POD:

LIGHTING MANAGEMENT PLAN

PREPARED BY: WSP

AMENDED IN RED
By: K McGill
Date: 20 December 2017
Queensland Government

PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL
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DESTINATION BRISBANE CONSORTIUM

QUEEN'S WHARF BRISBANE

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F	12.05.2017	Updated to incorporate DBC/URBIS comments

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1.0

Generally:
- any public/street/pedestrian luminaire to be on the Australian Energy Market Operator (AEMO) approved table and also on Energex approved list for Rate 2 lighting
- all lights to be LED

INTRODUCTION

The transformation of the Queen's Wharf Brisbane site into the Queens Wharf Integrated Resort development (QWBIRD) is a fundamental part of the Destination Brisbane Consortium's vision.

This significant project has the potential to be exemplary for the future of public realm lighting projects on a national, if not, international stage.

The project comprises of four distinct precincts:

- Precinct 1 – Integrated Resort Development (IRD) Precinct
- Precinct 2 – Treasury Hotel and Casino Repurposing Precinct
- Precinct 3 – Residential Precinct
- Precinct 4 – PDA Associated Development

This Lighting Management Plan has been developed to respond to the Public Realm Lighting needs of the entire Precinct.

The key elements that form the aspiration for Precinct 1 are outlined below in a series of Sub Precincts.

1.1 Key Elements

- Resort Sub-Precinct
- North-West Sub-Precinct
- North Quay Sub-Precinct
- Queen's Wharf Plaza Sub-Precinct
- The Landing Sub-Precinct
- Waterline Park Sub-Precinct
- Goodwill Extension Sub-Precinct
- IRD Heritage Sub-Precinct
- Miller Park Sub-Precinct

The main objectives for this development are to connect the Central Business District (CBD) to the River and to promote a safe and inviting environment for patrons and the general public and to encourage its use after dark.

Furthermore, during citywide celebrations, it is envisaged that the entire QWBIRD will harmoniously partake in these events and provide a suitable backdrop.

This report is a Lighting Management Plan to respond to the Public Realm Lighting needs of the QWBIRD.

Site-wide Needs

The Public Realm lighting needs have been identified as being:

- A means of connecting the CBD to the River
- An acknowledgement to the indigenous past by means of an Indigenous/Mangrove Walk
- An efficient continuation and extension of the Bicentennial Bikeway through the development
- A pedestrian focussed plaza
- A legible spine for navigation purposes
- An iconic street
- A 24 hour street

This vision is to be delivered through the implementation of six strategies that will feature public realm lighting as an intrinsic component.

The strategies include:

- Paving – the lighting of horizontal elements
- Trees
- Furniture
- Lighting
- Art
- The Edges

This Lighting Management Plan has been developed following consultation with a number of key stakeholders from the State Government, Destination Brisbane Consortium including investigations on the existing lighting and best practice research internationally and forms part of a series of documents

developed for the Queens Wharf Brisbane Integrated Resort Development (QWBIRD).

This document sets out the lighting principles to be applied throughout the lit QWBIRD and considers solutions in a holistic manner that integrates the lighting philosophy with broader design issues.

Scope

POD Lighting Management Plan applies to the entire site as identified in the Precinct / Sub-Precinct Plans in **Appendix C**.

The overall complex comprises of three main zones:

- Vehicular zones
- Pedestrian zones &
- Shared vehicle and pedestrian zones

The lighting management plan coalesces these into a holistic and site consistent lighting concept.

Lighting Design Scope

The lighting design covered under this Lighting Management Plan encompasses the elements identified in **Appendix C** of the Masterplan.

2.0

OBJECTIVES

The main aim of developing the QWBIRD Lighting Management Plan is to offer guidelines and design parameters to steer all future developments within the precinct and areas covered in the Precinct / Sub-Precinct Plans in **Appendix C**.

This document establishes design parameters which will allow the development of a coherent, sustainable and harmoniously lit night-time environment, enhancing the experience, appreciation and enjoyment of the QWBIRD Streetscape both at day and night-time.

The main objectives for the Lighting Management Plan and future lighting designs within the precinct have been identified as being those that:

- Provide an ambience which is in full harmony with the urban design of the precinct
- Assist in creating a unique environment and recognisable identity for QWBIRD.
- Needs to embrace various elements of development including the facades, sculptures/ monuments, landscape elements/ trees and urban furniture, rather than solely focussing on ground illuminance alone.
- Needs to embrace the use of both light and shadow to create focal points and visual hierarchies.
- Should thematically link the various sub-Precincts and areas into one continuous and consistent space and boulevard.
- Should create an exciting sophisticated, and elegant night-scape and promote a high feeling of comfort by improving the aesthetic quality of the environment at night time.
- Should facilitate orientation and way-finding and lead people through the precinct.
- Should assist in creating a safe and secure environment.
- Integrate the lighting seamlessly at the Central Business District (CBD) interface
- Integrate the development with Southbank without compromise to the aesthetic appeal of either.

