Triniti Stage 2

39 Delhi Road, North Ryde NSW 2113

External Lighting Concept Report

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Contents

Introduction

Project Intent

The project scope is to outline the external lighting design intent for the proposed Stockland Triniti Mixed use Development. Standards and requirements considered in the external lighting design include the following:

Australian Standards

- Study of the external area usages and application of appropriate lighting levels as per Australian Standards AS/NZS 1158 ‘Lighting for Roads and Public Spaces’ for night-time safe movement.
- Consideration for *Spill Lighting Control* and requirements to assess future impact on neighbouring properties. As per Australian Standards AS/NZS 4282:2023 ‘Control of the obtrusive effects of outdoor lighting’.

Best Design Practices for Outdoor Lighting

As urban life extends into the night, the role of lighting has become pivotal in the creation of 24-hour cities. Understanding the delicate balance between aesthetics and safety, and the lighting design needs to cultivate engaging nocturnal landscapes, that are as inviting as they are functional. This can be achieved using the following core design practices:

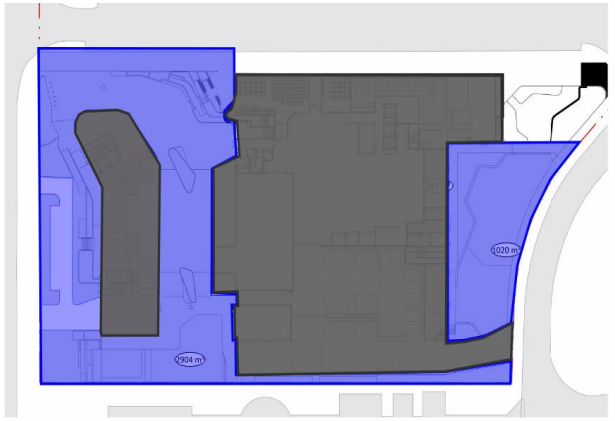
- Lighting for people and places
- Environmental Sustainability & Ecological Sensitivity:
- Safety & Wayfinding

Crime Risk and Crime Prevention Through Environmental Design (CPTED)

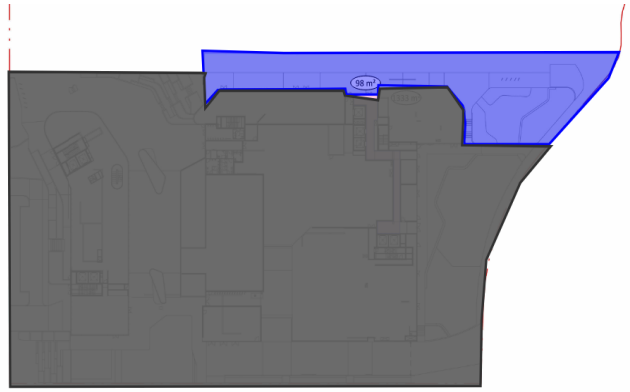
- Refer following sections, for analysis of Lighting Safety and Wayfinding Strategy

Project Area

The project area is within the property title for Triniti Stage 2, 39 Delhi Road, North Ryde NSW 2113. The proposed development is to cater for new mixed use residential, commercial use with connecting laneways and public landscaping.



1 COMMUNAL AREA - LEVEL 1
1 : 700



2 COMMUNAL AREA- LEVEL 2
1 : 700

Denotes areas covered by External Lighting Design

Australian Standards

The following Australian Standards have been referenced in the design for the Triniti Stage 2 External Lighting:

General External Lighting

The appropriate Australian Standards for general external lighting levels is defined in the Australian Standards AS/NZS 1158 series.

- The appropriate standards for pedestrian and cyclist pathways are defined in Australian Standard AS/NZS 1158.3.1 version 2020.
- The appropriate standards for public activity areas are defined in Australian Standard AS/NZS 1158.3.1 version 2020.

AS/NZS 1158.3.1 specifies the performance and design requirements for exterior public lighting. The standard defines a sub-category to suit the usage of the space considering the following features:

- Pedestrian and or cycle activity
- Fear of crime
- Need to enhance amenity

The recommended light technical parameters for the development are outlined in the following sections of the report.

Obtrusive Spill Lighting (*The control of*)

Australian Standards AS/NZS 4282:2023 specifies the performance and design requirements for exterior public lighting control and mitigating impact on neighbouring properties. Outdoor lighting should exhibit a high degree of glare and waste light control utilising optics, louvers, shields, snoots etc. shall be used liberally as required to minimize visual problems for neighbouring properties, and the surrounding environment.

