ATTACHMENT 12

Outdoor Lighting Impact Assessment prepared by WEBB Australia

LIGHT DREAMING
BRISBANE BOTANICAL GARDENS
MOUNT COOT-THA

ASSESSMENT OF THE OBTRUSIVE EFFECTS OF THE PROPOSED LIGHTING EXPERIENCE

CONSULTING ENGINEERS ELECTRICAL LIGHTING MECHANICAL SECURITY COMMUNICATIONS AUDIO VISUAL PV SOLAR
BRISBANE CANBERRA DOHA GOLD COAST MELBOURNE NEWCASTLE NEW ZEALAND SUNSHINE COAST SYDNEY

Q695A-E-REP-001[B] REVISION B 3 AUGUST 2022

CONSULTING ENGINEERS
ELECTRICAL LIGHTING
MECHANICAL
SECURITY
COMMUNICATIONS
AUDIO VISUAL

WEBB AUSTRALIA

DOCUMENT DETAILS

Project Title	LIGHT DREAMING - BRISBANE BOTANIC GARDENS, MOUNT COOT-THA		
Document Title	ASSESSMENT OF THE OBTRUSIVE EFFECTS OF THE PROPOSED LIGHTING EXPERIENCE		
Revision	Rev B		
Issue Date	3 AUGUST 2022		
Prepared By	SAM LINDERBERG		
Reviewed By	ROB SMITH		
Approved By	ROB SMITH	**RPEQ**	06385

WEBB AUSTRALIA GROUP (QLD) PTY LTD ABN 30 010 733 561
brisbane@webbaustralia.com.au
www.webbaustralia.com.au
3/29 WOODSTOCK ROAD TOOWONG (PO BOX 1005) QLD 4066 AUSTRALIA
T +61 7 3870 4900

REVISION HISTORY

REV	DESCRIPTION	BY	DATE
A	Draft Issue	RS	27/07/22
B	Final Issue	RS	3/08/22

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Webb Australia Group (QLD) Pty Ltd were engaged by Place Design Group to prepare the following obtrusive light impact report for Brisbane City Council. The report assesses the likely impact of the proposal noting that design of the lighting has not been undertaken yet. The assessment is based on typical arrangements provided by the designers. The report includes recommendations for ongoing monitoring of the design and installation.

The proposed lighting complies with the illuminance impacts on adjacent residential neighbours requirements of *AS/NZS 4282:2019* for a Zone A2 environment outside of curfew hours - refer Section 4 and 5 of this report. Based on the assessment, it complies with the requirements of the relevant standard.

For the proposed design, the following design controls must be met in order to achieve compliance:

- Design is developed to comply with the standard

1.0 INTRODUCTION

This report has been prepared by Webb Australia Group (QLD) Pty Ltd for the Brisbane City Council on behalf of Place Design Group. The aim of the report is to provide an assessment of the obtrusive lighting impact of the proposed lighting experience at the Botanical Gardens, Mount Coot-Tha.

The experience will involve a number of lighting effects including video projections, custom luminaires, lasers and light washes. Due to the complex and custom design precise calculation of the lighting will not be possible. The detailed design will only commence following the development submission.

This lighting report considers a number of lighting scenarios provided by the designers to assess the likely impact of the lighting on the surrounding residential neighbours.

CASA was consulted to confirm that the installation does not provide concern regarding the Heliport operations at Mount Coot tha.

2.0 LIGHTING BASICS

To assist with the interpretation, some basic information about lighting parameters as applicable to this report is explained below for reference.

Luminous Flux (lm) - this is the measure of the quantity of light. For a lamp or luminaire, it normally refers to the total light emitted irrespective of the directions in which it is distributed. Unit of measurement is lumens (lm).

Illuminance (lx) - this is the amount of light that reaches an area or a surface. It is measured in lux. Illuminance reduces significantly with distance from the source. It also depends on the area being lit and the reflectance properties of various objects off which the light is reflected. Standard unit is lux (lx).