Additionally, consideration shall be given to the role that light and lighting structures play during the day and how these are integrated within the urban and landscape architecture.

As such, any lighting infrastructure implemented should be an integral part of the precinct and in line with the urban design and street architecture philosophy. This approach will assist in minimising clutter and conveying a clear, minimal and elegant “language”.

Other objectives include that the:

- Lighting should be designed for the users of the space. To this end, the lighting scheme for the pedestrian zones should be of an appropriate human scale.
- Light sources should be shielded and concealed wherever possible, without glare. Thereby not distracting from important vistas or creating glare. .
- Lighting needs to be of high quality, considering light colour, rendering and distribution, in order to maximise the impact of the area’s night-time appeal to pedestrians, residents, tourists and passers-by.
- Implementation of a good lighting scheme will instil civic pride and can also lead to wider benefit through increased patronage
- Solutions provided for public safety lighting also cater for provision for temporary and event thereby resulting in optimum integration.
- Implemented lighting system should be sustainable and energy efficient.

3.0

DESIGN PARAMETERS

As noted above, the lighting system implemented to address the Public Realm lighting needs of the entire QWBIRD shall be one that unifies the development and instils civic pride for the City of Brisbane. To this end, the solutions need to be:

- Unique
- From a "suite" of luminaires that can be used precinct-wide in different situations
- Efficient
- Adopt best available technology to manage spill lighting
- Readily maintainable

Thus the lighting design principles must draw on these characteristics and reinforce the objectives identified above.

With reference to the key plans in **Appendix C** of the Masterplan, various parts of the precinct have been identified as requiring specific illuminance targets depending on usage, form and function.

Furthermore, it is noted that the most relevant targets are those as prescribed in the AS1158 suite of standards.

Conform to AS 4282: Control of the Obtrusive effects of Outdoor Lighting

AS 1158 Lighting Sub Categories

With reference to Tables 2.1, 2.2, 2.3 and 2.4 below, the most applicable lighting sub categories for the various paths around the development have been acknowledged as being:

- P2
- P6 and
- P9

TABLE 2.1

LIGHTING CATEGORIES FOR ROAD RESERVES IN LOCAL AREAS

1	2	3	4	5	6
Type of road or pathway		Selection criteria[a,b]			Applicable lighting subcategory[c,d]
General description	Basic operating characteristics	Pedestrian/ cycle activity	Risk[f] of crime	Need to enhance prestige	
Collector roads or non-arterial roads which collect and distribute traffic in an area, as well as serving abutting properties	Mixed vehicle and pedestrian traffic	N/A	High	N/A	P1
		High	Medium	High	P2
		Medium	Low	Medium	P3
		Low	Low	N/A	P4
Local roads or streets used primarily for access to abutting properties, including residential properties	Mixed vehicle and pedestrian traffic	N/A	High	N/A	P1
		High	Medium	High	P2
		Medium	Medium	Medium	P3
		Low	Low	N/A	P4
		Low	Low	N/A	P5[e]
Common area, forecourts of cluster housing	Mixed vehicle and pedestrian traffic	N/A	High	N/A	P1
		High	Medium	High	P2
		Medium	Low	Medium	P3
		Low	Low	N/A	P4

AS1158 Table 2.1

TABLE 2.2

LIGHTING CATEGORIES FOR PATHWAYS (INCLUDING CYCLEWAYS)

1	2	3	4	5	6
Type of pathway		Selection criteria[a,b]			Applicable lighting subcategory
General description	Basic operating characteristics	Pedestrian/ cycle activity	Risk of crime[f]	Need to enhance prestige	
Pedestrian or cycle orientated pathway, e.g. footpaths, including those along local roads[d] and arterial roads[e], walkways, lanes, park paths, cycleways	Pedestrian/cycle traffic only	N/A	High	N/A	P1[c]
		High	Medium	High	P2[c]
		Medium	Low	Medium	P3
		Low	Low	N/A	P4

AS1158 Table 2.2

TABLE 2.3

LIGHTING CATEGORIES 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	Risk of crime[c]	Need to enhance prestige	
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	P6
		Medium	Medium	Medium	P7
		Low	Low	N/A	P8
Transport terminals and interchanges, service areas	Mixed pedestrian and vehicle movement	High	High	High	P6
		Medium	Medium	Medium	P7
		Low	Low	N/A	P8

AS1158 Table 2.3

TABLE 2.4

LIGHTING CATEGORIES FOR CONNECTING ELEMENTS

Type of area	Applicable lighting subcategory
Steps and stairways, ramps, footbridges, pedestrian ways	P9
Subways, including associated ramps or stairways	P10

NOTE: Subways are listed as a separate subcategory because of a high risk of crime.

