WAVERLEY CREATIVE LIGHTING STRATEGY

2018 - 2028

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prepared by

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Waverley Council

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WAVERLEY
COUNCIL

IT IS MORE AND MORE IMPORTANT TO MAKE THE CITIES INVITING, SO WE CAN MEET OUR FELLOW CITIZENS FACE TO FACE AND EXPERIENCE DIRECTLY THROUGH OUR SENSES.

- JAN GEHL

Contents

Glossary

Accent	Where light is used to emphasise or highlight objects.
Colour rendering	The effect of a light source on the colour appearance of an object.
Correlated colour temperature	The absolute temperature of a black body radiator whose chromaticity most nearly resembles that of the light source being considered. Unit: Kelvin.
Efficacy	A factor which quantifies the effectiveness of a luminaire in converting electrical power to light.
Glare	The discomfort or impairment of vision experienced when parts of the field of view are excessively bright.
Illuminance	The luminous flux arriving at a surface divided by the area of the illuminated surface. Unit: lux
Lamp	Complete light source unit.
Luminaire	Complete lighting units consisting of lamp, control gear (if required), reflector and housing.
Lumen	Unit of luminous flux used to describe a quantity of light emitted by a source or received by a surface. Unit: lumens
Luminance	The physical quantity corresponding to the brightness of a surface in a specified direction. Unit: cd/m2
Watt	Unit of electrical power

Executive Summary

1. Executive Summary

1.1 Strategy Initiative

The Waverley Creative Lighting Strategy has been developed in response to the Council vision to create “a memorable application of light that integrates social gathering, public health and safety, sustainability and economic vitality into the urban environment”.

1.2 Purpose

The Strategy establishes an overall vision for the night-time journey and sets technical and design parameters for the creation of a holistic, sustainable and legible night-time environment that is vibrant and engaging after dark.

The strategy promotes a connected, inviting and memorable environment that supports active movement and use of Waverley’s public spaces at night time. It celebrates sense of place and the unique identity of each area within the overall Waverley LGA whilst maintaining a consistent visual language.

As well as the functional approach to lighting, the Strategy recognises light as a significant contributor to the precinct’s quality, as a means of artistic expression and as a contributor to character of each area

The strategy provides a framework for the implementation of lighting initiatives over a ten year period setting priorities and assisting in the transition of asset management to the Council and in the preparation of funding.

1.3 Structure and Approach

A Three Tier Approach will be applied to the lighting strategy to provide a level of consistency and visual connection as well as being used to define a legible night scape. The three tiers consist of:
1. Base lighting for orientation and safe movement
2. Architectural, urban and landscape lighting components to enhance the pedestrian experience and support pedestrian amenity
3. Lighting interventions which are site specific installations.

Introduction

2. Introduction

2.1 Strategy Scope

The Strategy encompasses the design direction for street lighting, public space and public area lighting for the Waverley Council public domain. It also provides direction for private developments that have an implication on the public domain in order to achieve a consistent visual outcome.

Detailed design direction has been applied to the three key areas of Bondi Junction, Bondi Beach and the Coastal Walk. There are presented in Attachments Section of this strategy.

The Strategy Scope may be expanded at a future time to provide detailed design direction for additional precincts. In this instance the steps outlined in 2.3 Methodology are to be followed.

2.2 Lighting Aspirations

Bondi Junction, Bondi Beach and the Coastal Walk each have unique opportunities and challenges with diverse characters and landscapes. The lighting strategies of the Creative Lighting Strategy aim to provide a holistic approach addressing both the functional and experiential aspirations of the project.

Functional

Public lighting is an essential community service that aims to provide pedestrians, cyclists and vehicles with a safe and comfortable visual environment at night. Lighting is also a contributing factor in reducing people's perception and fear of crime by addressing issues of facial recall, contrast ratio, glare, colour recognition and materiality, night time population and overall atmosphere.

Experiential

Lighting plays a pivotal role in the pedestrian journey at night in promoting distinct, unique, engaging and joyful experiences that encourage increased night-time patronage. Light in public places should create a memorable statement that celebrates the identity and sense of place in a way that provides recognisable connections across the LGA.

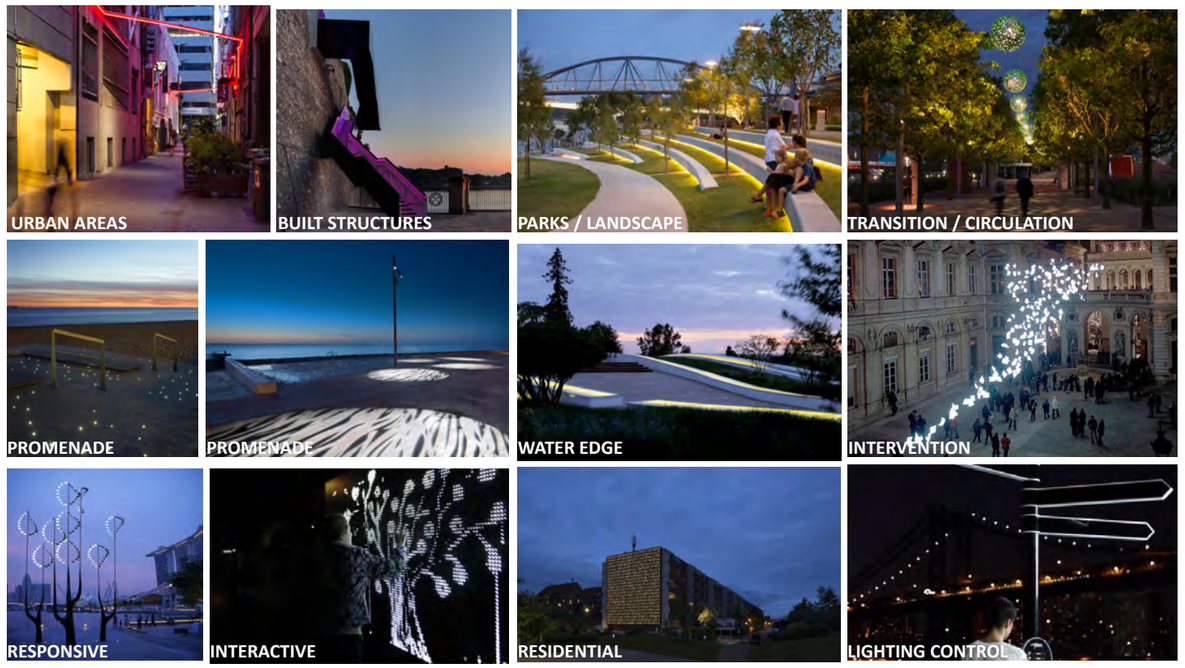
2.3 Methodology

The Creative Lighting Strategy for Bondi Junction, Bondi Beach and the Coastal Walk has been informed by the following process:

1. Precedent Study and Site Investigation

A precedent and benchmarking study was carried out to inform and inspire the detailed lighting design direction. The benchmark projects and precedent studies are used as a guide of best practice, to assess the application of new technologies, to ensure relevancy, and achieve the appropriate balance between various, often competing requirements.

The following space types were assessed:



A site investigation was undertaken to assess:

- Existing night time environment and atmosphere;
- Opportunities for improvement, intervention and activation;
- Existing illuminance levels;
- Existing user behaviour and subsequent key connections, nodes and destinations.

The Strategy addresses the identified outcomes of this study.

2. Place Strategy

A Place Strategy was developed to provide a framework and direction for the Creative Lighting Strategy by establishing a clear vision, night-time journey and strategic approach for each key area. The following framework was used to explore the appropriate lighting strategies for key locations within each of the site areas.

1. Identification of the types of 'places' within each site through spatial explorations including through spaces and dwell spaces.
2. Identification of key user groups who utilise those spaces and their potential needs.
3. Identification of how each space should be utilised after hours and for what duration. Consideration may be given to seasonal variations such as winter vs summer and weekend versus weekday use.

Key character drivers, objectives and strategies were developed for each area in the context of the overall place vision.

The following key objectives were identified for Bondi Junction, Bondi Beach and the Bondi to Clovelly Walk:

- Increase activity and enhance character at street level to enliven the street;
- Assist in increasing the sense of safety for pedestrians and users at night and encouraging users to stay longer;
- Provide strategic direction for under awning lighting to improve the quality of light at street level;
- Supporting key connections between transit modes;
- Artistic and cultural expression including support of temporary events;
- Lighting as a catalyst for after hours activation;
- Treating unattractive or inactive areas creatively;
- Interface with residential areas;
- Activation of key mall spaces including Oxford Street Mall and Waverley Mall;
- Enhance access and visibility into parks at night time to enable use after hours and increased passive surveillance;
- Creating unique experiences in key locations;
- Showcasing the character of each area responding to cultural stories and community values;
- Increasing visitation to the Coastal Walk during winter months when there are less daylight values available.

This investigation provided a framework and positioning strategy to inform the lighting hierarchy and strategic approach to the relevant lighting applications.

3. Ideation Workshop

An ideation workshop was carried out with key Council stakeholders to identify the role of the Creative Lighting Strategy within the framework of the Council policies, documents, and aspirations for the LGA. The outcome of the workshop established the functional and experiential aspirations of the Creative Lighting Strategy and provided direction for the key concepts and key lighting directions within this document.

4. Creative Lighting Strategy

The Creative Lighting Strategy was developed in conjunction with Waverley Council in consideration of the above findings.

5. Future Strategy Updates

The Creative Lighting Strategy has been structured in a way to allow adaptation of the design implementation to respond to changes in technology, site conditions and changing social context to ensure the document remains relevant through provision of clear aspirations and objectives.

In the event that detailed design direction for another key area in the LGA is to be incorporated as a new chapter in the document it is important that an assessment is made in keeping with the methodology carried out for areas already included in the document:

1. Carry out precedent study and site investigation;
2. Carry out additional place strategy for this area and ensure this aligns with the aspirations and objectives of the existing study;
3. Carry out an ideation workshop with relevant stakeholders;
4. Review this against over-arching aspirations, principles and vision already set out in this document;
5. Devise a new chapter for the Strategy based on the above process.

2.4 User

The Strategy is intended to be used by Waverley Council, developers, designers, planners, business owners involved in lighting works within the Waverley LGA.

2.5 Council Document Framework

The following Waverley Council Documents are applicable to design of the public domain.