AS4282 requires assessment of light spill from the proposed installation. This is performed in terms of four components:

1. Spill light received by specific receptors around the site i.e. at residential property boundaries pre-curfew and at windows of habitable rooms post-curfew
2. Luminous intensity emitted by luminaires
3. The spill light assessment does not consider the existing lighting around the site. It considers light received directly from the proposed installation and not its reflections off any surfaces. Any obstruction between the light poles and the receptors should be considered in this assessment
4. Light Spill assessments shall be performed at beginning-of-life of the floodlights. No maintenance factors shall be applied

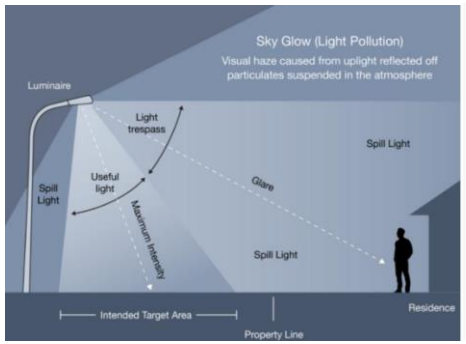
The new development is located within suburban Sydney and therefore the environmental zone can be considered as **Zone A3 Medium district brightness**, for suburban areas in towns and cities. Refer to following sections in the report for technical parameters.

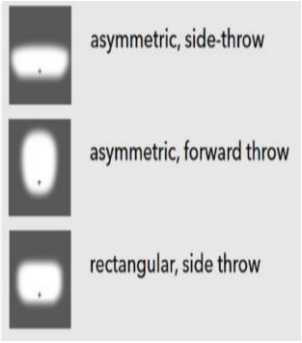
Luminaire Technical Parameters

Light Technical parameters to achieve the external design strategies are set below, in accordance with Australian Standards Lighting guidelines, industry best practices and International Dark-Sky Association.

Luminaire Optical Control

Understanding and selecting appropriate luminaire optics can help minimize Light Spill or Light Pollution. Spill is classified as, anywhere there is light emitted outside the Intended Target Area. This can range from spill behind the luminaire, into residential boundary lines or upward reflected light causing sky glow. This more spill light into the atmosphere, the less visible the night sky becomes. Luminaires and LED technology today have many options to reduce spill light including directional optics or spill control





Proposed Luminaire Colour Temperature

Studies show that blue light *(luminaires 4000K and above)* have more of an adverse impact on sky glow. This is caused by blue light scattering into the atmosphere more than lights at the red end of the colour spectrum. Therefore, for exterior lighting, warmer colour temperatures (3000K, 2700K) are preferred for ecological sensitivity. From a human perspective warmer colour temperatures have a relaxing effect, greater visual comfort in a nighttime context.

Colour Rendering Index

CRI, or Colour Rendering Index measures how well a light source reveals the true colors of objects. Its measured on a scale of 0-100, 100 being the most desirable.

Higher CRI is generally desired in situations where accurate color representation is important, such as in art galleries or in the case of external lighting for CCTV and security.

Lighting Philosophy (Best Practices)

As urban life extends into the night, the role of lighting has become pivotal in the creation of 24-hour cities. There is a delicate balance between aesthetics and safety, and the designs aim to cultivate engaging nocturnal landscapes, that are as inviting, as they are functional. Using adaptive lighting control solutions, specific luminaires that adopt smart optics, the external lighting design can minimise impact to location eco systems and neighbouring residences. Combining, statutory lighting, ambience and architectural feature the lighting design will also provide intuitive wayfinding for residents and visitors.

Place Making & Identity

- Accentuating architectural elements such as columns, walls or feature planning
- Integrated lighting at human scale to help anchor key areas
- Create visual interest through a layered lighting approach; ambient, accent, statutory

Environmental Sustainability & Ecological Sensitivity

Studies are increasingly finding, that the introduction of artificial lighting can have a detrimental effect on the many species natural ecosystems; specifically, migration or breeding patterns. Luminaire selection can help to minimize these disruptions and mitigate further contribution to light pollution. Important factors to consider include:

- Selecting warmer colour temperatures (3000K and below) to reduce the ‘blue’ wavelengths that are the most detrimental
- Adaptive lighting control; utilization of dimming, motion sensors and time clocks
- Utilizing advances in LED lenses and optics for directed light, deep recessed fittings, snoots or integrated lighting details that control light spill
- Use of lighting control technology being lighting control system, Photoelectric Cells (PE-Cell), timeclock and dimmable control of the external luminaires