AS1158 Table 2.4

Based on the above, the appropriate maintained illuminance levels are referenced from Tables 2.6, 2.7 and 2.8 (AS1158.3.1)

TABLE 2.6

VALUES OF LIGHT TECHNICAL PARAMETERS AND PERMISSIBLE LUMINAIRE TYPES FOR ROADS IN LOCAL AREAS AND FOR PATHWAYS

1	2	3	4	5	6
Lighting subcategory	Light technical parameters				Permissible luminaire type (see Table 2.10)
	Average horizontal illuminance[a,b] ($\bar{E}_h$) lux	Point horizontal illuminance[a,b] (E_{Ph}) lux	Illuminance (horizontal) uniformity[c] Cat. P (U_{E2})	Point vertical illuminance[a,b] (E_{Pv}) lux	
P1	7	2	10	2	Type 4 where part of a road reserve or Types 2, 3, 4 or 6 elsewhere
P2	3.5	0.7	10	0.7	
P3[e]	1.75	0.3	10	0.3[d]	
P4[e]	0.85	0.14	10	N/A	
P5[e]	0.5	0.07	10	N/A	

AS1158 Table 2.6

TABLE 2.7

VALUES OF LIGHT TECHNICAL PARAMETERS AND PERMISSIBLE LUMINAIRE TYPES FOR PUBLIC ACTIVITY AREAS (EXCLUDING CAR PARKS)

1	2	3	4	5	6
Lighting subcategory	Light technical parameters				Permissible luminaire type (see Table 2.10)
	Average horizontal illuminance[a,b] ($\bar{E}_h$) lux	Point horizontal illuminance[a,b] (E_{Ph}) lux	Illuminance (horizontal) uniformity[c] Cat. P (U_{E2})	Point vertical illuminance[a,b] (E_{Pv}) lux	
P6	21	7	10	7	Types 2, 3, 4, 5 or 6
P7	14	4	10	4	
P8	7	2	10	2	

AS1158 Table 2.7

TABLE 2.8

VALUES OF LIGHT TECHNICAL PARAMETERS AND PERMISSIBLE LUMINAIRE TYPES FOR CONNECTING ELEMENTS

1	2	3	4	5	6
Lighting subcategory	Light technical parameters				Permissible luminaire type (see Table 2.10)
	Average horizontal illuminance[a,b,d] ($\bar{E}_h$) lux	Point horizontal illuminance[a,b] (E_{Ph}) lux	Illuminance (horizontal) uniformity[c] Cat. P (U_{E2})	Point vertical illuminance[a,b] (E_{Pv}) lux	
P9	Same as for highest lighting subcategory applying to areas that abut the connecting element but, where forming part of a road or pathway, to be not less than subcategory P8 in Table 2.3.				
P10	35	17.5	10	17.5	Types 3, 4, 5 or 6

AS1158 Table 2.8

Using the above reference tables, each of the Sub-Precincts of the development have been categorised as outlined below:

- Resort Sub-Precinct – P9
- North-West Sub-Precinct – P9
- North Quay Sub-Precinct – P9
- Queen's Wharf Plaza Sub-Precinct – P9
- The Landing Sub-Precinct – P9
- Waterline Park Sub-Precinct – P6
- Goodwill Extension Sub-Precinct – P2
- IRD Heritage Sub-Precinct – P9
- Miller Park Sub-Precinct – P9

It is not clear why P9 lighting subcategories are selected for sub-precinct unless there are steps, stairway, ramps, footbridges and pedestrian ways

Principal Diagram

With reference to the various AS1158 table tables noted above, see below for the Hierarchical Principal Diagram (Pages 8 & 9) and the correlated table (Sub-Precinct Table for Principal Zones Diagram) which

incorporates Lighting Category and Target Illuminance Levels.

Sub-Precinct	Principal Dia Reference	Lighting Category	Proposed Target illuminance
Resort	1a	P9	7 lux (min)
North-West	1b	P9	7 lux (min)
North Quay	1c	P9	7 lux (min)
Queen's Wharf Plaza	1d	P9	7 lux (min)
The Landing	1e	P9	7 lux (min)
Waterline Park	1f	P6	21 lux
Goodwill Extension	1g	P2	3.5 lux
IRD Heritage	1h	P9	7 lux (min)
Miller Park	1i	P9	7 lux (min)