Council-wide Strategies

- Waverley Local Environment Plan
- Waverley Development Control Plan
- Community Strategic Plan
- Economic Development Strategy
- Events Policy
- Public Art Policy and Strategy
- People Places Movement Study (Draft)
- Commercial Activity in Public Spaces (Draft)

Precinct Design Guides

- Waverley Creative Lighting Strategy (Draft)
- Bondi Junction Complete Streets
- Campbell Parade Streetscape Upgrade
- West Oxford St Precinct Plan
- Bondi Junction Evening, Culture and Entertainment Strategy (Draft)
- Plans of Management

Delivery

- PDTM – materials and design details
- Village Centre Plans (detailed design, consultation and construction)
- Street/ park upgrade plans
- Public art commissions
- Event Plans
- Development Applications
- S94 contributions
- VPAs
- Operational Plan (Capital Works schedule)
- Grant funding

2.6 Implementation

Each lighting project undertaken in the Waverley LGA should follow the guidelines set out below:

1. Read the Creative Lighting Strategy and identify the relevant lighting tier and lighting approach that applies to the area. Review lighting guidelines for Bondi Junction, Bondi Beach and Coastal Walk, presented at the attachments section, for specific vision and design direction as applicable;

2. Study benchmark projects and integrate best practice and new technologies into project;

3. Refer to the Waverley Public Domain Technical Manual for the current approved luminaires types for Tier 1 and Tier 2 elements that are applicable and the associated installation details. If the project relates to a Tier 3 'Lighting Intervention' specialist equipment could be required to meet the design and technical requirements of the installation. In this instance proposed fittings should be included in concept documentation for the review and approval of the Council;

4. Resolve any initial design issues with the Council's Urban Design Team and ensure compliance with stakeholder requirements including Ausgrid, property owners and users and relevant Australian Standards;

5. Create concept documentation with visualisation for council approval in line with this document and all other relevant Council documents. Include any statements relating to the impact of the design in the context of adjacent areas;

7. Conduct mock-ups or site trials as required;

6. Following approval, finalise documentation for procurement purposes in line with site specific objectives for the project. Consult with Waverley Council for specific procurement documentation requirements.

2.7 Related Council Strategies

Waverley Council have developed multiple strategic documents that relate to this Creative Lighting Strategy in identifying high level aims for LGA and the specific areas of Bondi Junction, Bondi Beach and the Coastal Walk.

Waverley LGA Planning Controls:

- Waverley Local Environment Plan 2012
- Waverley Development Control Plan 2012

Waverley LGA Strategic Context

- Waverley Economic Development Strategy 2015 – 2020
- Play Space Strategy 2014 – 2029
- Bondi Road Corridor Transport Study (Draft)
- Waverley Public Art Strategy
- Waverley's People Movement and Places (Draft)
- Waverley Public Domain Technical Manual

- Bondi Junction – Heartbeat of the East 2016 - 2030
- Bondi Junction Complete Streets Project 2013
- Bondi Junction: Pedestrian and Public Life Study 2017 (Draft)
- Bondi Junction: Evening, Culture and Entertainment Strategy 2017 (Draft)
- Bondi Junction Vision Community and Stakeholder Engagement. UTS 2014

- Bondi Park, Beach and Pavilion Plan of Management 2014 - 2024
- Campbell Parade Streetscape Upgrade 2016
- Aboriginal and Historical Archaeological Assessment - Bondi Pavilion, Bondi Beach, NSW
- Bondi Pavilion and surroundings Conservation Management Plan (Draft)
- Local Village Centres Public Domain Improvement Plan 2006

Precedent Image: Bondi Beach

Lighting Principles

4. Lighting Principles

Guiding principles for the creation and implementation of the lighting master plan.

A Legible Nightscape

A layered lighting scheme to give structure and safety in the night environment and in intuitive wayfinding.

- A tiered lighting solution appropriate to site considerations;
- Consistent design approaches and luminaire types;
- Creation of focal points to guide people through each character area.

The Personalities of Waverley

A lighting solution that expresses the character of Waverley and the unique areas within.

- Creation of unique identities for each area within the wider context of the LGA;
- Activation and enlivenment of the evening environment;
- Varied lighting settings or modes to respond to the use of the space at different time of the evening and across different seasons;
- Specifically tailored interactive or responsive lighting elements as appropriate and fitting for each area to engage the community;
- Adaptability and flexibility of the lighting schemes.

A Pedestrian Metropolis

The creation of a pedestrian focused public domain that is engaging and encourages increased evening patronage.

- Creation of distinct and unique experiences throughout the user journey engaging both locals and tourists alike;
- Installations that are interactive, emotive, whimsical, inspirational and that promote joy and celebration of place;
- Use of light to tell stories and highlight meaningful cultural installations, natural features or heritage buildings that can contribute to the character of Waverley and its key destinations.
- Creation of memorable lighting statements and landmarks to serve as a vehicle for promotion, for attracting tourism, engaging with locals to encourage 'lingering' and increasing night-time patronage;
- Lighting to extend the usable hours of the public domain into the evening, encouraging active movement, improving night time visibility, enabling passive surveillance, safety and increasing access and usability of public places after dark;
- Lighting to improve access and visibility to create usable connections.

Visual Impact

Lighting solutions that consider both the day time and night time impact of the infrastructure.

- Consideration is to be given to the daytime impact of new lighting structures in particular in regards to pole design and scale;
- Lighting near the waters edge is to consider vistas looking out and should respect the natural environment enhancing form without impacting wildlife;
- Consideration is to be given to the timing of the installation elements to suit the site location and requirements;
- Sculptural elements from night time installations may contribute to the day time user experience; this should be considered in the design and development of the sculpture/ artwork;
- Where lighting is used to enhance heritage structures, luminaire selection and installation should be sympathetic to the structure and heritage fabric and should be integrated where possible with minimal impact;
- Luminaires selection to be visually unobtrusive at night time, promoting maximum glare control and visual comfort.

Sustainability

Providing an energy efficient and appropriate lighting solution.

- Selection of appropriate luminaire types and light sources to minimise energy consumption, maximise efficiency and obtain low maintenance expenses whilst considering their qualitative spectral properties and other technical requirements to suit the relevant application;
- Use of an appropriate and flexible lighting control system that facilitates various moods and is adaptable to cater for events, community and tourist use, interactive interfacing, creating a distinctive interplay of light levels, and adjustments and changes in future use and function;
- Use of time switches, motion sensors and photo sensors to control lighting when and where appropriate;
- Lighting equipment, mounting details and aiming to ensure the minimisation of spill light and impact on the evening environment;
- Photovoltaic cells may be used to provide energy for lighting elements where appropriate to maximise energy efficiency and minimise environmental impact;
- Consideration of luminaire selection and lighting design on sensitive environmental issues to mitigate the impact on flora and fauna and surrounding residential properties.

Application

5. Application

A three tier lighting approach is to be used to build a suitable night time environment that supports pedestrian amenity. A suite of lighting equipment provides the building blocks of each tier for a consistent lighting language.

5.1 A tiered lighting solution

To ensure a legible night time environment, a tiered lighting solution is to be utilised that is suitable for the location and project objectives and that responds to both the functional and experiential aspirations.

Each application requires the consideration of a 'Tier 1' base lighting element to ensure orientation and safe movement from a functional perspective. These elements provide a consistent backdrop which allows other 'non-standard' lighting elements to stand out.

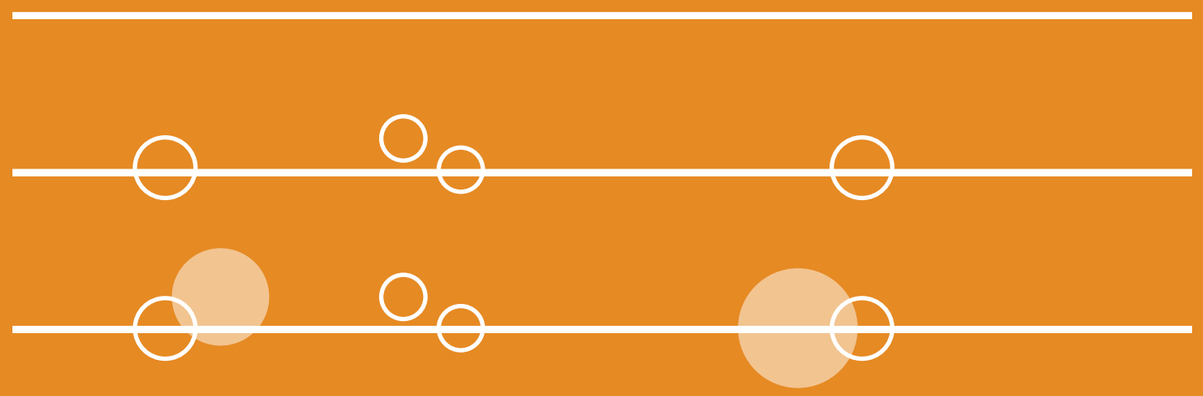
Tailored to the environment, 'Tier 2' lighting elements increase pedestrian amenity, provide more focused design opportunities and enhance the experience of the night-time environment.

Unique and site specific 'Tier 3' lighting interventions add elements of surprise, engagement, wonder or reflection to create a unique site experience.

Tier 1 is the **Base Lighting**.
This provides the base level of light for functional movement for streets, pedestrian pathways and cycleways.

Tier 2 is the **Amenity Lighting**.
This provides enhanced lighting to support the pedestrian experience to village/ commercial streets, malls, plazas, selected parks, the coastal walk and coastal perimeter areas. Lighting elements are to be layered to provide both functional and experience lighting. Tier 1 elements may form part of this strategy for the streetscape where applicable however should not be used for the coastal walk and coastal perimeter areas.

Tier 3 are the **Lighting Interventions**.
These are site specific installations at key locations that celebrate a unique sense of place or character, assist in activating the space, or assist in wayfinding. Lighting interventions may be overlaid on Tier 1 and Tier 2 elements where applicable.



5.1.1 Applying a Lighting Tier

In applying a lighting tier it is important to consider the context of the site in the overall night time lighting structure, it's location and proximity to urban development, commercial areas and residential areas and its function in the night time environment.

Tier 3 lighting are site specific installations and have been specifically identified within each area of the Strategy. Refer to chapter 6, 7 and 8 for relevant areas.

How to apply a lighting tier for a street?

Streetscape lighting should provide a consistent visual language across the LGA providing an integrated solution that reduces visual clutter and responds to the needs of vehicles, pedestrians and cyclists. In key commercial, retail, food and beverage areas, or key pedestrian movement corridors, the lighting response should support pedestrian amenity and a vibrant night time experience. The atmosphere should be one of welcome, warmth and safety.

