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Kamay Energy Storage

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for

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1. Introduction

Lighting, Art & Science (LA+S) was commissioned by Colliers to assess the obtrusive lighting impacts associated with the proposed outdoor lighting for the future Battery Energy Storage System (BESS) Kamay Energy Storage (referred to as the Project)..

To inform this assessment, the following scenarios have been evaluated:

- Scenario 1: Existing Kurnell Zone Substation Lighting
- Scenario 2: Project Outdoor Lighting
- Scenario 3: Combination of existing Kurnell Zone Substation Lighting and Project Outdoor Lighting

The assessment has been undertaken in accordance with AS/NZS 4282:2023 – *Control of the Obtrusive Effects of Outdoor Lighting*.



Figure 1 – Proposed site plan

2. Existing Conditions – Existing Outdoor Lighting

The site is located in Kurnell, on Captain Cook Drive and is bounded by:

- **North, South and West:** Towra Point Nature Reserve
- **East:** Captain Cook Drive and Ampol Kurnell Terminal

The Kurnell Zone Substation is currently illuminated by the following external lighting elements:

- Wall-mounted luminaires to the main building (Fig. 2)
- Street lighting mounted to transformer separation walls (Fig. 3)
- Wall-mounted batten luminaires to transformer separation walls (Fig. 4)
- Flood lights mounted to transformer separation walls (Fig. 5)
- Flood lights mounted to elevated steel structures, illuminating the live yard (Fig.6)

The luminaires observed on site utilise older lamp technology, predominantly high-pressure sodium (HPS) lamps with relatively high wattages.



**Figure 2 – Thorn Wallpack Luminaire
Main Building Wall Light**



**Figure 3 – Thorn Civic Street Light
Top of Wall both Ends**

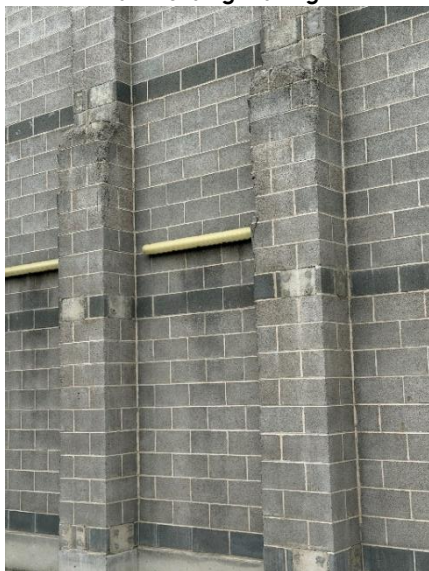


Figure 4 – 2 x Battens Wall Mounted



Figure 5 – Thorn Areapak



Figure 6 – Philips Floodlight – Steel Structure





The existing street lighting along Captain Cook Drive is provided by Ausgrid and consists of timber poles with aerial power lines. As public street lighting is a safety requirement, it is outside the scope of this assessment.

3. Existing Lighting – Obtrusive Lighting Assessment

3.1 Obtrusive Lighting Criteria – AS/NZS 4282:2023

AS/NZS 4282:2023 provides recommended limits for obtrusive lighting as a benchmark for what can reasonably be tolerated from adjacent outdoor lighting installations.

The preface of the standard states “These criteria have been utilized to ensure that the document is both credible to the interested parties and pragmatic in application”.

The standard sets limits for several lighting technical parameters (LTPs) based on:

- Environmental Zone (Ambient Lighting Conditions)
- Time of night (non-curfew and curfew periods).

Curfew period: Default 11:00 pm to 6:00 am (modifiable by the consent authority)

▪ **Environmental Zones:**

- Intrinsically dark (A0)
- Dark (A1)
- Low district brightness (A2)
- Medium district brightness (A3)
- High district brightness (A4)

The higher the ambient conditions, the higher the allowable obtrusive lighting limits. Environmental zones reflect the nature of the surrounding areas, expected ambient lighting, and activity levels.

Given the site’s location adjacent to Towra Point Nature Reserve, the applicable environmental classification for this assessment is: A2 – Low District Brightness.

Table 3.1 — Environmental zones

Environmental zones	Ambient light conditions	Descriptions/ Examples
A0	Intrinsically dark	UNESCO Starlight Reserve. IDA: Dark Sky Parks, Reserves or Sanctuaries Major optical observatories Other accreditations for dark sky places for example astrotourism, heritage value, astronomical importance, wildlife/ecosystem protection Lighting for safe access may be required
A1	Dark	Relatively uninhabited rural areas (including terrestrial, marine, aquatic and coastal areas) Generally roadways without streetlighting through rural areas
A2	Low district brightness	Sparsely inhabited rural and semi-rural areas Generally roadways without streetlighting through suburban, rural or semi-rural areas other than intersections
A3	Medium district brightness	Suburban areas in towns and cities Generally roadways with streetlighting through suburban, rural or semi-rural areas
A4	High district brightness	Town and city centres and other commercial areas Residential areas abutting commercial areas Industrial and Port areas Transport Interchanges
TV	High district brightness	Vicinity of major sport and event stadiums during TV broadcasts
NOTE Zones A0 and A1 would normally have a minimum area of 50 ha.(0.5 km ²). There may be smaller environmentally sensitive areas.		

Table 3.1 from AS/NZS 4282:2023 – Environmental zones

3.1.1 Obtrusive Lighting Parameters

Four parameters are considered in an Obtrusive Lighting assessment:

Vertical illuminance – This is a measure of the general light spill onto adjacent land or properties.

In accordance with AS/NZS 4282:2023, calculations were undertaken at a distance of 10 metres within the affected area, with measurement planes oriented perpendicular to the site boundary.

Only direct light from luminaires is considered in the assessment. Reflected light is excluded, as it is variable and cannot be reliably quantified.

Based on A2 – Low District Brightness Environmental Zone, the maximum vertical illuminance recommended during curfew by AS/NZS 4282 is 1.0 lux.

- **Luminous intensity** – This is an indication of the potential for the installation to cause glare. The luminous intensity does not reduce with distance. It is used as an indication of the level of discomfort, or the disabling effect that the lighting might cause. The luminous intensity relates to a specific direction and will depend on the light distribution of the light fitting and the direction of view.

Based on A2 - Low District Brightness Environmental Zone, and curfew conditions, the maximum luminous intensity recommended by AS/NZS 4282 is 1,000 cd.

Threshold Increment - This is a measure of the effect that the lighting will have on the ability for drivers to see objects and signs in the surrounding streets. The Threshold increment reduces with distance and as the angle between the direction of view of the driver and the light source increases. The recommended limit for dark surrounds is 20% based on an adaptation luminance of 0.2 cd/m².

- **Upward Light Ratio (ULR)** - This is used as a measure to limit direct spill light to the sky. It is a proportion of the luminous flux of an installation that is emitted at and above the horizontal. Based on A2 - Low District Brightness Environmental Zone, the maximum Upward Light Ratio recommended by AS/NZS 4282 is of 1%.

Table 3.2 — Light technical parameter limits

Zones	Maximum vertical illuminance (E_v) lux		Threshold increment (TI)		Upward Light Ratio
	Non-curfew	Curfew	Maximum TI %	Default Adaptation level (L_{ad}) cd/m ²	Maximum ULR _S or ULR _L
A0	0 ^a	0.0	N/A	N/A	0.00
A1	2	0.1	20	0.1	0.00
A2	5	1	20	0.2 ^b	0.01
A3	10	2	20	1	0.02
A4	25	5	20	5	0.03
TV	N/A	N/A	20	10	0.08

^a For A0, E_v shall be as close to zero as practicable without impacting safety considerations.

^b For an internally illuminated sign in a A2 zone, $L_{ad} \leq 0.25$ cd/m²

Table 3.2 from AS/NZS 4282:2023 – Light Technical Parameter Limits

Table 3.3 — Maximum luminous intensities per luminaire

Zone	Luminous intensity (I), cd		
	Non-curfew Level 1 (L1)	Non-curfew Level 2 (L2)	Curfew
A0	See Note	See Note	0
A1	2 500	5 000	500
A2	7 500	12 500	1 000
A3	12 500	25 000	2 500
A4	25 000	50 000	2 500
TV	100 000	165 000	0
NOTE For A0, I shall be as close to zero as practicable without impacting safety considerations.			

Table 3.3 from AS/NZS 4282:2023 – Maximum luminous intensities per luminaire

3.2 Assessment Methodology – Existing Lighting

To assess existing lighting on the site, AGI32 computer-based lighting calculation software was used, performing illuminance-based and spill-light calculations.

Calculations were performed using initial luminaire lumens (MF = 1.0).

Where photometric data were available for surveyed existing light fittings, these data were used in the assessment. For fittings where photometric data were not available, information from an equivalent luminaire was adopted.

In the absence of manufacturer-specific photometric data for the main building wall lights, a representative IES file from the same manufacturer and similar luminaire was used for the lighting calculations. Consequently, the assessment is based on assumed photometric performance and should be considered indicative only.

The use of assumed photometric data introduces a degree of uncertainty; however, the adopted approach is considered appropriate for the purposes of a comparative and indicative assessment.

3.3 Assessment Results – Existing Lighting

- **Environmental Category:** A2 – Low District Brightness
- **Period:** Curfew

Drawing CL-101 (refer Appendix) illustrates the calculated obtrusive lighting parameters associated with the existing lighting installation.

