



Updated Open-air Lagoon Show with Pyrotechnic Effects

Glare Impact Assessment Report

PREPARED FOR



Ocean Park Corporation

DATE

5 June 2024

REFERENCE

0540005



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Glare Impact Assessment Report

0540005



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CLIENT: Ocean Park Corporation

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DATE: 5 June 2024

VERSION: 01



Environmental Permit No. EP-249/2006/D

Ocean Park Master Redevelopment Project

Environmental Team Leader Certification

Reference Document/Plan

Document/ Plan to be Certified/ Verified :	Glare Impact Assessment Report
Date of Report:	5 June 2024

Reference EP Condition

Environmental Permit Condition: 2.34

The Permit Holder shall, at least one month before the commencement of the first lagoon show at an open-air venue in the Aqua City (as shown in Figure 10) and any outdoor activity within the Waterfront area (as shown in Figure 1), deposit with the Director four hard copies and one electronic copy of a detailed design of night time functional and thematic lighting. The design shall take into account the possible light pollution and night-time glare and shall at least describe:

- (a) the mounting height and direction of light fixtures;
- (b) the lighting schedule, including power, number and types of lighting;
- (c) the monitoring programme;
- (d) maintenance requirements; and
- (e) measures for avoiding/minimizing possible light pollution and negative glare impacts on nearby sensitive receivers.

Before submission to the Director, the design shall be certified by the ET Leader and verified by the IEC as conforming to the information and recommendations contained in the approved EIA report. All measures recommended in the deposited design shall be fully and properly implemented.

ETL Certification

I hereby certify that the above referenced document/~~plan~~ complies with the above referenced condition of EP-249/2006/D.

Ms Mandy To
Environmental Team Leader

Date: 6 June 2024

Our ref: 0540005_ETL Certification Cert_Glare_20240606.docx

Ocean Park Master Redevelopment Project

Environmental Permit No. EP-249/2006/D - Condition 2.34

**Updated Open-air Lagoon Show with Pyrotechnic Effects
Glare Impact Assessment Report**

Submitted by ERM-Hong Kong, Limited dated 05-06-2024

This is to verify that

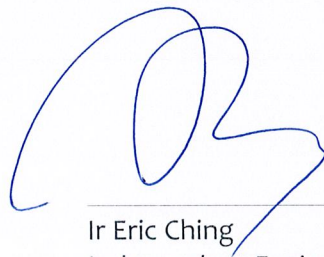
**Updated Open-air Lagoon Show with Pyrotechnic Effects
Glare Impact Assessment Report**

Submitted by ERM-Hong Kong, Limited

dated 05-06-2024

Has been verified by the undersigned.

Signed



Ir Eric Ching
Independent Environmental Checker (IEC)
Retained by Ocean Park Corporation
pursuant to Environmental Permit No. EP-249/2006/D

Date

06 June 2024

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1. INTRODUCTION

1.1 BACKGROUND

An updated open-air lagoon night show with pyrotechnic effects will be hosted in Aqua City in Ocean Park starting from July 2024. Detailed description of the show is presented in *Section 2*.

The potential environmental impacts of the Ocean Park Master Redevelopment Plan (MRP) have been assessed and presented in the Environmental Impact Assessment Report for “*Relocation and Long Term Operation Plan of Ocean Park*” (Register No. AEIAR-101/2006) (the approved EIA Report), and an Environmental Permit (EP-249/2006) for the MRP was granted on 28 July 2006. The EP was varied subsequently with the latest version of EP-249/2006/D issued by EPD on 2 July 2014.

A Glare Impact Assessment was deposited to EPD on 19 October 2010 (*GIA 2010*) under the requirement of Condition 2.34 of the EP, in which potential impacts of light pollution and glare impact to the nearby glare sensitive receivers (GSRs) from the lagoon night show, *Symbio*, were assessed. Following to the design updates of the lagoon show, an updated Glare Impact Assessment were submitted to EPD on 8 January 2020 (*GIA 2020*) for Soul of the Ocean (SOTO) and Visions of Hong Kong (VHK).

ERM Hong Kong has been appointed by the Ocean Park Corporation (OPC) to prepare the updated glare impact assessment based on the detailed design layout and other relevant design details provided by OPC.

1.2 PURPOSE OF THE REPORT

The objective of this Glare Impact Assessment (GIA) is to update the *GIA 2020*, which was deposited to EPD on 8 January 2020, based on the proposed updates of the show to demonstrate that the environmental impacts on glare arise from the lagoon night show will be no worse than those assessed in *GIA 2010* and *GIA 2020*. It also provides recommendations as to whether any modification and/or refinement of environmental monitoring and audits requirements are needed.