Within the streetscape, streets perform various roles in the vehicular, cyclist and pedestrian journey. Whilst larger streets on the perimeter of a precinct may focus on vehicles and cyclists, village streets that form the central hub and support food and beverage, retail and pedestrian connections require an enhanced pedestrian quality to encourage active use and active movement in the evening. When classifying a street it is important to consider:

- Does it form part of a key movement corridor?
- Is it in close proximity to transport hub?
- Is it in close proximity to food and beverage or retail?
- Is it close proximity to residential areas?
- Is it in close proximity to pedestrian focused areas including malls?
- What is the desired level of activation in the evening?

If the street forms part of or is in close proximity to an active public area, it will require a different lighting response to a street in a residential area.

A street type will determine the suitable lighting tier and will also assist in identifying the most suitable illuminance level. Refer to 5.1.2 Selecting a light level.

General Street

Definition: General streets are typically located on the perimeter of a commercial area and do not form part of a key pedestrian connection or active food/ beverage and retail destination. The desired level of activation in the evening is low. These streets are not classified as a neighbourhood street due to their proximity to urban areas. The function of a general street is to provide a functional and consistent backdrop to the street and footpath for safe movement.
Lighting Tier Elements: Predominately MFP, pedestrian crossing, cycleway treatment. Lighting Tier elements of retail frontages, under awning lighting, connecting element lighting, wayfinding signage, bus shelter lighting may be applied where required.
Lighting Tier: Tier 1. Tier 2 as required.

Village/ Commercial Street

Definition: Village/ Commercial Streets support food and beverage, retail and major pedestrian connections. As such their desired level of activation in the evening is high and there is a strong requirement for pedestrian amenity. The function of a village/ commercial street is to enhance the pedestrian journey and experience encouraging after hours trade and lively activity.
Lighting Tier Elements: MFP, pedestrian pole, pedestrian crossing lighting, cycleway treatment, facade and alfresco lighting, retail frontages, under awning lighting, connecting element lighting, wayfinding signage, bus shelter lighting, seating and urban structures, tree and plant lighting, monument, artwork and sculptural lighting,
Lighting Tier: Tier 1 as a base layer. Tier 2 lighting enhancement.

Laneway

Definition: A laneway is located in close proximity to a commercial area and is a narrow, often single lane low traffic street. Laneways may be considered an urban laneway where desired evening activation is low or an active laneway where desired evening activation is high or the laneway forms a key pedestrian route. In both laneway types it is important to consider pedestrian amenity and perception of safety with lighting used to reduce dark alcoves and allow facial recognition.
Lighting Tier Elements: Facade and alfresco, retail frontages, under awning lighting, catenary lighting, seating and urban structure lighting, monument, artwork and sculpture lighting.
Urban Laneway Lighting Tier: Tier 2 lighting enhancement. This may be combined with Tier 1 elements where Tier 2 lighting alone is not creating safe movement.
Active Laneway Lighting Tier: Tier 3. This may be combined with Tier 1 and Tier 2 elements where Tier 3 lighting alone is not creating safe movement.

Neighbourhood Street

Definition: A neighbourhood Street forms part of a residential area. The desired level of activation in the evening is low.
Lighting Tier Elements: Ausgrid Pole
Lighting Tier: Tier 1

How to apply a lighting tier for a mall or pedestrian area?

As a pedestrian focused area the lighting approach should focus on enhancing the pedestrian journey, assisting in wayfinding and orientation and providing a vibrant and active night time atmosphere that draws people to certain districts and encourages them to gather and linger.

The lighting approach should distinguish the mall or pedestrian area from the general streetscape with a different atmosphere and stronger focus on pedestrian amenity. Lighting should be provided to main passageways with modulation to the lighting levels to perimeter and seating areas using light and shade to provide an engaging environment and assist in defining focal points.

Lighting should be integrated into the urban fabric and landscape of the space and should respond to the character or history of the site. Lighting of trees, benches, facades, street level food, beverage and retail, public art and catenary lighting are encouraged rather than uniform ground illumination only.

Lighting Tier Elements: Typically Tier 3 lighting intervention. In other pedestrian areas pedestrian pole, cycleway treatment, facade and alfresco, retail frontages, under awning lighting, wayfinding signage, catenary lighting, seating and urban structures, tree and plant lighting, monument, artwork and sculpture lighting.
Lighting Tier: In most instances Tier 3 is suitable for malls and pedestrian areas with a site specific installation. In large malls or pedestrian areas, Tier 1 and Tier 2 elements may also be applicable. In smaller malls or pedestrian areas, and in areas where Tier 3 has not been identified as part of the Strategy, Tier 2 elements are to be used to provide the functional and experiential lighting.

How to apply a lighting tier for a park?

Park lighting requires a considered approach that allows safe movement along main through pathways and the street perimeter pathways to increase pedestrian sense of comfort. For local parks, lighting should focus on enhancing the streetscape experience for pedestrians through lighting of elements along the footpath such as trees, benches or public art to reduce the perceived darkness of these areas in the general streetscape.

For larger parks with a key pedestrian thoroughfare, lighting should focus on the main entries, street perimeter and main pathways and path surrounds. A consistently bright lighting strategy should not be used, rather a varied lighting approach is recommended using light and shade to provide a comfortable pedestrian experience. Lighting to any key pathways should be extended off the pathway to provide greater comfort by extending visual access.

Opportunities for after hours play in the winter months until 9pm should also be considered for playground areas designed for older children. This may be supported with interactive or sculptural public art as identified in the public art Strategy. Suitability of playground lighting is to be assessed on a case by case basis by Waverley Council.

Lighting Tier Elements: Pedestrian pole, cycleway treatment, seating and urban structures, tree and plant lighting, monument, artwork and sculptural lighting.
Lighting Tier: Tier 1 for pathway lighting. Tier 2 lighting enhancement for park perimeter and main entries.

Specific design direction has been applied to Bondi Beach Park due to its relationship with coastal areas.

How to apply a lighting tier for coastal perimeter?

In Coastal areas such as the Coastal Walk and Bondi Beach Promenade, it is important that the lighting approach is sympathetic to the natural ecology and maintains visibility of the ocean and night time views. The viewing of the night time environment and night-time sky is generally influenced by sky glow, light trespass, glare and visual clutter. A low level lighting solution is to be provided to limit the potential for sky glow as this approach is highly localised to avoid light trespass and is integrated to avoid glare and visual clutter. Lighting should utilise light and shade rather than being uniform to respond to the natural characteristics and changing nature of the walk.

The lighting is to enhance the pedestrian experience in the early morning and late afternoon to evening encouraging greater use and therefore greater passive surveillance.

Lighting Tier Elements Coastal Walk: Connecting element lighting, seating and urban structures, lighting other natural features, marker lighting, monument, artwork, sculpture lighting, lighting interventions.
Coastal Walk Lighting Tier: Due to the environmental considerations and desired night time atmosphere Tier 1 lighting elements including pole lighting applications are not suitable for the Coastal Walk. Tier 2 lighting should be used to provide safe passage by defining the path edge and guiding the user journey. Tier 3 lighting marks key beacons along the path and is outlined in chapter 8.

Lighting Tier Elements Coastal Walk Park: Pedestrian pole, seating and urban structures, tree and plant lighting, monument, artwork and sculpture lighting.
Coastal Walk Park Lighting Tier: Tier 1 lighting may be applied to main pedestrian paths through park areas however should be limited along the promenade. Park promenades and coastal parks are typically to use Tier 2 elements.

How to apply Tier 3 lighting?

Tier 3 lighting is a site specific installation used to celebrate and define a key destination or beacon on the user journey. Appropriate areas have been defined within the three main areas of the Waverley LGA in response to the place strategy that provides a framework for the strategic lighting approach.

Tier 3 lighting may consist of adaptions of tier 1 and 2 elements or may be an overlay to these elements. Lighting should be used to tell a story, engage the public, encourage interaction, and activate specific sites to encourage gathering and increased night time use.

If additional areas are added at a later date it is important to assess appropriate locations for additional tier 3 lighting sites in the overall LGA context.

Which elements are suitable?

The following table provides an outline of lighting tier elements that are suitable for each application:

	Tier 1: Multi Function Pole	Tier 1: Pedestrian Pole	Tier 1: Ausgrid Pole	Tier 1: Pedestrian Crossing Luminaire	Tier 1: Cycleway Treatment	Tier 2: Façade and Alfresco Dining	Tier 2: Retail Frontages (Internal)	Tier 2: Under Awning Lighting	Tier 2: Connecting Element Lighting	Tier 2: Wayfinding Signage	Tier 2: Bus Shelter Lighting	Tier 2: Catenary Lighting	Tier 2: Seating and Urban Structures	Tier 2: Tree and Plant Lighting	Tier 2: Lighting other natural features	Tier 2: Marker Lighting	Tier 2: Monument, Artwork, Sculpture Lighting	Tier 3: Lighting Intervention (site specific to key areas)
General Streets	■			■	■		■	■	■	■	■							■
Campbell Parade	■	■			■	■	■	■	■	■	■		■	■			■	■
Village/ Commercial Streets	■	■		■	■	■	■	■	■	■	■		■	■			■	■
Laneways	■					■	■	■				■	■				■	■
Active Laneways						■	■	■				■	■				■	■
Neighbourhood Street			■								■							
Shared Paths	■	■		■	■													
Parks Major Pathways		■			■								■	■			■	■
Parks Minor Pathways		■			■								■	■			■	
Parklets													■	■				
Bondi Park		■							■				■	■	■	■	■	■
Malls/ Plaza		■			■	■	■	■		■		■	■	■			■	■
Coastal Walk									■				■		■	■	■	■
Beach Promenade									■				■	■	■	■	■	■

5.1.2 Selecting a Light Level

Lighting levels set the base requirements providing horizontal illuminance on the floor surface, however the quality of light, colour of light, luminaire distribution and atmosphere created are important for the overall perception of space and pedestrian comfort.

Setting quantitative 'lighting levels' for the functional lighting applications in accordance with the relevant Australian Standards, include consideration of a range of factors including volume of pedestrian and vehicle use, crime statistics and the importance of enhancing the area.

Pedestrian safety and amenity is also to be considered as when there are concerns about safety, there is a tendency to over-light; however too much light can be as detrimental as too little lighting. To assist in the creation of a safe night-time environment, the atmosphere that needs to be created should be one of welcome, warmth and safety. People need to be able to move with ease and confidence. This can be achieved in part by successful lighting design that illuminates the designated areas correctly and in part by the overall urban context, please management and area policing.

Safety is not guaranteed by the achievement of a particular illuminance requirement. People's perceptions of safety are much more governed by night-time population and activity of an area as well as issues such as facial and colour recognition, contrast ratio, glare and the overall atmosphere created.