It is noted the existing lighting system predates AS/NZS 4282:2023, including the introduction of Environmental Area classifications and the corresponding obtrusive lighting limits. Earlier versions of the Standard primarily addressed potential impacts on residential receivers; however, such sensitive receptors are not present or applicable to the site.

Furthermore, the existing lighting installation was designed and implemented in accordance with the applicable Ausgrid network standards and operational requirements at the time of installation.

4. The Project Lighting Design

The Project proposes the construction of a Battery Energy Storage System (BESS) within the site, including the installation of sound attenuation walls approximately 8 metres in height surrounding the battery pack infrastructure. These walls are primarily intended to mitigate operational noise emissions associated with the Project equipment.

The proposed walls will also act as a physical barrier to light spill. This will assist in reducing potential light intrusion toward the adjacent Nature Reserve, which is considered environmentally sensitive, and thereby minimise potential impacts on surrounding flora and fauna.

LA+S was engaged to develop a compliant lighting design for the Project. The proposed lighting scheme has been assessed against the relevant Australian Standards, including applicable requirements for outdoor workplace lighting and obtrusive light control.

4.1 Outdoor Workplace Lighting Requirements

Lighting for the BESS has been designed in accordance with:

AS/NZS 1680.5:2012 – Interior and Workplace Lighting – Outdoor Workplace Lighting

The Project operational areas are classified as: **General Storage – Pedestrian Access**

Illuminance levels and uniformity have been designed to meet the recommended criteria for this classification.

TABLE 3.1
RECOMMENDED LIGHT TECHNICAL PARAMETERS
FOR GENERAL OUTDOOR AREAS

Description	Basic operating characteristics	[*] E _{av} lx	⁺ E _{min} lx	[#] U	[†] GR _{max}
Assembly, fabrication, manufacture or maintenance	General access and movement around work areas and related areas.	80	10	5	45
Loading and unloading – manual	Loading and unloading of trucks by manual labour including manually moving objects between the truck and another form of transport.	40	5	5	45
Loading and unloading – forklift	Loading and unloading of trucks by forklift, the area surrounding the truck and 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

^{*}E_{av} = average illuminance (lx)

⁺E_{min} = minimum illuminance (lx)

[#]U = uniformity of illuminance

[†]GR_{max} = CIE glare rating (maximum)

Table 3.1 from AS/NZS 1680.5:2012 – Recommended Light Technical Parameters for General Outdoor Areas

4.2 Stair Lighting Design

AS/NZS 1680.5 does not provide specific recommendations for outdoor stair lighting in workplace environments. Accordingly, the stair lighting design has been based on:

AS/NZS 1158.3.1:2020 – *Lighting for Roads and Public Spaces – Pedestrian Area (Category P) Lighting*; specifically, requirements for **Connecting Elements (stairs and steps)**.

The four sets of stairs within the Project layout have been designed to meet: **Lighting Category PA3**

TABLE 2.4
LIGHTING SUBCATEGORIES
FOR CONNECTING ELEMENTS

Type of area	Applicable lighting subcategory
Subways, including associated ramps or stairways	PE1
Steps and stairways, ramps, footbridges, pedestrian ways	PE2
Ramps and footbridges associated with low use pathways (e.g. in parks and reserves)	PE3

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

Table 2.4 from AS/NZS 1158.3.1:2020 – Lighting Categories for Connecting Elements

TABLE 3.6
VALUES OF LIGHT TECHNICAL PARAMETERS
FOR CONNECTING ELEMENTS

1	2	3	4	5
Lighting subcategory	Light technical parameters (LTP)			
	Average horizontal illuminance ^{a,b,d} ($\bar{E}_h$) lx	Point horizontal illuminance ^{a,b} (E_{Ph}) lx	Illuminance (horizontal) uniformity ^c Cat. P (U_{E2})	Point vertical illuminance ^{a,b} (E_{Pv}) lx
PE1	35	17.5	8	17.5
PE2	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 PA3 in Table 3.5.			
PE3	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 PP3 in Table 3.4.			

Table 3.6 from AS/NZS 1158.3.1:2020 – LTP for Connecting Elements

TABLE 3.5
VALUES OF LIGHT TECHNICAL PARAMETERS
FOR PUBLIC ACTIVITY AREAS (EXCLUDING CAR PARKS)

1	2	3	4	5
Lighting subcategory	Light technical parameters (LTP)			
	Average horizontal illuminance ^{a,b} (E_h)	Point horizontal illuminance ^{a,b} (E_{Ph})	Illuminance (horizontal) uniformity ^c Cat. P (U_{E2})	Point vertical illuminance ^{a,b,d} (E_{Pv})
	lx	lx		lx
PA1	21	7	8	7
PA2	14	4	8	4
PA3	7	2	8	2

Table 3.5 from AS/NZS 1158.3.1:2020 – LTP for Public Activity Areas

5. Obtrusive Lighting Control Strategy

5.1 Luminaire selection and Optical Control

Given the site's proximity to Towra Point Nature Reserve particular consideration must be given to the control of light spill and the minimisation of potential ecological impacts.

To achieve compliance with the obtrusive lighting criteria set out in AS/NZS 4282:2023, and to limit spill light from the Project to adjoining areas, both the photometric performance and physical configuration of the selected luminaires must be carefully considered.

It is understood that the Original Equipment Manufacturer (OEM) will nominate specific lighting requirements for the Project. These requirements shall be incorporated alongside the relevant Australian Standards, not in substitution of them.

Luminaire selection plays a critical role in controlling light distribution beyond site boundaries. Key parameters such as intensity distribution, shielding, mounting height, and aiming angles must be optimised to reduce obtrusive light emissions.

It is acknowledged that compliance with AS/NZS 4282:2023 does not preclude all light spill beyond the site boundary; rather, it establishes acceptable limits for such effects. The design objective is therefore to ensure that all spill light remains within the prescribed thresholds for the applicable environmental zone.

Accordingly, luminaires must be selected with appropriate optical control to satisfy both the functional lighting requirements and the need to minimise obtrusive light, particularly in the context of the site's environmentally sensitive surroundings.

Luminaires with exposed or poorly shielded light sources (e.g. decorative lanterns, opal diffusers, or spherical fittings) should be avoided, as they contribute to glare, sky glow, and inefficient light distribution.

Figure A.1 from AS/NZS 4282 – Control of the obtrusive effects of outdoor lighting gives simplified indication of the different types of luminaires and the impact these might have on obtrusive light:

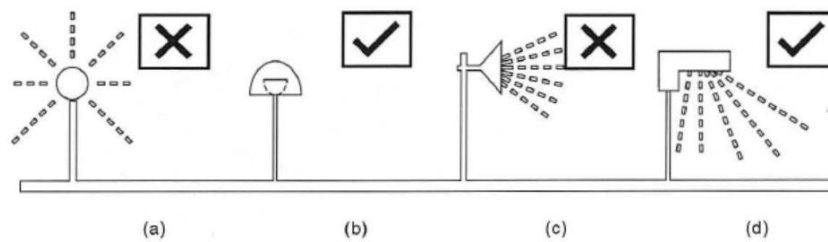


Figure A.1 from AS/NZS 4282:2023 – Lighting Types

Luminaire type (a) represents a sphere style luminaire. The light is emitted equally in all directions. This type of light does not comply with the Upward Light Ratio criteria as it emits directly to the sky.

Luminaire type (b) uses a shield which limits the upward light component.

Luminaire type (c) represents a floodlight installed horizontally emitting most of the light above the horizontal plane.

Luminaire type (d) use reflectors or lenses to direct the light to the area required without the need to tilt the fitting. This style of light minimises glare.

The advent of light emitting diodes (LEDs) has meant that luminaires can now be produced in such manner that can throw light forward without emitting any light in or above the horizontal plane. These fittings are very efficient as they only project light onto the task area. And, in doing so, limit the spill light.

It is important to note that wall-mounted batten luminaires, particularly those with symmetrical or near-symmetrical light distribution (comparable to Luminaire Type (c) identified in AS/NZS 4282:2023 Appendix A), should be avoided in environmentally sensitive locations.

This type of luminaire typically emits light in both upward and downward directions. When installed externally on vertical surfaces without shielding above, a significant proportion of the luminous flux is emitted above the horizontal plane. In practical terms, up to approximately half of the light output can be directed toward the sky, contributing to sky glow and, therefore, not meet the upward waste light ratio (UWLR) limit.

The ability of a luminaire to control light spill is strongly influenced by its optical style and distribution. AS/NZS 4282:2023 (Figure A.2) illustrates the impact of different luminaire types on obtrusive lighting:

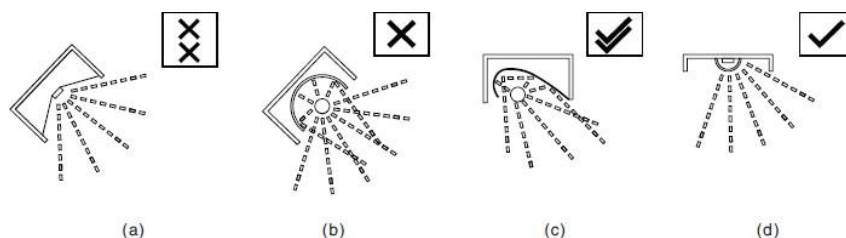


Figure A.1 from AS/NZS 4282:2023 – Effect of the Light Distribution

The use of luminaires that have wide distributions and do not have the ability to limit or shield the spread of light must be avoided.

