PRIMEPORT
TIMARU

PrimePort

Lighting Management Plan

PRIMEPORT TIMARU

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Document History and Status

Revision	Date	Author	Reviewed by	Approved by	Status
A	03/12/21	M Dent			Draft
B	10/12/21	M Dent			Draft
C	16/03/22	M Dent	J Bretherton	J Bretherton	Issue

Revision Details

Revision	Details
A	Draft issue
B	Draft issue to TDC
C	Submission to TDC

PrimePort Approval

Revision	Date	Name	Signed
C	06/04/22	P Melhopt	

TDC Approval

Revision	Date	Name	Signed
C	22/07/2022	H Barrell	

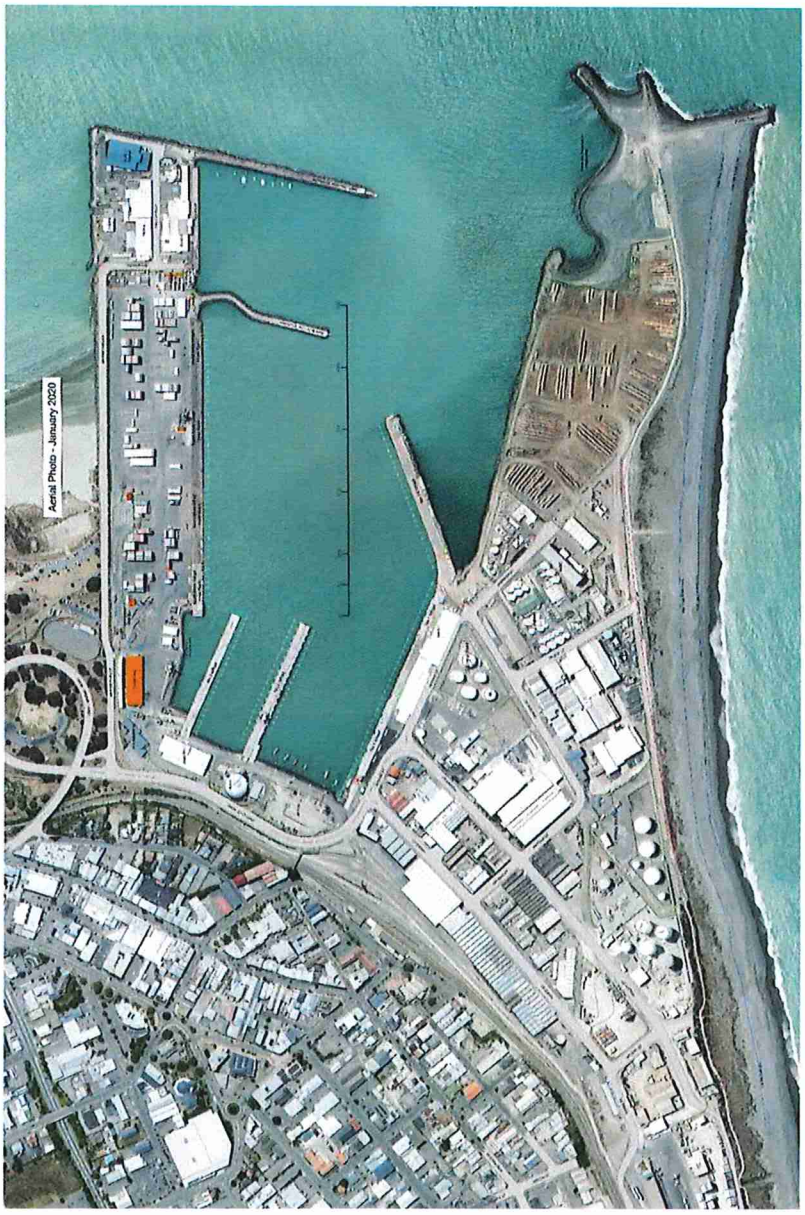
1 Introduction

1.1 General

PrimePort Timaru is a multi-freight port servicing the central and southern regions of the South Island.