Luminous Intensity (cd) - the concentration of luminous flux emitted in a specified direction. Standard unit is candela (cd).

Luminance (cd/m^2) - the physical quantity corresponding to the light projected of a surface (e.g. a lamp, luminaire, sky or reflecting material) in a specified direction. It is the luminous intensity of an area of the surface divided by that area. Standard unit is cd/m^2. (Non-Standard term is nits).

Maintenance Factor - ratio of the light flux emitted from a luminaire at a given time to that emitted initially.

Glare - is the potential difficulty with seeing things in the presence of bright lights. If the light source is excessively bright in relation to the general surrounding; a person's ability to see surrounding details is reduced.

Effects of Glare

- Squinting and Eye Fatigue
- Annoyance and Inconvenience
- Decreased Visual Comfort
- Colour Distortion
- Poor Depth Perception
- Momentary loss or reduced quality of vision
- Decreased Safety

Threshold Increment (TI) - with respect to requirements in *AS/NZS 4282:2019*, threshold increment is similar to disability glare which can be calculated either manually or by software. This measure of disability glare is expressed as the percentage increase in contrast required between an object and its background for it to be seen equally well with a source of glare present. Higher values of TI correspond to greater disability glare. As per the standard, TI should be less than 20% and road luminance 1cd/m^2.

Veiling Luminance (L_v) - a measure of disability glare, veiling luminance is a luminance superimposed over the eye's retinal image that is produced by stray light within the eye.

Upward Waste Light Ratio (UWLR) - the proportion of the direct light from the luminaire and/or installation that is emitted above horizontal when the luminaire is mounted in its installed position.

3.0 SITE LOCATION

The proposed site is located at the Botanical Gardens Mount Coot-Tha.

Figure 1 - Location of Site

The local area consists of several property zonings, including rural residential and community facilities. The diagram below in Figure 2 outlines the zoning of these properties in the vicinity of the installation.