Luminaire type (a) represents a symmetrical distribution. The light is emitted equally in all directions around the centre of the beam. There are some improvements that make the distribution wider in one direction, but fundamentally the light has to be tilted up to light the area. This type of light distribution is not recommended.

Luminaire type (b) represents a luminaire where the distribution has been modified with reflectors. This reduces the light emitted at wide angles but still requires the fitting to be tilted to light the area.

Luminaires Type (c) and (d) are forward throw fittings that use reflectors or lenses to direct the light to the area required without the need to tilt the fitting. This style of light minimises glare.

Preference should be given to lens-based, forward-throw luminaires (Types (c) or (d)) that efficiently direct light to the intended area, reduce glare, and minimise ecological impact.

5.2 Wall Lights

Figure 8 below illustrates the wall-mounted luminaires recommended for the Project. These types of luminaires are recommended for use at Ausgrid BESS sites as they provide full cut-off optics and controlled light distribution, helping to minimise spill light and potential environmental impacts.



Figure 8 – We-ef OLV – Wall Light with lenses available in different optics and wattages

5.3 Post top Lights

Figure 9 below illustrates the post top lights recommended for the Project. These types of luminaires are recommended for use at Ausgrid BESS sites as they provide full cut-off optics and controlled light distribution, helping to minimise spill light and potential environmental impacts.



Figure 9 – We-ef VFL530 – Post Top Light with lenses available in different optics and wattages

All the proposed new luminaires would be lens-based LED luminaires in which the light is directed to the area where light is required without the need to tilt the light fitting. This type of light fitting efficiently lights the ground with minimal glare under the luminaire and has no glare for any observer position above the light mounting height due to the full cut off design.

5.4 Correlated Colour Temperature (CCT)

To further minimise ecological impacts, luminaires have been specified with a maximum correlated colour temperature of: 3000 K. Correlated colour temperature is a direct result of the distribution of wavelength in the light source. It is expressed in Kelvin (K) and describes the colour of light. Warmer light sources (with a lower CCT) have a warmer appearance, whilst cool light sources (with a higher CCT) have a cooler appearance.

Warm white light reduces short-wavelength (blue) content, which:

- Reduces ecological disruption
- Minimises sky glow and atmospheric scatter
- Reduces insect attraction
- Creates a more visually comfortable nighttime environment

This approach is consistent with best practice for lighting installations adjacent to environmentally sensitive areas.

6. Assessment Outcomes and Conclusions

This assessment considered the obtrusive lighting impacts associated with three distinct scenarios:

- Scenario 1: Existing Kurnell Zone Substation Lighting
- Scenario 2: Project Outdoor Lighting
- Scenario 3: Combination of existing Kurnell Zone Substation Lighting and Project Outdoor Lighting

The assessment of **Scenario 1 (Existing Lighting)** indicates the installation predates the current standard and was designed in accordance with the applicable requirements at the time, with no sensitive residential receptors affected.

The assessment of **Scenario 2 (Project Lighting)** demonstrates that, through the adoption of contemporary LED luminaires with full cut-off optics, controlled distributions, and a maximum CCT of 3000K, the proposed lighting design is capable of achieving compliance with the relevant obtrusive lighting criteria while meeting the operational lighting requirements of the Project.

Furthermore, the proposed 8 m high sound attenuation walls surrounding the battery pack infrastructure will also act as a physical barrier to light spill. This will assist in reducing potential light spill toward the adjacent Towra Point Nature Reserve.

When considering **Scenario 3 (Combined Existing and Proposed Lighting)**, the cumulative assessment indicates that spill light levels beyond the site boundary experience only a **marginal increase** relative to the existing condition.

To achieve the required illuminance levels for safe and effective operation of the BESS, the detailed lighting design shall be developed in accordance with the relevant provisions of AS/NZS standards, the Original Equipment Manufacturer (OEM) lighting requirements, and applicable Ausgrid lighting guidelines.

The proposed lighting introduces significantly improved optical control, reduced upward light emissions, and lower ecological impact compared to the existing installation.

In the context of the site's proximity to the Towra Point Nature Reserve, the overall outcome is considered acceptable, as the design minimises spill light and aligns with the intent of AS/NZS 4282:2023.



7. General Recommendations

The lighting design will consider the relevant AS/NZS Standards, in addition to any Original Equipment Manufacturer (OEM) lighting requirements associated with the BESS infrastructure, as well as applicable lighting guidelines from Ausgrid.

Furthermore, the following lighting elements are proposed to be considered for implementation during detailed design:

- All luminaires shall have a correlated colour temperature (CCT) $\leq 3000\text{K}$
- Luminaires shall be installed with zero tilt and no upward light emission
- Floodlights and wall-mounted luminaires shall incorporate forward-throw optical control
- Where tilt is unavoidable, luminaires shall be fitted with glare shields or equivalent accessories



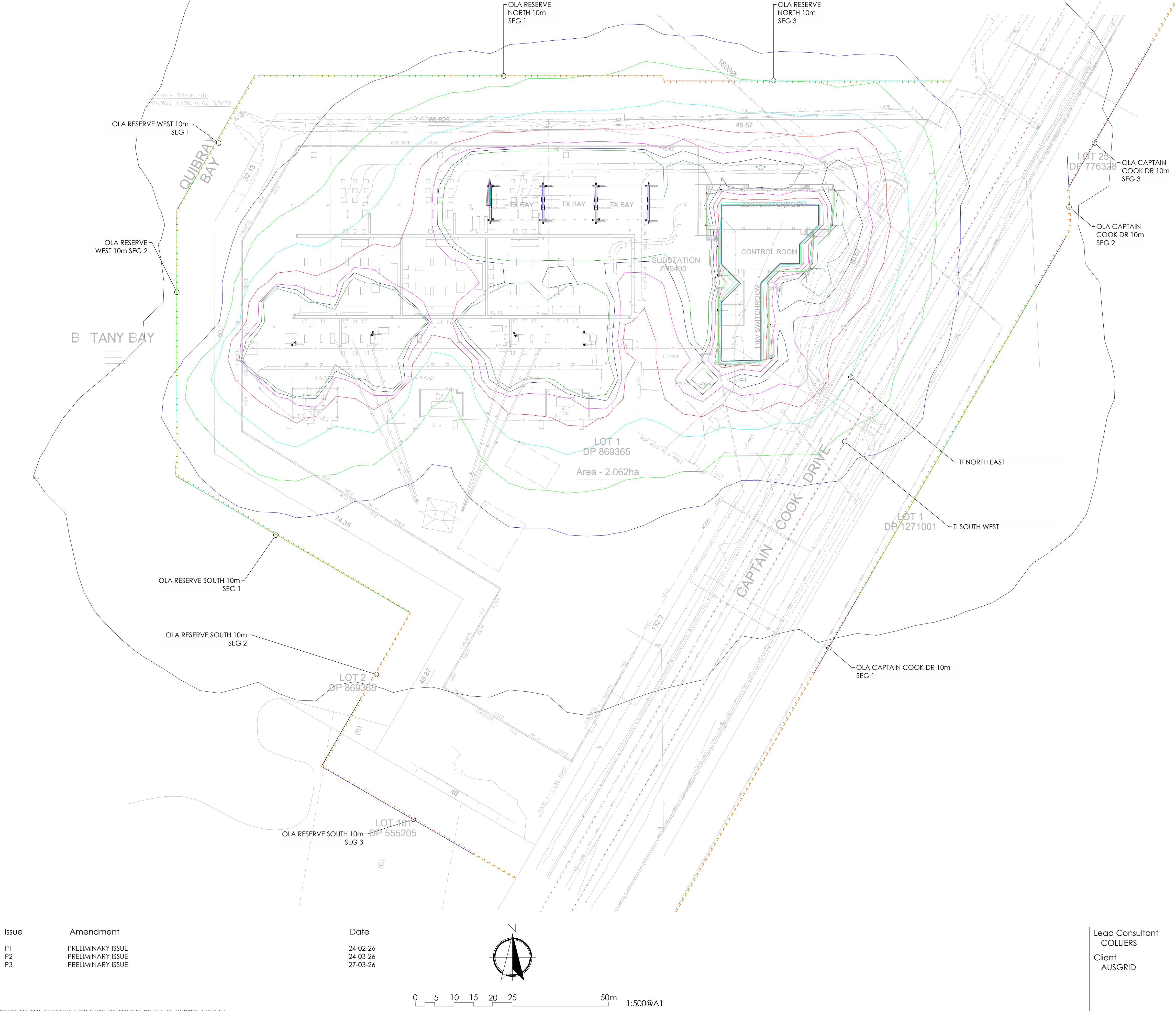
8. Appendix

CL-101 – EXISTING KURNELL SUBSTATION LIGHTING – OBTRUSIVE LIGHTING CALCULATIONS

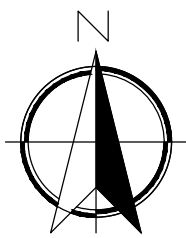
Note: Lighting Calculation values are best reviewed by zooming into the digital PDF drawings.