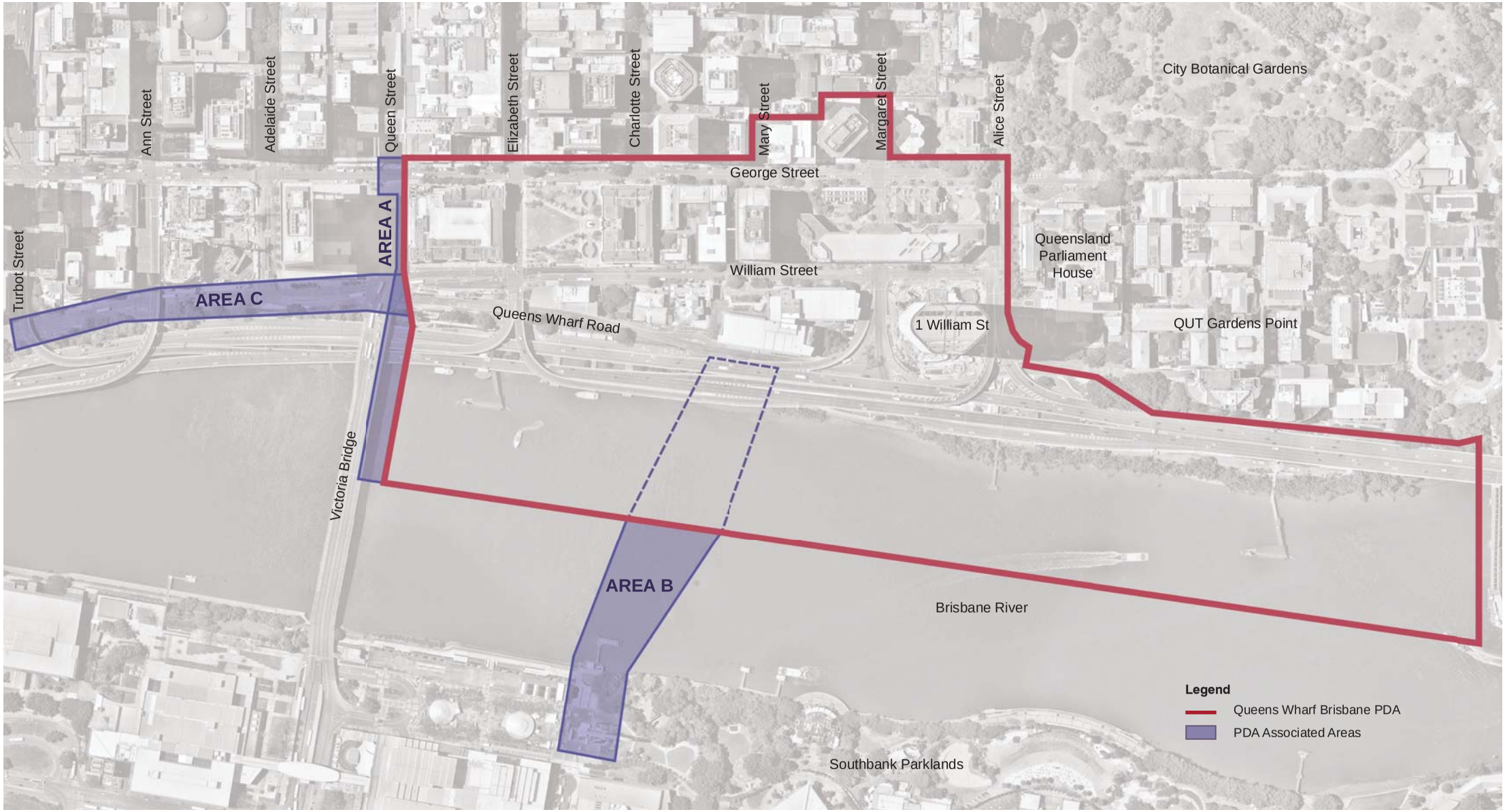
Sub-Precinct Table for Principal Area Diagram

Note:

The foregoing levels relate to horizontal levels and are provided for guidance purposes only. The lighting designer shall adopt the illuminance levels and uniformity requirements prescribed in the AS1158 suite of Australian Standards.

This table requires:
- The vertical illuminance level and not only the horizontal level for the applicable category
- Consideration to the area adjacent to P9 subcategory as the lighting level may not always be 7 lux. This is an AS1158 requirement. Refer table 2.8

