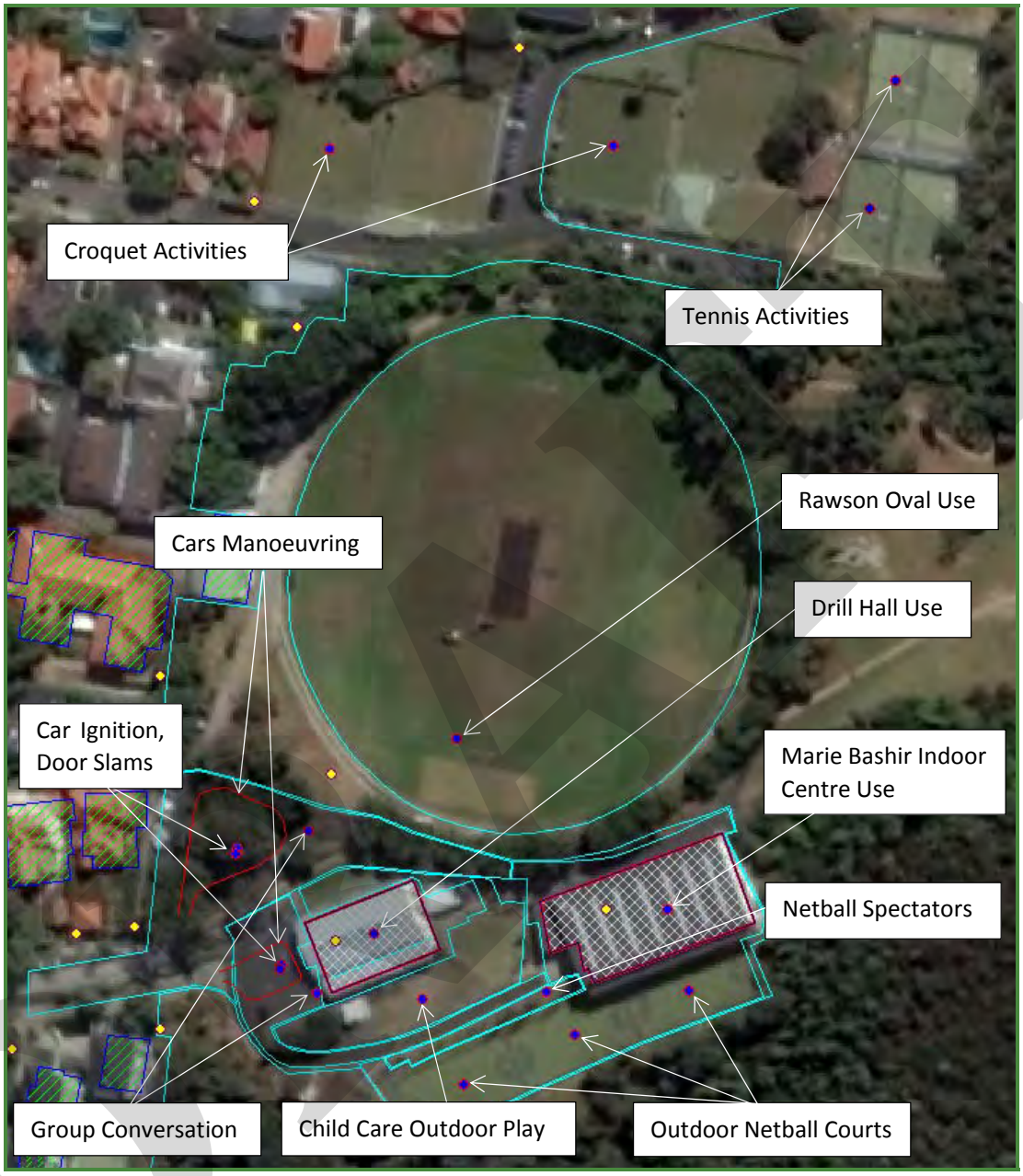


Figure 5-5: Scenario 5 – Evening Cumulative Scenario

5.2.2 Modelling Assumptions

The relevant assessment period for operational noise emissions is 15 minutes when assessing noise levels against the Intrusive Criterion; therefore noise source durations detailed throughout the following assumptions section should be considered per 15 minute period in view of potential noise impacts under worst-case scenarios. Each assessment-specific assumption has been detailed below:

- Off-site topographical information has been obtained from Google Earth and implemented in SoundPLAN v.7.3. On site topographical information of Rawson Oval, the Rawson Oval carpark and Drill Hall precinct have been obtained from site surveys and implemented in the model.

- All ground areas surrounding the subject site and the nearest nominated occupancies have been modelled considering different ground factors ranging from 0 to 1. The site car parks and netball courts have been modelled with a ground absorption factor of 0 (hard). The residential areas of Mosman to the West, North and South of the site have been modelled with a ground absorption factor of 0.5. Grassland and bushland areas within the National park, Drill Hall Precinct, Rawson Oval and surrounds have been modelled with an absorption factor of 1.0.

- In the operational scenarios, analysis of vehicles is limited to car movements on the properties containing the Drill Hall Precinct and Rawson Oval, and is assessed against the Noise Policy for Industry. Road Traffic Noise from Cross Street itself is assessed against the Road Noise Policy in section 7.

- Vehicle movements into the Drill Hall Precinct consider 11 movements into the site, 11 movements out of the site, 11 car door slams and 11 car ignitions per 15 minute period.

- For the cumulative scenarios, vehicle movements into Rawson Oval consider 14 movements into the site, 14 movements out of the site, 14 car door slams and 14 car ignitions per 15 minute period.

- Car park conversations in the Drill Hall precinct car park and Rawson Oval car park are assumed to involve 4 people for 30 seconds per 15 minute period.

- Netball is assumed to use all three courts with approximately ten players training on each court. The applied sound power level was based on attended measurements of training sessions, with activities assumed to take place during the 15 minute period. Use of whistles during the 15 minute period has been included in the modelling to provide a worst case scenario, as whistles were regularly in use when measurements were conducted.

- Netball spectators have been included in the model, with four in conversation for 5 minutes of the 15 minute period.

- Based on observations, outdoor child play takes place for more than 15 minutes at a time, and has therefore been applied over the entire 15 minute scenario. Outdoor play is considered only during the day scenario, for 100% of the 15 minute period.

- Attended measurements inside and outside the Drill Hall during use have been utilised to provide the sound power level of the point source inside the venue. The Drill Hall has been modelled with 0.5 mm corrugated steel sheeting (R_w 22 dB) and 3 mm glass windows (R_w 27 dB). Indoor activities are assumed to be conducted for 100% of the 15 minute period.

- Attended measurements inside and outside the Marie Bashir Indoor Centre during indoor netball use have been utilised to provide the sound power level of the point source inside the venue. The Marie Bashir Indoor Centre has been modelled with 0.5 mm corrugated steel sheeting (R_w 22 dB) and 3mm glass windows (R_w 27 dB). Indoor activities are assumed to be conducted for 100% of the 15 minute period.

- For the cumulative scenarios, the sound power level of the rugby training session was taken from 15 under 15's players on a Wednesday evening, located close to Cross Street to provide a worst case scenario. Activities are assumed to be conducted 100% of the 15 minute period.

- For the cumulative scenarios, the croquet greens are assumed to be in use during the day. Two greens are assumed to be in use, for 100% of the 15 minute period, with the sound power level based on attended measurements.

- For the cumulative scenarios, the tennis courts are assumed to be in use during the day and evening periods. Two courts are assumed to be in use, for 100% of the 15 minute period, with the sound power level based on attended measurements.

- All residential receivers were modelled at 1.5 m above ground level.

5.3 PREDICTED NOISE LEVELS – OPERATIONAL

The predicted operational noise levels from the Drill Hall Precinct are shown in Table 5-3. The predicted cumulative noise levels from the activities of the surrounding precinct are shown in Table 5-4.

Table 5-3: Predicted Noise Levels – Site Operational Activities dB(A)

Receptor	Project Criteria $L_{eq(15\ minute)}$		Predicted $L_{Aeq(15\ minute)}$		
	Day (Scenario 1)	Evening (Scenario 2 and 3)	1. Current Day Scenario	2. Current Evening Scenario	3. Proposed Evening Scenario
R1	42	39	20 ✓	14 ✓	20 ✓
R2	42	39	17 ✓	9 ✓	16 ✓
R3	42	39	34 ✓	25 ✓	30 ✓
R4	42	39	39 ✓	30 ✓	35 ✓
R5	42	39	45 ✗	36 ✓	40 ✗
R6	42	39	35 ✓	31 ✓	32 ✓
R7	42	39	38 ✓	35 ✓	37 ✓
R8	42	39	40 ✓	38 ✓	39 ✓
R9	42	39	30 ✓	28 ✓	29 ✓
R10	42	39	14 ✓	9 ✓	13 ✓
R11	42	39	12 ✓	7 ✓	11 ✓
R12	42	39	16 ✓	13 ✓	16 ✓
R13	42	39	23 ✓	16 ✓	23 ✓
R14	53		36 ✓	33 ✓	35 ✓
R15	50		15 ✓	10 ✓	14 ✓

✓Complies ✗ Non-compliance

From Table 5-3, it can be seen that the Drill Hall Precinct operational scenarios are predicted to comply with the project specific criteria at all considered receivers, except for R5 during the current day scenario (scenario 1) and the proposed evening scenario (scenario 3).

For the current day scenario (scenario 1), noise levels are predicted to exceed the criteria by 3 dB at the closest receiver R5, 1/2 Cross Street, Mosman. Exceedance of the criteria is predicted during outdoor child care play, with netball activities being a lower noise contributor. When outdoor child care play is not occurring, compliance with the criteria is predicted at all surrounding receivers during the day period. It is noted that no changes to the current day use are proposed.

For the proposed evening scenario, a residual noise level of 1 dB is predicted at R5 during evening outdoor netball use. This scenario assumes netball training will include the use of whistles, as per current practices, a worst case scenario. In section 4.2 of the Noise Policy for Industry (EPA, 2017), a residual noise level of 1 dB is described as of negligible significance, “not being discernible by the average listener and therefore not warranting receiver-based treatments or controls”.

Further noise mitigation measures beyond the assumptions listed throughout this chapter are listed in Section 6 in order to further reduce noise levels at surrounding receivers. It is predicted that noise compliance will be achieved at all receivers during the proposed evening activities (Scenario 3), if the proposed mitigation measures are adopted.

Table 5-4: Predicted Noise Levels – Cumulative Operational Activities dB(A)

Receptor	Project Criteria $L_{eq(15\ minute)}$		Predicted $L_{Aeq(15\ minute)}$	
	Cumulative Day Criteria (Scenario 4)	Cumulative Evening Criteria (Scenario 5)	4. Cumulative Day Scenario	5. Cumulative Evening Scenario
R1	58	48	21 ✓	20 ✓
R2	58	48	18 ✓	17 ✓
R3	58	48	35 ✓	31 ✓
R4	58	48	39 ✓	36 ✓
R5	58	48	45 ✓	42 ✓
R6	58	48	37 ✓	36 ✓
R7	58	48	41 ✓	40 ✓
R8	58	48	45 ✓	45 ✓
R9	58	48	36 ✓	36 ✓
R10	58	48	33 ✓	24 ✓
R11	58	48	31 ✓	26 ✓
R12	58	48	24 ✓	24 ✓
R13	58	48	24 ✓	24 ✓
R14	-	-	42 ✓	42 ✓
R15	-	-	29 ✓	24 ✓

✓Complies × Non-compliance

Table 5-4 displays the predicted noise levels from the cumulative activities from the Drill Hall precinct and surrounding uses. It is shown that the cumulative scenarios during the day and evening period are predicted to comply with the cumulative noise criteria at all surrounding receptors.