2. THE LAGOON NIGHT SHOW

2.1 OVERVIEW OF THE SHOW

The lagoon night show is an open-air entertainment event to be hosted at the Aqua City featuring a combination of audio and visual effects. Pyrotechnic Special Effect Material (PSEM) will be used in the updated show of SOTO, but not for VHK. The glare impact due to the show with PSEM display was assessed for *Symbio* in the *GIA 2010*, while the glare impact was updated and assessed for SOTO and VHK without PSEM display in the *GIA 2020*.

The show will be held in an exterior area of about 4,000m². There are no changes in the show of SOTO and VHK, excepted that PSEM will be used for SOTO. Details of the lagoon night shows are summarised in **Table 2.1**.

TABLE 2.1 DETAILS OF THE LAGOON NIGHT SHOW

Show	Frequency every Night ^a	Duration	Description
Main show One, "Soul of the Ocean"	1	About 12 minutes	A timeless story told through a shape-shifting sea creature. PSEM will be used.
Main show Two, "Vision of Hong Kong"	1	About 5 minutes	An unparalleled visual celebration of culture and beauty beneath the night sky of the Southern District of Hong Kong. PSEM will not be used.
	Total	About 17 minutes	

Note:

^a The shows will be started at 19:00 hours and ended before 22:00 hours, i.e. before the Park closes daily.

3. POTENTIAL SOURCES OF LIGHTS

The lagoon show is an open-air entertainment event to be hosted at the Aqua City featuring a combination of audio and visual effects and the use of PSEM. There are no changes in the lighting layout and lighting schedule for the updated lagoon show of SOTO and VHK as compared to those as presented in *GIA 2020*, excepted that PSEM will be used. The lighting schedule, including power, number and types of lighting of the updated lagoon show are given in **Table 3.1**.

TABLE 3.1 LIGHTING SCHEDULE

No.	Description	Power	Mounting Height	Beaming Direction	Nos.	Type	Lumen Output
1	Pole, and Roof Mount Static LED Strobe Light (<i>SGM P-10</i>)	1152W	6m + Grand Aquarium lower rooftop	70 degree	12	MSI metal halide	39690
2	Roof Mount Rotating Head Projector (<i>Elation Proteus</i>)	470W	12m Grand Aquarium lower rooftop	70 degree	8	MSD Platinum + LED	23000
3	Roof Mount Rotating Head Projector (<i>PR Aqua 480 WS</i>)	480W	16m Grand Aquarium upper rooftop	70 degree	8	Metal halide	31000
4	Rack and Roof Mount Projection Projector (<i>Panasonic PT-RZ31k</i>) & Rack and Roof Mount Laser Show Machine (<i>Mega Laser</i>)	2870W & 30W	5m/6m + 12m East, West retail building rooftop, around the Lagoon planter area and Grand aquarium rooftop	To grand aquarium wall and peacock water screen in lagoon, the beam projected on buildings around the lagoon	24 & 5	Laser Diode	31000
5	PSEM	-	Level to water surface	90 degree upward	3	-	10,000 (assumed)

Note:

Lights less than 100W are considered as low power hence will not affect the glare impact on the nearby building.

A comparison of the lumen output for Symbio in *GIA 2010*, SOTO in *GIA 2020* and Updated SOTO is given in **Table 3.2**. The light sources that have the potential to cause adverse glare

impact to the nearby GSRs is expected to be similar to those presented in the *GIA 2010* and *GIA 2020*.

TABLE 3.2 COMPARISON OF THE TOTAL LUMEN OUTPUT FOR SYMBIO, SOTO AND UPDATED SOTO

	Symbio in <i>GIA 2010</i>	SOTO in <i>GIA</i> <i>2020</i>	Updated SOTO
Total Lumen Output	1,279,640 (including 30,000 from PSEM)	1,652,280 (no PSEM)	1,682,280 (including 30,000 from PSEM)

4. REPRESENTATIVE GLARE SENSITIVE RECEIVERS

A review of GSRs in the vicinity of the Project has been conducted. No new representative GSRs have been identified as compared to the *GIA 2020*. The details of the representative GSRs are presented in **Table 4.2** and their locations are shown in **Figure 4.1**.