The Timaru port functions as a 24/7 import-export operation handling a wide range of products including:- containers, construction steel, cement, logs, stock feed, fertiliser, petroleum, bulk liquid products and special cargos. Medium-sized cruise vessels are also regular visitors to the port.

Timaru is New Zealand's second largest fishing port. It is home to several deep sea trawling vessels and a number of inshore fishing vessels. There are two major fish processing plants adjacent to the fishing harbour.



1.2 Objectives

This Lighting Management Plan (LMP) provides guidance and objectives for the management and development of exterior lighting at PrimePort, consistent with the priority of workplace health and safety, and the functional requirements of an operational port.

The port is a dynamic outdoor workplace with heavy equipment and mobile plant in common use, in all weather conditions, and during both daylight and darkness hours. That high risk environment necessitates lighting in accordance with industry best practice, as defined in this LMP, to support safe and efficient operations.

Lighting installations must also feature the efficient use of energy and resources as much as practical, within the application constraints.

The LMP shares the objectives of the Timaru District Plan (TDP) in relation to the minimisation of adverse environmental effects, and uncompromised health and safety beyond the port.

For the purposes of this plan, PrimePort covers the area defined by the PORTZ special purpose zone of the draft Timaru District Plan (TDP). The full extent of the PORTZ zone will be confirmed following notification of the proposed District Plan in 2022.