6. RECOMMENDED MITIGATION MEASURES

The noise assessment in Section 5 predicted that noise levels would be met at the vast majority of receivers and activities. To further reduce noise levels at the surrounding receptors, the following noise mitigation measures are recommended:

- Outdoor child play at the child care centre is recommended to be limited to between 7am and 6pm;
- The Drill Hall precinct and car park is not recommended to be used after 10pm. The Drill Hall, Marie Bashir Indoor Centre and Netball courts are recommended to finish use at 9:30pm to enable cars to leave the carpark before 10pm.
- Outdoor netball activities are recommended to take place between 7am and 8:30pm. Preference is recommended to be given to conduct activities on the eastern courts. i.e. if only one court is used, the eastern court is used (Court 3). If two courts are used, the eastern court and the central court are recommended to be used (Courts 2 and 3). The western court is recommended to be used only when all three courts are simultaneously required (Courts 1, 2 and 3).
- Outdoor netball activities are recommended to be limited to training, i.e. not match play.
- It is recommended that whistles are not used during evening netball activities (after 6pm).
- Signs are recommended to be erected to encourage quiet behaviour when leaving the site, and to encourage patrons to leave the car park before 10pm.
- A community engagement procedure is recommended to be undertaken. A phone number should be available for residents to call and seek feedback on, if they believe noise levels are outside the recommended criteria and are affecting their amenity.

6.1 POTENTIAL NOISE BERM

The 2006 Noise Impact Assessment (16015_rep (rev3)) included analysis of potential earth berms next to the netball courts or the property boundary. The two analysed options are shown in Figure 6-1 and Figure 6-2 below.

Figure 6-1: Potential option 1 earth berm as per the 2006 report (16015_rep (rev3))

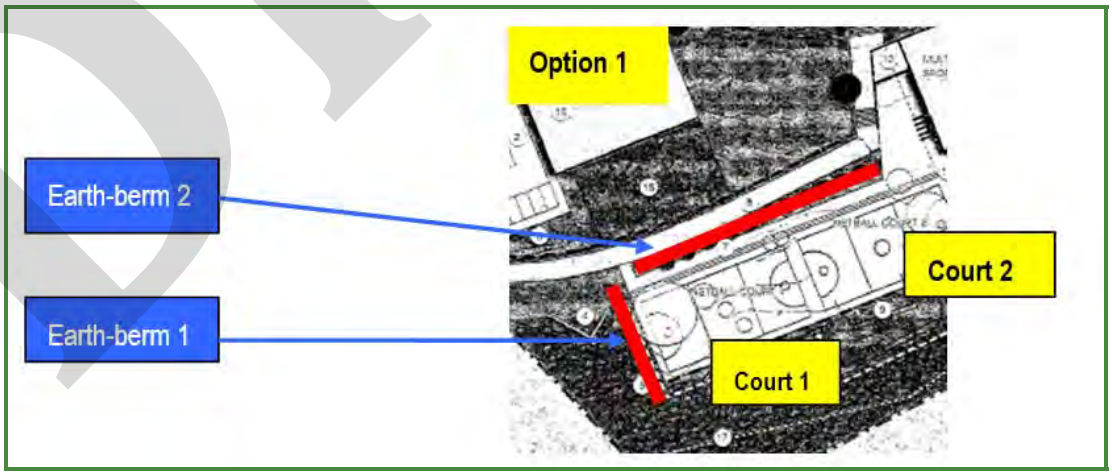
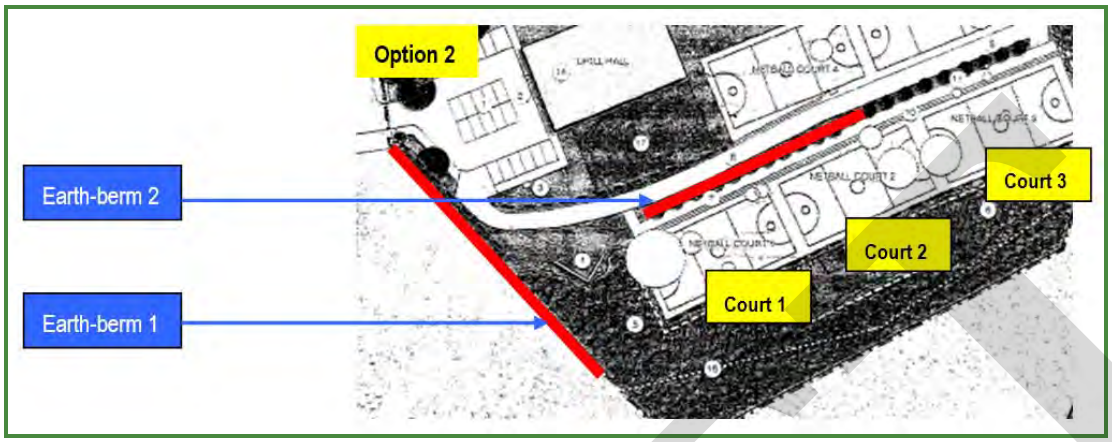


Figure 6-2: Potential option 2 earth berm as per the 2006 report (16015_rep (rev3))



Noise modelling in the 2006 report obtained terrain data from a 1:25,000 topographic map with 10m contour intervals (IPI NSW 9130-2N & 3N Third Edition), a reasonable assumption at the time of that report. The current model utilises site surveys to 0.01m height accuracy for the Drill Hall Precinct, Rawson Oval and surrounding residents. The more accurate local terrain data used in this assessment, in particular regarding the significant fall of the site away from Cross Street allows for a more accurate prediction of the potential impacts of the earth berms.

Current modelling shows that under Option 1, less than 1 dB of attenuation would be achieved at any receiver. Under option 2, less than 1 dB of attenuation is achieved at any receiver except for R5. The receiver R5 would only get minor attenuation from earth berm 1 of option 2 at part of the property, with little attenuation achieved on the second storey of the house or on parts of the property further from the berm.

The earth berms presented in the 2006 report therefore provide almost negligible attenuation at surrounding receivers. If the earth berms were to provide significant attenuation to surrounding receivers, the heights and lengths of the proposed berms would need to be significantly increased from the dimensions quoted in the 2006 report.

It is understood that given the current terrain and layout of the Drill Hall Precinct, there is not enough space for any of the three earth berms to be constructed as per the 2006 report, let alone possible increased dimensions. Furthermore, earth berm 1 is located on land not managed by the Harbour Trust and would require destruction of significant vegetation to be constructed.

In this case, controlling noise at the source itself is more effective than control of the transmission path once the noise is created. The recommended noise mitigation measures outlined in section 6 focusing on managing noise sources will provide greater attenuation for all surrounding receivers than the earth berms presented in the 2006 report. Therefore the construction of earth berms is not recommended.

7. ROAD TRAFFIC NOISE IMPACT ASSESSMENT

A description of the calculation methodology and the noise predictions associated with road traffic has been provided below. Road Traffic Noise from movements on Cross Street itself are analysed in this section. Vehicle movements within the Rawson Oval carpark and Drill Hall Precinct carpark are covered under the Noise Policy for Industry, and were included in the operational scenarios as examined in section 5.

Traffic movements are predicted to be as shown in Table 7-1. Vehicle movements are based upon site observations from Benbow Environmental, the 2009 Christopher Hallam and Associates Traffic Study and traffic data supplied by GTA traffic consultants for their 2018 study.

Table 7-1: Vehicles travelling on Cross Street, worst case 15 minute scenario

Location	Current Vehicles		Future Vehicles	
	Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles
Cross Street (All Vehicles)	58	0	64	0
Cross Street (Drill Hall Precinct Vehicles)	24	0	27	0

Vehicle movements to and from the Drill Hall site and Rawson Oval are primarily through Cross Street. The closest residential receptor to Cross Street is 4 Cross Street (R6).

Calculation of the road traffic noise contribution has been undertaken using the Calculation of Road Traffic Noise (CoRTN) algorithm within SoundPLAN v7.3. The CoRTN algorithm was utilised to predict the contribution from site road traffic at the nearest residential receiver during the day period. No traffic movements into or out of the Drill Hall Precinct are predicted during the night road traffic period (between 10pm and 7am). The following correction factors have been used within the CoRTN algorithm:

- For Australian conditions (free field corrected), –0.7 dB;
- L_{10} to L_{eq}, -3.0 dB;
- For low traffic flow, -30 dB with the traffic volumes therefore multiplied by 1000;
- For Heavy Engines, -0.6 dB; and
- For Heavy Exhausts, -8.6 dB.

Vehicles are assumed to travel at the posted speed of 50 km/h.

The $L_{Aeq,\ 1\ hour}$ noise descriptor has been calculated at the most affected residential receptor, 4 Cross Street, Mosman (R6). The predicted noise levels are displayed in Table 7-2. The highest contribution from the route to/from the site is predicted at this location; therefore it is the only result displayed.

Table 7-2: Predicted Levels for Road Traffic Noise, dB(A)

Receptor	Noise Criteria	Site Contribution Day $L_{Aeq, 15\ hour}$			
	Day (7am-10pm) $L_{Aeq, 1\ hour}$	All Traffic Cross Street		Drill Hall Precinct Cross Street	
		Current	Future	Current	Future
4 Cross Street, Mosman	55	54.0 ✓	54.4 ✓	50.4 ✓	50.8 ✓

For the residential dwelling at 4 Cross Street, the predicted noise levels associated with the entire Cross Street traffic and the Drill Hall Precinct traffic would be below the daytime criteria of $L_{Aeq\ (1\ hour)}$ 55 dB(A) during the current and future scenarios. The contribution of traffic noise from the Drill Hall site is less than the contribution from Rawson Oval traffic.

Step 3 of Section 3.4.1 of the RNP identifies possible reasonable and feasible control measures when exceedances of either of the outlined criteria. As no exceedances are predicted, the proposed vehicle movements comply with the RNP, and no additional mitigation strategies are recommended.

Vehicle movements in and out of the Drill Hall precinct are recommended to continue to be limited to between 7am and 10pm.

8. CONCLUDING REMARKS

Benbow Environmental has been engaged by the Sydney Harbour Federation Trust to prepare a noise impact assessment for the Mosman Drill Hall Precinct, at 1A Cross Street Mosman, Lot 2 in DP 541799.

In 2006, the Harbour Trust adopted the Management Plan for the Mosman Drill Hall Precinct. Since the 2006 Management Plan, a number of projects have been undertaken at the site including:

- Re-use of the Drill Hall for out of school hours care, private functions and community facilities;
- Construction and use of three outdoor netball courts; and
- Construction and use of the Marie Bashir Sports Centre.

Additionally, the possible use of netball courts during the evening period before 8:30pm has been investigated. This Noise Impact Assessment therefore examines the current activities and proposed evening netball court use.

The noise impact assessment was undertaken in accordance with the following guidelines:

- NSW Noise Policy for Industry (EPA, 2017); and
- NSW Road Noise Policy (RNP) (DECCW, 2011).

Assessment criteria for noise emissions from the subject site were used to determine whether the potential noise impacts from the site were within the derived limits or in exceedance of the guidelines.

The site operations and road traffic impacts were modelled using the predictive noise software, Sound Plan V7.3. The noise generating scenarios are predicted to comply with the project specific noise levels at the vast majority of receivers and activities. Road traffic noise levels associated with the development have been considered against the NSW Road Noise Policy, with compliance predicted at all considered receptors.

To further reduce noise levels at surrounding receptors, noise mitigation measures and noise management practices have been recommended in section 6, including the following:

- Outdoor child play limited to between 7am and 6pm;
- The Drill Hall precinct is not recommended to be used after 9:30pm, with the car park not recommended to be used after 10pm;
- Evening outdoor netball activities are to be training, not match play, and be limited to before 8:30pm;
- Preference given to use the eastern outdoor netball courts;
- Whistles are not recommended during evening netball activities (after 6pm);
- Signs are recommended to be erected to encourage quiet behaviour; and
- A community engagement procedure is recommended to be undertaken.