Add:
Bikeway - P3
Mangrove Walk - P4



DESTINATION BRISBANE CONSORTIUM

CLIENT NAME:
DESTINATION BRISBANE CONSORTIUM

PROJECT NAME:
QUEENS WHARF BRISBANE

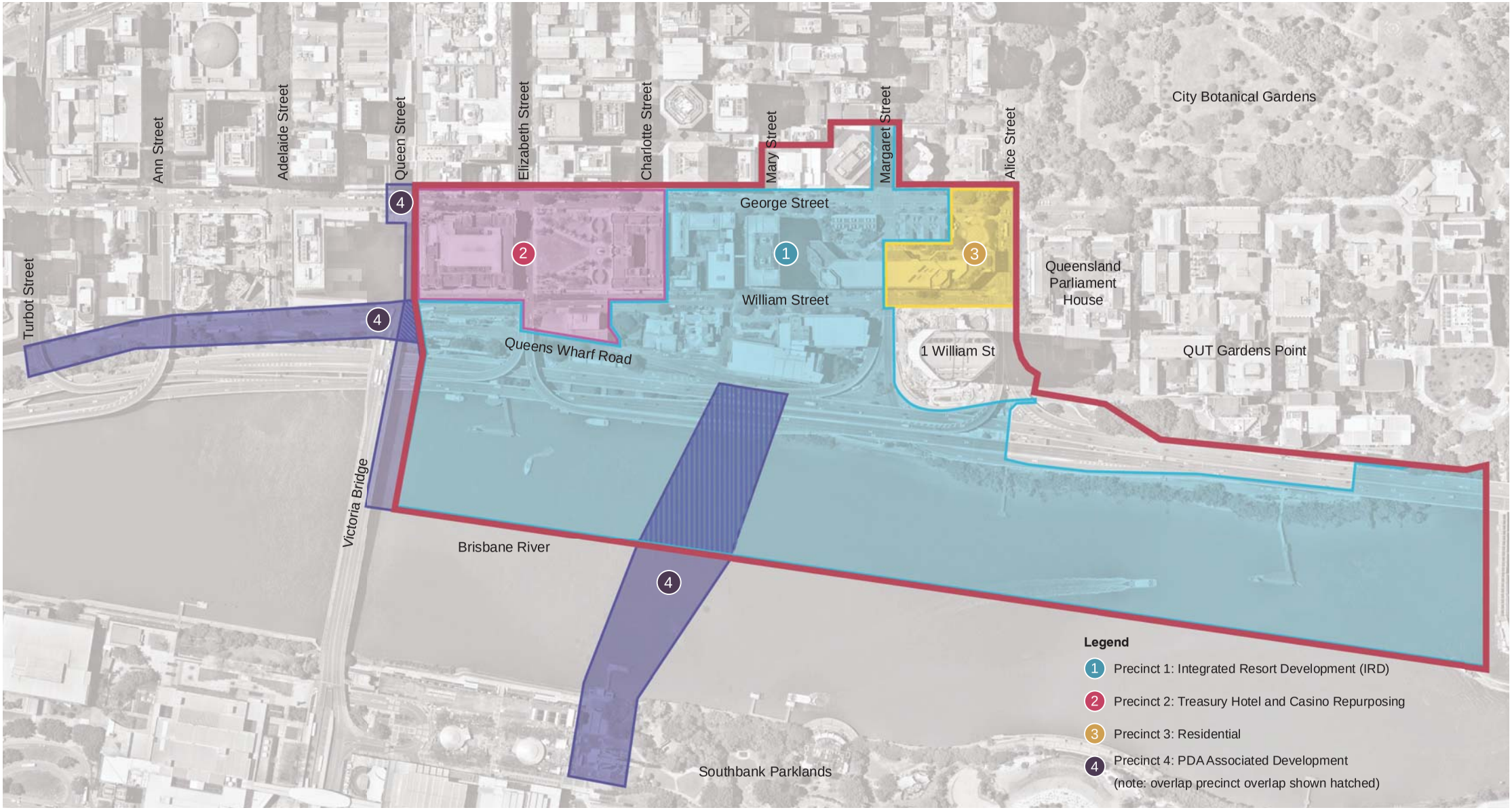
DRAWING NAME:
AREAS PROPOSED FOR PDA ASSOCIATED DEVELOPMENT

SCALE
NOT TO SCALE

DRAWN BY: URBIS (KT)

DATE: 06/02/2017

REVISION: L



DESTINATION BRISBANE CONSORTIUM

CLIENT NAME:
DESTINATION BRISBANE CONSORTIUM

PROJECT NAME:
QUEENS WHARF BRISBANE

DRAWING NAME:
POD PRECINCT PLAN

SCALE
NOT TO SCALE

DRAWN BY: URBIS (KT)

DATE: 06/02/2017

REVISION: L

DESTINATION BRISBANE CONSORTIUM

CLIENT NAME:
DESTINATION BRISBANE CONSORTIUM

PROJECT NAME:
QUEENS WHARF BRISBANE

DRAWING NAME:
POD SUB-PRECINCT PLAN

SCALE
NOT TO SCALE

DRAWN BY: URBIS (KT)

DATE: 06/02/2017

REVISION: L

4.0

DESIGN CONSIDERATIONS

Pole Design

All new poles throughout the precinct shall be in keeping with the characteristics of the site if possible. The poles shall ideally be of uniform height and spaced at regular intervals between the trees and shrubs (subject to integration with the final detailed design).

The poles shall be provided in the various zones outlined above. Furthermore, the structure of each pole shall be dictated by functionality of each of the components that form the pole.