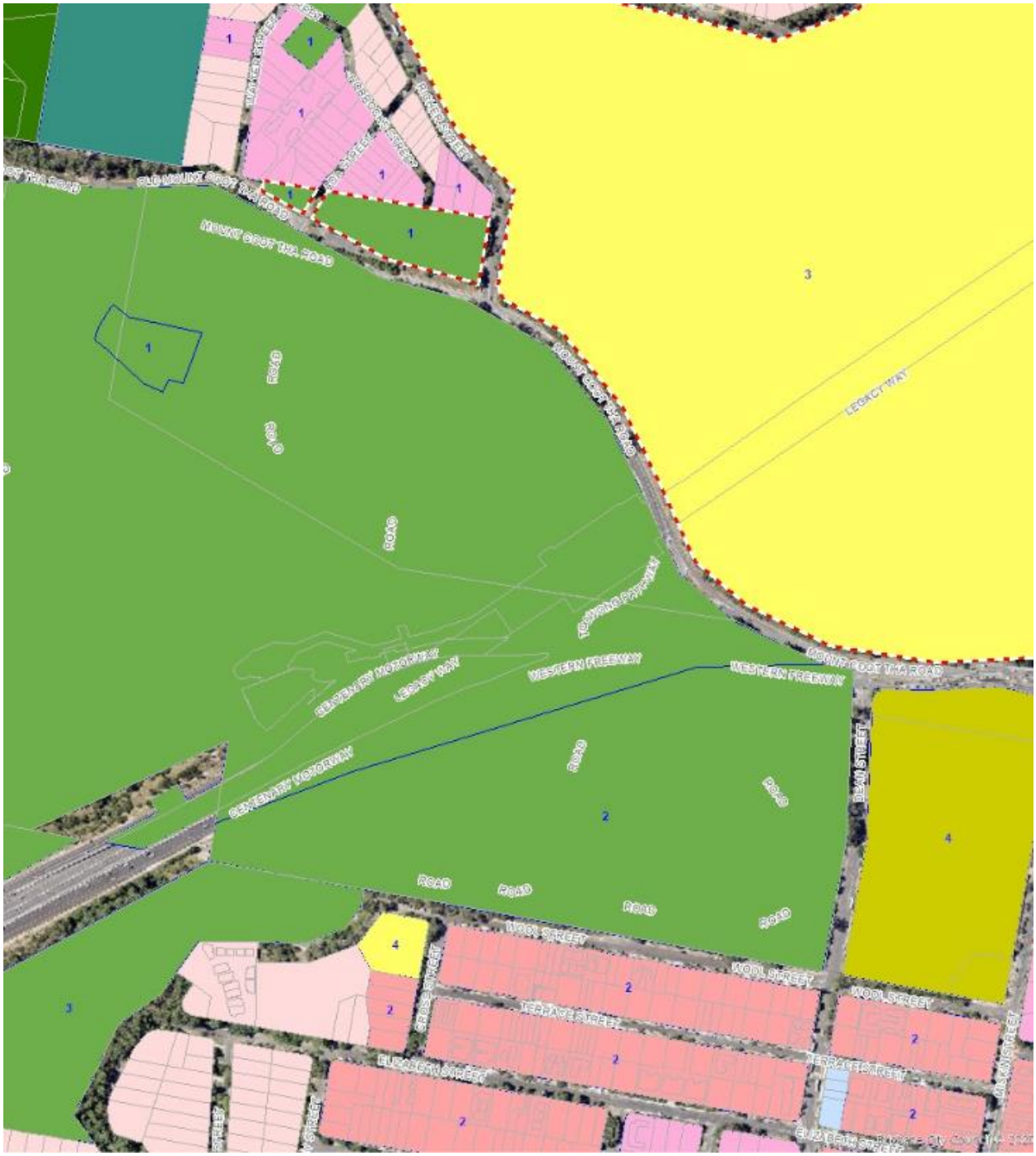

Figure 2 - Property Mapping (Source: BCC Property mapping.)

Zones marked various shades of pink are zoned residential, green are parks and gardens and yellow are community facilities, mainly Toowong Cemetery.

For the proposed field lighting, *AS/NZS 4282:2019* requires that the impact of the lighting to residential properties around an installation is limited as for the environmental zones as given in Table 3.1 of the Standard (see below). Zones A0-A4 are used to assess the obtrusive impact on residential neighbours from installations. Zones V, R1 to R3 and RX are used to assess the impact of public lighting.

TABLE 3.1
ENVIRONMENTAL ZONES

Zones	Description	Examples
A0	Intrinsically Dark	UNESCO Starlight Reserve. IDA Dark Sky Parks Major optical observatories No road lighting – unless specifically required by the road controlling authority
A1	Dark	Relatively uninhabited rural areas No road lighting – unless specifically required by the road controlling authority
A2	Low district brightness	Sparsely inhabited rural and semi-rural areas
A3	Medium district brightness	Suburban areas in towns and cities
A4	High district brightness	Town and city centres and other commercial areas Residential areas abutting commercial areas
TV	High district brightness	Vicinity of major sports stadium during TV broadcasts
V	Residences near traffic routes	Refer AS/NZS1158.1.1
R1	Residences near local roads with significant setback	Refer AS/NZS1158.3.1
R2	Residences near local roads	Refer AS/NZS1158.3.1
R3	Residences near a roundabout or local area traffic management device	Refer AS/NZS1158.3.1
RX	Residences near a pedestrian crossing	Refer AS/NZS1158.4

Although the zone could be considered A3 as the housing is generally of a suburban nature as the nearest neighbours face onto bushland zone A2 has been considered for this report.

4.0 PROPOSED LIGHTING DESIGN

Three scenarios were provided by the designers as typical installations for consideration. The final lighting design is likely to be significantly different from an aesthetic point of view but the total amount of light produced would be equivalent.