EXISTING KURNELL SUBSTATION LIGHTING
Existing Lighting Isoline Diagram

Isoline Legend	
Illuminance (Lux)	
Scenario: OBTRUSIVE LIGHTING	
Color	Value
	0.1
	1
	2
	5
	10
	20
	30
	40



Issue	Amendment	Date
P1	PRELIMINARY ISSUE	24-02-26
P2	PRELIMINARY ISSUE	24-03-26
P3	PRELIMINARY ISSUE	27-03-26



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Project KAMAY BESS
KURNELL ZONE SUBSTATION

Drawing EXISTING KURNELL SUBSTATION LIGHTING
EXISTING LIGHTING ISOLINE DIAGRAM

Drawn	Approv. RM	Date FEB 2026	Scale 1:500@A1
Project No L186N	Drawing No CL-101	Rev P3	



CL-201 – PROPOSED LIGHTING BESS – OUTDOOR WORKPLACE ILLUMINANCE CALCULATIONS

Note: Lighting Calculation values are best reviewed by zooming into the digital PDF drawings.

KAMAY BATTERY ENERGY STORAGE SYSTEM (BESS) Outdoor Workplace Lighting Compliance

Scope The scope of works is to assess the proposed outdoor lighting for the Battery Energy Storage System (BESS) in Kamay to comply with:

- AS/NZS 1680.5:2012 recommended light technical parameters for general outdoor areas namely General Storage - Pedestrian Access

- AS/NZS 1158.3.1:2020 recommended light technical parameters for connecting elements namely Steps and Stairways, ramps - PE2 Category / not less than PA3

Category			General Storage Pedestrian Access		
Average Horizontal Illuminance	(lux)			>10.0	
Minimum Horizontal Illuminance	(lux)			>1.0	
Horizontal Illuminance Uniformity	(max/avg)			<7	

Category			PE2 / PA3 Connecting Elements (Stairs)		
Average Horizontal Illuminance	(lux)			>7.0	
Minimum Horizontal Illuminance	(lux)			>2.0	
Horizontal Illuminance Uniformity	(max/avg)			<8	
Minimum Vertical Illuminance	(lux)			>2.0	

Luminaire Schedule					
Project: LIGHTS - PROPOSED BESS					
Scenario: ILLUMINANCE CALCULATION					
Symbol	Qty	Label	Luminaire Lumens	LLF	Filename
6	6	BATTEN ARAGON 1200mm 32W	3900	1.000	ARAGON-1200-S-8-3900-840.ies
9	9	BATTEN ARAGON 1200mm 13W	1430	1.000	ARAGON-1200-S-8-1430-840.ies
2	2	WE-EF OLV334 A60 14W	1476	1.000	132-0530.ies
15	15	WE-EF OLV334 S70 14W	1549	1.000	132-0526.ies
4	4	WE-EF OLV344 A60 54W	5261	1.000	132-0540.ies
9	9	WE-EF OLV344 S70 27W	3098	1.000	132-0546.ies
3	3	WE-EF OLV344 S70 54W	5521	1.000	132-0556.ies
1	1	WE-EF VFL330 A60 27W 2890	3252	1.000	108-1159.ies
2	2	WE-EF VFL330 A60 54W	5775	1.000	108-1174.ies
3	3	WE-EF VFL330 P65 27W	3417	1.000	108-1556.ies
4	4	WE-EF VFL330 P65 54W 2890	6245	1.000	108-1558.ies

Calculation Summary							
Project: EH CIRCULATION							
Scenario: ILLUMINANCE CALCULATION							
Label	CalcType	Units	Avg	Max	Min	Max/Avg	Meter Type
EH CIRCULATION 01	Illuminance	Lux	12.36	34.0	2.4	2.75	Horizontal
EH CIRCULATION 02	Illuminance	Lux	11.14	26.3	2.9	2.36	Horizontal
EH CIRCULATION 03	Illuminance	Lux	15.59	43.6	4.5	2.80	Horizontal
EH HANGAR	Illuminance	Lux	75.38	95.7	50.7	1.27	Horizontal

Calculation Summary							
Project: EH BESS							
Scenario: ILLUMINANCE CALCULATION							
Label	CalcType	Units	Avg	Max	Min	Max/Avg	Meter Type
EH BESS 01 - PATH 01 E-W	Illuminance	Lux	17.72	55.6	4.5	3.14	Horizontal
EH BESS 01 - PATH 02 E-W	Illuminance	Lux	10.02	21.9	4.7	2.19	Horizontal
EH BESS 01 - PATH 03 N-S	Illuminance	Lux	19.86	56.2	5.1	2.83	Horizontal
EH BESS 01 - PATH 04 N-S	Illuminance	Lux	20.93	56.6	5.1	2.70	Horizontal
EH BESS 02 - PATH 01 E-W	Illuminance	Lux	22.42	56.3	9.7	2.51	Horizontal
EH BESS 02 - PATH 02 N-S	Illuminance	Lux	14.43	24.2	5.3	1.48	Horizontal
EH BESS 02 - PATH 03 N-S	Illuminance	Lux	23.02	56.4	6.6	2.45	Horizontal
EH BESS 02 - PATH 04 N-S	Illuminance	Lux	23.97	56.1	10.0	2.34	Horizontal
EH BESS 02 - PATH 05 N-S	Illuminance	Lux	13.93	23.4	4.0	1.48	Horizontal
EH BESS 02 - PATH 06 E-W	Illuminance	Lux	10.83	17.4	4.1	1.61	Horizontal

Calculation Summary							
Project: EH STAIRS							
Scenario: ILLUMINANCE CALCULATION							
Label	CalcType	Units	Avg	Max	Min	Max/Avg	Meter Type
EH STAIRS 01	Illuminance	Lux	30.78	44.3	6.5	1.44	Horizontal
EH STAIRS 02	Illuminance	Lux	30.42	45.5	8.8	1.50	Horizontal
EH STAIRS 03	Illuminance	Lux	37.46	55.1	30.3	1.47	Horizontal
EH STAIRS 04	Illuminance	Lux	34.27	53.0	28.3	1.55	Horizontal

Calculation Summary							
Project: EV STAIRS							
Scenario: ILLUMINANCE CALCULATION							
Label	CalcType	Units	Max	Min	Meter Type		
EV STAIRS 01 DOWN	Illuminance	Lux	29.2	10.1	Fixed		
EV STAIRS 01 UP	Illuminance	Lux	30.6	9.2	Fixed		
EV STAIRS 02 DOWN	Illuminance	Lux	27.0	6.1	Fixed		
EV STAIRS 02 UP	Illuminance	Lux	32.7	8.4	Fixed		
EV STAIRS 03 DOWN	Illuminance	Lux	29.4	7.0	Fixed		
EV STAIRS 03 UP	Illuminance	Lux	40.2	3.3	Fixed		
EV STAIRS 04 DOWN	Illuminance	Lux	26.9	4.3	Fixed		
EV STAIRS 04 UP	Illuminance	Lux	44.9	6.4	Fixed		

Scenario/Channel Summary			
Scenario: ILLUMINANCE CALCULATION			
Channel	Switched	Dimming	# Lums
PROPOSED NEW LIGHTING	On	0.80	60

NOTE: Dimming level used to adjust the luminaire maintenance factor

Certification

The proposed outdoor lighting for the Battery Energy Storage System (BESS) in Kamay will comply with:

- AS/NZS 1680.5:2012 recommended light technical parameters for general outdoor areas namely General Storage - Pedestrian Access

- AS/NZS 1158.3.1:2020 recommended light technical parameters for connecting elements namely Steps and Stairways, ramps - PE2 Category / not less than PA3

Maria Albuquerque

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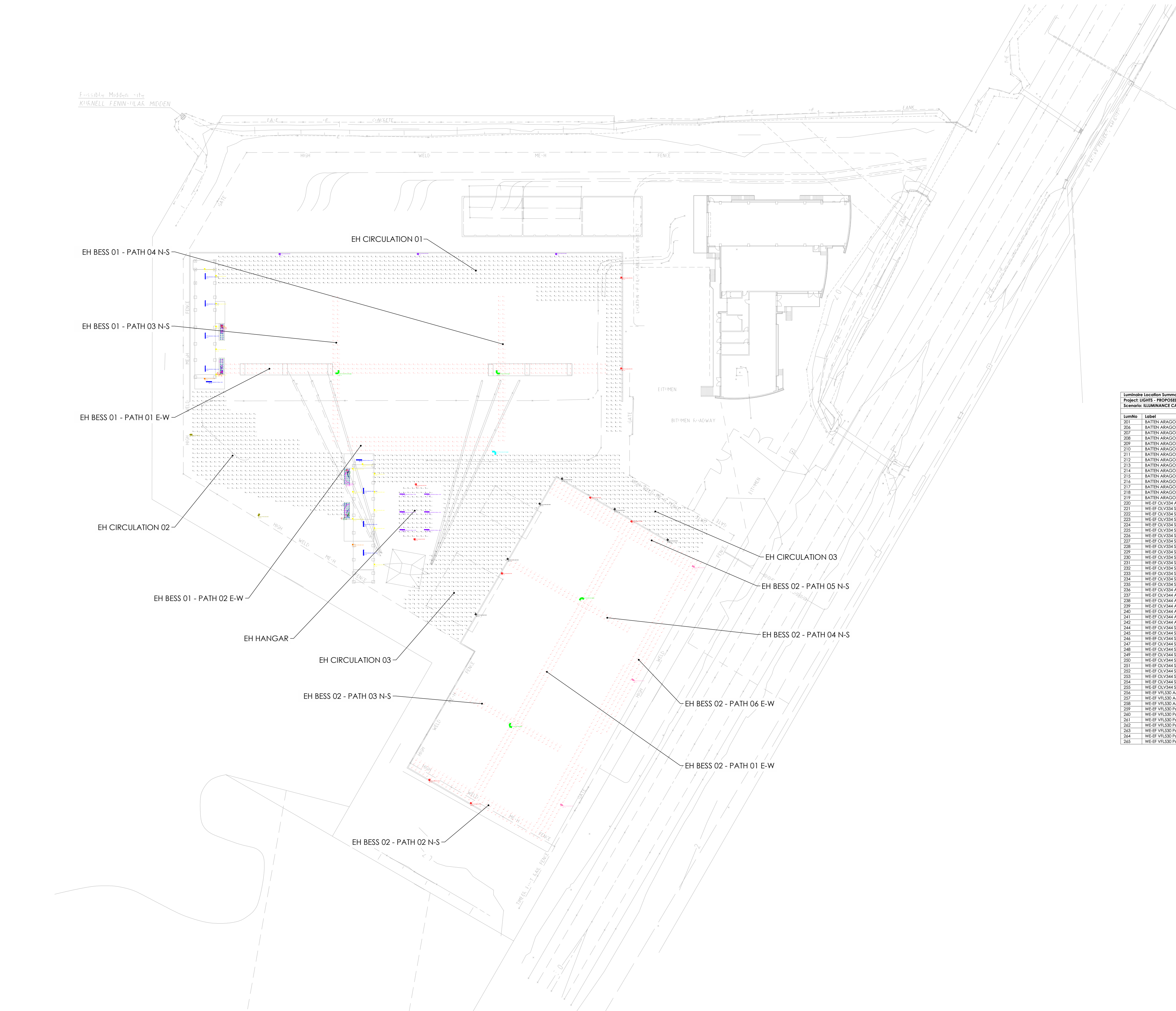
Project KAMAY BESS
KURNELL ZONE SUBSTATION