This concludes the report.

Peter Gangemi
Senior Acoustic Engineer

R T Benbow
Principal Consultant

9. LIMITATIONS

Our services for this project are carried out in accordance with our current professional standards for site assessment investigations. No guarantees are either expressed or implied.

This report has been prepared solely for the use of Sydney Harbour Federation Trust, as per our agreement for providing environmental services. Only Sydney Harbour Federation Trust is entitled to rely upon the findings in the report within the scope of work described in this report. Otherwise, no responsibility is accepted for the use of any part of the report by another in any other context or for any other purpose.

Although all due care has been taken in the preparation of this study, no warranty is given, nor liability accepted (except that otherwise required by law) in relation to any of the information contained within this document. We accept no responsibility for the accuracy of any data or information provided to us by Sydney Harbour Federation Trust for the purposes of preparing this report.

Any opinions and judgements expressed herein, which are based on our understanding and interpretation of current regulatory standards, should not be construed as legal advice.

ATTACHMENTS

Attachment 1: Noise Terminology

'A' FREQUENCY WEIGHTING

The 'A' frequency weighting roughly approximates to the Fletcher-Munson 40 phon equal loudness contour. The human loudness perception at various frequencies and sound pressure levels is equated to the level of 40 dB at 1 kHz. The human ear is less sensitive to low frequency sound and very high frequency sound than midrange frequency sound (i.e. 500 Hz to 6 kHz). Humans are most sensitive to midrange frequency sounds, such as a child's scream. Sound level meters have inbuilt frequency weighting networks that very roughly approximates the human loudness response at low sound levels. It should be noted that the human loudness response is not the same as the human annoyance response to sound. Here low frequency sounds can be more annoying than midrange frequency sounds even at very low loudness levels. The 'A' weighting is the most commonly used frequency weighting for occupational and environmental noise assessments. However, for environmental noise assessments, adjustments for the character of the sound will often be required.

AMBIENT NOISE

The ambient noise level at a particular location is the overall environmental noise level caused by all noise sources in the area, both near and far, including all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. Usually assessed as an energy average over a set time period 'T' (L_{Aeq},T).

AUDIBLE

Audible refers to a sound that can be heard. There are a range of audibility grades, varying from "barely audible", "just audible" to "clearly audible" and "prominent".

BACKGROUND NOISE LEVEL

Total silence does not exist in the natural or built-environments, only varying degrees of noise. The Background Noise Level is the minimum repeatable level of noise measured in the absence of the noise under investigation and any other short-term noises such as those caused by all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc.. It is quantified by the noise level that is exceeded for 90 % of the measurement period 'T' (L_{A90}, T). Background Noise Levels are often determined for the day, evening and night time periods where relevant. This is done by statistically analysing the range of time period (typically 15 minute) measurements over multiple days (often 7 days). For a 15 minute measurement period the Background Noise Level is set at the quietest level that occurs at 1.5 minutes.

'C' FREQUENCY WEIGHTING

The 'C' frequency weighting approximates the 100 phon equal loudness contour. The human ear frequency response is more linear at high sound levels and the 100 phon equal loudness contour attempts to represent this at various frequencies at sound levels of approximately 100 dB.

DECIBEL

The decibel (dB) is a logarithmic scale that allows a wide range of values to be compressed into a more comprehensible range, typically 0 dB to 120 dB. The decibel is ten times the logarithm of the ratio of any two quantities that relate to the flow of energy (i.e. power). When used in acoustics it is the ratio of square of the sound pressure level to a reference sound pressure level, the ratio of the sound power level to a reference sound power level, or the ratio of the sound intensity level to a reference sound intensity level. See also Sound Pressure Level and Sound Power Level. Noise levels in decibels cannot be added arithmetically since they are logarithmic numbers. If one machine is generating a noise level of 50 dB, and another similar machine is placed beside it, the level will increase to 53 dB (from 10 $\log_{10}$ ($10^{(50/10)}$ + $10^{(50/10)}$) and not 100 dB. In theory, ten similar machines placed side by side will increase the sound level by 10 dB, and one hundred machines increase the sound level by 20 dB. The human ear has a vast sound-sensitivity range of over a thousand billion to one so the logarithmic decibel scale is useful for acoustical assessments.

dBA – See 'A' frequency weighting

dBC – See 'C' frequency weighting

EQUIVALENT CONTINUOUS SOUND LEVEL, LAeq

Many sounds, such as road traffic noise or construction noise, vary repeatedly in level over a period of time. More sophisticated sound level meters have an integrating/averaging electronic device inbuilt, which will display the energy time-average (equivalent continuous sound level - L_{Aeq}) of the 'A' frequency weighted sound pressure level. Because the decibel scale is a logarithmic ratio, the higher noise levels have far more sound energy, and therefore the LAeq level tends to indicate an average which is strongly influenced by short term, high level noise events. Many studies show that human reaction to level-varying sounds tends to relate closer to the L_{Aeq} noise level than any other descriptor.

'F'(FAST) TIME WEIGHTING

Sound level meter design-goal time constant which is 0.125 seconds.

FLETCHER–MUNSON EQUAL LOUDNESS CONTOUR CURVES

The Fletcher–Munson curves are one of many sets of equal loudness contours for the human ear, determined experimentally by Harvey Fletcher and Wilden A. Munson, and reported in a 1933 paper entitled "Loudness, its definition, measurement and calculation" in the Journal of the Acoustic Society of America.

FREE FIELD

In acoustics a free field is a measurement area not subject to significant reflection of acoustical energy. A free field measurement is typically not closer than 3.5 metres to any large flat object (other than the ground) such as a fence or wall or inside an anechoic chamber.

FREQUENCY

The number of oscillations or cycles of a wave motion per unit time, the SI unit is the hertz (Hz). 1 Hz is equivalent to one cycle per second. 1000 Hz is 1 kHz.

IMPACT ISOLATION CLASS (IIC)

The American Society for Testing and Materials (ASTM) has specified that the IIC of a floor/ceiling system shall be determined by operating an ISO 140 Standard Tapping Machine on the floor and measuring the noise generated in the room below. The IIC is a number found by fitting a reference curve to the measured octave band levels and then deducting the sound pressure level at 500 Hz from 110 decibels. Thus the higher the IIC, the better the impact sound isolation. Not commonly used in Australia.

'I' (IMPULSE) TIME WEIGHTING

Sound level meter time constant now not in general use. The 'I' (impulse) time weighting is not suitable for rating impulsive sounds with respect to their loudness. It is also not suitable for assessing the risk of hearing impairment or for determining the 'impulsiveness' of a sound.

IMPACT SOUND INSULATION ($L_{nT,w}$)

Australian Standard AS ISO 717.2 – 2004 has specified that the Impact Sound Insulation of a floor/ceiling system be quantified by operating an ISO 140 Standard Tapping Machine on the floor and measuring the noise generated in the room below. The Weighted Standardised Impact Sound Pressure Level ($L_{nT,w}$) is the sound pressure level at 500 Hz for a reference curve fitted to the measured 1/3 octave band levels. Thus the lower $L_{nT,w}$ the better the impact sound insulation.

IMPULSE NOISE

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

LOUDNESS

The volume to which a sound is audible to a listener is a subjective term referred to as loudness. Humans generally perceive an approximate doubling of loudness when the sound level increases by about 10 dB and an approximate halving of loudness when the sound level decreases by about 10 dB.

MAXIMUM NOISE LEVEL, LAFmax

The root-mean-square (rms) maximum sound pressure level measured with sound level meter using the 'A' frequency weighting and the 'F' (Fast) time weighting. Often used for noise assessments other than aircraft.

MAXIMUM NOISE LEVEL, LASmax

The root-mean-square (rms) maximum sound pressure level measured with sound level meter using the 'A' frequency weighting and the 'S' (Slow) time weighting. Often used for aircraft noise assessments.

NOISE RATING NUMBERS

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

NOISE

Noise is unwanted, harmful or inharmonious (discordant) sound. Sound is wave motion within matter, be it gaseous, liquid or solid. Noise usually includes vibration as well as sound.

NOISE REDUCTION COEFFICIENT – See: "Sound Absorption Coefficient"

OFFENSIVE NOISE

Reference: Dictionary of the NSW Protection of the Environment Operations Act (1997). "Offensive Noise means noise:
(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:
(i) is harmful to (or likely to be harmful to) a person who is outside the premise from which it is emitted, or
(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or
(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances prescribed by the regulations."

PINK NOISE

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

REVERBERATION TIME, T60

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

SOUND ABSORPTION COEFFICIENT, α

Sound is absorbed in porous materials by the viscous conversion of sound energy to a small amount of heat energy as the sound waves pass through it. Sound is similarly absorbed by the flexural bending of internally damped panels. The fraction of incident energy that is absorbed is termed the Sound Absorption Coefficient, α. An absorption coefficient of 0.9 indicates that 90 % of the incident sound energy is absorbed. The average α from 250 to 2 kHz is termed the Noise Reduction Coefficient (NRC).

'S' (SLOW) TIME WEIGHTING

Sound level meter design-goal time constant which is 1 second.

SOUND ATTENUATION

A reduction of sound due to distance, enclosure or some other devise. If an enclosure is placed around a machine, or an attenuator (muffler or silencer) is fitted to a duct, the noise emission is reduced or attenuated. An enclosure that attenuates the noise level by 20 dB reduces the sound energy by one hundred times.

SOUND EXPOSURE LEVEL (LAE)

Integration (summation) rather than an average of the sound energy over a set time period. Use to assess single noise events such as truck or train pass by or aircraft flyovers. The sound exposure level is related to the energy average (L_{Aeq}, T) by the formula L_{Aeq}, T = L_{AE} – 10 $\log_{10}$ T. The abbreviation (SEL) is sometimes inconsistently used in place of the symbol (L_{AE}).

SOUND PRESSURE

The rms sound pressure measured in pascals (Pa). A pascal is a unit equivalent to a newton per square metre (N/m^2).

SOUND PRESSURE LEVEL, Lp

The level of sound measured on a sound level meter and expressed in decibels (dB). Where L_P = 10 $\log_{10}$ $(Pa/Po)^2$ dB (or 20 log10 (Pa/ Po) dB) where Pa is the rms sound pressure in Pascal and Po is a reference sound pressure conventionally chosen is 20 µPa (20 x 10^{-6} Pa) for airborne sound. L_p varies with distance from a noise source.

SOUND POWER

The rms sound power measured in watts (W). The watt is a unit defined as one joule per second. A measures the rate of energy flow, conversion or transfer.

SOUND POWER LEVEL, Lw

The sound power level of a noise source is the inherent noise of the device. Therefore sound power level does not vary with distance from the noise source or with a different acoustic environment. Lw = Lp + 10 $\log_{10}$ 'a' dB, re: 1pW, (10^{-12} watts) where 'a' is the measurement noise-emission area (m^2) in a free field.

SOUND TRANSMISSION CLASS (STC)

An internationally standardised method of rating the sound transmission loss of partition walls to indicate the sound reduction from one side of a partition to the other in the frequency range of 125 Hz to 4000 kHz. (Refer: Australian Standard AS 1276 – 1979). Now not in general use in Australia see: weighted sound reduction index.

SOUND TRANSMISSION LOSS

The amount in decibels by which a random sound is reduced as it passes through a sound barrier. A method for the measurement of airborne Sound Transmission Loss of a building partition is given in Australian Standard AS 1191–2002.

STATISTICAL NOISE LEVELS, Ln.