Safety and Wayfinding Strategy

Lighting plays a vital role in the perception of safety within nighttime environments. There are ongoing studies, investigating the correlation between ‘comfort and perception of illumination’ and ‘higher lux levels’. The findings show higher lumens or increasing lux levels does not in fact prevent crime. One of the biggest factors in comfort and safety is contrast in illumination levels. The higher the variance between lit and unlit areas, increases the difficulties for one's eyes to adjust in low light conditions (ambient nighttime contexts). There are other industry standards for creating safe and intuitive night time environments:

- Layered lighting; multiple light sources across the precinct
- Horizontal illuminance and articulation of level changes to facilitate safe movement
- Creating ‘desire lines’ to encourage suitable paths of travel
- Luminaire colour temperature (3000K or under)

Colour temperature is very important. In the past exterior rated luminaires were recommended to be 4000K due to superior performance of Metal Halide luminaires, older generation LED and poor colour rendering quality of Sodium vapor lamps.

With the advances in LED technology the lumen outputs of 3000K engines are only fractionally lower than the 4000K counter parts, making it just as efficient in terms of lumen output to specify the warmer colour temperature. Similarly, colour rendering of new amber (2200K) - 3000K LED options is comparable with that of a 4000K version.

Given the retail and dining opportunities within the forecourt area and to create an inviting, comfortable space, Stantec would recommend using a maximum of 3000K exterior luminaire to compliment the nighttime environment.

External Lighting Established Standards

Public realm lighting illumination recommendations are outlined Australian Standards recommendations. These guidelines determine a specific lux level for each area depending on the nighttime activity ie pedestrian, cycle or vehicle. Other factors include risk of crime or need to enhance amenity (or architectural features). Refer Australian Standard AS/NZS 1158.3.1, 2020 table extracts below:

PA2 : Publicly accessible laneway and central dining precinct

PP3 : New Link Road public pathway

PP5: Gardens

PA2 : Main entry external circulation, drop off and residential driveway and service lane