Pole Components

The following components shall form an integral part of the overall pole design and may have designated elements that include:

- Road / Area Lighting, on every pole for the safe movement of pedestrians and vehicles in various parts of the precinct
- A signature beacon on top of lighting poles. This colour-change feature can allow the precinct to further celebrate and coordinate with events and functions, ie. St Patrick's Day (green) or Breast Cancer Awareness functions (pink). To comply with **Volume 1** – *Planning and Design Report Module 14.1 Maritime Safety Code*, the beacons that are situated along the waterway have appropriate shields to avoid interference with safe waterway navigation. These shields can be positioned on the water side of the beacons to eliminate issues of glare, visual acuity, flickering and conflicting maritime navigation colours. It is noted that any signature lights employed on luminaires to pedestrian zones adjacent to the river can be such that any colour changing lighting does not impede with the lighting provided by the Harbour Master and under the Maritime Safety Code for safe navigation of the Brisbane River.
- The design and implementation of any luminaires capable of producing colour and washes can be such that the resultant effect is restrained and sophisticated without being ostentatious.
- All lighting deployed near the river that may have a potential impact on maritime traffic will be orientated and directed away from the river such that disability glare is managed to within acceptable standards.
- Integral gobo projection instruments for the projection of leaf breakups and abstract patterns.
- Integral DMX controlled red, green, blue and amber (RGBA) coloured lighting effects to allow the street-scape to be 'painted' with colour to commemorate special events and occasions.
- Provision only for future catenary wiring/lighting (where required, if wires cannot be mounted on other structures)
- Provision only for microcells (where required)
- Provision only for street name signage (if required)
- CCTV (where required) – refer to CPTED report for details
- Help (duress) Points (where required)
- Provision only for emergency warning system: speakers and in some cases LED signs (where/if required)
- Pedestrian scale lighting for pedestrian walkways.
- Pedestrian crossing lights and buttons (where/if required) - refer to and coordinate locations and types with the Traffic Management Report/Consultants
- Provision only for traffic signage (where/if required)
- Provision only for way finding information.

- Braille signage to assist persons with visual impairment (where/if required) – refer to and consult with Access Report and Access Consultant
- Where practical, to minimise street clutter, the pole design shall be such that allow for the integration of other elements such as street signs, wayfinding features and other items that, would, under normal circumstances, be provided on dedicated poles.

Traffic lights for vehicular traffic control may be mounted separately; mostly on infrastructure identified in the Traffic Consultant's Traffic Management Report

There is a possibility that embellishments such as banners and flags may be introduced periodically to mark special events, as such, a provision could be made for these.

Where used in zones which abut the foreshore, the lighting may include features that either direct light away from vegetation and the aquatic habitat or be provided with louvers to minimise spill lighting to these areas.

Pole Functional Zones

The intent is to in-so-far-as practical, reduce and declutter the street. Thus preference should be given to a multifunctional pole design.

The functional zones of each pole should be considered as a TOP ZONE and a BOTTOM ZONE particularly as not all of the Pole Components outlined above are required at each pole location. The final zoning and heights need to be determined with the relevant codes, standards and requirements.

It is anticipated that the pole design shall be such that all elements are flush mounted with a pole diameter of no greater than 300mm with all elements and including the flush mounting of luminaires and recessed or semi-recessed equipment like speakers.

The ultimate vision for the 'Street Lighting' is to maintain an elegant, slender pole design without compromise to the structural integrity and yet have a consistent visual appeal throughout the precinct.

To avoid mal-use by the general public, the pole design shall also be one that does not lend itself to be climbed. Any potential footholds shall be avoided insofar as practical.

Major Events

Colour changing and dynamic effects lighting may be considered and would form part of a special event overlay for the precinct.

To commemorate and celebrate major and significant events in the City, the implemented poles may be capable of providing infrastructure for such events for example:

A signature beacon atop of the pole could have the ability to change colour using a DMX controllable luminaire. The colour could be customisable to theme the lighting to suit the event.

Public Art

The site-wide lighting designer shall be actively involved with the development of concepts for the integration of artificial lighting within installations and elements within the urban artists' scope. Where applicable, the implemented solutions shall demonstrate integration and sympathy to the environment and respectful to any sensitive aspects such as heritage and/or cultural issues that may exist.

Pedestrian Bridge

All lighting implemented for pedestrian traffic to the pedestrian bridge shall be self-contained and designed such that all lighting is managed and contained with the confines of the bridge. This is of particular importance where the pedestrian bridge passes over the Riverside Expressway.

5.0 IMPLEMENTATION

Implementation Strategy

The implementation of the Lighting Management Plan may not occur concurrently and may be staged to suit activities on site.

With this in mind, reference shall be made to this Lighting Management Plan to ensure all light sources, luminaires and the technical components of the various components are consistent within the same product family.

Each progressive project throughout the complex shall seek to exploit advancements made in light quality, control and technology for the long term benefit of the site whilst maintaining the look and feel of a visually flowing homogenous design.