Noise which varies in level over a specific period of time 'T' (standard measurement times are 15 minute periods) may be quantified in terms of various statistical descriptors for example:-

- The noise level, in decibels, exceeded for 1 % of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as L_{AF1}, T. This may be used for describing short-term noise levels such as could cause sleep arousal during the night.
- The noise level, in decibels, exceeded for 10 % of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as L_{AF10}, T. In most countries the LAF10, T is measured over periods of 15 minutes, and is used to describe the average maximum noise level.
- The noise level, in decibels, exceeded for 90 % of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as L_{AF90}, T. In most countries the LAF90, T is measured over periods of 15 minutes, and is used to describe the average minimum or background noise level.

STEADY NOISE

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

WEIGHTED SOUND REDUCTION INDEX, Rw

This is a single number rating of the airborne sound insulation of a wall, partition or ceiling. The sound reduction is normally measured over a frequency range of 100 Hz to 3.150 kHz and averaged in accordance with ISO standard weighting curves (Refer AS/NZS 1276.1:1999). Internal partition wall Rw + C ratings are frequency weighted to simulate insulation from human voice noise. The R_w + C is similar in value to the STC rating value. External walls, doors and windows may be R_w + C_{tr} rated to simulate insulation from road traffic noise. The spectrum adaptation term Ctr adjustment factor takes account of low frequency noise. The weighted sound reduction index is normally similar or slightly lower number than the STC rating value.

WHITE NOISE

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

'Z' FREQUENCY WEIGHTING

The 'Z' (Zero) frequency weighting is 0 dB within the nominal 1/3 octave band frequency range centred on 10 Hz to 20 kHz. This is within the tolerance limits given in AS IEC 61672.1–2004: 'Electroacoustics - Sound level meters – Specifications'.

Attachment 2: Calibration Certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: **SLM 20815 & FILT 4015**

Equipment Description:	Sound & Vibration Analyser		
Manufacturer:	Svantek		
Model No:	Svan-957	**Serial No:**	15335
Microphone Type:	7052E	**Serial No:**	40814
Filter Type:	1/3 Octave	**Serial No:**	15335
Comments:	All tests passed for class 1. (See over for details)		
Owner:	Benbow Environmental 13 Daking Street North Parramatta NSW 2151		
Ambient Pressure:	1014 hPa ±1.5 hPa		
Temperature:	23 °C ±2° C	**Relative Humidity:**	53% ±5%
Date of Calibration:	14/06/2017	**Issue Date:**	16/06/2017

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....

Jack Rose

Accredited for compliance with ISO/IEC 17025
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

NATA
ACCREDITATION

Accredited Lab. No. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS

HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
web site: www.acu-vib.com.au

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: 23100

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: Rion
Type No: NC-73 **Serial No:** 10186522
Owner: Benbow Environmental
13 Daking Street
North Parramatta NSW 2151

Tests Performed: Measured output pressure level was found to be:

Parameter	Pre-Adj	Adj Y/N	Output: (db re 20 µPa)	Frequency: (Hz)	THD&N (%)
Level 1:	NA	N	94.16	990.12	3.98
Level 2:	NA	N	NA	NA	NA
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:
Ambient Pressure: 1010 hPa ±1.5 hPa **Relative Humidity:** 31% ±5%
Temperature: 24 °C ±2° C
Date of Calibration: 11/07/2018 **Issue Date:** 11/07/2018
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2004
CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Lab. 9262
Acoustic and Vibration Measurements

ACU-VIB
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Sound Level Meter
IEC 61672-3.2013

Calibration Certificate

Calibration Number C17611

Client Details Benbow Environmental
13 Daking Street
North Parramatta NSW 2151

Equipment Tested/ Model Number : ARL Ngara
Instrument Serial Number : 8780AC
Microphone Serial Number : 317859
Pre-amplifier Serial Number : 27984

Pre-Test Atmospheric Conditions
Ambient Temperature : 22.6°C
Relative Humidity : 50.2%
Barometric Pressure : 99.88kPa

Post-Test Atmospheric Conditions
Ambient Temperature : 22.3°C
Relative Humidity : 49.2%
Barometric Pressure : 99.84kPa

Calibration Technician : Vicky Jaiswal
Calibration Date : 15/11/2017

Secondary Check: Riley Cooper
Report Issue Date : 15/11/2017

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*Pass*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*Pass*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2002 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002 and because the periodic tests of IEC 61672-3:2006 cover only a limited subset of the specifications in IEC 61672-1:2002.

Least Uncertainties of Measurement -

Acoustic Tests
31.5 Hz to 8kHz ±0.16dB
12.5kHz ±0.2dB
16kHz ±0.29dB

Electrical Tests
31.5 Hz to 20 kHz ±0.12dB

Environmental Conditions
Temperature ±0.05°C
Relative Humidity ±0.46%
Barometric Pressure ±0.017kPa

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

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Sound Level Meter
IEC 61672-3.2013
Calibration Certificate

Calibration Number C17613

Client Details Benbow Environmental
13 Daking Street
North Parramatta NSW 2151

Equipment Tested/ Model Number : ARL Ngara
Instrument Serial Number : 8780AE
Microphone Serial Number : 321775
Pre-amplifier Serial Number : 27982

Pre-Test Atmospheric Conditions
Ambient Temperature : 22.6°C
Relative Humidity : 48.7%
Barometric Pressure : 99.74kPa

Post-Test Atmospheric Conditions
Ambient Temperature : 22.5°C
Relative Humidity : 46.1%
Barometric Pressure : 99.68kPa

Calibration Technician : Vicky Jaiswal
Calibration Date : 15/11/2017

Secondary Check: Riley Cooper
Report Issue Date : 15/11/2017

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*Pass*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*Pass*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2002 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002 and because the periodic tests of IEC 61672-3:2006 cover only a limited subset of the specifications in IEC 61672-1:2002.

Least Uncertainties of Measurement -

Acoustic Tests
31.5 Hz to 8kHz *±0.16dB*
12.5kHz *±0.2dB*
16kHz *±0.29dB*

Electrical Tests
31.5 Hz to 20 kHz *±0.12dB*

Environmental Conditions
Temperature *±0.05°C*
Relative Humidity *±0.46%*
Barometric Pressure *±0.017kPa*

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
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The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

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Attachment 3: QA/QC Procedures

Calibration of Sound Level Meters

A sound level meter requires regular calibration to ensure its measurement performance remains within specification. Benbow Environmental sound level meters are calibrated by a National Association of Testing Authority (NATA) registered laboratory or a laboratory approved by the NSW Environment Protection Authority (EPA) every two years and after each major repair, in accordance with AS 1259-1990.

The calibration of the sound level meter was checked immediately before and after each series of measurements using an acoustic calibrator. The acoustic calibrator provides a known sound pressure level, which the meter indicates when the calibrator is activated while positioned on the meter microphone.

The sound level meters also incorporate an internal calibrator for use in setting up. This provides a check of the electrical calibration of the meter, but does not check the performance of the microphone. Acoustical calibration checks the entire instrument including the microphone. Calibration certificates for the instrument sets used have been included as Attachment 1.

Care and Maintenance of Sound Level Meters

Noise measuring equipment contains delicate components and therefore must be handled accordingly. The equipment is manufactured to comply with international and national standards and is checked periodically for compliance. The technical specifications for sound level meters used in Australia are defined in Australian Standard AS 1259 – 1990 "*Sound Level Meters"*.

The sound level meters and associated accessories are protected during storage, measurement and transportation against dirt, corrosion, rapid changes of temperature, humidity, rain, wind, vibration, electric and magnetic fields. Microphone cables and adaptors are always connected and disconnected with the power turned off. Batteries are removed (with the instrument turned off) if the instrument is not to be used for some time.

Investigation Procedures

All investigative procedures were conducted in accordance with AS 1055.1-1997 *Acoustics – "Description and Measurement of Environmental Noise (Part 1: General Procedures)"*.

The following information was recorded and kept for reference purposes:

- type of instrumentation used and measurement procedure conducted;
- description of the time aspect of the measurements, ie. measurement time intervals; and
- positions of measurements and the time and date were noted.

As per AS 1055.1-1997, all measurements were carried out at least 3.5 m from any reflecting structure other than the ground. The preferred measurement height of 1.2 m above the ground was utilised. A sketch of the area was made identifying positions of measurement and the approximate location of the noise source and distances in meters (approx.).

Unattended Noise Monitoring

NOISE MONITORING EQUIPMENT

ARL noise loggers type Ngara and EL-215 were used to conduct the long-term unattended noise monitoring. This equipment complies with Australian Standard 1259.2–1990 "*Acoustics – Sound Level Meters*" and is designated as a Type 1 and Type 2 instrument suitable for field use.

The measured data is processed statistically and stored in memory every 15 minutes. The equipment was calibrated prior and subsequent to the measurement period using a Rion NC-73 sound level calibrator. There were no significant variances observed in the reference signal between the pre-measurement and post-measurement calibrations. Instrument calibration certificates have also been included in Attachment 1.

METEOROLOGICAL CONSIDERATION DURING MONITORING

For the long-term attended monitoring, meteorological data for the relevant period were provided by the Bureau of Meteorology, which was considered representative of the site for throughout the monitoring period.

DESCRIPTORS & FILTERS USED FOR MONITORING

Noise levels are commonly measured using A-weighted filters and are usually described as dB(A). The "A-weighting" refers to standardised amplitude versus frequency curve used to "weight" sound measurements to represent the response of the human ear. The human ear is less sensitive to low frequency sound than it is to high frequency sound. Overall A-weighted measurements quantify sound with a single number to represent how people subjectively hear different frequencies at different levels.

Noise environments can be described using various descriptors depending on characteristics of noise or purpose of assessments. For this survey the L_{A90} was used to analyse the monitoring results. The statistical descriptors L_{A90} measures the noise level exceeded for 90% of the sample measurement time, and is used to describe the “Background noise”. Background noise is the underlying level of noise present in the ambient noise, excluding extraneous noise or the noise source under investigation.

Measurement sample periods were fifteen minutes. The Noise -vs- Time graphs representing measured noise levels at the noise monitoring location are presented in Attachment 3.

ATTENDED NOISE MONITORING

NOISE MONITORING EQUIPMENT

The attended short-term noise monitoring was carried out using a SVANTEK SVAN957 Class 1 Precision Sound Level Meter. The instrument was calibrated by a NATA accredited laboratory within two years of the measurement period. The instrument sets comply with AS 1259 and was set on A-weighted, fast response.

The microphone was positioned at 1.5 metres above ground level and was fitted with a windsock. The instrument was calibrated using a Rion NC-73 sound level calibrator prior and subsequent to the measurement period to ensure the reliability and accuracy of the instrument sets. There were no significant variances observed in the reference signal between the pre-measurement and post-measurement calibrations. Instrument calibration certificates have also been included in Attachment 1.