Use of light should be considered holistically with other aspects rather than solely light levels on the walking surface to aid in reducing the fear of crime and increasing the perception of safety. By good design that embraces light and shade and subtle contrasts, it is more likely to achieve a safe design solution than the mere distribution of light across the ground. Based on the relevant Australian Standards, the following lighting levels are to be considered in the design of future lighting projects and upgrades.

The final lighting level is to be agreed with Waverley Council following an assessment of the specific area and it's surrounds.

Considerations include:

- Desired night time use;
- Level of use;
- Type of activity (vehicular, pedestrian, shared);
- Desired character as defined in this Strategy;
- Site specific issues governing people's perception of safety.

Refer to Section 6, Section 7 and Section 8 for area specific information in each area.

Roadways	**V1**	**P1**	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**
General Streets	■	■	■	■	■					
Campbell Parade	■	■								
Village/ Commercial Streets			■	■	■					
Laneways			■	■	■					
Neighbourhood low Activity				■	■	■				
Neighbourhood Med/ High Activity			■	■						
Pedestrian and Shared										
Cycleways			■	■	■					
Malls				■	■	■		■	■	
Coastal Walk Pathways					■	■				
Major Park Pathways				■	■					
Pocket Parks						■				
Stairs and Connecting Elements									■	■

5.1.3 Selecting Timing

The 'hours of operation' of a lighting installation are to respond to the functional use of the space and the intended night time atmosphere as guided by Waverley Council.

Typically lighting is to be automatically activated at dusk and de-activated at dawn.

A static lighting control approach often results in a consistently high lighting level which is unnecessary and inefficient in terms of energy use and adversely impact neighbouring residents and wildlife. In certain sites a dynamic lighting control approach may be used to reduce the lighting level or switch off certain lighting elements outside of peak use times to provide a lower level of light for safe passage.

This is particularly important to the Coastal Walk where higher lighting levels may be required at peak hours of use in the early morning and early evening but may not be required to the same level for the other hours of the night. Refer to Chapter 8 for further information.

5.1.4 Selecting a light colour temperature

A coherent use of light colour temperature should be considered across all areas for visual consistency. Light colour temperature can assist in visual differentiation of areas with different functions such as vehicular and pedestrian zones.

White light (2500K to 4500K) is considered suitable for use in the public domain as it renders objects and people in their true forms. Vehicular focused areas are to generally use 4000K whilst pedestrian focused areas are generally to use 3000K to create a warm and welcoming environment.

Where light is applied to a material or texture a warm white light (2500 - 3000K) or cool white light (3000K - 4000k) may be considered to suit the surrounding environment, object or area being lit and function of the object or area being lit.

A warm white colour temperature of 3000K is to be provided to the Coastal Walk and all Coastal Perimeter areas to reduce any potential penetration of light into the water.

Tier 3 lighting provides designers with the opportunity to introduce coloured lighting, to enhance the installation.

Refer to Chapter 6, Chapter 7 and Chapter 8 for area specific information in each area.

5.1.5 Selecting a luminaire; the lighting suite

It is important that a standard suite of light fittings is established for the tier 1 elements to provide a consistent visual language and identity of the Waverley LGA area as well as assist in reducing capital costs and maintenance costs. Specific tier 2 elements including marker lighting and tree lighting also form part of the standard luminaire suite. The use of a standard luminaire suite would provide a practical and cost effective way for Council to manage and maintain public lighting.

Refer to Waverley Council's Public Domain Technical Manual for technical information.

It is recognised that other tier 2 lighting elements and tier 3 lighting installations may require a non-standard luminaire to achieve the design intent. The performance criteria as outlined in the following chapter is to guide the selection of these light fittings. The final fitting selection is to be approved by Waverley Council.

5.1.6 Lighting impact on flora and fauna

It is important that in the selection of the above elements and in the application of the lighting tiers, that consideration is given to the impact of lighting on plants and animals in their natural habitat.

For all works along the Coastal Walk, Coastal Perimeter zones and Parks, a site specific risk assessment and environmental impact assessment, including scientific nocturnal fauna surveys, is required to be undertaken during the design development phase of each project.

The following are to be considered to minimise the impact on flora:

- Placing of luminaires should avoid the damaging of tree roots with locations chosen accordingly.
- Placement of luminaires needs to avoid the use of heavy machinery in sensitive areas; hand digging and water jet trenching may be considered.

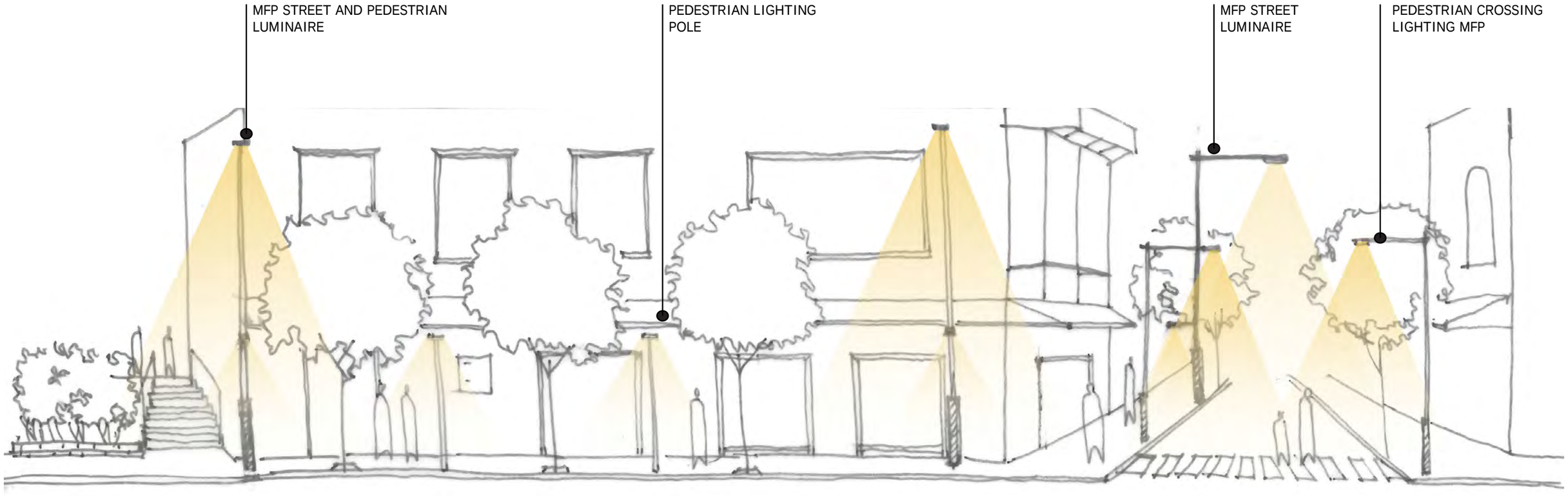
Whilst artificial lighting can assist and facilitate foraging for some animal species due to higher concentration of insects (being attracted by night-time lighting), it can cause a negative impact to other species.

The following are to be considered to minimise impact on fauna:

- Lighting design approach is to minimise upwards light and contribution to sky glow. Lighting in coastal areas should be concealed, integrated and localised to avoid light trespass and preserve the night time environment and reduce potential impact on flight paths of birds and bats.
- Light intensity is to be considered to respond to animal vision under low light level conditions. Lighting levels should therefore be reduced when a high lighting level is not required. Certain lighting elements may also be switched off outside of peak use times when not required for functional lighting.
- Generally animals have a different spectral sensitivity than humans thus selection of light sources is to consider a warm white light with reduced blue and UV wavelengths. This assists in reducing the risk of disturbance of vision and in reducing the influence on animal circadian rhythm and overall biology.
- Use of shields, louvres and low brightness fixtures where appropriate.
- Lighting that causes flashing or intermittent lighting beams should be shielded to minimise their impact.

5.2 Tier 1: Base Lighting Elements

The Tier 1 Base Lighting elements provide the base level of light for functional movement and provides a consistent foundation of light for streets, laneways, pedestrian pathways, cycle routes and transit areas.



5.2.1 Street Lighting

The street lighting solution is to be suitable for the scale, function and level of use in order to support the night time hierarchy, wayfinding and language of the streetscape.

The multi-function pole (MFP) is a Council initiative aimed to reduce visual street scape clutter by integrating services and to provide a consistent lighting aesthetic. The multi-function pole is to be used on **General streets** and **Village/ Commercial streets** within Waverley Council LGA for a consistent identity.

Neighbourhood streets in residential areas have a different streetscape language to the more public and larger scale commercial and gateway streets. As such the MFP is not suitable for these streets and the Ausgrid assets are to remain.

The MFP may be configured to integrate a range of services. For the Tier 1 **General** and **Village/ Commercial street** application the MFP provides general street lighting, pedestrian lighting and where applicable may be scaled to support pedestrian crossing lighting.

MFP Street Lighting Luminaire

Pole Height: 9m
Light Source: LED Lighting
Colour Temperature: 4000K
CRI: RA70
Minimum IP rating: IP65
Minimum IK rating: IK04
Lighting Control: Dimmable
Optical Controls: In sensitive areas where the MFP may be located in close proximity to residential areas above commercial sites, rear spill light louvres should be provided to limit the impact of the light source.

In areas where high colour rendering is critical for activation and safety, such as Campbell Parade which requires a high quality light , a supplementary or replacement may be considered.

MFP Pedestrian Lighting Luminaire

The pedestrian luminaire aims to provide a human scale of lighting in pedestrian focused areas where the MFP is located and where under awning lighting may not be possible. The pedestrian luminaire may be mounted to the MFP if spacing is suitable.