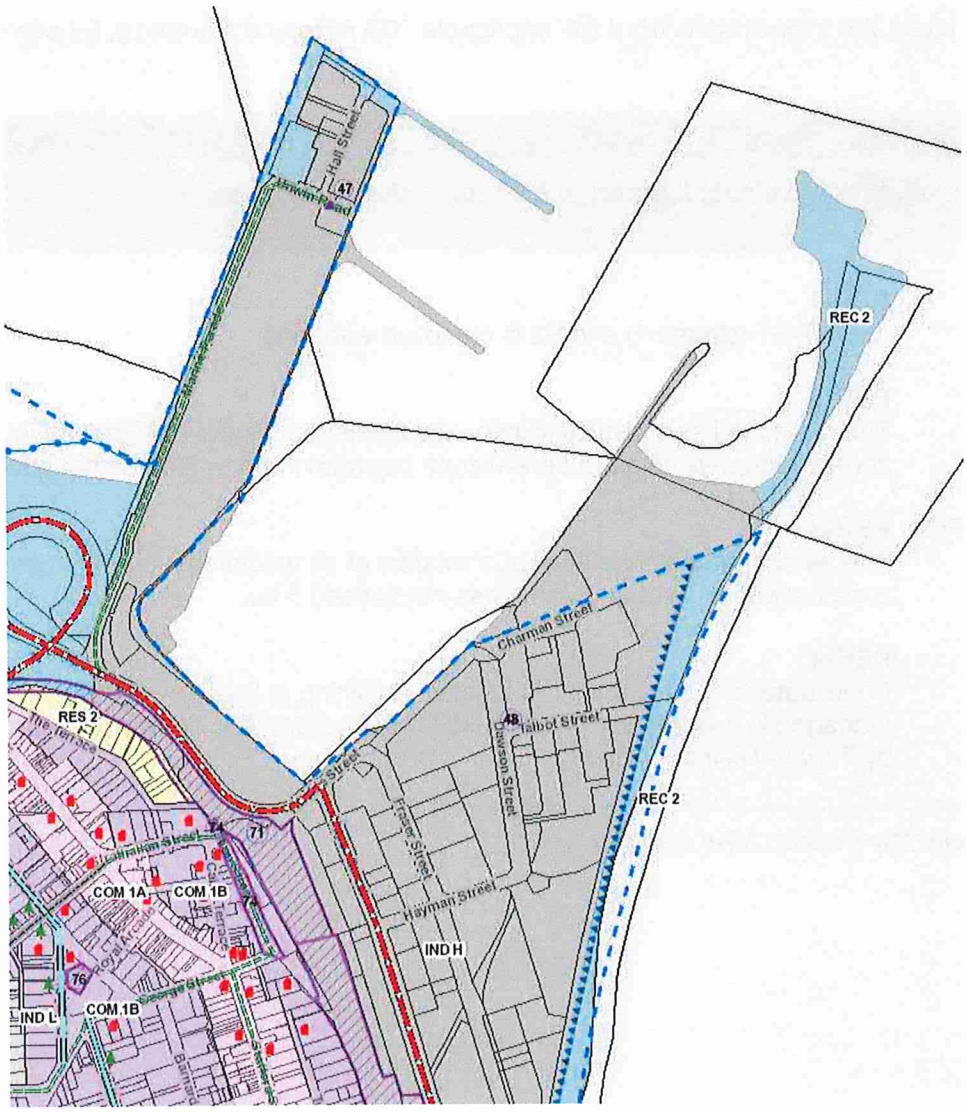


Fig. 2. Proposed PORTZ Zone Area Plan (draft Timaru District Plan extract).

1.3 Scope

The LMP addresses all general aspects of outdoor lighting design and management, with particular emphasis on the minimisation of obtrusive effects beyond the PORTZ zone.

Although primarily relating to new lighting installations and developments, the LMP is also intended as a reference for the improvement of existing installations where opportunity exists through maintenance or other initiatives.

In view of the evolving nature of both port operations and lighting technology, the LMP is intended to be a 'live' document which will be developed in conjunction with those factors, and will also include additional input and reference when available.

1.4 Timaru District Plan (TDP)

The draft TDP defines a special purpose zone for Timaru Port (i.e. PORTZ zone) which recognises the industrial nature and scale of the port, its strategic importance, and its 24-hour operation. The proposed PORTZ zone provisons for the management of light include specific rules and standards for protection to neighbouring residential properties, and reference to the PrimePort LMP for the management of obtrusive lighting effects otherwise.

Refer to Tables 1, 2 & 3 for extracts from the applicable TDP rules and standards, for permitted activity.

Rules	
LIGHT-R1	**Outdoor artificial lighting outside light sensitive areas**
Special Purpose Port Zone	**PER-1** LIGHT-S1 (clause 1) and S2 is complied with; and **PER-2** The horizontal and vertical illuminance levels (above the background level) at the zone boundary with a residential zone between 10pm – 7am do not exceed 5 lux. **PER-3** The vertical illuminance level at a window of an adjoining property in a residential zone between 10pm and 7am does not exceed 5 lux. **PER-4** If the outdoor artificial light is located adjoining a light sensitive area, it must be managed in accordance with the LMP (insert reference), submitted to and approved by Timaru District Council.

Table 1. draft TDP PORTZ Zone Rules - Light

Standards	
LIGHT-S1	**General lighting standards**
All zones (excluding PORTZ)	1. All exterior lighting must be oriented so that light is emitted away from any adjoining and adjacent properties. 2. N/A 3. N/A
LIGHT-S2	**Traffic safety on roads**
All zones	1. Outdoor artificial lighting operating on any site between sunset and sunrise must not exceed the threshold increment limit stated in Table 3, on any state highway, arterial or principal road, calculated within each traffic lane in the direction of travel. 2. All exterior lighting must be oriented so that light is emitted away from any state highway or arterial or principal roads, or any oncoming traffic.

Table 2. TDP PORTZ Zone Standards - Light

	Zones and Areas			
Threshold increment	**Rural lifestyle zone; Natural open space zone; Light Sensitive Areas**	**General rural zone; Settlement zone; Open space zone; Māori purpose zone**	**General residential zone; Medium density residential zone; Neighbourhood centre zone**	**Town centre zone; Local centre zone; Large format retail zone; City centre zone; Sports and active recreation zone; General industrial zone; Special Purpose Port zone**
	15 percent (based on adaption luminance of 0.1 cd/m^2)	15 percent (based on adaption luminance of 0.1 cd/m^2)	15 percent (based on adaption luminance of 1 cd/m^2)	15 percent (based on adaption luminance of 2 cd/m^2)

Table 3. Threshold Increment

2 Existing Lighting

2.1 General

The exterior lighting at PrimePort has evolved in conjunction with changing operations, layout, and technology, and also with advancements in safety standards and lighting application. As a result there is range of fixture types and condition across the site.