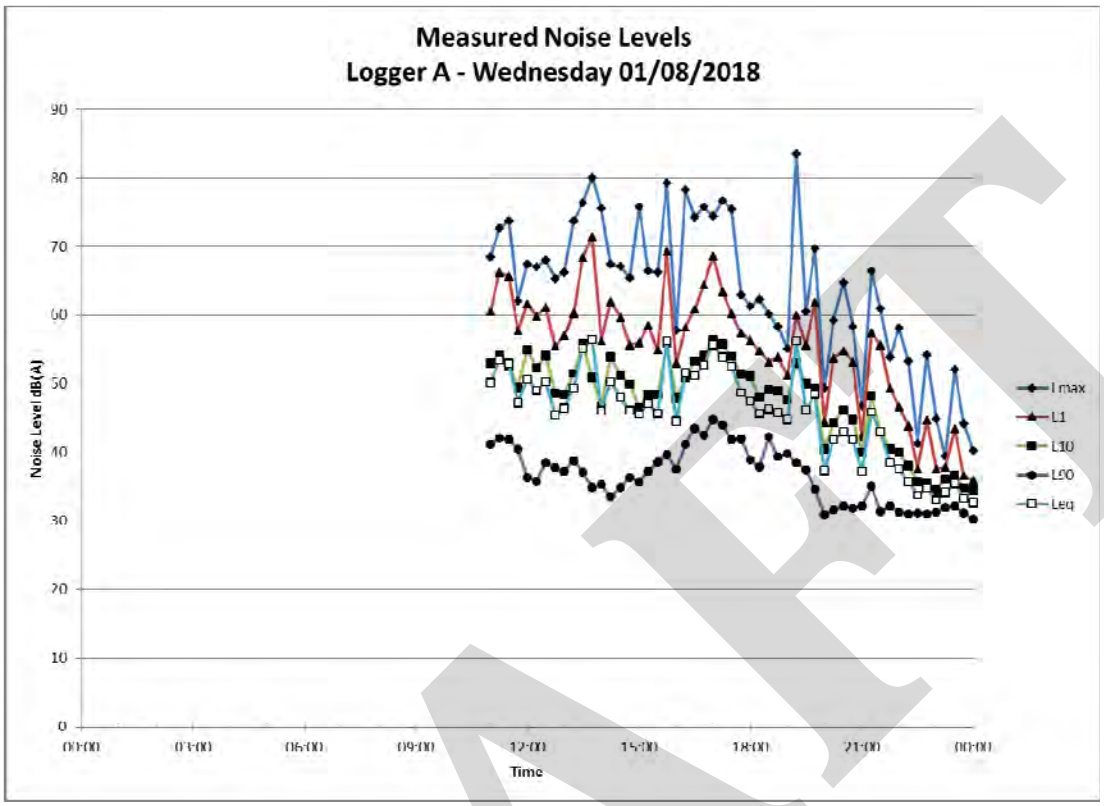
WEATHER CONDITIONS

It was partially cloudy, fine without significant breeze.

METHODOLOGY

The attended noise measurements were carried out generally in accordance with Australian Standard AS 1055-1997 "*Acoustics – Description and Measurement of Environmental Noise*".

Attachment 4: Daily Noise Logger Charts


Measured Noise Levels
Logger A - Wednesday 01/08/2018
Noise Level dB(A)
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80
70
60
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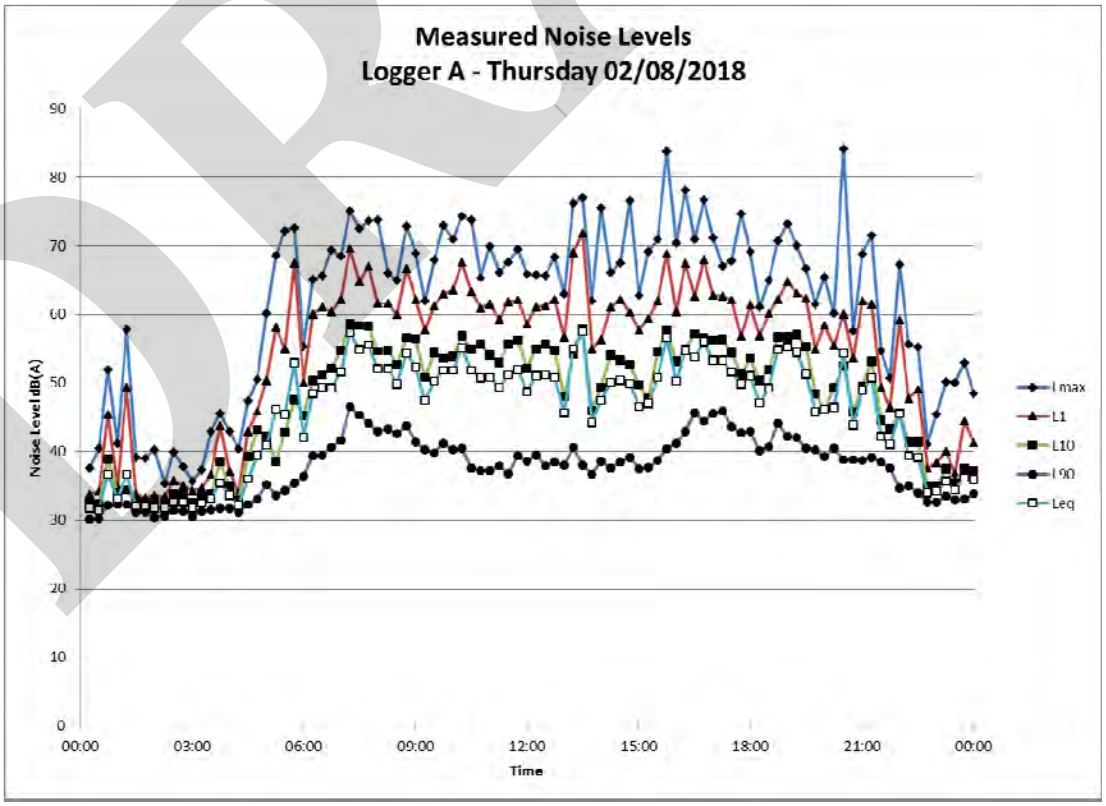
40
30
20
10
0
Time
L max
L1
L10
L90
Leq