Design Methodology

To ensure a site-wide coherent design solution regardless of the date at which a design commences, the following outlines the preferred methodology to be adopted at the inception of any project in the complex:

- Review of the Lighting Management Plan in conjunction with the site Master Plan
- Study similar exemplar installations
- Assess the impact of the design in the context of adjacent areas (including an assessment of any proposed changes/ developments to key adjacent/ significant areas etc)
- Meet with relevant stakeholders and external parties such as Heritage and Planning Consultants with expertise in the precinct and other stakeholders
- Make a presentation of the proposed design to the stakeholders and demonstrate how the proposed design meets the requirements of this Management Plan
- Produce appropriate visualisations in context using photorealistic images and sketches
- Produce Environmental, Risk Management and Heritage Impact Statements where appropriate
- Conduct mock-ups or site trials as required

Luminaire to have 7-pin NEMA to allow for the increase in lighting level above the maintained value when needed for major events.

6.0 CONTROLS

Lighting Controls

Lighting control shall comprise of two components:

Day to Day Controls

Time switched controls that will initiate and extinguish luminaires on a daily basis either on a predetermined schedule by means of a time switch or automatically via a photoelectric (PE) cell for dusk to dawn operation.

Typically this means of control shall be reserved for the functional lighting component of the lighting system possibly extending to any signature beacon luminaires as well.

Further, with the use of LED technology throughout the precinct, the day to day operational strategy of the road/area lighting could include passive detection devices such that these luminaires can dim to code compliant minimum illuminance levels during periods of reduced activity. This system could also work hand-in-hand with the lighting system to ensure that optimum illuminance levels are maintained throughout the maintenance cycle of the installation (ie luminaires are dimmed to achieve appropriate illuminance levels initially and then progressively increased in intensity as the installation ages – thereby ensuring optimum illuminance levels at all times).

Lights not to dim below the minimum level of the Australian Standard with the maintenance factor is taken into consideration

Installation to be based on 3 year maintenance period

Personnel Management Control

Any of the feature lighting components of the lighting system would be initiated by authorised personnel on site. These would be luminaires such as gobo projectors and thematic colour washes. The initiation of these would be on an as required basis when the precinct is celebrating a city-wide event. These luminaires would be c switches the appropriate lighting on at the relevant times. The second element is the personnel management.

The implementation of these controls strategies would ensure that the lighting systems are fully maintained and operational in accordance with the objectives of this Lighting Management Plan. Additionally, this can assist with the maintenance and control of the lighting for the precinct and allow for adjustment to the various lighting elements and levels to be made in an interactive manner and/or generally operate autonomously.

The following are items to be considered prior to settling on an appropriate lighting control strategy:

- Level of technology required.
- The dimming and controls of luminaires for both static and dynamic lighting effects (to celebrate events)
- Overlaying of various luminaires and their respective effects such that the system can be tiered and layered to flexibly cater for the day to day operations and high impact events
- Energy considerations (allowing luminaires to dim to a minimum level during periods of low activity)
- Photoelectric (PE) cell controls for dusk to dawn operation
- Multichannel astronomical time switch controls for the switching of feature lighting components at various curfew during the night
- Provisions and procedures for the periodic special event lighting this may include gobo projections and/or colour washes
- Dimming of street and pedestrian lighting components to for periods of low activity and to cater for degradation in lumen output of the luminaires

To facilitate the desired lighting control flexibility, cabling requirements for each area zone and element shall be considered holistically so that a master cabling and control strategy could result if appropriate. The cabling and control system shall address current and future control requirements of the lighting system. In-so-far-as possible, the electrical infrastructure shall be fully utilised and expandable to accommodate the level of control required.

needs to be compatible with 7-pin NEMA

7.0 SAFETY

Perception of Safety

To increase the perception of a safe, inviting nocturnal environment, the atmosphere that needs to be generated is one that promotes a welcoming, warm and safe surrounding. This shall encourage the public to move freely through the precinct without feeling intimidated. This is generally achieved, in part, by a positive lighting design system that correctly and comfortably illuminates the areas in an appropriate manner creating a desired visual hierarchy.

It is noted that whilst appropriate illuminance levels do have an impact on safety, considerations can also include other elements such as facial recognition, contrast ratios, glare and colour rendering as well as the overall atmosphere created.

The QWBIRD Lighting Management Plan considers the holistic use of light and considers other aspects rather than just target illuminance levels prescribed in AS1158. A successful lighting design pivots on the subtle differences between light, shadow and contrast, rather than merely illuminance levels.

Principles Affecting Perception of Safety

The following principles can be applied to maintain and enhance the sense of visual security within the precinct.