PP4 : Perimeter walkways

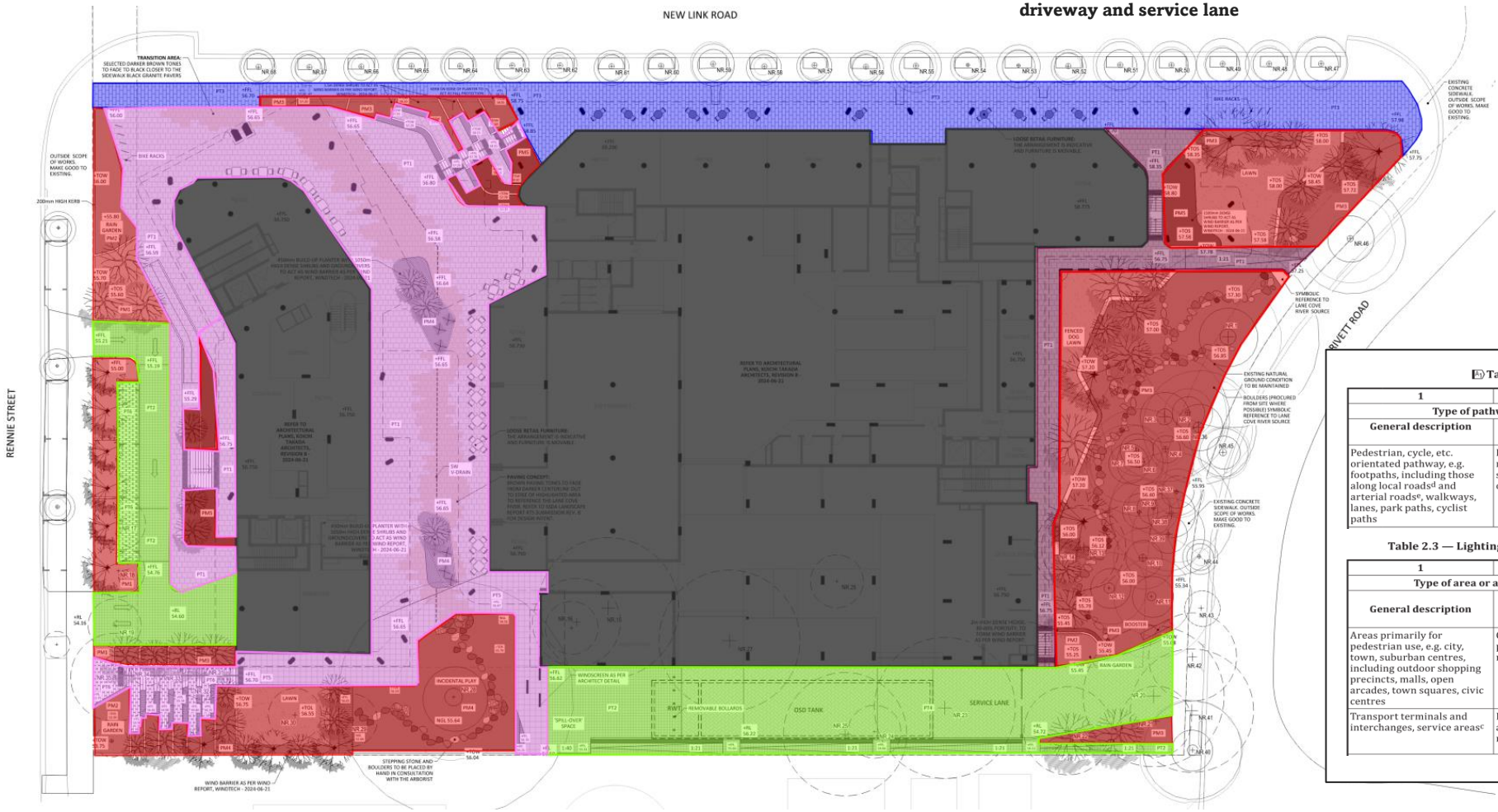


Table 2.2 — Lighting subcategories for pathways

1	2	3	4	5
Type of pathway		Selection criteria[a,b,c]		Applicable lighting subcategory
General description	Basic operating characteristics	Pedestrian/cycle activity	Fear of crime	
Pedestrian, cycle, etc. orientated pathway, e.g. footpaths, including those along local roads[d] and arterial roads[e], walkways, lanes, park paths, cyclist paths	Pedestrian, cycle, mobility devices, scooter, etc. traffic only	N/A	High	PP1[c]
		High	Medium	PP2[c]
		Medium	Medium	PP3
		Medium	Low	PP4
		Low	Low	PP5

Table 2.3 — Lighting subcategories for public activity areas (excluding car parks)

1	2	3	4	5	6
Type of area or activity		Selection criteria[a,b]			Applicable lighting subcategory
General description	Basic operating characteristics	Night time vehicle movements	Fear of crime	Need to enhance amenity	
Areas primarily for pedestrian use, e.g. city, town, suburban centres, including outdoor shopping precincts, malls, open arcades, town squares, civic centres	Generally pedestrian movement only	N/A	High	High	PA1
		Medium	Medium	Medium	PA2
		Low	Low	N/A	PA3
Transport terminals and interchanges, service areas[c]	Mixed pedestrian and vehicle movement	High	High	High	PA1
		Medium	Medium	Medium	PA2
		Low	Low	N/A	PA3

Lighting Concepts

Publicly accessible laneway and central dining precinct

1. Accent uplighting to columns
3. Poles with dedicated optics at laneway arrivals for functional lighting *(poles to be kept to periphery of precinct)*
4. Discreet catenary for accent lighting throughout laneway
4. Linear LED integrated in handrails
5. Flexible linear LED under seating
6. Uplighting to select planters and trees
7. Flexible linear LED integrated within feature timber at terraced steps

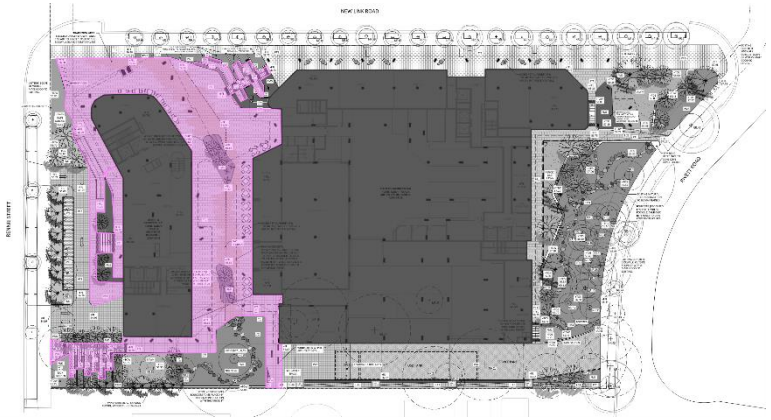


Table 3.5 — Values of light technical parameters for public activity areas (excluding car parks)

1	2	3	4	5
Lighting subcategory	Light technical parameters (LTP)			
	Average horizontal illuminance[a,b] ($\bar{E}_h$) lx	Point horizontal illuminance[a,b] (E_{Ph}) lx	Illuminance (horizontal) uniformity[c] Cat. P (U_{E2}) (max/avg)	Point vertical illuminance[a,b,d] (E_{Pv}) lx
PA1	21	7	8	7
PA2	14	4	8	4
PA3	7	2	8	2

a These values are maintained.
b Conformance is achieved by being greater than or equal to the applicable table value.
c Conformance is achieved by being less than or equal to the applicable value.