Measured Noise Levels
Logger A - Thursday 02/08/2018
Noise Level dB(A)
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20
10
0
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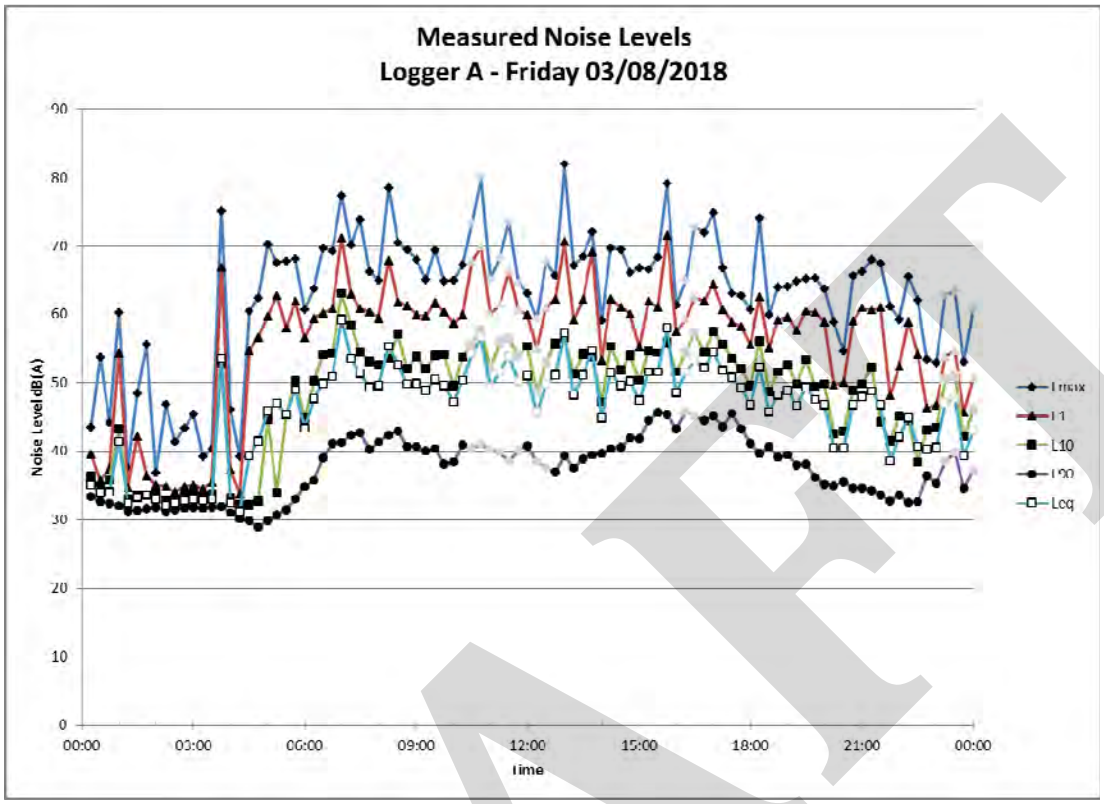
Time
L max
L1
L10
L90
Leq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Logger A - Friday 03/08/2018
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40
30
20
10
0
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18:00
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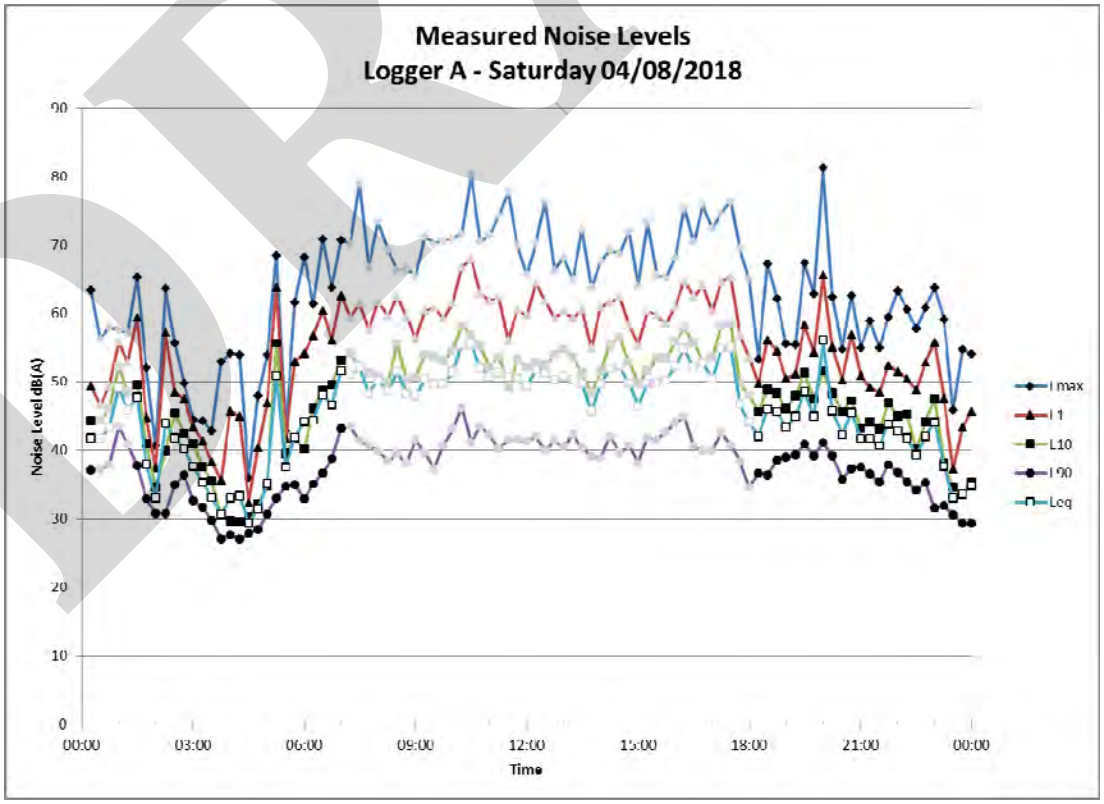
00:00
Time
L max
L1
L10
L90
Leq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70
60
50
40
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20
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18:00
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Time
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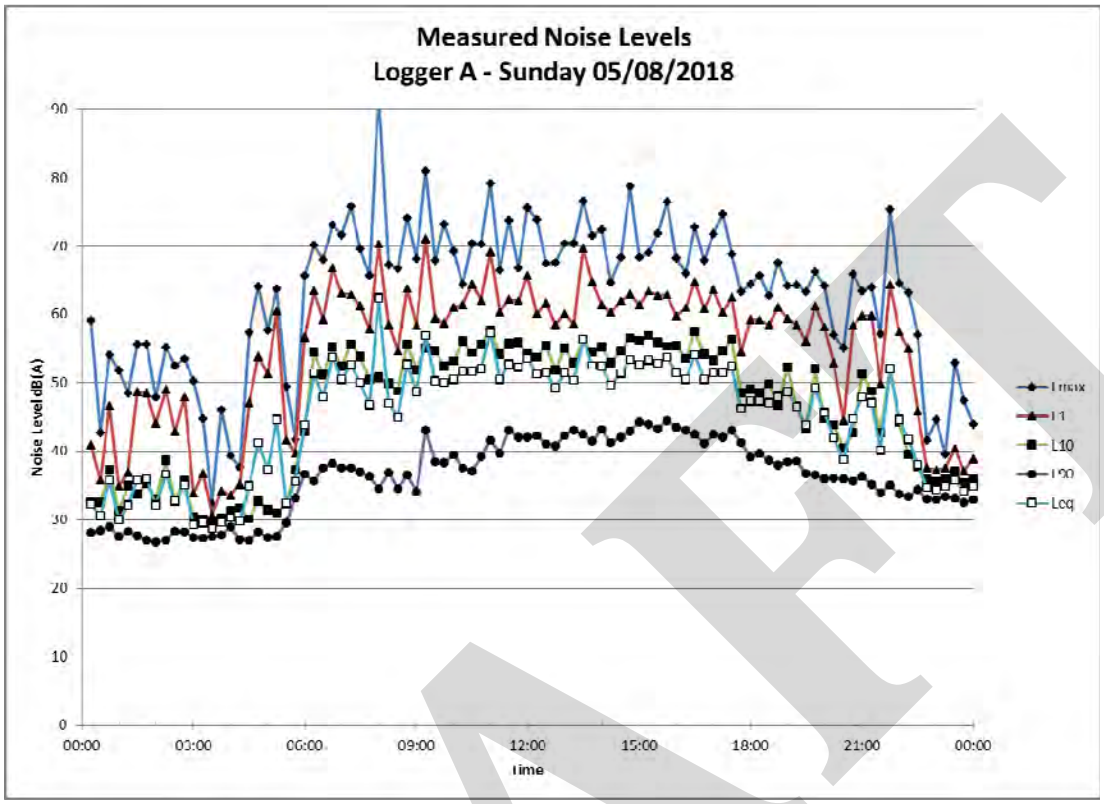
Measured Noise Levels
Logger A - Sunday 05/08/2018
Noise Level dB(A)
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60
50
40
30
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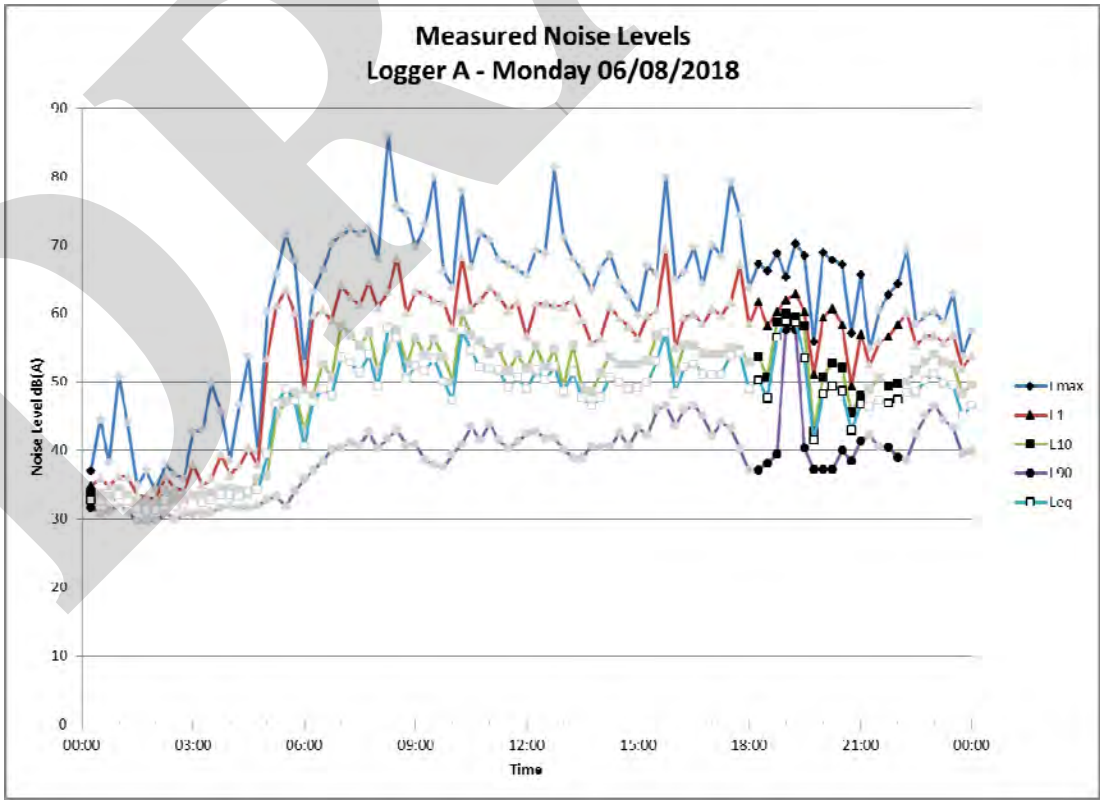
Time
L max
L1
L10
L90
Leq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Logger A - Monday 06/08/2018
Noise Level dB(A)
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60
50
40
30
20
10
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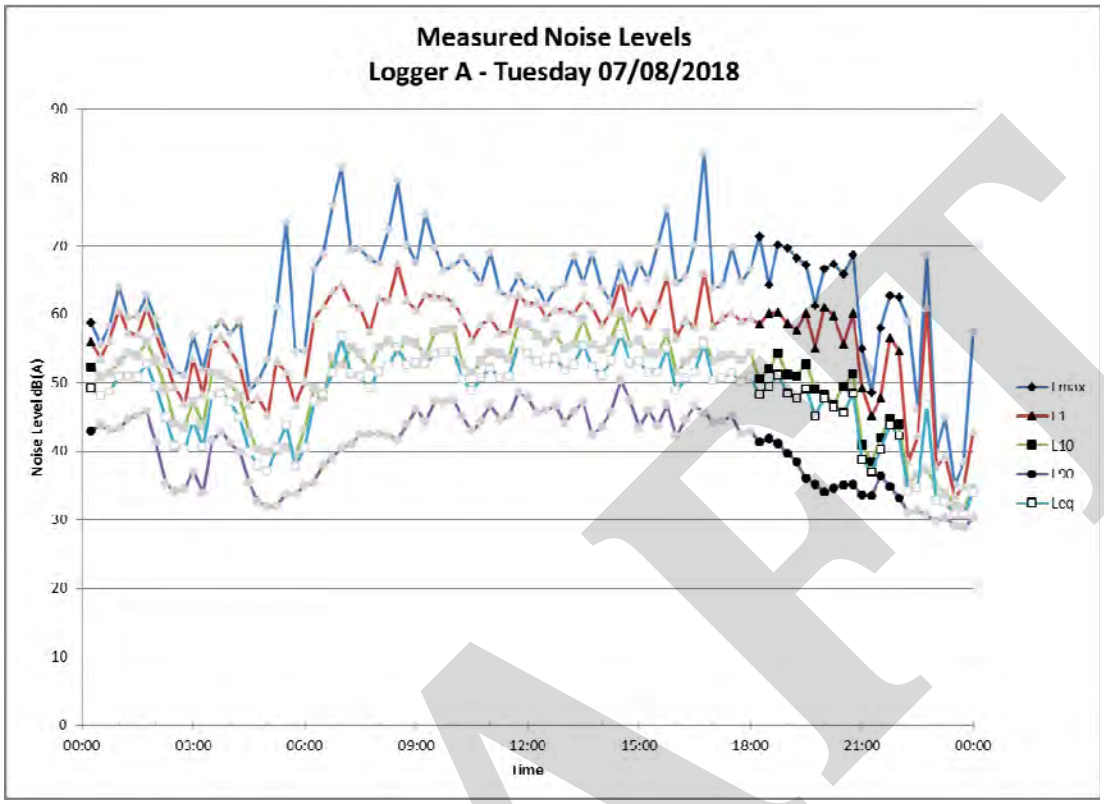
Time
L max
L1
L10
L90
Leq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Logger A - Tuesday 07/08/2018
Noise Level dB(A)
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70
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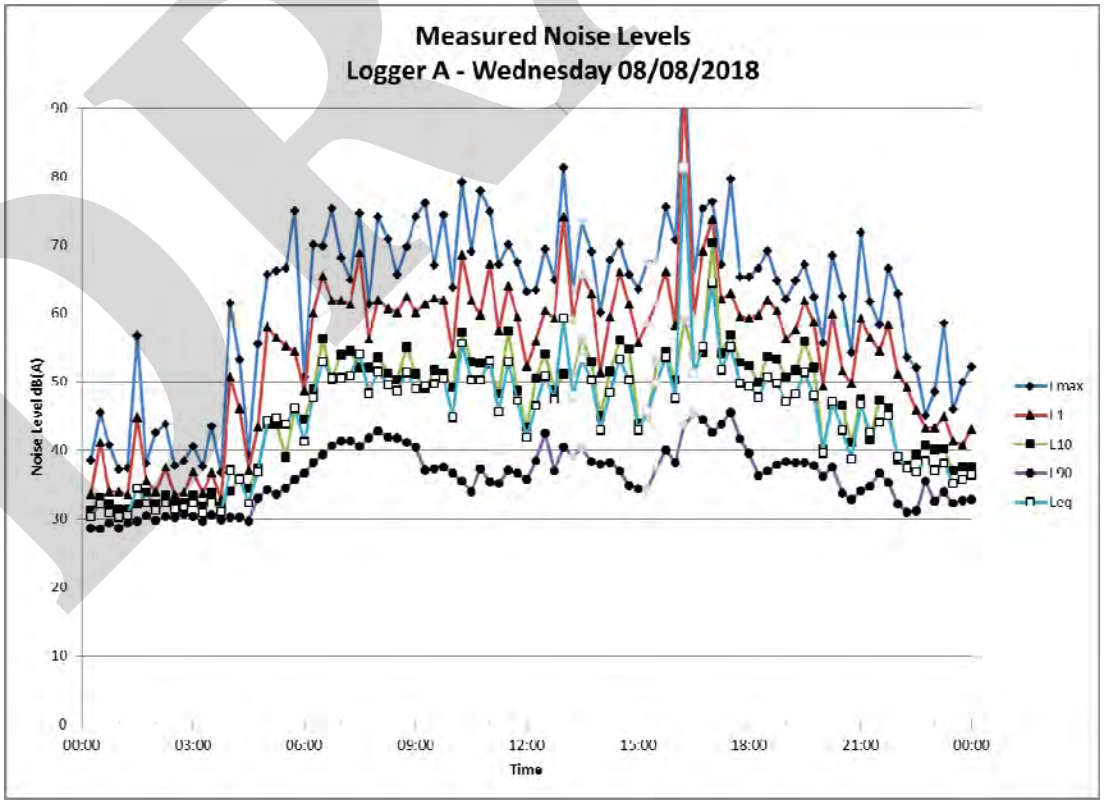
L90
Leq