4.1 Scenario 1 – Lighting Zone

The following equipment was used in the example:

- 151 × 1M linear lighting fixtures
- 8 × RGBW 15W LED wash fixtures

Based on an allowance of 2,000 lumens per metre for the linear lights and 100 lumen/W system efficacy for the wash fixtures the total flux produced by the fittings would be approximately 314,000 lumens. Assuming that 70% of the light is projected onto surfaces or blocked by foliage then the lighting level would drop to 5 lux 39m from the centre of the installation.

4.2 Scenario 2 – Video Zone

The following equipment was used in the example:

- 2 × 12 000 lumens projectors
- 8 × RGBW 15W LED wash fixtures

Based on an allowance of 100 lumen/W system efficacy for the wash fixtures the total flux produced by the fittings would be approximately 48,000 lumens. Assuming that 80% of the light is projected onto surfaces or blocked by foliage then the lighting level would drop to 5 lux approximately 13m from the centre of the installation.

4.3 Scenario 3 – Transition Zone

The following equipment was used in the example:

- 20 × Custom made lantern-type fixtures with encapsulated LED tape or bulb

Based on an allowance of 5,000 lumens per fitting for the fixtures the total flux produced by the fittings would be approximately 100,000 lumens. Assuming that 60% of the light is projected onto surfaces or blocked by foliage then the lighting level would drop to 5 lux approximately 26m from the centre of the installation.

Considering that the installation will be a combination of a mixture of the scenarios above the lighting impact was assessed based on the worst case scenario (Scenario 1) and the light was to reach 5 lux approximately 40m from the path. The impact of this is shown in the diagram below.

Figure 3 - Impacted Area

5.0 COMPLIANCE OF LIGHTING WITH AS/NZS 4282:2019

The following properties and streets have been identified which may be impacted by the proposed lighting:

- Ada Street and Old Mount Coot-Tha Road
- Wool St

The limits for Illuminance and Luminous Intensities are based on Table 3.2 and Table 3.3 of *AS/NZS 4282:2019.* Values of interest have been included in the table below based on Environmental Zone A2. L1 control limits were applied as the lighting new infrastructure.

The standard categorises pre and post curfew limits on the lighting, where the post curfew limits are significantly stricter than the pre-curfew limits. All calculations will assume worst case conditions with a Light Loss Factor (LLF) of 1. It is assumed that the lighting will only operate during Non-curfew hours

Item Number	Application or Calculation Conditions:	Recommended Maximum Values
1. Vertical Illuminance levels (Ev) – Non-curfew	Limits apply in the plane of existing building parallel with the property boundary or 10m from the property boundary (whichever is closer to the boundary)	5 lux
2. Vertical Illuminance levels (Ev) – Curfew	Limits apply in the plane of existing building parallel with the property boundary or 10m from the property boundary (whichever is closer to the boundary)	1 lux
3. Luminous Intensity Emitted by luminaires – Non-curfew	Limits apply to each luminaire (irrespective of the number on a head frame) in the principal plane, for all angles at and above the control direction when aimed in accordance with the installation design.	7,500 cd
4. Luminous Intensity – Emitted by luminaires – Curfew	Limits apply to each luminaire (irrespective of the number on a head frame) in the principal plane, for all angles at and above the control direction when aimed in accordance with the installation design.	1,000 cd

5.1 ILLUMINANCE COMPLIANCE

Limits apply in the plane of an existing building parallel with the property boundary or 10m from the property boundary (whichever is closer to the boundary). If compliance is demonstrated at the boundary or outside of the resident's property boundary, then it will also be achieved at the required plane. As demonstrated in Figure 3 above the 5 lux limit is well within the boundary of the gardens so will comply at all residential properties.

Due to the bespoke nature of the design it is recommended that monitoring is undertaken during the design and testing of the installation to confirm compliance.

5.2 LUMINOUS INTENSITY COMPLIANCE

Limits apply in the plane of an existing building parallel with the property boundary or 10m from the property boundary (whichever is closer to the boundary). If compliance is demonstrated at the boundary, then it will also be achieved at the required plane.