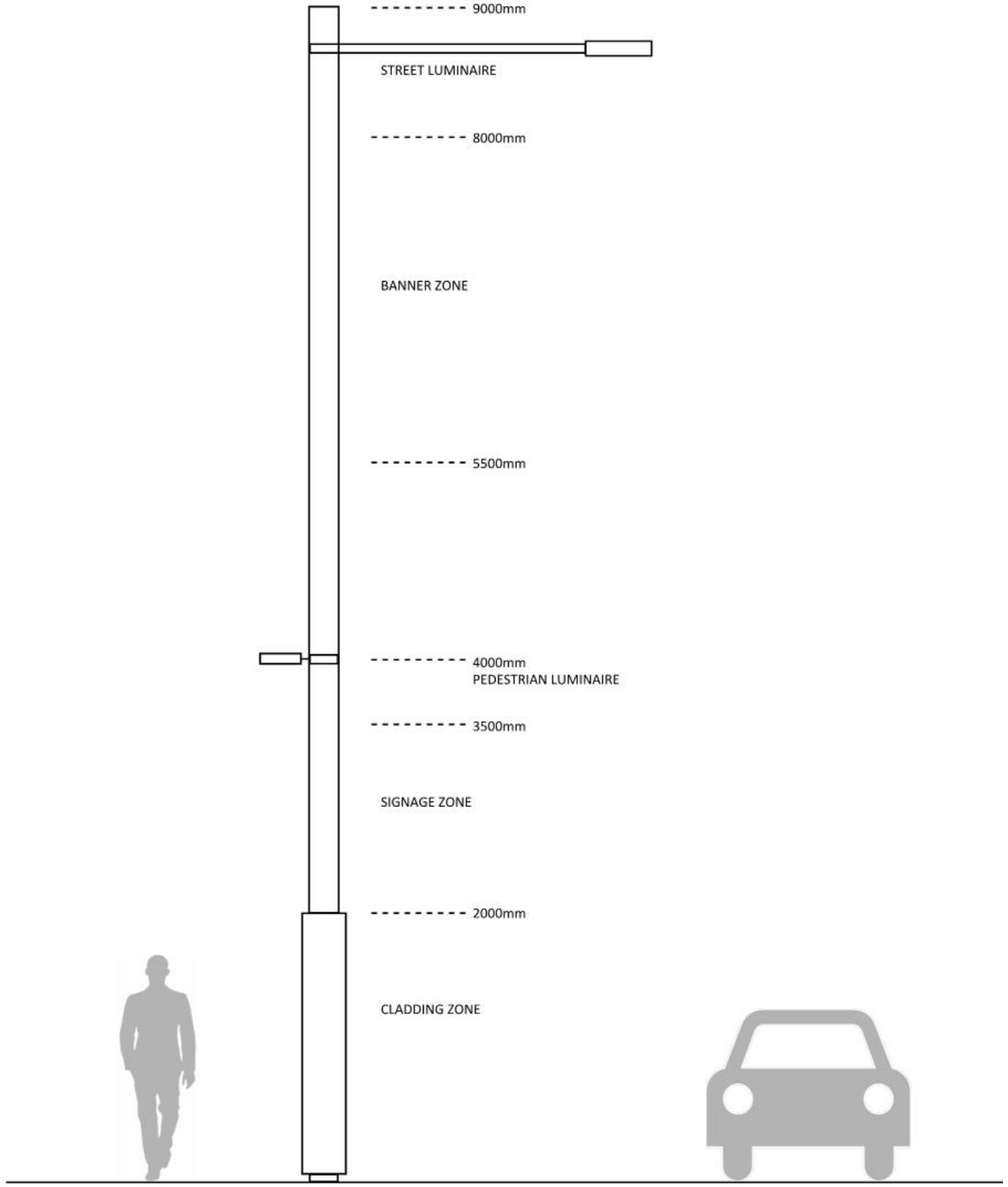
Mounting Height: 4m
Light Source: LED
Lighting Colour Temperature: 3000K
Minimum CRI: RA90 for pedestrian focused areas
Minimum IP rating: IP65
Minimum IK rating: IK04
Lighting Control: Dimmable

Where the pedestrian luminaire cannot be mounted to the MFP or due to spacing additional pedestrian luminaires are required, the fitting is to be mounted on a slim intermediate 4m pole.

In urban laneways the MFP street luminaire may be wall mounted if this is required for functional lighting. Typically Tier 2 and Tier 3 elements are to be used in these applications.

The multi-function pole may be used in conjunction with pedestrian lighting poles, awning lighting and additional street lighting typologies outlined in the next section of this report.

Refer to Section 6, Section 7and Section 8 for street specific information. Refer to Waverley Council's Public Domain Technical Manual for technical information.

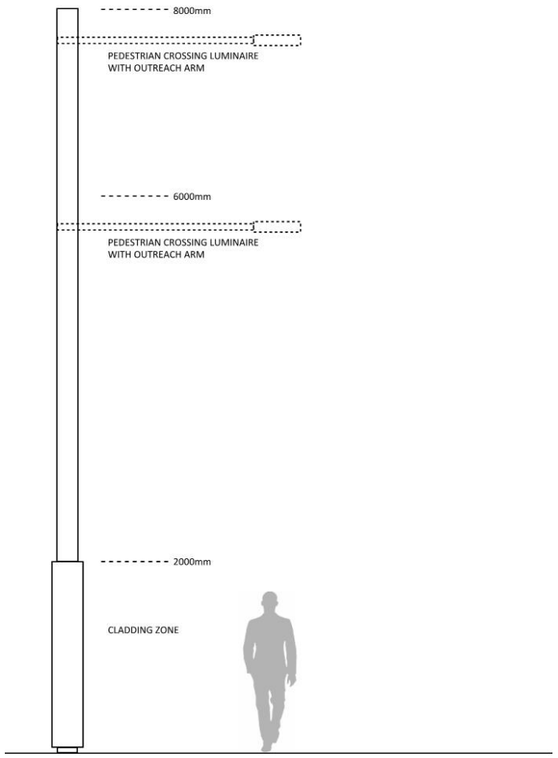


5.2.2 Pedestrian Crossing

Pedestrian crossings recognise the need for pedestrian safety and the relationship of pedestrians and vehicles. Vertical illuminance is paramount for pedestrian safety in these areas.

Pedestrian crossing lighting should be provided with a dedicated luminaire in the same family as the street lighting MFP pole on either side of the crossing in accordance with AS/NZS1158.4.

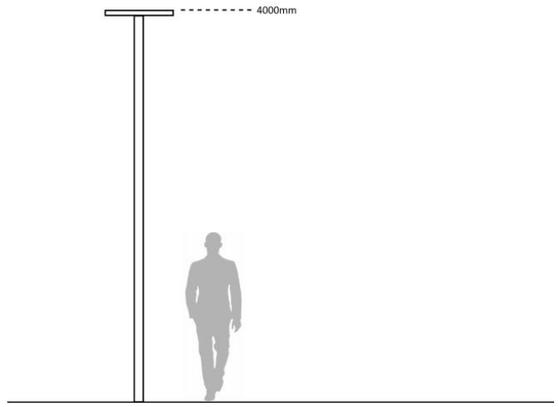
Pole Height: 6m – 8m with outreach arm angled to suit the size and type of pedestrian crossing
Light Source: LED
Lighting Colour Temperature: 3000k or 4000K (Selected to suit surrounding CCT)
Minimum CRI: RA70
Location: Poles to be located not closer than 3m to the kerb and should be located to align with AS1158.4.
Minimum IP rating: IP65
Minimum IK Rating: IK04
Lighting Control: Dimmable



5.2.3 Pedestrian Lighting Pathways

The pedestrian lighting pole aims to provide a human scale of lighting in pedestrian focused areas that do not form part of the streetscape such as to malls or major park pathways. The luminaire should provide lighting to not only the path but the path surrounds to increase pedestrian comfort.

Pole Height: 4m
Light Source: LED
Lighting Colour Temperature: 3000K
Minimum CRI: RA90 for pedestrian focused areas
Minimum IP rating: IP65
Minimum IK Rating: IK04
Lighting Control: Dimmable



5.2.4 Cycleway Lighting

Lighting for pedestrians and cyclists at night is vital to encourage active movement by providing a feeling of safety and reinforcing way-finding and legibility.

Dedicated cycle zones may form part of a street typology or pedestrian/ cycle mall. Cycleways require visual differentiation from the general surroundings to ensure rider safety.

For general streets, village/ commercial streets and neighbourhood streets, the general streetscape lighting is to be designed to provide sufficient illuminance. In key instances this may be used in conjunction with an integrated glowing or reflective element. The glowing or reflective element is to reflect the day time image in the night environment by expressing the lane lines and bike graphics that provide visual separation during the day. A solar paint, reflective tape or LED marker is to be considered for this application.

General Streets

Where cycleways form part of a general street, lighting is to be provided from the MFP pole and may be in conjunction with an integrated glowing or reflective element .

Pole Height: 9m
Light Source: LED
Lighting Colour Temperature: 4000K
Minimum CRI: RA70
Minimum IP rating: IP65
Minimum IK Rating: IK04
Lighting Control: Dimmable
(Refer to Parks and Malls for integrated glowing or reflective element parameters.)

Village/ Commercial Streets

Where cycleways form part of a village/ commercial street, lighting is to be provided from either the MFP the pedestrian pole and may be in conjunction with an integrated glowing or reflective element.

Pole Height: 4m
Light Source: LED
Lighting Colour Temperature: 3000K
Minimum CRI: RA90
Minimum IP rating: IP65
Minimum IK rating: IK04
Lighting Control: Dimmable
(Refer to Parks and Malls for integrated glowing or reflective element parameters.)

Neighbourhood Streets

Where cycleway form part of a neighbourhood street, lighting is to be provided from the Ausgrid pole and may be in conjunction with an integrated glowing or reflective element.

Shared Paths, Parks and Malls

Where cycleways form part of a shared path with pedestrians, or form part of a park or pedestrian only area such as a mall sufficient general lighting is to be provided in the design solution. In addition to this in key locations where is it important to provide visual separation for rider safety and wayfinding, an integrated glowing element may be provided to define the path.

In smaller parks or pedestrian areas where a dedicated pole light may not be suitable, an integrated glowing element may be provided to define the path. This is to be assessed with Waverley Council on a case by case basis.