Existing lighting commonly utilises metal halide type lamps, and is mounted on the side of buildings or structures for local application, or on poles for wide area application. Lighting poles vary in height up to approximately 34m, with multiple fixtures mounted on halo type headframes.

For the purposes of this plan, only lighting installations which provide relevant reference to future developments or upgrades, through scale/prominence or solution integrity, are included in the LMP. Those installations are as follows.

2.2 Installations

2.2.1 Railway Corridor (2021 – 2022)

- 6 poles (18 – 20m)
- 24 x 700W LED, high asymmetry floodlights (Midstream Titan 720)
- CCT = 5000°K
- 12° - 15° tilt
- 27 – 66 Lux (horiz. @ 1.0m), MF=0.8
- Refer project file for detailed layout and performance data

2.2.2 North Mole Container Terminal & Wharf (2021-2022)

- 10 poles (1x12m, 1x19m, 1x20m, 2x25m, 5x30m)
- 67 x 700W LED, high asymmetry floodlights (Midstream Titan 720)
- CCT = 4000°K
- >20m = 0° - 10° tilt
- ≤20m = 10 - 26° tilt
- 17 – 108 Lux (horiz. @ 1.0m), MF=0.8
- Refer project file for detailed layout and performance data

2.2.3 Log Yard (2021)

- 8 poles (@30m)
- 25 x 1580W LED, medium beam asymmetric floodlights (Philips OptiVision LED gen 3 - BVP527 OUT T20 LED2210 757 A55-MB (L))
- CCT = 5700°K
- 10° tilt
- 10 – 220 Lux
- Refer project file for detailed layout and performance data

3 Development

3.1 General

New exterior lighting developments and upgrades shall be based on an engineered design produced by a professional lighting designer with relevant expertise and experience in comparable applications.

3.2 Design

Lighting designs shall be based upon a clearly defined brief which includes the following:

- functional requirements
- application area
- interfaces
- control
- Location constraints (i.e. fixtures & poles)

Designs shall be developed in accordance with the standards and features defined subsequently in this LMP. It shall also take into account; Safety in Design (SID), maintenance, durability, economics, and sustainability considerations.

Designs shall be prepared using industry standard software such as Dialux Evo or AGI 32, with fixture specific photometric data, and accurate set-out, on a site plan for the whole application area.

The completed design shall be documented in a report which clearly addresses the inputs and features outlined above, defines the solution and anticipated performance, and is complete with substantive support documentation (e.g. layout drawings and design outputs).

The design report shall form the basis for an installation delivery process, as determined by PrimePort

3.3 Standards

In addition to any specific requirements of the design brief, all new lighting installations, upgrades, and maintenance replacements shall be designed in accordance with the following standards:

AS/NZS 1680.5	*Outdoor Workplace Lighting*
AS/NZS 1158	*Lighting for Roads and Public Spaces*
AS/NZS 4282	*Control of the Obtrusive Effects of Outdoor Lighting*

3.4 Illuminance Recommendations

Refer to *Table 4. Recommended Light Technical parameters for General Outdoor areas* for a summary of applicable design illuminance guidelines for typical areas, based upon the minimum requirements of AS/NZS 1680.5, with supplementary input from PrimePort derived from specific operational requirements and practical experience.