Drawing PROPOSED LIGHTING - BESS - OUTDOOR
WORKPLACE ILLUMINANCE CALCULATIONS

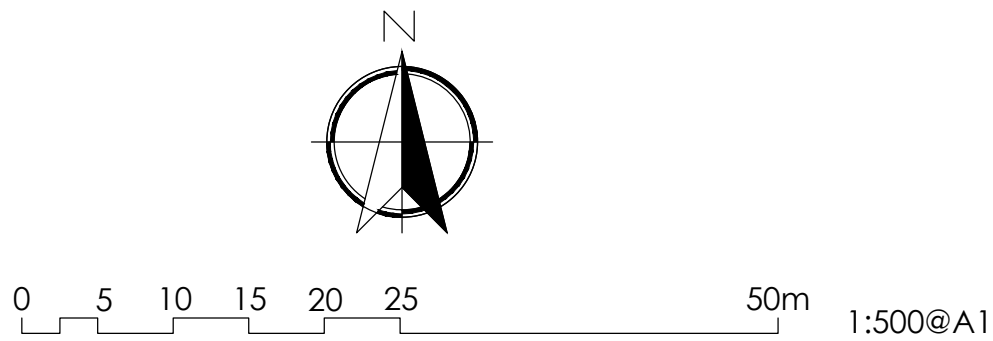
Drawn MA Date FEB 2026 Scale 1:500@A1

Project No Drawing No Rev

L186N CL-201 P3



Issue	Amendment	Date
P1	PRELIMINARY ISSUE	24-02-26
P2	PRELIMINARY ISSUE	24-03-26
P3	PRELIMINARY ISSUE	27-03-26



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CL-202 – PROPOSED LIGHTING BESS – OBTRUSIVE LIGHTING CALCULATIONS

Note: Lighting Calculation values are best reviewed by zooming into the digital PDF drawings.

KAMAY BATTERY ENERGY STORAGE SYSTEM (BESS)
Review of the Obtrusive Effects
of Outdoor Lighting

Scope
The scope of the works is to assess the proposed outdoor lighting for the Battery Energy Storage System (BESS) in Kamay to comply with:

- AS/NZS 4282:2023 Control of obtrusive effects of outdoor lighting requirements for A2 Environmental Zone (Low District Brightness), Curfew Conditions.

Control of obtrusive effects of outdoor lighting - AS/NZS 4282:2023 (Curfew Conditions)

- Environmental zone: A2 - Low district brightness - Sparsely uninhabited rural and semi-rural areas
- Maximum Vertical Illuminance (CURFEW) < 1.0 lux
- Upward light ratio < 0.01
- Maximum luminous intensity (I) from each luminaire < 1,000 cd (CURFEW)
- Threshold increment (TI) recommended maximum value: 20% Based on adaptation luminance of 0.2 cd/m2
- Maintenance factor 1.0

Luminaire Schedule					
Project: LIGHTS - PROPOSED BESS					
Scenario: OBTRUSIVE LIGHTING					
Symbol	Qty	Label	Luminaire Lumens	LF	Filename
6	1	BATTEN ARAGON 1200mm 32W	2900	1.000	ARAGON-1200-S-B-3900-840.lvs
9	1	BATTEN ARAGON 1200mm 13W	1430	1.000	ARAGON-1200-S-B-1630-840.lvs
2	2	WE-EF OLV34 A60 14W	1476	1.000	132-0550.lvs
15	1	WE-EF OLV34 A70 14W	1547	1.000	132-0556.lvs
6	6	WE-EF OLV344 A60 54W	5261	1.000	132-0560.lvs
9	9	WE-EF OLV344 A70 57W	5298	1.000	132-0566.lvs
3	3	WE-EF OLV344 A70 54W	5521	1.000	132-0556.lvs
1	1	WE-EF VFL30 A60 27W 2890	3392	1.000	108-1197.lvs
2	2	WE-EF VFL30 A60 54W	3775	1.000	108-1174.lvs
3	3	WE-EF VFL30 P65 27W	3417	1.000	108-1556.lvs
4	4	WE-EF VFL30 P65 54W 2890	6245	1.000	108-1556.lvs

Scenario/Channel Summary			
Scenario: OBTRUSIVE LIGHTING			
Channel	Switched	Dimming	# Lums
PROPOSED NEW LIGHTING	On	1.00	60

Luminance	switched	lumens
PROPOSED NEW LIGHTING	On	1.00

UWLR Area Summary	
Scenario: OBTRUSIVE LIGHTING	

Calculation Summary				
Project: OLA				
Scenario: OBTRUSIVE LIGHTING				
Label	CalcType	Units	Max	Min
OLA CAPTAIN COOK DR 10m_Cd_Seg1	Obtrusive - Cd	N/A	82	0
OLA CAPTAIN COOK DR 10m_Cd_Seg1	Obtrusive - Cd	N/A	15	0
OLA CAPTAIN COOK DR 10m_Cd_Seg2	Obtrusive - Cd	N/A	15	0
OLA CAPTAIN COOK DR 10m_Cd_Seg2	Obtrusive - Cd	N/A	15	0
OLA CAPTAIN COOK DR 10m_Cd_Seg3	Obtrusive - Cd	N/A	15	0
OLA CAPTAIN COOK DR 10m_Cd_Seg3	Obtrusive - Cd	N/A	15	0
OLA CAPTAIN COOK DR 10m_III_Seg1	Obtrusive - III	Lux	0.1	0.0
OLA CAPTAIN COOK DR 10m_III_Seg1	Obtrusive - III	Lux	0.0	0.0
OLA CAPTAIN COOK DR 10m_III_Seg2	Obtrusive - III	Lux	0.0	0.0
OLA CAPTAIN COOK DR 10m_III_Seg2	Obtrusive - III	Lux	0.0	0.0
OLA CAPTAIN COOK DR 10m_III_Seg3	Obtrusive - III	Lux	0.0	0.0
OLA CAPTAIN COOK DR 10m_III_Seg3	Obtrusive - III	Lux	0.0	0.0
OLA RESERVE NORTH 10m_Cd_Seg1	Obtrusive - Cd	N/A	28	0
OLA RESERVE NORTH 10m_Cd_Seg1	Obtrusive - Cd	N/A	28	0
OLA RESERVE NORTH 10m_Cd_Seg2	Obtrusive - Cd	N/A	0	0
OLA RESERVE NORTH 10m_Cd_Seg2	Obtrusive - Cd	N/A	0	0
OLA RESERVE NORTH 10m_Cd_Seg3	Obtrusive - Cd	N/A	67	0
OLA RESERVE NORTH 10m_Cd_Seg3	Obtrusive - Cd	N/A	67	0
OLA RESERVE NORTH 10m_III_Seg1	Obtrusive - III	Lux	0.0	0.0
OLA RESERVE NORTH 10m_III_Seg1	Obtrusive - III	Lux	0.0	0.0
OLA RESERVE NORTH 10m_III_Seg2	Obtrusive - III	Lux	0.0	0.0
OLA RESERVE NORTH 10m_III_Seg2	Obtrusive - III	Lux	0.0	0.0
OLA RESERVE NORTH 10m_III_Seg3	Obtrusive - III	Lux	0.0	0.0
OLA RESERVE NORTH 10m_III_Seg3	Obtrusive - III	Lux	0.0	0.0
OLA RESERVE SOUTH 10m_Cd_Seg1	Obtrusive - Cd	N/A	108	0
OLA RESERVE SOUTH 10m_Cd_Seg1	Obtrusive - Cd	N/A	108	0
OLA RESERVE SOUTH 10m_Cd_Seg2	Obtrusive - Cd	N/A	280	0
OLA RESERVE SOUTH 10m_Cd_Seg2	Obtrusive - Cd	N/A	280	0
OLA RESERVE SOUTH 10m_Cd_Seg3	Obtrusive - Cd	N/A	414	0
OLA RESERVE SOUTH 10m_Cd_Seg3	Obtrusive - Cd	N/A	414	0
OLA RESERVE SOUTH 10m_III_Seg1	Obtrusive - III	Lux	0.1	0.0
OLA RESERVE SOUTH 10m_III_Seg1	Obtrusive - III	Lux	0.1	0.0
OLA RESERVE SOUTH 10m_III_Seg2	Obtrusive - III	Lux	0.2	0.0
OLA RESERVE SOUTH 10m_III_Seg2	Obtrusive - III	Lux	0.2	0.0
OLA RESERVE SOUTH 10m_III_Seg3	Obtrusive - III	Lux	1.0	0.0
OLA RESERVE SOUTH 10m_III_Seg3	Obtrusive - III	Lux	1.0	0.0
OLA RESERVE WEST 10m_Cd_Seg1	Obtrusive - Cd	N/A	175	0
OLA RESERVE WEST 10m_Cd_Seg2	Obtrusive - Cd	N/A	78	0
OLA RESERVE WEST 10m_III_Seg1	Obtrusive - III	Lux	0.5	0.0
OLA RESERVE WEST 10m_III_Seg2	Obtrusive - III	Lux	0.0	0.0
TI NORTH EAST	Obtrusive - TI	%	0	0
TI SOUTH WEST	Obtrusive - TI	%	0	0