The luminous intensity compliance could not be fully assessed at this stage but is based on the direct view of the fittings to the residential properties. The proposed path is located in a valley and there is significant bush blocking views of the installation.

Further Wool Street is located on the far side of the motorway creating more features blocking the view.

During the design the output of fittings will need to be checked to determine if they exceed the 7,500 cd/m^2 limit and also checks of the view of the installation locations.

6.0 CASA INPUT

The indicative design information was provided to CASA along with the approximate location relative to the S&S Aviation Heliport at Mount Coot-tha and CASA confirmed that they have no objections to the proposals. Refer Appendix A for the relevant correspondence.

7.0 SUMMARY & CONCLUSION

The proposed Lighting will be able to comply with the requirements of *AS/NZS 4282:2019* for a Zone A2 environment under operation during curfew hours - refer Section 4 and 5 of this report. Further CASA does not have concerns regarding the development.

For the proposed design, the following design controls must be met in order to achieve compliance:

- Design is undertaken to comply with the requirements of AS/NZS 4282
- Direct sighting of fittings is check during design
- Testing is undertaken of the Illuminance levels confirming compliance

APPENDIX A – CASA CORRESPONDENCE

Robert Smith

From: Airspace Protection <Airspace.Protection@casa.gov.au>
Sent: Wednesday, 3 August 2022 1:14 PM
To: Robert Smith; Airspace Protection
Subject: RE: Lighting Installation - Botanical Gardens Mt Coot tha, Brisbane [SEC=OFFICIAL]

OFFICIAL

Good afternoon Robert,

The information provided indicates that the majority of lighting will be contained within a vegetation canopy with minimal light escaping into the higher altitudes.
The main lighting concern CASA would have, is the possibility of lights blinding a pilot or disrupting their night vision while flying at night. Another factor we take into consideration is the possibility of a pilot mistaking lighting for that which you would find at an airport or helipad.

On review, I do not believe the proposal will have any negative impact on pilot vision and the lighting proposed will certainly not look like an airport or helipad.

On that basis I do not consider the proposal likely to be a hazard to aircraft operations and consequently CASA has no objection to the proposal.

Regards

Matthew Windebank
Aerodrome Engineer | Aerodrome Developments and Airspace Protection
Air Navigation, Airspace & Aerodromes Branch
CASA\ Aviation Group
p: (02) 6217 1183
e: matthew.windebank@casa.gov.au

Australian Government
Civil Aviation Safety Authority

From: Robert Smith <rsmith@webbaustralia.com.au>
Sent: Wednesday, 3 August 2022 9:29 AM
To: Airspace Protection <Airspace.Protection@casa.gov.au>
Subject: Lighting Installation - Botanical Gardens Mt Coot tha, Brisbane

We are working on a planning report for a proposed lighting installation at the Botanical Gardens, Mt Coot tha, Brisbane. In a pre-lodgement meeting BCC requested that the report considered the impact of the lighting on the S&S Aviation Heliport which is approximately 3.5km from the site. The lighting has not been designed yet but the attached provides an indication of the likely installation. Please advise CASAs requirements for the installation.

Regards
Robert Smith
Electrical Discipline Lead
BEng MLighting CPEng RPEQ NER, MIEAust

WEBB AUSTRALIA GROUP (QLD) PTY LTD
www.webbaustralia.com.au
SUITE 3 29 WOODSTOCK ROAD TOOWONG QLD 4066 AUSTRALIA
T +61 7 3870 4900 | M +61 438 646 688 | E rsmith@webbaustralia.com.au

CONSULTING ENGINEERS
ELECTRICAL LIGHTING MECHANICAL SECURITY COMMUNICATIONS AUDIO VISUAL PV SOLAR
BRISBANE | CANBERRA | DOHA | GOLD COAST | MELBOURNE | NEWCASTLE | SUNSHINE COAST | SYDNEY