TABLE 4.1 REPRESENTATIVE GLARE SENSITIVE RECEIVERS

Ref	Description	Type of Sensitive Receiver	Approximate Distance from the Show	Type of View
1	Mini Range Complex	Commercial / Municipal	87m	Obstructed view toward site, blocked by building inside Ocean Park
2	Wong Chuk Hang Road Garden	Municipal	292m	Obstructed view toward site, blocked by building inside Ocean Park
3	Buildings near Shouson Hill Road	Residential	270m	Obstructed view toward site, blocked by building inside Ocean Park
4	Country Villa	Residential	228m	Obstructed view toward site, blocked by building inside Ocean Park
5	Ocean Park Marriott Hotel	Hotel	62m	Obstructed view toward site, blocked by building inside Ocean Park
6	Ocean Park MTR Station and Train Line	Transportation	203m	Obstructed view toward site, blocked by building inside Ocean Park

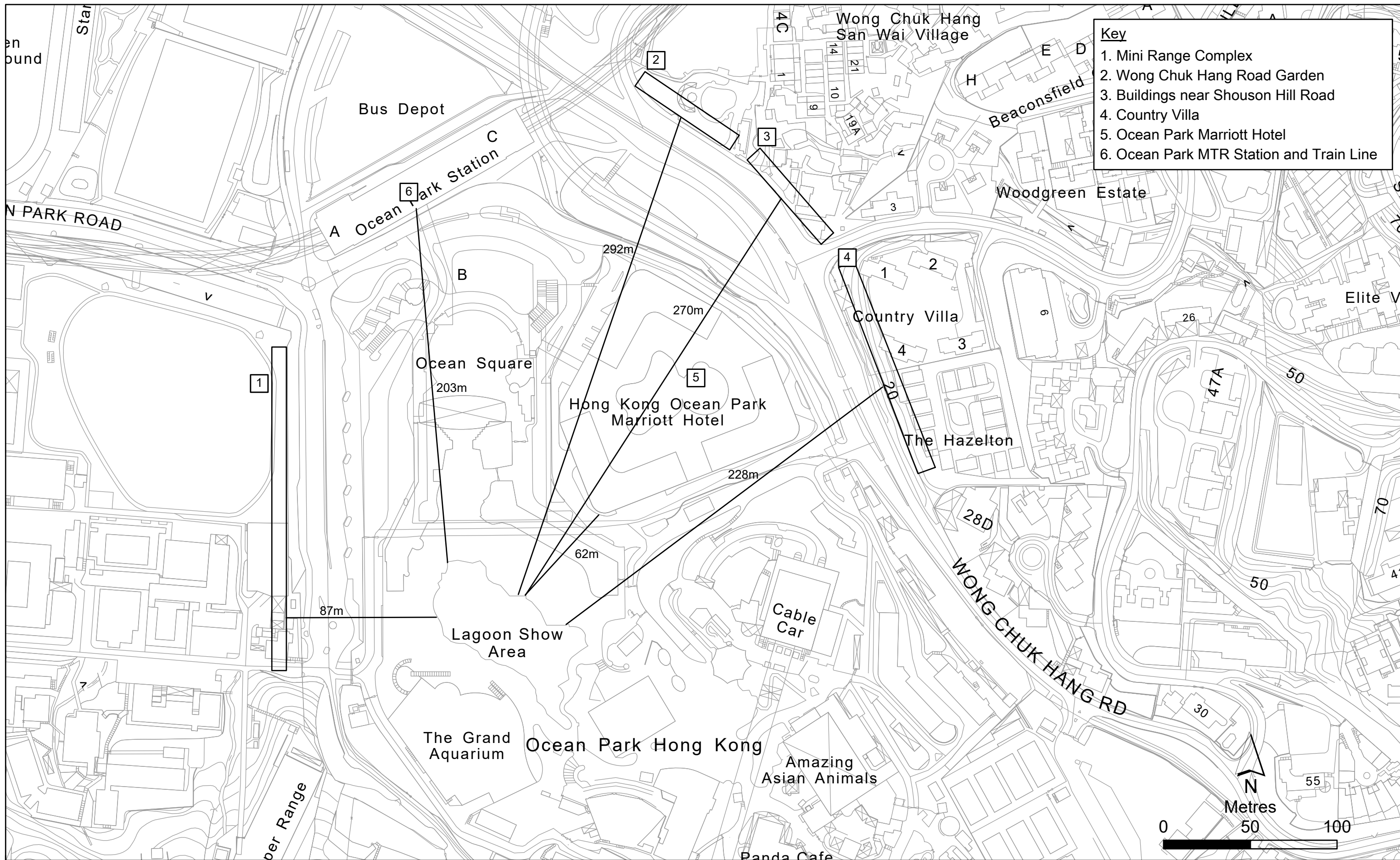


Figure 4.1

Locations of Representative Sensitive Receivers and the Lagoon Night Show



5. ASSESSMENT

There is no legislative criterion for glare impact assessment in the *EIAO-TM*. References were made to relevant guidelines issued by the Highways Department (HyD) and The Chartered Institution of Building Services Engineers (CIBSE) in accordance with the *GIA 2010* and *GIA 2020*. Quantitative assessments were conducted in *GIA 2010* and *GIA 2020* with results indicated that the potential glare impacts of the event lighting from the lagoon night show on relevant parameters, including veil luminance, source intensity and light entry through window, to the representative GSRs were well below the identified criteria from the guidelines. A summary of assessment results presented in *GIA 2010* and *GIA 2020* is provided in **Table 5.1**.

TABLE 5.1 ASSESSMENT RESULTS FROM GIA 2010 AND GIA 2020

Assessment Criteria	Maximum Allowable Glare Level	<i>GIA 2010</i> (<i>Symbio with PSEM</i>)	<i>GIA 2020</i> (<i>SOTO and VHK without PSEM</i>)
Veil Luminance (cd/m ²)	3.64	3.15	3.15
Source Intensity (kcd)	30	3.72	3.67
Light Entry Through Window (Lux)	10	1.30	1.30