Isoline Legend	
Illuminance (lux)	
Color	Value
0.1	
1	
2	
5	
10	
20	
30	
40	

Certification
The proposed lighting for the Kamay Battery Energy Storage System will meet the requirements of AS/NZS 4282:2023 - Environmental Zone A2 - Curfew conditions.

Maria Albuquerque

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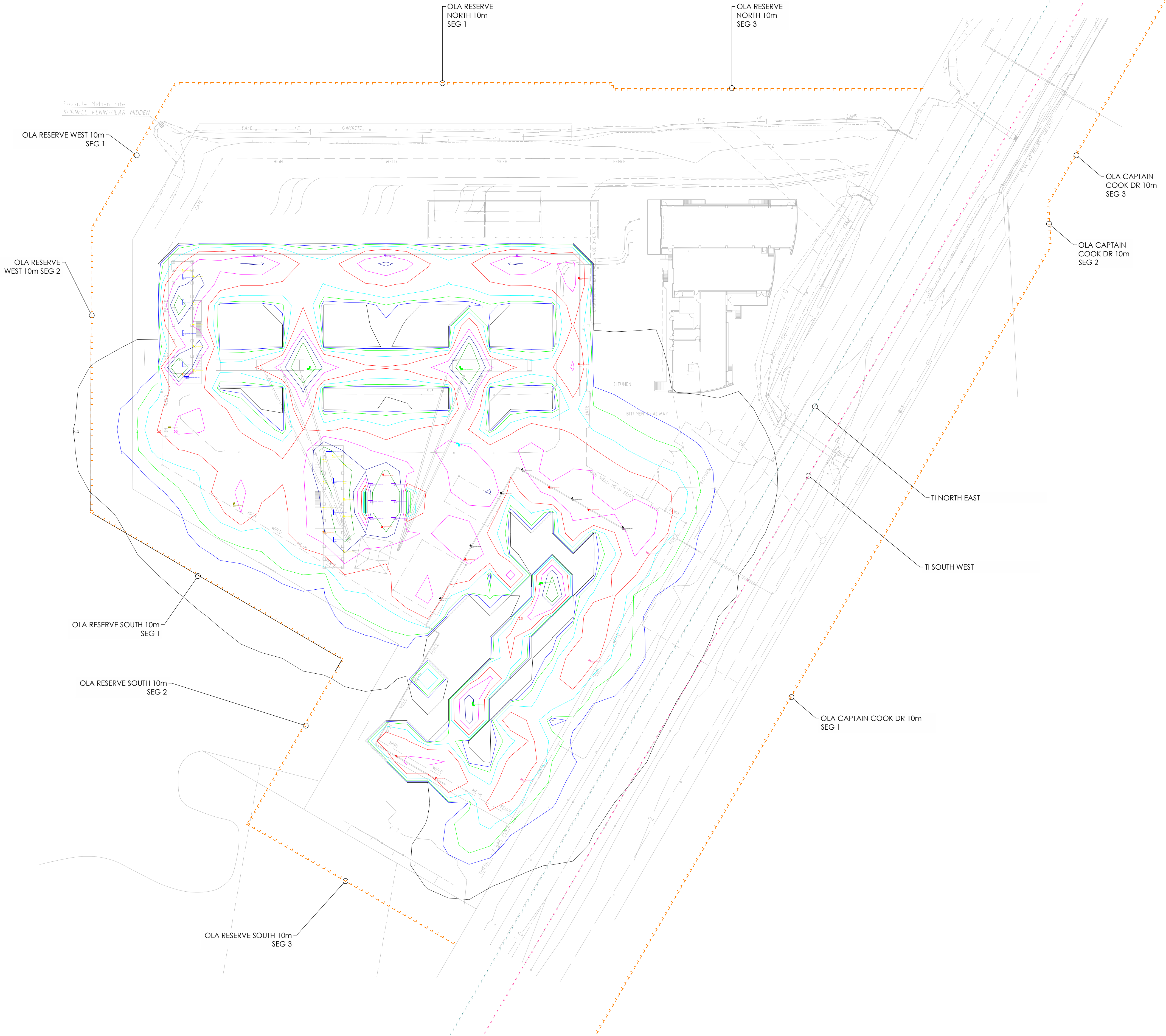
Project KAMAY BESS
KURNELL ZONE SUBSTATION

Drawing PROPOSED LIGHTING - BESS
OBTRUSIVE LIGHTING CALCULATIONS

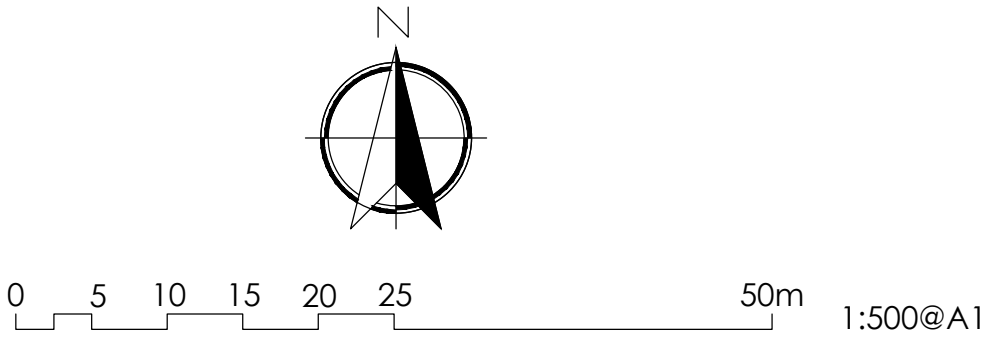
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Project No Drawing No

L186N CL-202 P3



Issue	Amendment	Date
P1	PRELIMINARY ISSUE	24-02-26
P2	PRELIMINARY ISSUE	24-03-26
P3	PRELIMINARY ISSUE	27-03-26





CL-301 – EXISTING + PROPOSED LIGHTING BESS – OUTDOOR WORKPLACE ILLUMINANCE CALCULATIONS

Note: Lighting Calculation values are best reviewed by zooming into the digital PDF drawings.

KAMAY BATTERY ENERGY STORAGE SYSTEM (BESS) Outdoor Workplace Lighting Compliance

Scope
The scope of works is to evaluate the proposed outdoor lighting for the Battery Energy Storage System (BESS) located at Kamay, in conjunction with the existing lighting at the Kurnell Zone Substation to comply with:

- AS/NZS 1680.5:2012 recommended light technical parameters for general outdoor areas namely General Storage - Pedestrian Access

- AS/NZS 1158.3.1:2020 recommended light technical parameters for connecting elements namely Steps and Stairways, ramps - PE2 Category / not less than PA3

Category		General Storage		General Storage	
		Pedestrian Access			
Average Horizontal Illuminance	(lux)	>10.0			
Minimum Horizontal Illuminance	(lux)	>1.0			
Horizontal Illuminance Uniformity	(max/avg)	>7			

Category		PE2 / PA3		Connecting Elements (Stairs)	
Average Horizontal Illuminance	(lux)	>7.0			
Minimum Horizontal Illuminance	(lux)	>2.0			
Horizontal Illuminance Uniformity	(max/avg)	<8			
Minimum Vertical Illuminance	(lux)	>2.0			

Luminaires Schedule					
Project: LIGHTS - EXISTING					
Scenario: ILLUMINANCE CALCULATION					
Symbol	Qty	Label	Luminaire Lumens	LF	Filename
4	4	EXIST SL WALL MOUNT_2	4682	1.000	Suburban_570D - 203352.IES
14	14	EXIST THORN BATTEN WALL MOUNTED_2	1998	1.000	REG400.IES
17	17	EXIST THORN SL ON WALL_2	12251	1.000	CV158150.4_HPSEVILLI.IES
17	17	EXIST THORN WALL LIGHT_2	10220	1.000	CV170.4.IES
14	14	EXIST THORN AREA PAK_2	42072	1.000	REG400.IES