In any situations where the appropriate lighting performance requirements are uncertain, the overriding determinant shall be *health and safety.*

Activity	Description	Illuminance (Lux)			
		E_{AV}	E_{MIN}	E_{MAX}/E_{AV}	GR $_{MAX}$
Assembly, fabrication, manufacture, or maintenance	General access and movement around work areas and related areas	80	10	5	45
Wharf operations	*Mooring* *Ship loading & unloading*	*50*	*20*	*3*	*45*
Container handling	*Crane and forklift operations for container set-down, uplift, and transfer; inspection & supervision; Site inducted personnel access only.*	*40*	*20*	*3*	*45*
General loading and unloading - manual	Loading and unloading of trucks by manual labour, including manually moving objects between the truck and other forms of transport	40	5	5	45
General loading and unloading - forklift	Loading and unloading of trucks by forklift, the area surrounding the truck, and the route of the forklift	40	5	5	45
General storage - pedestrian access with through traffic	Large open area for storage of large objects: placement , movement, and retrieval of objects by machines with integrated movement and working light; general through traffic; controlled pedestrian access; no access to the general public.	20	2.5	7	50
General storage - pedestrian access	Large open area for storage of large objects: placement , movement, and retrieval of objects by machines with integrated movement and working light; through traffic - internal only (site inducted personnel); site inducted pedestrian access; only.	10	1	7	50
General storage - no pedestrian access	Large open area for storage of large objects: placement , movement, and retrieval of objects by machines with integrated movement and working light; minimal through traffic; no pedestrian access; no access to the general public.	5	1	10	55

Table 4. Recommended Light Technical parameters for General Outdoor areas

3.5 Light Colour

3.5.1 General

Artificial light enables visibility and supports activity during darkness hours. However it can have adverse or obtrusive effects on flora and fauna, human biology, aesthetic perception, and astronomical observation. Furthermore, the spectral profile of the light can significantly influence the magnitude of such effects.

The relationship between the spectral profile of lighting and the nature of lighting effects is complex and varied. However a common perspective is that the blue part of the spectrum is most associated with those effects.

Light sources are commonly classified according to their colour appearance, based on equivalence with the appearance of a black body radiator at a reference temperature (°K). That appearance can be derived from differing spectral profiles. However, high values of corelated colour temperature (CCT), with a cool appearance, commonly have strong emphasis in the blue part of the spectrum, and are therefore more implicated with negative environmental effects. For that reason entities such as the Dark Sky Association, and the Royal Society Te Aparangi[1] recommend sources with a CCT of 3000°K or less to minimise environmental impact.

The spectral profile of lighting, and the associated CCT, are determined by light source technology, and manufacturing variables, which also affect performance, and application characteristics. The available light output characteristics for fixtures is therefore limited by manufacturer response to standard market requirements and applications.

3.5.2 PrimePort Application

PrimePort is a large scale industrial facility with a coastal marine environment and demanding visual requirements for safe and efficient 24/7 operation, in all weather conditions. In combination with a typical pole mounted installation for open areas, that also necessitates relatively high output lighting fixtures.

The CCT of suitable fixtures is therefore a balance of the various factors outlined above.

The existing area lighting includes high intensity discharge (HID) sources, such as high pressure sodium vapour and metal halide, and newer LED fixtures with a range of CCT reflecting the evolving nature of that technology.

With the current dominance of LED fixtures for this type of application, and the available output options with suitable performance, new lighting installations shall have a **CCT of ≤4000°K,** where practical.

For areas of particular environmental sensitivity, a CCT design objective of 3000°K should be referenced.

[1] Blue Light Aotearoa: Royal Society Te Aparangi

3.6 Fixtures

Light Fixtures for general exterior application must incorporate the following features:

(a) Robust industrial construction
(b) Corrosion protection suitable for a coastal marine environment
(c) ≥ IP66 ingress protection
(d) ≥ IK08 impact protection
(e) Current best practice light source technology (i.e. LED)
(f) Collocated control gear, with surge protection
(g) DALI-2 control compatible
(h) Internal full cut-off optic control
(i) Flat glass distribution cover

Refer to Fig. 3. *Typical examples of suitable fixture types for general area lighting application.*

3.7 Installation

Light fixtures shall be either pole mounted, or attached to the side of structures, with spacing, mounting height, and layout, resolved to optimise distribution efficiency, minimise obstructions within operation areas, and support the minimisation of obtrusive effects.

Light fixtures shall be positioned and orientated such that their output is directed within the application area as efficiently as possible.