Assessment results from *GIA 2010* (*Symbio with PSEM*) indicated that the glare impact due to the use of PSEM is insignificant considering that light source from PSEM is pointed upwards. Given that the predicted veil luminance, source intensity and light entry through window as assessed in *GIA 2010* and *GIA 2020* is well below the maximum allowable level and there is no change in the potential light source from the updated lagoon night show in comparison with that assessed in *GIA 2020*, the conclusion of the assessments remains valid. Therefore, unacceptable glare impacts are not anticipated due to the updated lagoon show.

6. RECOMMENDATIONS

In accordance with the EP Condition 2.35, a specialist with training and practical experience in outdoor sport lighting and illumination had been employed to design, manage and oversee the implementation and maintenance of the illumination requirements and system for the show.

Although no significant glare impact is anticipated at the representative GSRs from the updated lagoon show, it is still recommended to undertake at least two times of monitoring during the performance after commencement by the specialist, as suggested in *GIA 2010* and *GIA 2020*. During each monitoring, the Lux levels should be measured with a Lux Meter or Light Meter at one of the mostly affected sensitive receivers before and during the show. The increase in the Lux level with the show should be compared with that before the show. The Lux level measured during the show should also be compared with the recommended CIBSE's requirement of 10 Lux.

In case the monitoring results indicate measured Lux level higher than 10 Lux, an investigation on the exceedance is required to be conducted by the specialist. Recommendations should be given on any need to adjust the lighting schedule of the show.

The specialist is also required to conduct regular checks, at least once a month, on the lights for the show to ensure all lights are fixed at not more than 70 degree vertical beam angle and all lights being used are under the lighting schedule.

Implementation schedule is presented in **Appendix B**.

7. CONCLUSION


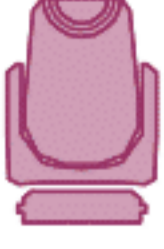










The potential light source arising from the updated lagoon show were reviewed. It is expected that the glare impacts to be not worse than those assessed in *GIA 2010* and *GIA 2020*. Also, the updated SOTO (including 30,000 PSEM) has similar total lumen output compared with the previous SOTO assessed in *GIA 2020* (no PSEM). Thus potential glare impacts of lighting of the lagoon night show to the representative GSRs are considered insignificant.