Luminaires Schedule					
Project: LIGHTS - PROPOSED NEW					
Scenario: ILLUMINANCE CALCULATION					
Symbol	Qty	Label	Luminaire Lumens	LF	Filename
6	6	BATTEN ARAGON 1200mm 32W	3900	1.000	ARAGON_1200-S-8-3900-840.IES
9	9	BATTEN ARAGON 1200mm 13W	1430	1.000	ARAGON_1200-S-8-1430-840.IES
2	2	WE-EF OLVS34 A60 14W	1470	1.000	132-0530.IES
15	15	WE-EF OLVS34 570 14W	1549	1.000	132-0526.IES
6	6	WE-EF OLVS44 A60 54W	5261	1.000	132-0540.IES
9	9	WE-EF OLVS44 570 27W	3096	1.000	132-0546.IES
3	3	WE-EF OLVS44 570 54W	5521	1.000	132-0556.IES
1	1	WE-EF VL530 A60 27W 2890	3552	1.000	106-1199.IES
2	2	WE-EF VL530 A60 54W	5775	1.000	106-1174.IES
3	3	WE-EF VL530 P65 27W	3417	1.000	106-1556.IES
4	4	WE-EF VL530 P65 54W 2890	6245	1.000	106-1558.IES

Calculation Summary							
Project: EH CIRCULATION							
Scenario: ILLUMINANCE CALCULATION							
Label	CalcType	Units	Avg	Max	Min	Max/Avg	Meter Type
EH BACK ENTRY	Illuminance	Lux	82.31	989.7	9.5	12.02	Horizontal
EH CIRCULATION 01	Illuminance	Lux	12.41	34.0	2.4	2.74	Horizontal
EH CIRCULATION 02	Illuminance	Lux	11.14	26.3	2.9	2.36	Horizontal
EH CIRCULATION 03	Illuminance	Lux	15.89	43.6	4.5	2.74	Horizontal
EH FRONT OF BUILDING	Illuminance	Lux	22.23	740.2	3.2	34.20	Horizontal
EH HANGAR	Illuminance	Lux	75.38	95.7	50.7	1.27	Horizontal
EH TRANSFORMERS AND SOUND WALL	Illuminance	Lux	442.59	1737	146.0	3.93	Horizontal

Calculation Summary							
Project: EH BESS							
Scenario: ILLUMINANCE CALCULATION							
Label	CalcType	Units	Avg	Max	Min	Max/Avg	Meter Type
EH BESS 01 - PATH 01 E-W	Illuminance	Lux	17.72	55.6	4.5	3.14	Horizontal
EH BESS 01 - PATH 02 E-W	Illuminance	Lux	10.02	21.9	4.7	2.19	Horizontal
EH BESS 01 - PATH 03 N-S	Illuminance	Lux	19.86	56.2	5.1	2.63	Horizontal
EH BESS 01 - PATH 04 N-S	Illuminance	Lux	20.93	56.6	5.1	2.70	Horizontal
EH BESS 02 - PATH 01 E-W	Illuminance	Lux	22.42	56.3	9.7	2.51	Horizontal
EH BESS 02 - PATH 02 N-S	Illuminance	Lux	14.40	24.2	5.3	1.68	Horizontal
EH BESS 02 - PATH 03 N-S	Illuminance	Lux	23.02	56.4	6.6	2.45	Horizontal
EH BESS 02 - PATH 04 N-S	Illuminance	Lux	22.97	56.1	10.0	2.34	Horizontal
EH BESS 02 - PATH 05 N-S	Illuminance	Lux	14.03	23.4	6.0	1.67	Horizontal
EH BESS 02 - PATH 06 E-W	Illuminance	Lux	10.89	17.4	4.1	1.60	Horizontal

Calculation Summary						
Project: EH STAIRS						
Scenario: ILLUMINANCE CALCULATION						
Label	CalcType	Units	Avg	Max	Min	Max/Avg
EH STAIRS 01	Illuminance	Lux	30.78	44.3	8.5	1.44
EH STAIRS 02	Illuminance	Lux	30.42	45.5	8.8	1.50
EH STAIRS 03	Illuminance	Lux	37.46	55.1	30.3	1.47
EH STAIRS 04	Illuminance	Lux	34.27	53.0	28.3	1.55

Calculation Summary					
Project: EV STAIRS					
Scenario: ILLUMINANCE CALCULATION					
Label	CalcType	Units	Max	Min	Meter Type
EV STAIRS 01 DOWN	Illuminance	Lux	29.2	10.1	Fixed
EV STAIRS 01 UP	Illuminance	Lux	30.6	9.2	Fixed
EV STAIRS 02 DOWN	Illuminance	Lux	27.0	6.1	Fixed
EV STAIRS 02 UP	Illuminance	Lux	32.7	8.4	Fixed
EV STAIRS 03 DOWN	Illuminance	Lux	29.4	7.0	Fixed
EV STAIRS 03 UP	Illuminance	Lux	40.2	3.3	Fixed
EV STAIRS 04 DOWN	Illuminance	Lux	26.9	4.3	Fixed
EV STAIRS 04 UP	Illuminance	Lux	44.9	6.4	Fixed

Scenario/Channel Summary			
Scenario: ILLUMINANCE CALCULATION			
Channel	Switched	Dimming	# Lums
EXISTING LIGHTING	On	0.70	33
PROPOSED NEW LIGHTING	On	0.80	60

NOTE: Dimming level used to adjust the luminaire maintenance factor

Certification

The proposed outdoor lighting for the Battery Energy Storage System (BESS) located at Kamay, in conjunction with the existing lighting at the Kurnell Zone Substation will comply with:

- AS/NZS 1680.5:2012 recommended light technical parameters for general outdoor areas namely General Storage - Pedestrian Access

- AS/NZS 1158.3.1:2020 recommended light technical parameters for connecting elements namely Steps and Stairways, ramps - PE2 Category / not less than PA3

De Alge

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Project KAMAY BESS
KURNELL ZONE SUBSTATION

Drawing EXISTING + PROPOSED LIGHTING BESS - OUTDOOR
WORKPLACE ILLUMINANCE CALCULATIONS

Drawn MA Date FEB 2026 Scale 1:500@A1

Project No Drawing No Rev

L186N CL-301 P2

Luminaires Location Summary					
Project: LIGHTS - EXISTING					
Scenario: ILLUMINANCE CALCULATION					
LumNo	Label	Insertion Point X Y Z	Orient	File	
328	EXIST THORN SL ON WALL_2	334339.9 624739.5 4	270	0	
329	EXIST THORN SL ON WALL_2	334353.6 624739.5 4	270	0	
330	EXIST THORN SL ON WALL_2	334367.2 624739.5 4	270	0	
331	EXIST THORN SL ON WALL_2	334380.8 624739.5 4	270	0	
332	EXIST SL WALL MOUNT_2	334339.9 624748.8 4	90	0	
333	EXIST SL WALL MOUNT_2	334353.6 624748.8 4	90	0	
334	EXIST SL WALL MOUNT_2	334367.2 624748.8 4	90	0	
335	EXIST SL WALL MOUNT_2	334380.8 624748.8 4	90	0	
336	EXIST THORN BATTEN WALL MOUNTED_2	334339.7 624745.1 3	90	0	
337	EXIST THORN BATTEN WALL MOUNTED_2	334353.7 624745.1 3	90	0	
338	EXIST THORN BATTEN WALL MOUNTED_2	334367.3 624745.1 3	90	0	
339	EXIST THORN BATTEN WALL MOUNTED_2	334380.9 624745.1 3	90	0	
340	EXIST THORN BATTEN WALL MOUNTED_2	334394.9 624745.1 3	90	0	
341	EXIST THORN BATTEN WALL MOUNTED_2	334408.9 624745.1 3	90	0	
342	EXIST THORN BATTEN WALL MOUNTED_2	334422.9 624745.1 3	90	0	
343	EXIST THORN BATTEN WALL MOUNTED_2	334436.9 624745.1 3	90	0	
344	EXIST THORN BATTEN WALL MOUNTED_2	334450.9 624745.1 3	90	0	
345	EXIST THORN BATTEN WALL MOUNTED_2	334464.9 624745.1 3	90	0	
346	EXIST THORN BATTEN WALL MOUNTED_2	334478.9 624745.1 3	90	0	
347	EXIST THORN BATTEN WALL MOUNTED_2	334492.9 624745.1 3	90	0	
348	EXIST THORN BATTEN WALL MOUNTED_2	334506.9 624745.1 3	90	0	
349	EXIST THORN BATTEN WALL MOUNTED_2	334520.9 624745.1 3	90	0	
350	EXIST THORN AREA PAK_2	334534.9 624748.6 3	0	30	
351	EXIST THORN AREA PAK_2	334548.9 624748.6 3	0	30	
352	EXIST THORN AREA PAK_2	334562.9 624748.6 3	0	30	
353	EXIST THORN AREA PAK_2	334576.9 624748.6 3	0	30	
354	EXIST THORN AREA PAK_2	334590.9 624748.6 3	0	30	
355	EXIST THORN AREA PAK_2	334604.9 624748.6 3	0	30	
356	EXIST THORN AREA PAK_2	334618.9 624748.6 3	180	30	
357	EXIST THORN AREA PAK_2	334632.9 624748.6 3	180	30	
358	EXIST THORN AREA PAK_2	334646.9 624748.6 3	180	30	
359	EXIST THORN AREA PAK_2	334660.9 624748.6 3	180	30	
360	EXIST THORN AREA PAK_2	334674.9 624748.6 3	180	30	
361	EXIST THORN AREA PAK_2	334688.9 624748.6 3	180	30	
362	EXIST THORN AREA PAK_2	334702.9 624748.6 3	180	30	
363	EXIST THORN AREA PAK_2	334716.9 624748.6 3	180	30	
364	EXIST THORN WALL LIGHT_2	334730.9 624747.7 5.5	90	0	
365	EXIST THORN WALL LIGHT_2	334744.9 624747.7 5.5	90	0	
366	EXIST THORN WALL LIGHT_2	334758.9 624747.7 5.5	90	0	
367	EXIST THORN WALL LIGHT_2	334772.9 624747.7 5.5	90	0	
368	EXIST THORN WALL LIGHT_2	334786.9 624747.7 5.5	90	0	
369	EXIST THORN WALL LIGHT_2	334800.9 624747.7 5.5	90	0	
370	EXIST THORN WALL LIGHT_2	334814.9 624747.7 5.5	90	0	
371	EXIST THORN WALL LIGHT_2	334828.9 624747.7 5.5	90	0	
372	EXIST THORN WALL LIGHT_2	334842.9 624747.7 5.5	90	0	
373	EXIST THORN WALL LIGHT_2	334856.9 624747.7 5.5	90	0	
374	EXIST THORN WALL LIGHT_2	334870.9 624747.7 5.5	90	0	
375	EXIST THORN WALL LIGHT_2	334884.9 624747.7 5.5	90	0	
376	EXIST THORN WALL LIGHT_2	334898.9 624747.7 5.5	90	0	
377	EXIST THORN WALL LIGHT_2	334912.9 624747.7 5.5	90	0	
378	EXIST THORN WALL LIGHT_2	334926.9 624747.7 5.5	90	0	
379	EXIST THORN WALL LIGHT_2	334940.9 624747.7 5.5	90	0	
380	EXIST THORN WALL LIGHT_2	334954.9 624747.7 5.5	90	0	