Measured Noise Levels
Logger A - Wednesday 08/08/2018
Noise Level dB(A)
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70
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Time
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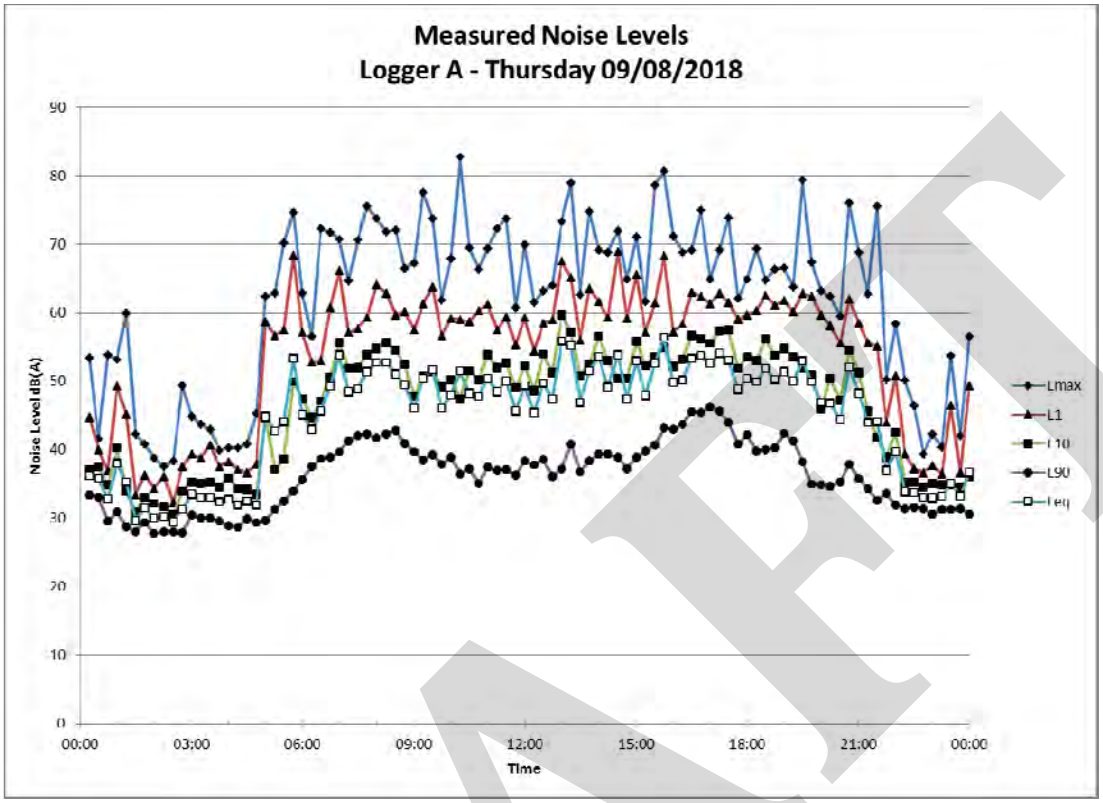
Leq