Light Source: Photo luminescent paint, reflective material, LED marker light or similar
Reference Projects/ Technology:

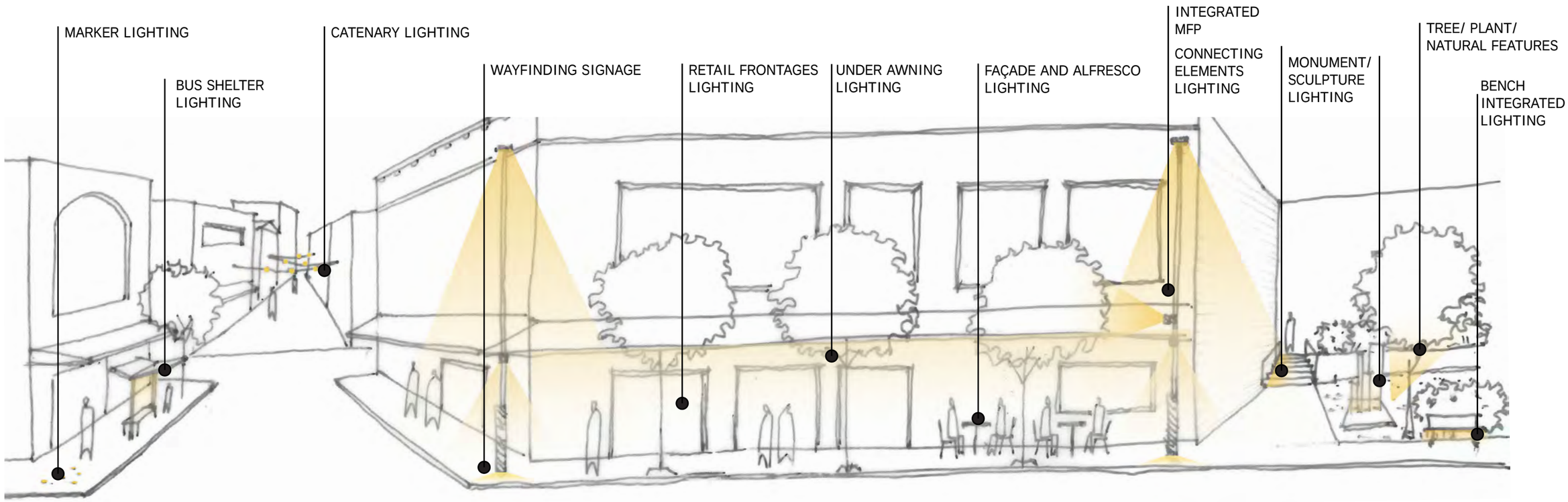
1. 'The Starry Night' Cycle Path by Daan Roosegaarde, Netherlands
2. Cycleway by TPA Instytut Badan Technicznych, Libzbark Warminski, Poland
3. N329 Pilot Project of Smart Highways in the Netherlands by Heijmans and design firm Studio Roosegaarde
4. Luna Road Glo solar paint
5. TraxEyes photo luminescent road studs in the Clyne Valley for Swansea City Council



5.3 Tier 2: Amenity Lighting Elements

Amenity lighting provides enhanced lighting to support the pedestrian experience to village/ commercial streets, malls, plazas, selected parks, the coastal walk and coastal perimeter areas. Amenity lighting elements provide a typical approach to specific urban or natural structures that may be adopted where the elements repeat. The typical approaches set out in this section of the document allow for area specific variation (e.g. catenary lighting may be used in different plazas, however the 'look' of the suspended catenary fitting may change. Where this occurs the light source and distribution should be the same to provide a consistent outcome). Lighting elements are to be layered to provide both functional and experience lighting.

Tier 1 elements may form part of this strategy for the streetscape where applicable however should not be used for the coastal walk and coastal perimeter areas.



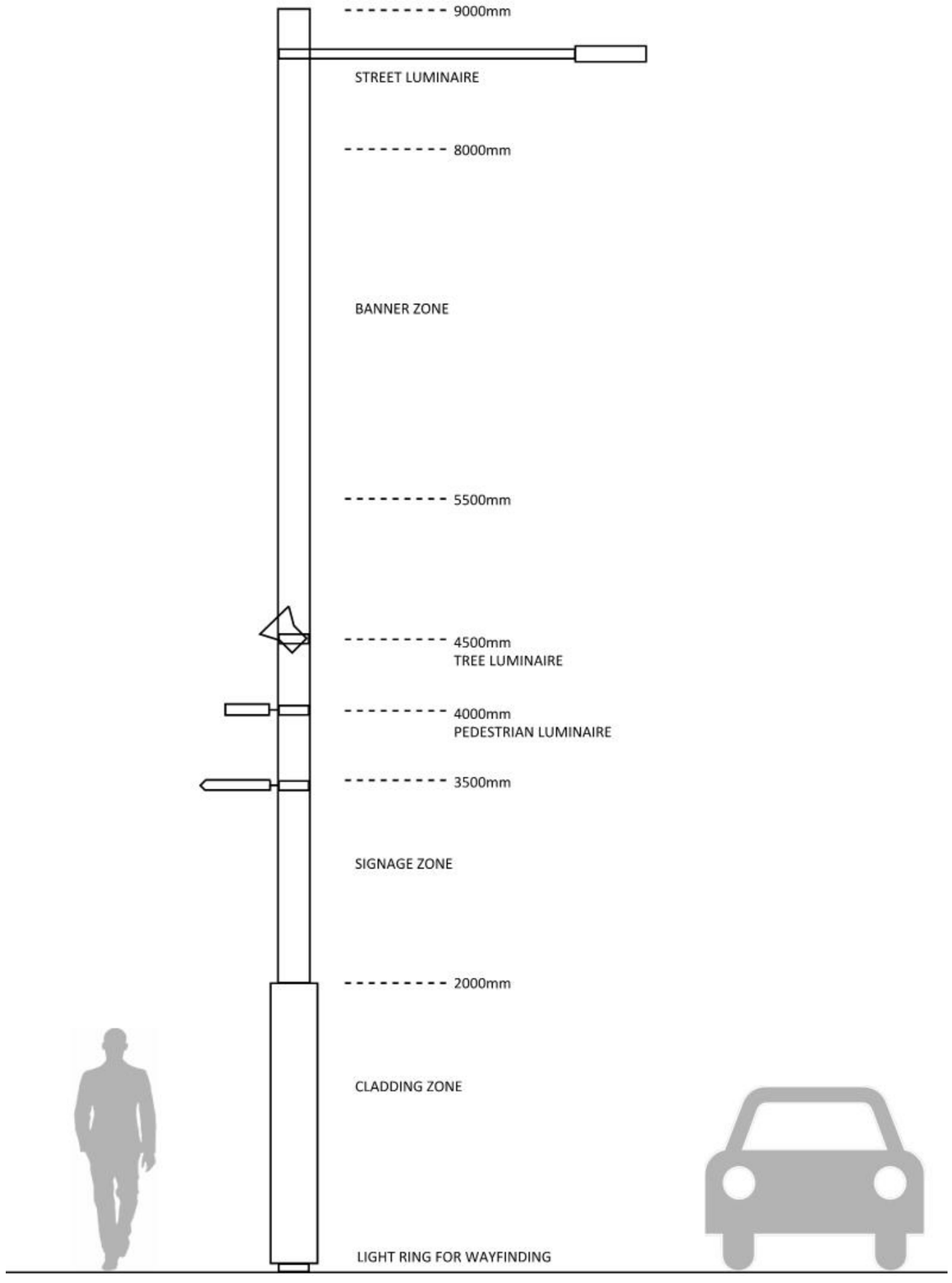
5.3.1 Integration of amenity lighting with the MFP

Amenity lighting elements may be integrated into the MFP where possible and as required in locations where the MFP is located. This initiative aims to reduce visual streetscape clutter by integrating services.

Suitable lighting elements for integration include:

- Integrated ring of light for wayfinding
- Backlit or digital street signage
- Pedestrian luminaire (Base lighting element)
- Tree luminaire
- Street luminaire (Base lighting element)

Refer to the following guidelines for the criteria and intent pertaining to each of these amenity lighting elements.



5.3.2 Façade Lighting and Alfresco Dining Lighting

Subtle and well-considered architectural façade lighting assists in the legibility and atmosphere of the night time environment and streetscape when used in key locations. It is important to not light all buildings as this detracts from the overall effect and purpose. Key facades are highlighted in Section 6, Section 7 and Section 8 of this document where façade lighting is considered suitable in enhancing the overall lighting strategy.

Light Source: LED
Colour Temperature Façade Lighting: 2700K – 4000K to suit material and surrounding environment
Minimum CRI Façade Lighting: RA80
Colour Temperature Alfresco Dining: 2700K – 3000K to create sense or warmth and ambiance
Minimum CRI Alfresco Dining: RA90 for rendering of human skin.
Minimum IP rating: IP65
Minimum IK rating: IK04
Lighting Control: Dimmable
Installation: External lighting fixtures are to be integrated with the architecture of the building where possible and the daytime appearance of the luminaires is not to be visually imposing.

The following design considerations are to be considered:

- Lighting is to be appropriate to highlight certain architectural features of a building. Floodlighting entire facades or over illumination of business premises for promotional purposes is not supported.
- General commercial buildings are to have a low key approach to lighting so as to not compete with landmark buildings.
- Dark recesses in building facades affect the perception of safety within the streetscape of the public domain. Adequate lighting should be provided to these areas as an integrated part of the building scheme.
- Where retro-fitting existing buildings and structures consultation is to be carried our with adjoining business owners and residents. Where a building or structure is of a heritage nature, consultation with a Heritage Officer is required.
- For new buildings and structures the lighting is to meet these requirements. Refer to additional requirements in the DCP Controls and DA Conditions.

Alfresco dining activates the streetscape and encourages a welcoming and exciting atmosphere. Lighting to alfresco dining spaces falls within the private domain, however the following guidelines are to be followed by business owners.

- Warm white local table lighting is encouraged;
- Floodlighting is not supported;
- Lighting should be soft, warm light.

5.3.3 Retail Frontages (Internal Lighting)

Activation of retail frontages forms part of the strategy to enhance the night time experience of the streetscape and mall spaces. Lighting should focus on highlighting merchandise or internal surfaces rather than floodlighting and may be used to create a visual hierarchy. Luminaires should be located in a manner to reduce glare and reflections on the window surfaces to provide a considered lighting quality to the adjacent streetscape.

Light Source: LED
Colour Temperature: 3000K – 4000K. Colour may be used in specific instances if deemed appropriate
Minimum CRI: RA85

(Note: Luminaire selection and design by individual tenant)

The brightness of all light sources, luminous surfaces and lit surfaces that are visible from the street, including digital and internally lit signage and billboards, should be of an appropriate candela/square meter to suit the surrounding environment.

Consideration is to be given to night-time control to reduce or turn-off shopfront lighting after 2am if the establishment or retail shop is not open.

5.3.4 Under Awning Walkway Lighting

Awnings provide a transition from the private to the public domain and vice versa. Despite being attached to private buildings they extent into and affect the public domain. Under awning lighting forms part of the vision for the streetscape in commercial areas and have been considered in the overall lighting strategy for each street. To see if under awning lighting applies to your project area, refer to the specific street design direction in Section 7, Section 8 or Section 9 in this report.

All private lighting related designs that interface with the public domain are to be submitted to the Council for review and development consent.

Light Source: LED
Lighting Colour Temperature: 3000K
Minimum CRI: RA80
Minimum IP rating: IP55
Minimum IK Rating: IK04
Illuminance Requirements: Lighting may be required below awnings to supplement existing street lighting and 'spill' lighting from shopfronts and other ground floor uses to achieve the required lighting level. Lighting is to be in line with the light level requirements as the street or pedestrian area the awning is covering; however with a minimum P3 category to be achieved. Spill lighting from streetlights is to be considered.
Installation: Lighting must be recessed into the awning and be integral to the awning's structure and form. All associated wiring and conduits are to be completely concealed. Light fittings should be readily accessible to support their regular maintenance.
Lighting Control and Use: The Council may impose conditions on any awning lighting requiring it to be switched on or off between certain hours.