Fixtures with adjustable tilt shall be installed with their flat cover glass in a horizontal orientation, for full downward distribution, where practical. In applications where spacing and/or layout constraints necessitate an **upward tilt orientation**, that shall be **limited to ≤ 10°**, or shielding employed to mitigate upward transmission.

Lighting poles shall be structurally engineered for the applicable wind and gravity loads. They shall also be provided with mounting facilities that are compatible with fixture manufacturer recommendations, and enable accurate aiming and orientation according to the lighting design.

For maintenance and installation access, and an appropriate cost/benefit balance, the default **maximum mounting height is 30m** above ground.

Fig. 3. Typical examples of suitable fixture types for general area lighting application

4 External Effects

4.1 General

New and upgraded existing lighting installations shall be designed with the objective of minimising adverse or obtrusive lighting effects, within the practical constraints of a port environment. To support that objective such installations shall generally be designed in accordance with AS/NZS 4282 *Control of the Obtrusive Effects of Outdoor Lighting*, with supplementary qualifications as outlined below.

AS/NZS 4282 provides comprehensive guidance on the nature of obtrusive effects, design methodology, and mitigation. For clarification, those effects include; light spill, glare, and sky glow.

The TDP defers to this LMP in relation to the management of lighting effects emanating from the PORTZ zone, except for the specific provisions referenced in section 1.4. Those provisions relate to light spill at a residential zone boundary, and the limitation of glare to external roadways, and have the effect of modifying the standard interpretation of *AS/NZS 4282* for the purpose of this LMP.

4.2 Light Spill

In recognition of the functional lighting requirements for port operations and the practical constraints of managing the associated light spill, the draft TDP defines specific light spill limits from the PORTZ zone. With the applicable guidance from AS/NZS 4282, and the practical constraints of the port environment, the combined light spill limitations for the PORTZ zone are provided in Table 5.

<table>
<tr><th rowspan="2"></th><th colspan="3">Light Spill Limits (Lux)</th></tr>
<tr><th>Residential zones*</th><th>Other zones*</th><th>Light Sensitive Areas (LSA)*</th></tr>
<tr><td>Horizontal and vertical illuminance above the background level at a site boundary
Times: 7am – 10pm</td><td>10 Lux</td><td rowspan="2">25 Lux</td><td rowspan="2">Refer Section 5</td></tr>
<tr><td>Horizontal and vertical illuminance above the background level at a site boundary
Times: 10pm – 7am</td><td>5 Lux</td></tr>
</table>

Table 5. Light Spill Limits from draft PORTZ zone * *Receiving Zones*

4.3 Glare

4.3.1 General

Glare is defined as visual discomfort or disability, resulting from excessive brightness or contrast in the field of vision. To limit the glare from new and upgraded lighting, for compatibility with neighbouring zones, the principles of AS/NZS 4282 shall be adopted. In particular the output intensity from fixtures in the normal field of view, and the associated background contrast, shall be limited through efficient fixture selection and output beam utilisation within the application area.

Because of the necessary fixture types and mounting locations, the maximum fixture intensities defined in AS/NZS 4282 shall be regarded as a design objective, rather than an absolute limit.

4.3.2 Roadways

In accordance with AS/NZS 4282 the glare to external roadways users from new lighting installations within the PORTZ zone shall be assessed using the Threshold Increment method. However the limiting value of **Threshold Increment applicable to PORTZ zone installations shall be 15 percent** (based on adaption luminance of 2 cd/m^2), as defined in standard *Light-S2* of the TDP for Traffic Safety on roads. Refer Table 3.

4.3.3 Port Operations

In addition to the perspective of neighbouring zones and external roadways, the control of glare for safe and efficient port operations is a critical design factor. Generally that control shall be in accordance with the following standards:

AS/NZS 1158.1.1 Lighting for roads and public spaces – Vehicular traffic (Cat. V) lighting

AS/NZS 1680.5 Interior & workplace lighting – Outdoor workplace Lighting

AS/NZS 4842. Control of the obtrusive effects of outdoor lighting

Particular emphasis shall be placed on design mitigation to minimise glare in the primary view of drivers, operators, and pilots, including the perspective from vessels in the harbour and approach channels.