Measured Noise Levels
Logger A - Thursday 09/08/2018
Noise Level dB(A)
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60
50
40
30
20
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Time
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L90
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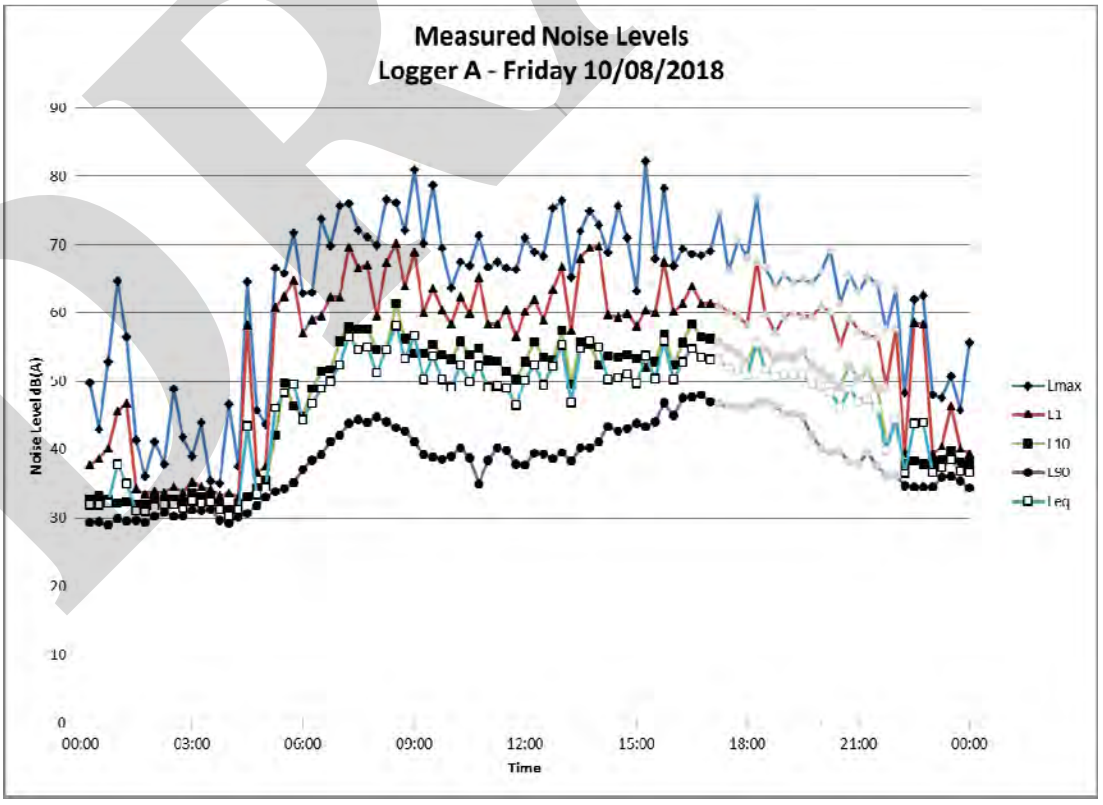
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Logger A - Friday 10/08/2018
Noise Level dB(A)
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Time
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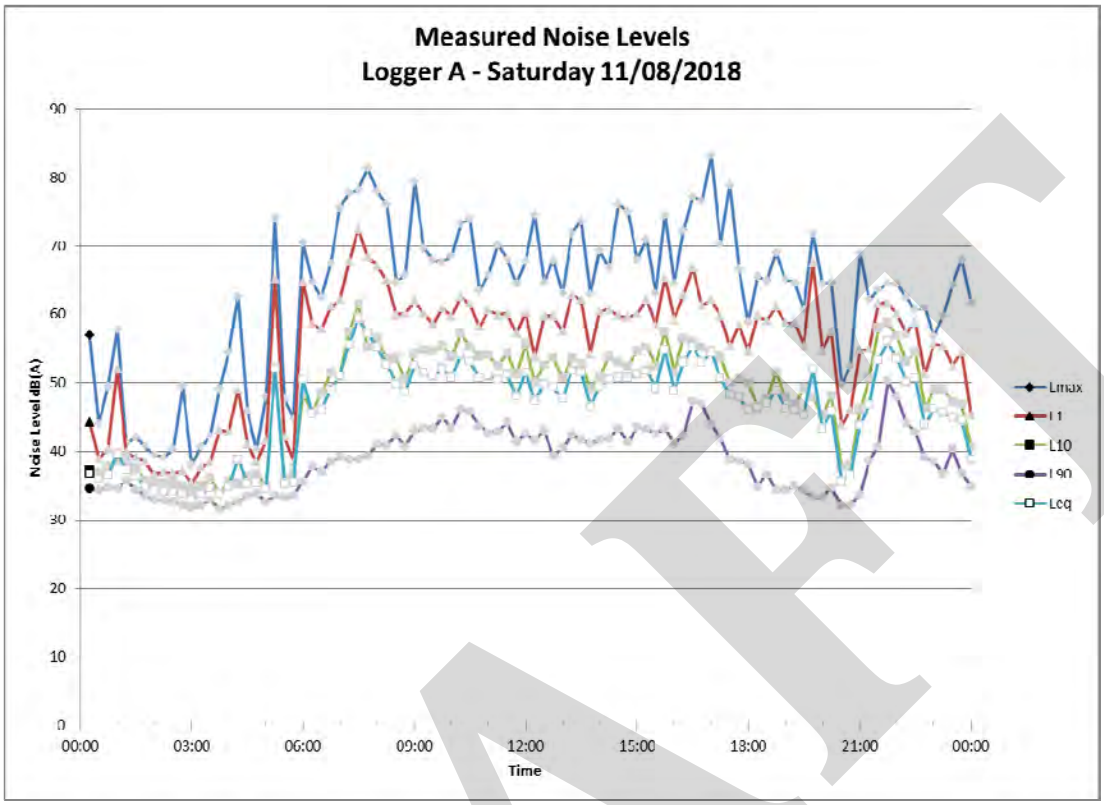
Measured Noise Levels
Logger A - Saturday 11/08/2018
Noise Level dB(A)
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Time
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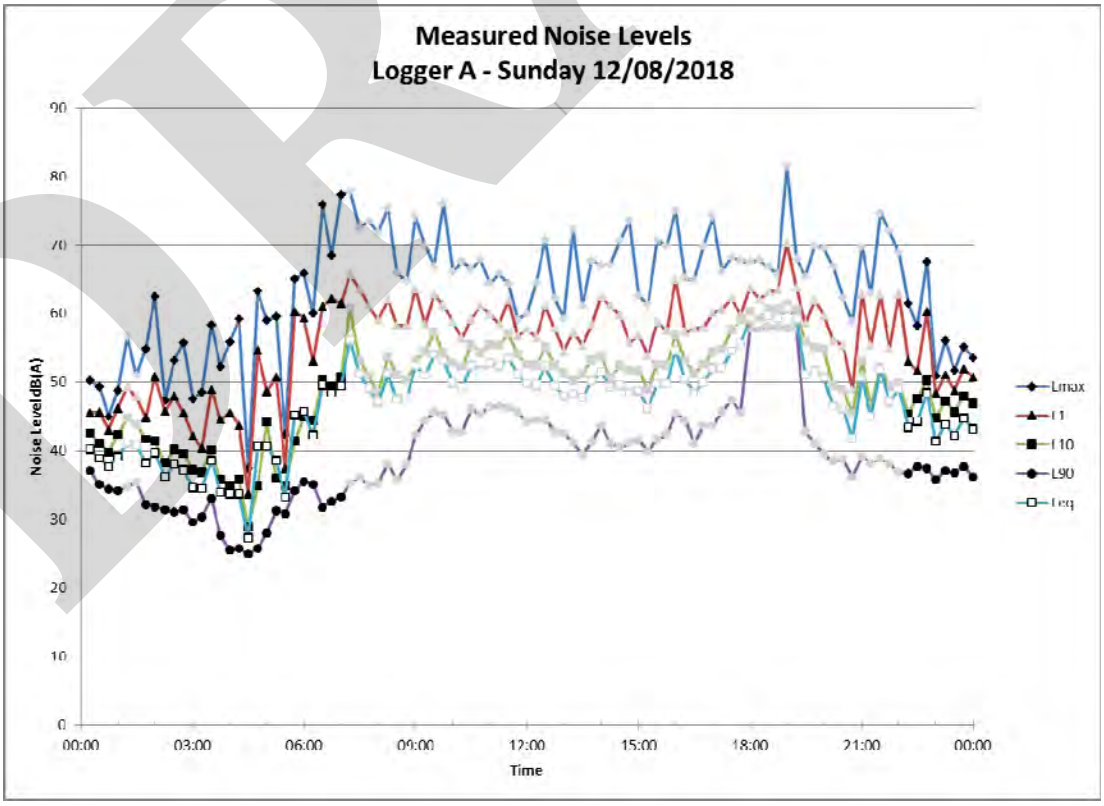
Measured Noise Levels
Logger A - Sunday 12/08/2018
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Time
Lmax
L1
L10
L90
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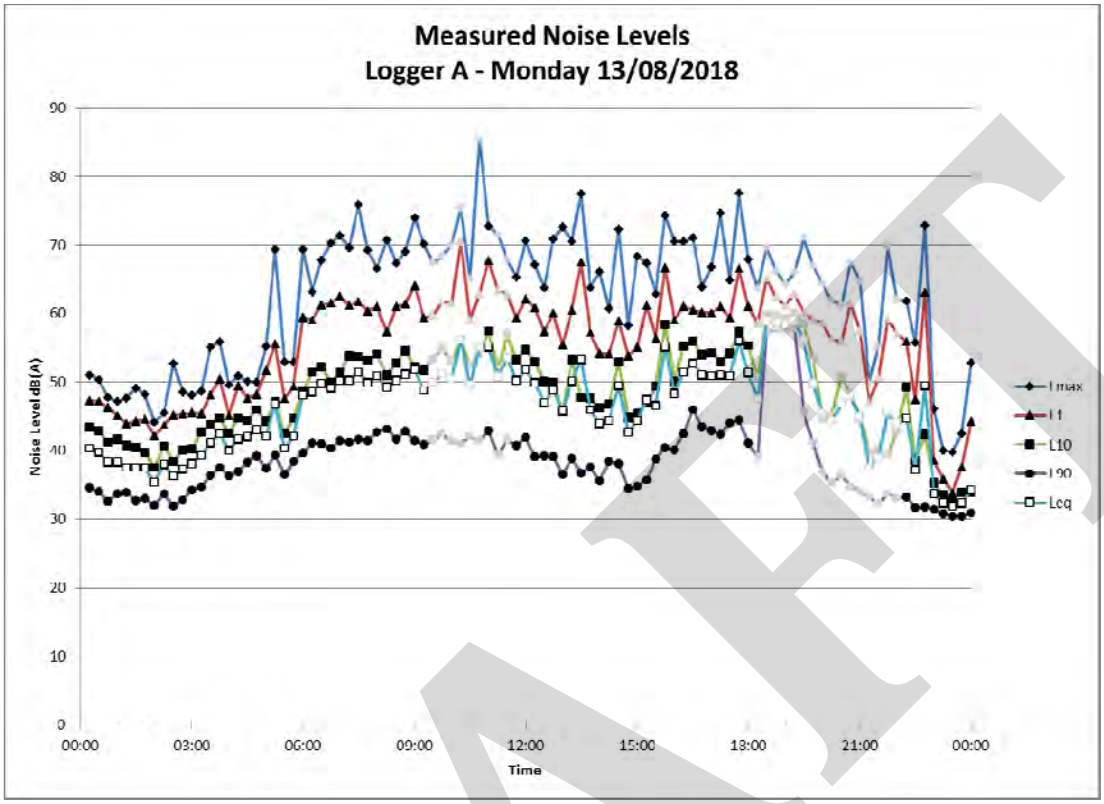
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Logger A - Monday 13/08/2018
Noise Level dB(A)
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60
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40
30
20
10
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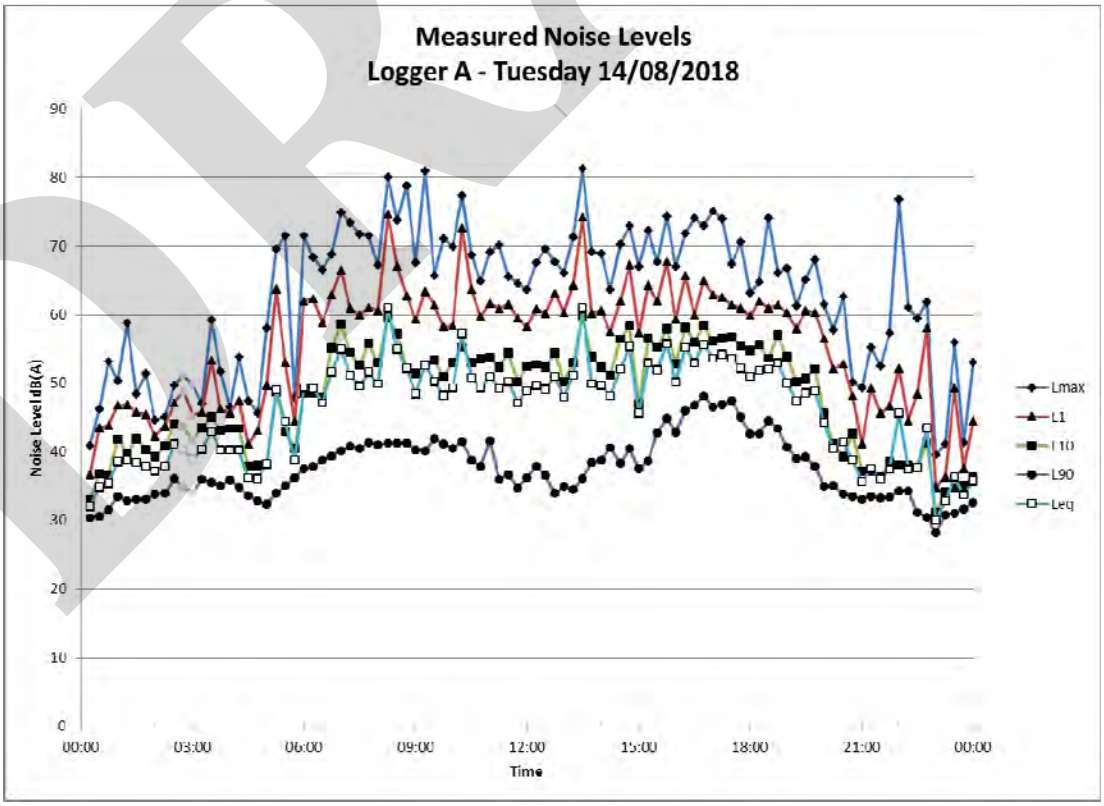
00:00
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger A - Tuesday 14/08/2018
Noise Level dB(A)
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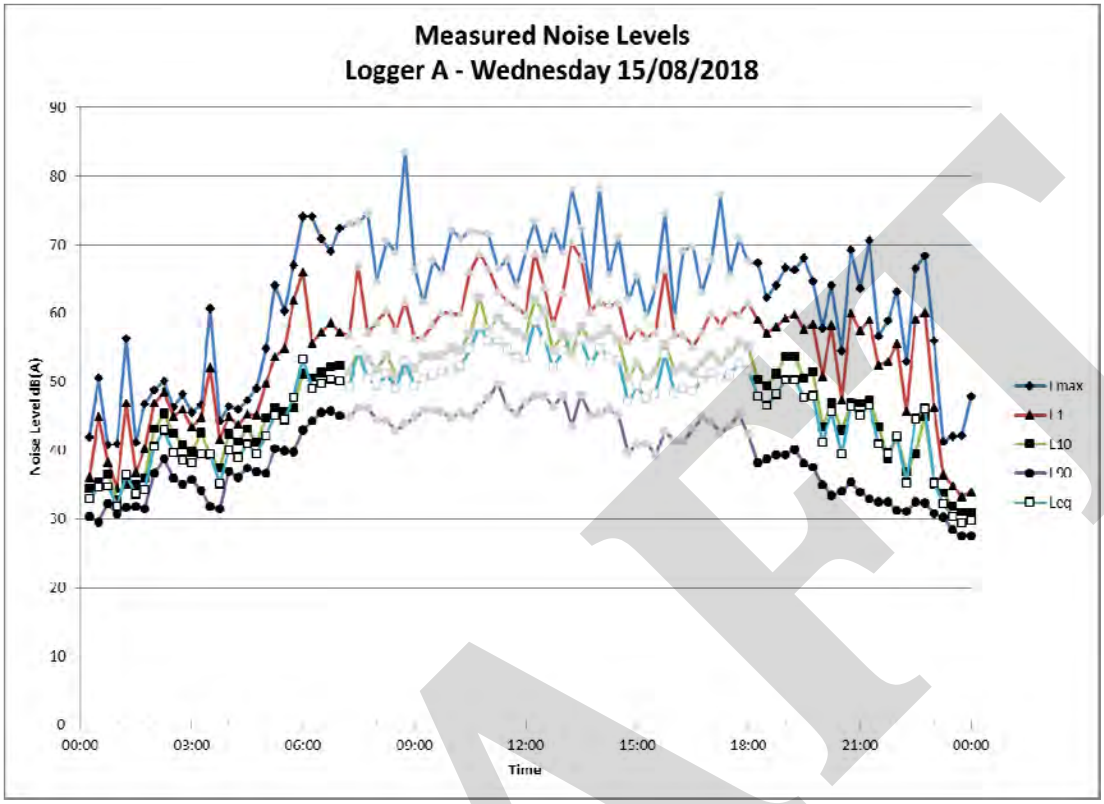
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Logger A - Wednesday 15/08/2018
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Time
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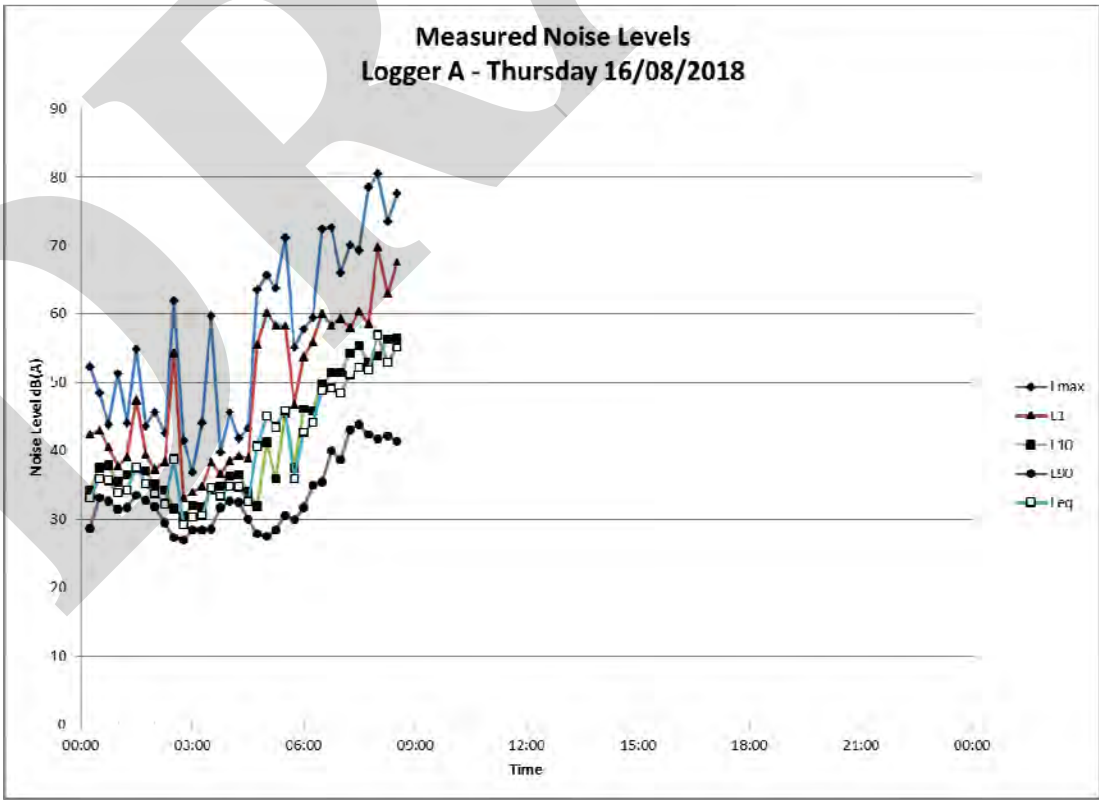
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Logger A - Thursday 16/08/2018
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15:00
18:00
21:00
00:00
Time
L max
L1
L10
L90
Leq