LIGHTING REFERENCE IMAGES TO CONVEY DESIGN INTENT ONLY

Lighting Concepts

Main entry circulation, drop off and residential driveway and service lane

1. Poles with dedicated optics at laneway arrivals for functional lighting *(poles to be kept to periphery of precinct)*
2. Linear LED integrated in handrails
3. Wall mounted lights for general service lane area lighting
4. Flexible linear LED integrated within feature timber at terraced steps
5. Uplighting to select planters and trees
6. Wall recessed lights for accent to feature walls

Table 3.5 — Values of light technical parameters for public activity areas (excluding car parks)

1	2	3	4	5
Lighting subcategory	Light technical parameters (LTP)			
	Average horizontal illuminance[a,b] ($\bar{E}_h$) lx	Point horizontal illuminance[a,b] (E_{Ph}) lx	Illuminance (horizontal) uniformity[c] Cat. P (U_{E2}) (max/avg)	Point vertical illuminance[a,b,d] (E_{Pv}) lx
PA1	21	7	8	7
PA2	14	4	8	4
PA3	7	2	8	2

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LIGHTING REFERENCE IMAGES TO CONVEY DESIGN INTENT ONLY

Lighting Concepts

New Link Road public pathway and Perimeter walkways

1. Accent uplighting to columns
2. Poles with dedicated optics at laneway arrivals for functional lighting *(poles to be kept to periphery of precinct)*
3. Linear LED integrated in handrails
4. Accent lighting to façade along perimeter walkway (extent TBC with further coordination)
5. Uplighting to select planters and trees
6. Flexible linear LED integrated within feature timber at terraced steps

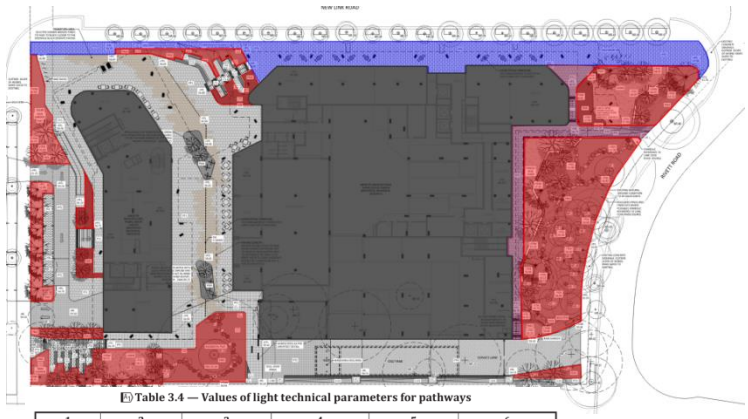

Table 3.4 — Values of light technical parameters for pathways

1	2	3	4	5	6
Lighting sub-category	Light technical parameters				
	Average horizontal illuminance[a,b] $(\bar{E}_h)$	Point horizontal illuminance[a,b] (E_{Ph})	Illuminance (horizontal) uniformity[c] Cat. P (U_{E2})(max/avg)	Point vertical illuminance[a,b] (E_{Pv})	Pathway Surround Illuminance[a,b,d] (E_{PhS})
	lx	lx		lx	lx
PP1	10	2	5	1	1
PP2	7	1	5	0.3	0.5
PP3	3	0.5	5	0.1	0.25
PP4[f]	1.5	0.25	5	0.05[e]	0.12
PP5[f]	0.85	0.14	5	0.02[e]	0.07

a These values are maintained.
b Conformance is achieved by being greater than or equal to the applicable table value.
c Conformance is achieved by being less than or equal to the applicable table value.
d Required unless deemed otherwise by the relevant authority (see Clause 4.6).
e For luminaires with mounting heights of 1.5 m or less, the E_{Pv} values need not be applied.
f See Clause 3.2 for lumen derating values for light sources with S/P ratio < 1 and/or CCT < 2 500 K.

Please note: With respect to garden bed and landscape area lighting, as this is not a dedicated pathway or area associated with high movement, a category of PP5 has been applied. As per AS, *condition e,* for luminaires with a mounting height of 1.5m or less the point vertical illuminance values need not be applied. This will be adopted to the approach of lighting throughout the PP5 areas


1

2


3


4


5


6

LIGHTING REFERENCE IMAGES TO CONVEY DESIGN INTENT ONLY

Thank you.

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