4.4 Sky Glow

Sky glow, or the lightening of the night sky from scattered artificial light, is a wide area affect which reduces visual amenity. To limit the sky glow contribution from new and upgraded lighting, the principles of AS/NZS 4282 shall be adopted. In particular, upward light output emissions shall be limited through the use of fixture types with a high degree of vertical cut-off, and minimised tilt orientation.

Because of the necessary fixture types and mounting locations, the maximum upward light output ratios (ULR) defined in AS/NZS 4282 shall be regarded as a design objective, rather than an absolute limit.

In applications where spacing and/or layout constraints necessitate an **upward tilt orientation**, that shall be **limited to ≤ 10°**, or shielding employed, to mitigate upward transmission.

5 Light Sensitive Areas

The draft TDP has identified two penguin habitat areas (Significant Natural Areas (SHA)) and a wahi tapu site in close proximity to the western boundary of the PORTZ zone. All three areas fall under the definition of Light Sensitive Areas (LSA) in the draft TDP. However, in recognition of the operational lighting requirements of the port, and the close proximity, the draft TDP currently exempts the PORTZ zone from the provisions relating to lighting effects to LSAs, and defers to the LMP in that respect.

Obtrusive lighting effects to LSAs shall therefore be managed in accordance with AS/NZS 4282, with an emphasis on lighting layout and orientation geometry which minimises both the direct view of fixtures from LSAs and light spill contribution.

The penguin habitats have established and evolved alongside the long term development of PrimePort. While the existing and, in some cases, relatively new lighting installations and/or fittings' form a major part of the baseline environment for the LSA, overtime, as asset renewal or new fixtures are needed, opportunities to lessen the impact of such fixtures, shall be undertaken.

6 Mitigation

6.1 General

The mitigation of environmental lighting effects to external areas shall be provided through a combination of design and control, to efficiently utilise the light distribution within the application area, and minimise unnecessary lighting use.

The design requirements essentially involve the use of; appropriate design standards, performance requirements, fixture types, source characteristics, and installation arrangements, as defined in sections 3 and 4.

6.2 Lighting Control

New exterior lighting installations shall be provided with control systems which enable the limitation of unnecessary lighting operation through either reduced (i.e. dimmed) output or ON/OFF control. Where possible that control shall be automated according to daylight, time, or operational requirements for normal use. Otherwise the control system interface shall be located to enable direct operator access and thereby support efficient operation.

Consideration should also be given to the prospect of moderating lighting output according to extended or regular periods of reduced visual requirements (e.g. access/circulation instead of loading operations).

In any case the over-riding control priority must be for the lighting control to support safe and efficient port operations, including a manual override of any automatic control functionality.

Wireless control systems are preferred for flexibility, and to support the typical distances and layout arrangements.

7 Monitoring

7.1 General

A survey of light spill at relevant external boundaries is required in conjunction with any lighting developments which have potential to significantly affect existing boundary conditions.

7.2 Light Spill Survey

The default methodology for a light spill survey over extended boundary areas shall consist of outward illuminance measurement, on the vertical plane at approximately 1500mm above ground level, at the boundary defined by the security fence line. The measurement instrument shall be a laboratory calibrated digital illuminance meter, with traceable calibration. The survey documentation shall include the instrument specifications and calibration report.

Surveys shall be carried out under stabilised darkness conditions, with all associated lighting in operation.

The measurement should be undertaken by a suitably qualified professional, in accordance with the instrument's application guidelines.

In addition to recording maximum and minimum illuminance over each perimeter boundary zone, any notable features of the lighting installation or area conditions, including obstructions, shall be recorded, and photographs taken of the general lighting scene.

7.3 Records

An initial light spill survey was undertaken on 13/02/21, prior the referenced developments. Reports relating to that and subsequent surveys can be referenced on separate file.