Refer to the latest DCP and DA conditions for further requirements.

5.3.5 Connecting Elements Lighting

Handrail lighting aims to provide integrated lighting into urban infrastructure for low level, focused functional lighting where other lighting elements do not provide necessary lighting levels or there is concern with maintaining vistas in coastal areas. Handrail lighting is appropriate to use in both urban and coastal settings including ;

- Stair lighting;
- Pedestrian Connections;
- Urban pedestrian pathways;
- Coastal walkways;
- Bridges

Light Source: LED
Lighting Colour Temperature: 3000K
Minimum CRI: RA80
Minimum IP rating: IP65
Minimum IK Rating: IK04
Distribution: Symmetric for centre handrail/ Asymmetric for single handrail to minimise spill light.
Urban Infrastructure Upgrade: Waverley Council Standard Handrail to be implemented. Handrail to be 38mm – 45mm diameter hollow tube with maximum wall thickness of 5mm to accommodate luminaire installation.
Lighting Control: Where used on the coastal walk lighting is to be dimmable and set to a low base level. This level may increase when presence is detected.



5.3.6 Wayfinding Signage

Providing legible wayfinding signage that translates from day time to night time is critical in encouraging active movement and increasing usability and legibility of the LGA area in the evening. Wayfinding signage addresses Waverley Council owned signs and not advertising or retail signage.

Luminous wayfinding signage provides a consistent visual language that is recognisable within the LGA and provides clear guidance to pedestrians, cyclists and motorists alike in locating transport hubs, locating main buildings or key destinations. Lighting is to be integrated within the signage element to provide a glowing surface that is legible. Light may be used to define a word, or graphic as required.

Luminous wayfinding signage may be integrated into the MFP where located at key junctions in either a backlit or digital format. Smart wayfinding signage may be considered in the long term for Bondi Junction and Bondi Beach that is live and active providing times to destinations, weather information, beach conditions, traffic conditions.

A ring of light may be integrated into the base of the MFP at key junctions with the colour programmed to assist in wayfinding and orientation. The integrated ring of light may also change colour for specific events.

In coastal areas, wayfinding initiatives such as marker lighting, lighting of identifiable cultural icons and use of lighting typologies and lighting interventions are used in place of signage elements due to the linear journey and importance of maintaining vistas. Both at Ben Bucker Park and the Waverley Cemetery junction with Randwick Council the existing signs are to be treated in a subtle and integrated manner suitable to the environment. Refer to Section 8 of this document for further information

5.3.7 Bus Shelter Lighting

The urban design of the bus shelter is to be characterised as open and transparent to support an environment where commuters feel comfortable waiting. Lighting is to provide sufficient vertical lighting within the shelter itself. In urban and commercial areas, it would be considered appropriate to light urban and/or natural features in close proximity to increase visual depth in the surrounding environment. This assists in increasing the perception of safety. This would not be suitable in residential areas.

In conjunction with the built form, an integrated lighting solution is to support a unique, recognisable Waverley LGA identity. Lighting may be integrated within the structural beams in a location that reduces glare. A glass roof structure may be considered suitable to reflect an open and transparent environment.

The user experience is to be enhanced by a lighting installation that is responsive to the seasonal or environment. This may be through a seasonal response with the lighting changing from cool white in the summer to warm white in the winter.

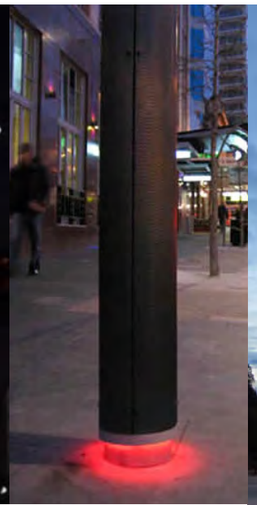
The user experience should not be dominated by advertising signage. Digital and internally lit signage shall be of an appropriate brightness so as to not dominate the space. Advertising signage may be dimmed after dark to suit the environmental conditions.

Smart wayfinding signage may be integrated within the bus shelter such as live timetables, maps, directions.

Light Source: LED
Light Colour Temperature: 2400K to 4000K
Minimum IP rating: IP65
Minimum IK rating: IK08
Lighting Control: Dimmable and Colour Tuneable

Once a solution is tested and found to be successful, this should be rolled out across the Waverley LGA.

Whilst the above is a longer term vision, in the short term lighting should be integrated into all bus stops with a consistent approach across the LGA. In urban areas lighting should also be provided to urban or natural features in close proximity to increase visual depth in the surrounding environment as outlined above.



5.3.8 Catenary Lighting

Catenary lighting is a high tension suspended cable lighting system that is to be used to differentiate a space from the surrounding environment, create a unique character to a space, or create a more intimate and informal atmosphere.

Light Source: LED
Colour Temperature: 3000K – 4000K to suit surrounding environment
Minimum IP rating: IP65
Minimum IK Rating: IK04
Distribution: To suit the design solution. Spill light to be appropriately controlled or aimed.
Installation: Cable suspension system is to be building mounted. The installation should provide minimal visual impact and should be concealed and respective of building fabric. Approval is to be sought with building owners.
In the event that catenary lighting cannot be building mounted, consult with Waverley Council for approval of pole mount and locations. Large diameter poles are not supported.
Lighting Control: Dimmable

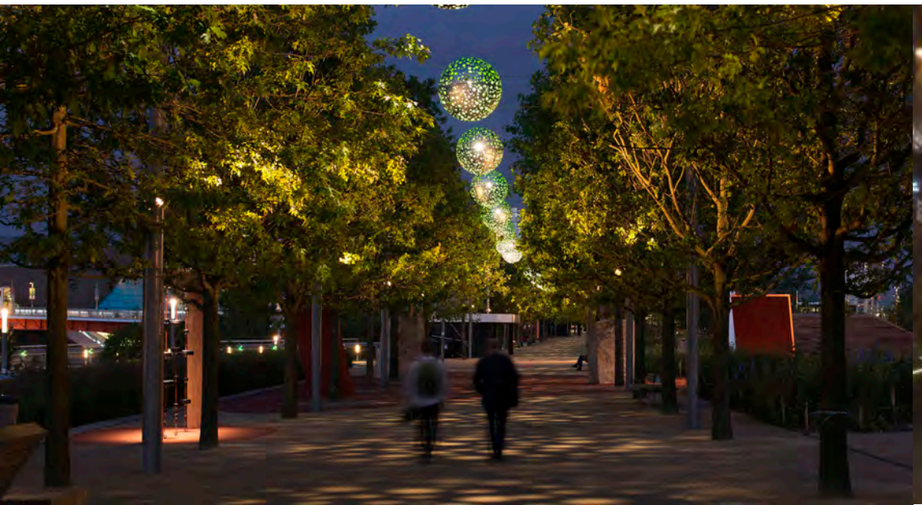
The light source is to meet the above requirements however the form, layout and design of the catenary object is at the discretion of the designer and should change from area to area to respond to the site specific identity. The design is subject to the approval of the Council.

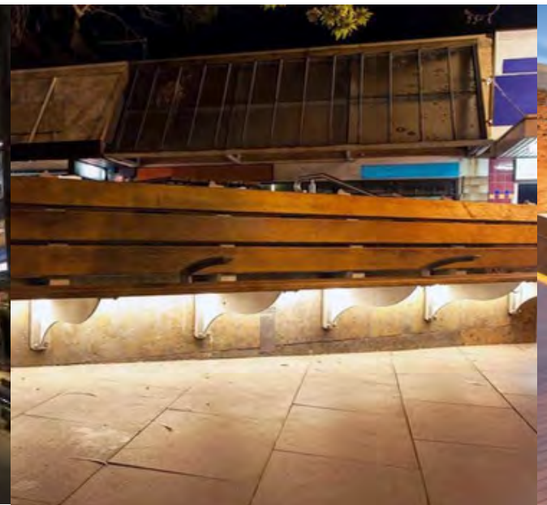
5.3.9 Seating and Urban Structures

Lighting integrated within seating elements and urban structures adds an intimate pedestrian scale to the general streetscape that signifies a place to gather, reflect, linger and relax. Within a larger context such as a park or pedestrian mall, local lighting within the urban fabric creates a focal point and enhances the night time atmosphere in an informal, playful way. It can be used as a directional tool to draw people to certain areas, and can assist in creating visual depth.

Lighting is to be concealed and seamlessly integrated into the structure to minimise vandalism or damage to the luminaires in such a publicly accessible location. Typically , luminaires for this function are small with remote control gear. All associated control gear and electrical equipment is to be located in an area that allows for future maintenance but that is not accessible to the general public.

Light Source: LED
Colour Temperature: 3000K – 4000K to suit materiality and surrounding environment
Minimum IP rating: IP65 to IP68 to suit installation location and detail
Minimum IK rating: IK04
Lighting Control: Dimmable






5.3.10 Tree and Plant Lighting

Used within parks or along pedestrian pathways or promenades, tree and plant lighting can assist in enhancing pedestrian amenity and increasing the perception of safety. Tree lighting increases the perception of brightness through lit vertical surfaces contributing to the overall atmosphere. As a lit element a tree or plant can act as a visual marker to define a space or an edge. Light and contrast of the lit foliage can be used to enhance drama and express natural textures.

Where a tall tree is located in close proximity to an MFP pole, the luminaire may be mounted to the pole at a height of 4500mm to ensure this is above the pedestrian level lighting for an integrated solution. In this application the fitting should be aimed and locked into position.

Light Source: LED
Colour Temperature: 3000K – 4000K to suit foliage type. (coloured lighting is not deemed suitable for general tree and plant lighting).
Minimum IP rating: IP65 pole mounted/ IP68 in-ground
Distribution Tree: Wide flood for general coverage. In-ground luminaires should have an internal gimbal or adjustment to place light where it is required and reduce upwards spill light. Use of louvres or lenses are to be used to direct light and reduce glare.
Distribution Plant: General diffused to enhance foliage pending installation detail.
Installation: Luminaires are generally to be located on adjacent poles (tree only) or in ground. In ground lighting should be directed towards the tree trunk and underside of the canopy to minimise upward spill light. An arborist is to be consulted where luminaire positioning effects tree roots or branches. If planting is located in close proximity to an urban structure, lighting may be integrated in this structure pending approval from Waverley Council. Suitable drainage is to be provided to in-ground luminaires in accordance with the manufacturers instructions.
Lighting Control: Dimmable and lighting to deciduous trees must be controlled via a seasonal timer to turn lights off when the tree is bare.