Luminaires Location Summary					
Project: LIGHTS - PROPOSED NEW					
Scenario: ILLUMINANCE CALCULATION					
LumNo	Label	Insertion Point X Y Z	Orient	File	
201	BATTEN ARAGON 1200mm 13W	334317.1 624667.1 2.6	90	0	
206	BATTEN ARAGON 1200mm 32W	334331.7 624680.3 4.56	180	30	
207	BATTEN ARAGON 1200mm 32W	334345.1 624672.4 4.56	180	30	
208	BATTEN ARAGON 1200mm 32W	334358.9 624680.3 4.56	0	30	
209	BATTEN ARAGON 1200mm 32W	334372.1 624672.4 4.56	0	30	
210	BATTEN ARAGON 1200mm 32W	334385.7 624680.3 4.56	180	30	
211	BATTEN ARAGON 1200mm 32W	334399.1 624672.4 4.56	0	30	
212	BATTEN ARAGON 1200mm 13W	334412.9 624680.3 2.6	90	0	
213	BATTEN ARAGON 1200mm 13W	334426.9 624672.4 2.6	90	0	
214	BATTEN ARAGON 1200mm 13W	334440.9 624680.3 2.6	90	0	
215	BATTEN ARAGON 1200mm 13W	334454.9 624672.4 2.6	90	0	
216	BATTEN ARAGON 1200mm 13W	334468.9 624680.3 2.6	90	0	
217	BATTEN ARAGON 1200mm 13W	334482.9 624672.4 2.6	90	0	
218	BATTEN ARAGON 1200mm 13W	334496.9 624680.3 2.6	90	0	
219	BATTEN ARAGON 1200mm 13W	334510.9 624680.3 2.6	90	0	
220	WE-EF OLVS34 A60 14W	334524.9 624672.4 5.8	90	0	
221	WE-EF OLVS34 570 14W	334538.9 624672.4 5.8	90	0	
222	WE-EF OLVS34 570 14W	334552.9 624672.4 5.8	0	0	
223	WE-EF OLVS34 570 14W	334566.9 624672.4 5.8	0	0	
224	WE-EF OLVS34 570 14W	334580.9 624672.4 5.8	0	0	
225	WE-EF OLVS34 570 14W	334594.9 624672.4 5.8	180	0	
226	WE-EF OLVS34 570 14W	334608.9 624672.4 5.8	180	0	
227	WE-EF OLVS34 570 14W	334622.9 624672.4 5.8	180	0	
228	WE-EF OLVS34 570 14W	334636.9 624672.4 5.8	180	0	
229	WE-EF OLVS34 570 14W	334650.9 624672.4 5.8	180	0	
230	WE-EF OLVS34 570 14W	334664.9 624672.4 5.8	0	0	
231	WE-EF OLVS34 570 14W	334678.9 624672.4 5.8	0	0	
232	WE-EF OLVS34 570 14W	334692.9 624672.4 5.8	0	0	
233	WE-EF OLVS34 570 14W	334706.9 624672.4 5.8	0	0	
234	WE-EF OLVS34 570 14W	334720.9 624672.4 5.8	0	0	
235	WE-EF OLVS34 A60 14W	334734.9 624672.4 5.8	0	0	
236	WE-EF OLVS34 A60 14W	334748.9 624672.4 5.8	180	0	
237	WE-EF OLVS34 A60 14W	334762.9 624672.4 5.8	180	0	
238	WE-EF OLVS34 A60 14W	334776.9 624672.4 5.8	180	0	
239	WE-EF OLVS34 A60 14W	334790.9 624672.4 5.8	180	0	
240	WE-EF OLVS34 A60 14W	334804.9 624672.4 5.8	150	0	
241	WE-EF OLVS34 A60 14W	334818.9 624672.4 5.8	150	0	
242	WE-EF OLVS34 A60 14W	334832.9 624672.4 5.8	150	0	
243	WE-EF OLVS34 A60 14W	334846.9 624672.4 5.8	180	0	
244	WE-EF OLVS34 250 27W	334860.9 624672.4 5.8	180	0	
245	WE-EF OLVS34 250 27W	334874.9 624672.4 5.8	90	0	
246	WE-EF OLVS34 250 27W	334888.9 624672.4 5.8	90	0	
247	WE-EF OLVS34 250 27W	334902.9 624672.4 5.8	90	0	
248	WE-EF OLVS34 250 27W	334916.9 624672.4 5.8	90	0	
249	WE-EF OLVS34 250 27W	334930.9 624672.4 5.8	330	0	
250	WE-EF OLVS34 250 27W	334944.9 624672.4 5.8	330	0	
251	WE-EF OLVS34 250 27W	334958.9 624672.4 5.8	60	0	
252	WE-EF OLVS34 250 27W	334972.9 624672.4 5.8	60	0	
253	WE-EF OLVS34 250 27W	334986.9 624672.4 5.8	60	0	
254	WE-EF OLVS34 250 27W	334999.9 624672.4 5.8	270	0	
255	WE-EF OLVS34 250 27W	335013.9 624672.4 5.8	270	0	
256	WE-EF OLVS34 A60 54W	335027.9 624672.4 5.8	0	0	
257	WE-EF OLVS34 A60 54W	335041.9 624672.4 5.8	0	0	
258	WE-EF OLVS34 A60 54W	335055.9 624672.4 5.8	0	0	
259	WE-EF OLVS34 A60 54W	335069.9 624672.4 5.8	0	0	
260	WE-EF OLVS34 A60 54W	335083.9 624672.4 5.8	150	0	
261	WE-EF OLVS34 A60 54W	335097.9 624672.4 5.8	150	0	
262	WE-EF OLVS34 A60 54W	335111.9 624672.4 5.8	150	0	
263	WE-EF OLVS34 A60 54W	335125.9 624672.4 5.8	45	0	
264	WE-EF OLVS34 A60 54W	335139.9 624672.4 5.8	15.5	0	
265	WE-EF OLVS34 A60 54W	335153.9 624672.4 5.8	15.5	0	



CL-302 – EXISTING + PROPOSED BESS LIGHTING - OBTRUSIVE LIGHTING CALCULATIONS

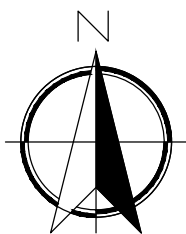
Note: Lighting Calculation values are best reviewed by zooming into the digital PDF drawings.

EXISTING KURNELL SUBSTATION LIGHTING + BESS LIGHTING
Existing + BESS Proposed Lighting Isoline Diagram



Isoline Legend	
Illuminance (Lux)	
Scenario: OBTRUSIVE LIGHTING	
Color	Value
	0.1
	1
	2
	5
	10
	20
	30
	40

Issue	Amendment	Date
P1	PRELIMINARY ISSUE	24-03-26
P2	PRELIMINARY ISSUE	27-03-26



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Project	KAMAY BESS KURNELL ZONE SUBSTATION	
Drawing	EXISTING + PROPOSED LIGHTING BESS OBTRUSIVE LIGHTING CALCULATIONS	
Drawn	Approv. RM	Date FEB 2026
Project No	Drawing No	Scale 1:500@A1
L186N	CL-302	Rev P2