- Appropriate management of disability and veiling glare. Typically this shall be achieved by the appropriate integration of light sources and the placement of luminaires
- The performance characteristics of the closed circuit television (CCTV) equipment. It is noted that new digital imaging technologies can function at considerably relatively lower light levels than previous technology
- Improved illuminance is only one contributor to making an area feel safe. All issues regarding integration between security and the lighting design must be coordinated in close collaboration with the stakeholder and relevant local authorities to yield a robust resilient site wide security strategy
- Luminaires shall be designed to deter vandalism and malicious damage
- The selected light source shall be of appropriate colour rendering as not only will this yield an improved aesthetic but also enhance the perception of security and wellbeing
- All way finding elements such as directional signs, street names and maps must be adequately illuminated without veiling reflections or glare to pedestrians and motorists alike
- The elemental palette that makes up a luminaire shall comprise of components that operate independently without other components and can be readily replaced in the event of malfunction or damage.

8.0

MAINTENANCE

Maintenance

Luminaire maintenance should be undertaken in accordance with the manufacturers' recommendations.

Where conventional technologies are utilised, it is recommended that the light sources be replaced on a bulk, site wide basis.

Where solid state light sources are utilised, these shall have a minimum service life of 50,000 hours at which point the luminous flux drops down to 70% of the initial output. In this instance the light engines could be modular and replaceable such that luminaires do not need to be replaced.

All pedestrian lighting implemented to the pedestrian bridge shall be such that is completely serviceable off the bridge without impact to the operations of the REX and not requiring any fall arrestors or specialist safety equipment to facilitate maintenance.

The appropriate training of facilities personnel and maintenance staff is essential for the facility to present well and be respected by patrons. This training will not only empower the staff but also verse them into the technical aspects of the installation and the lighting design principles and objectives.

9.0

ENERGY EFFICIENCY

Energy Efficiency & Environmental Considerations

The lighting design for the QWBIRD shall implement solutions which take into account environmental impacts by means of balancing a number of issues.

Sustainability is paramount as well as energy conservation including ongoing maintenance costs. To this end, the use of LED light sources will be maximised.

Whilst the environmental sustainability aspects can be addressed with the selection of the light source/luminaire selection, a responsible approach is still required with respect to placement to facilitate maintenance.

Master controls may be applied and be connected to time switch controls and/or photoelectric cells for the spaces globally.

The detailed lighting may be designed to preserve and protect the night-time environment particularly with respect to the obtrusive effects of lighting - again, management strategies must be implemented to manage this within the guidelines of the relevant standards by means of 'cut-off' shields and shielding as appropriate.

Luminaire placement and aiming shall be such that all light propagated from a luminaire is emitted below the horizontal plane. In the event that luminaires are required to be aimed above the horizontal plane, all light emitted must strike a solid surface thereby managing the upward light component which could potentially contribute to night time sky glow. (with the exception of vegetation lighting and event lighting which shall be managed appropriately)

Visual comfort shall be considered to manage glare and spill lighting to adjacent properties – particularly residential properties either in the site or adjacent to the site is to be ensured by the minimisation of glare - sky glow and spill light on to neighbouring areas.

To ensure optimum sustainability, the lighting controls shall be flexible such that energy consumption can be minimised.

10.0

RECOMMENDATIONS AND TECHNICAL GUIDELINES

Recommendations

Illuminance Levels

To promote the appropriate appeal for the QWB precinct, it is recommended that illuminance levels adopted be as per those prescribed in the AS1158 suite of Standards. Typically illuminance levels will be in the order of 7 lux to 21 lux depending on space usage.

Luminaires

To ensure sustainability and for compliance with AS4282, it is recommended that LED light sources are considered throughout the QWBIRD. Not only will this result in improved illuminance levels but also assist with increased visual acuity as a direct result of the high colour rendering light produced by these sources. The benefits of this will manifest with promoting an air of increased perception safety as well as improving CCTV footage.

Pole Design

The QWBIRD merits a high profile public realm lighting system. The lighting system needs to be flexible enough to accommodate for a variety of elements including (as needed):

- Public safety lighting
- Vantage points for CCTV
- Locations for way finding signs
- Locations for help call points
- Provision for event lighting
- Provision for Wi-Fi
- Provision for small power

The above need to be seamlessly integrated within a pole designed to be sympathetic with the aesthetic needs of the QWBIRD precinct.

Technical Guidelines

To deliver the vision the QWBIRD has with respect to pedestrian lighting of the public realm, the following technical guidelines should be considered:

Characteristic	Recommendation
Light Source	*LED*
Colour Rendering Index	*CRI 85+ (up to 95 in critical areas)*
Pole Type	*Integrated pole*
International Protection (IP) Rating	*IP65*
IK Impact Protection	*IK08* IK10 preferred
Ambient Temperature	*55°C*
Luminaire Protection	*Integral surge protection*
LED McAdam Shift	*2 McAdam Step Ellipse*
Colour Temperature Council's LED installations are 4000K	*3000K or as considered appropriate*
Lowest Maintained Illuminance Level	*P2 (AS1158)*
Highest Maintained Illuminance Level	*P6 (AS1158)*

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