5.3.11 Lighting other Natural Features

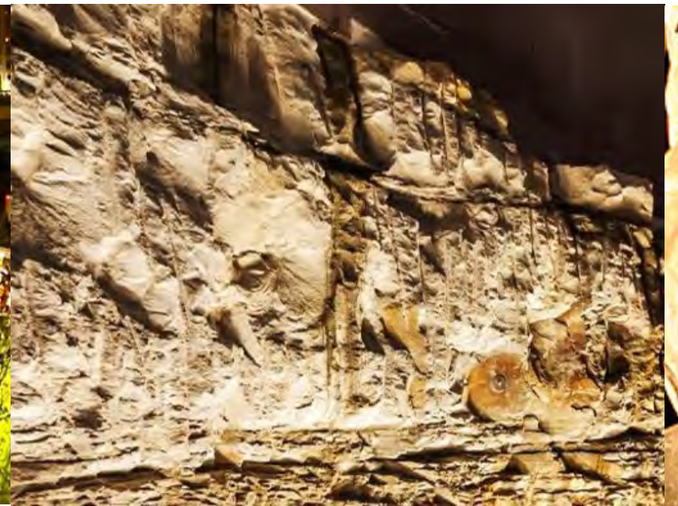
Lighting to natural features is to celebrate the texture and forms of these elements through a lighting approach that expresses light and dark, contrast and shadows.

In lighting natural features, particularly coastal rocks, it is important to consider the light source colour temperature and colour rendering as these will affect the visual perception of the materials, specifically the sandstone walls. Under some light sources sandstone can appear quite green. Typically a warm to cool white light are recommended with a CRI90 or above, however it is recommended that varying CRI indexes are tested on-site prior to installation to account for upgrades in LED technology.

Light Source: LED
Colour Temperature: 3000K – 4000K
Minimum CRI: RA90
Minimum IP rating: IP68
Minimum IK rating: IK04
Lighting Control: Dimmable

Luminaires are not to be fixed directly to any natural features and should be located in a concealed location. The location should consider vistas and views from all surrounding locations particularly from residential blocks or adjacent pedestrian pathways. Luminaire locations and optics are to be considered to ensure the natural surfaces are expressed and not visually flattened by the light. The luminaires should be suitable for a salt environment.






5.3.12 Marker Lighting

Marker luminaires are to provide a glowing surface in the ground thus are required to have a diffused surface with no visibility of the light source within. As this light does not provide functional lighting, but acts as a visual marker, the visual comfort is of greater importance than the lumen output.

Visually the size of the luminaire should suit the scale of the environment. It is generally recommended to be within 30mm – 50mm diameter.

Due to the in-ground coastal location, the luminaire is required to have an IP67/ IP68 rating with a corrosion resistant finish. The luminaire should be flush mounted in the urban fabric in a seamless manner. In some locations as identified in the 'Lighting Interventions' the marker lighting is to be activated to create a 'sparkle'.

Light Source: LED
Colour Temperature: 3000K
Minimum IP rating: IP68
Distribution: Diffused
Lighting Control: Non-Dimmable

5.3.13 Monuments, Artwork and Sculptures

Lighting of monuments, artworks and sculptures provides reference points in the user journey and creates visual interest. Lighting may be used to draw attention to monuments of cultural significance such as the surf lifesaving clubs in Bondi Beach and may bring joy to the night environment through lighting of art and sculpture.

Lighting should be used with purpose to key areas rather than applied to all monuments, artworks and sculptures. These guidelines may be applicable to existing local artworks in the Bondi Beach area, local monuments, and as a future provision for sculptures in Hunter Sculpture Park.

The lighting installations should minimise glare and glare sources; lighting is not to distract but enhance artwork. Mounting of luminaires is not to affect viewing of the monument, artwork or sculpture.

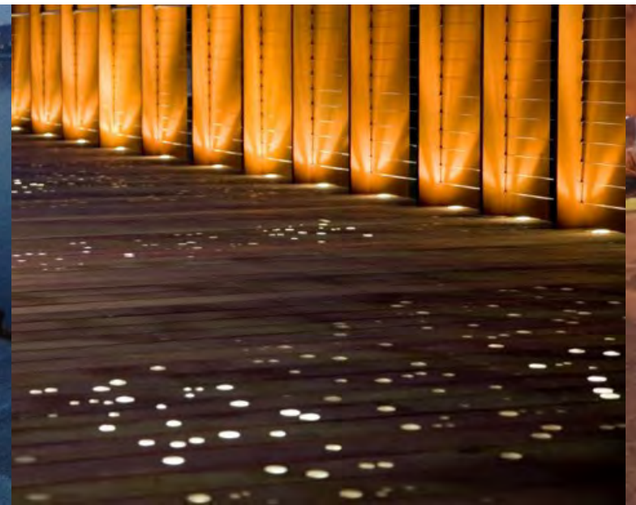
For new installations, or where the artist/ sculptor/ architect is know, collaboration and dialogue is encouraged to ensure the lighting is appropriate to the artists intent.

The following are not supported:
- General floodlighting
- Artwork mounted luminaires (unless luminaires form part of the artwork)
- Strobing or flashing lighting

Light Source: LED
Colour Temperature: White light of appropriate colour temperature to enhance natural colour, materiality and texture. Coloured light may only be used in specific circumstances in consultation with Waverley Council.
Minimum IP rating: IP65 - IP68 to suit installation location
Lighting Control: Dimmable

Lighting to monuments, artworks and sculptures are to work in harmony with the design direction for the 'Lighting Interventions' outlined in this document.

Specific lighting direction has been provided for monuments, artworks and sculptures that have been identified as suitable locations for lighting interventions. Refer Section 6, Section 7 and Section 8.

A Connected Network

9. A Connected Network

9.1 Lighting Control

Lighting is an important Council asset in providing a legible and functional night time environment. A local lighting infrastructure system is often difficult to manage with intensive operational requirements. Globally many cities are moving towards a connected network lighting solution for a 'smart city' lighting solution. As Waverley Council transitions ownership of the street lighting assets from Ausgrid and upgrades the infrastructure to the MFP in key areas the installation of a connected network is recommended.

A connected network provides many benefits including:

- **A solution that can be remotely managed and monitored providing alerts when a luminaire fails. This allows faulty fittings to be quickly located and replaced resulting in reduced maintenance costs and a safer street environment;**
- **Reduced energy consumption for street lighting infrastructure through managed and automated switching and dimming of luminaires. Fittings can be programmed to turn on at a certain time and off at a certain time. A networked solution can also automate diming reducing overall light levels in the later evening when higher lighting levels may no longer be required;**
- **Networked adjustment of lighting including colour tuning of selected fittings such as the MFP pole integrated wayfinding lighting ring. Colour may be altered across the network for a special event and then return to the every day setting once the event is over. This may also offer the ability to tune lighting for weekday and weekend use where the function of certain public spaces may change;**
- **Seasonal or weather predictive lighting control may be implemented in the future for a dynamic and responsive night environment;**
- **Remote programming and adjustment of the Coastal Walk and Coastal Perimeter areas may be undertaken to reduce light levels outside of peak use and turn certain elements off when not required;**
- **An open source network solution can expand as the Council takes on greater ownership of lighting infrastructure across different upgrades;**
- **An open source solution allows different manufacturers to be connected to the same network without limitations of luminaire selection;**
- **Networked solutions can be capable of supporting many applications in addition to street lighting for a complete solution from a central location.**

The system should be capable of;

- **Fault detection;**
- **Central Management;**
- **Future information transfer, connection to the Internet of Things and extension of public wi-fi;**
- **Technology to enable future integration of weather adaptive lighting solutions, tuneable white colour control, dynamic RGBW colour control;**
- **Open source;**
- **Dynamic dimming;**
- **Programmed settings with time clock;**
- **Lumen maintenance adjustments;**
- **Integration with road management systems.**

Technical Guidance

10. Technical Guidance

10.1 Light Quality

Light quality is an important consideration in the perception of the public domain at night. This includes consideration of the correlated colour temperature of light sources, its consistency, colour rendering and light direction. White light (in hues between 2500K and 4500K), compared to previous traditional yellow light of sodium lamps and bluish tones of mercury vapor lamps, is the preferred light colour for urban lighting applications due to it providing a more natural ambiance and improved visibility. Colour Rendering is a key consideration in regards to legibility, comfort and safety. The direction of lighting in relation to the activity and background environment impacts on the night-time environment and needs to be considered as part of the design.

10.2 Minimisation of Adverse Lighting Impacts

If used inappropriately, lighting can cause adverse impacts on the environment and spatial quality of an area. Luminaires can cause light pollution and spill light which can affect local biodiversity and clarity of astronomical observations. Luminaires can also cause discomfort glare if not used correctly, which can affect adjacent residences, reduce visibility and cause distractions to both pedestrians and vehicles. Techniques to minimise adverse impacts of light:

- Luminaires should be directed to focus light as required for specific applications.
- Luminaires should only be turned on when required to conserve energy and minimise the unnecessary emission of greenhouse gases.
- Masking techniques are to be used where required to minimise stay light into the sky including baffles and glare shields.
- Lens selection should also be considered when selecting luminaires. Where possible, luminaires are to be full cut off fittings.
- Up light floodlighting of buildings is not recommended.
- Consideration is to be given to reduce the impacts on local biodiversity through programming of lighting scenes, dimming levels and turning certain fittings off at certain times of the evening.

10.3 Lighting Distribution

A cohesive lighting night time structure is to be implemented to ensure that darker spaces of the streetscape do not appear unsafe or dimly lit when contrasted with adjacent brightly lit areas. Over-lit spaces can create high contrast with others and is to be avoided.

Awnings, verandas and trees may block street lighting and cast shadows. Lighting to these elements should be considered in the overall design and lighting scheme.

10.4 Luminaires and vandalism

Vandalism is a key consideration in the selection and mounting of a luminaire. Considerations for luminaire selection include:

- IK Rating: The IK rating of a luminaire refers to the degree of protection by enclosures for electrical equipment against external mechanical impacts in accordance with IEC 62262:2002 and IEC 60068-2-75:1997.
- The IK Rating ranges from IK00 for luminaires not protected to a rating of IK10 that protects a luminaire against 20 joules impact.
- Materiality and design of luminaires and brackets should be able to withstand environmental conditions of the site
- Fixings to be concealed and tamper proof where required.
- Mounting height to be considered for public access.