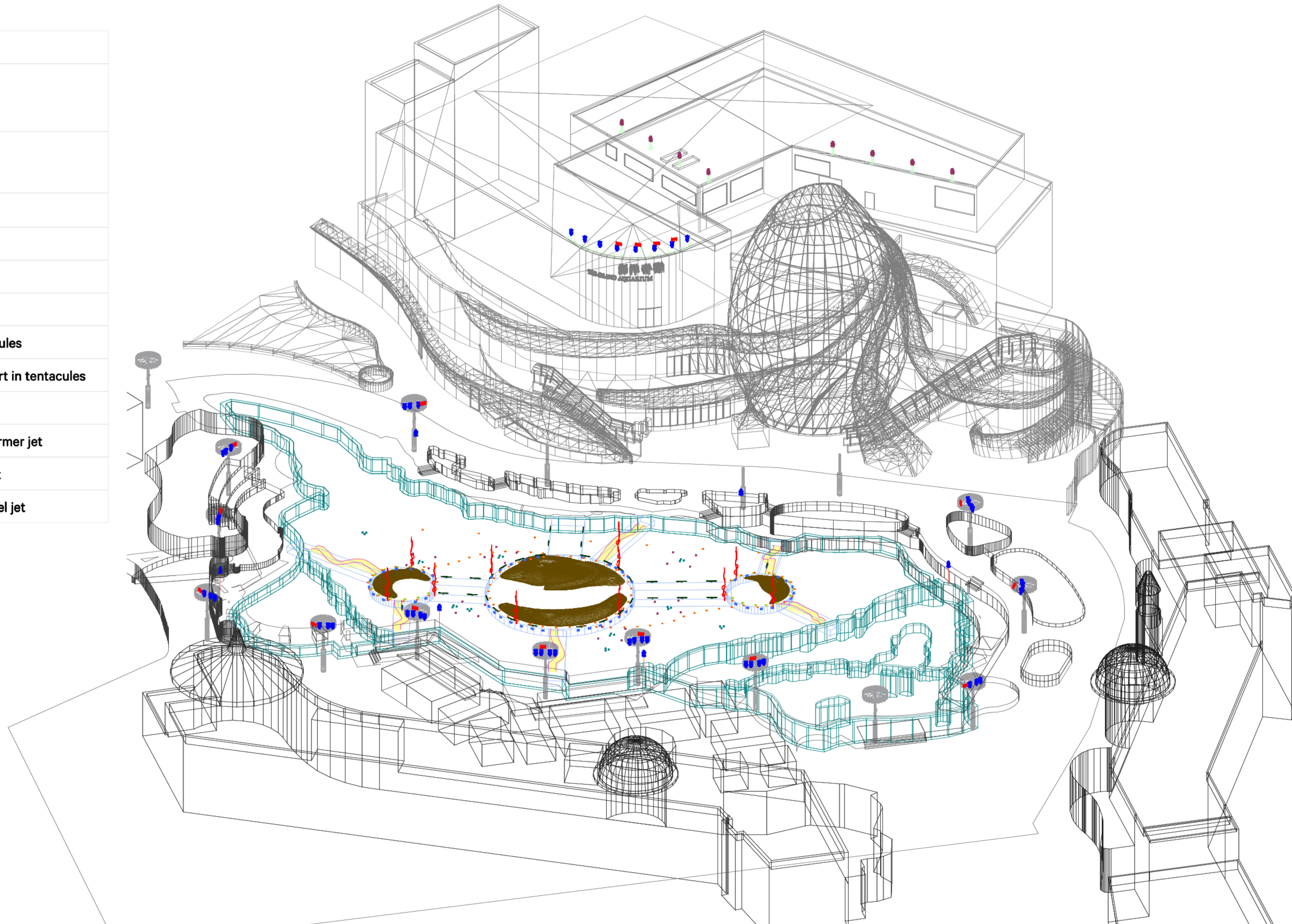
The potential night-time glare impacts are expected to be further mitigated by its absorption into the overall operational lighting of Ocean Park.



APPENDIX A LIGHTING DESIGN LAYOUT PLAN

LEGEND

Symbol	Name	Count	Lens	Notes
	Proteus Hybrid	56		
	Aqua 480 BWS	8		
	P-10	16	19deg	Strob light
	Aqua Graze HO 4ft	30	60x60	Foot light
	Aqua Graze HO 1ft	26	60x60	Foot light
	Aqua Drum HO	8	40deg	Side light
	Dive 1R FC	114	Wide	Insert in tentacles
	Digital Led Strip	114		By meter / Insert in tentacles
	UWLED.E2B	47	15deg	
	UL 800 RGBW	30	Spot	Helix & transformer jet
	UL 800 RGBW	24	45deg	Transformer jet
	ULR 900 RGBW	93	16deg	Straight & Swifel jet



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Project

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Project manager	Moment Factory / Ptmigan	No.	Date	Description	Title	Modified date	
		R6.0	20190705	P10 and lagoon proteus patch update (mode change)	OPeX FULL ISOMETRIC VIEW LAGOON AND AQUARIUM	11/07/2019	
Lighting designer	Guillaume Fournier	R6.1	20190709	Remove 50 UWLED		Scale	NTS
Technical director	Pierre-Olivier Durand					Revision	R6.1
Drawing by	Guillaume Fournier					Drawing name	101_Full iso
						Sheet	101_Full iso



APPENDIX B IMPLEMENTATION SCHEDULE

Reference of GIA Report	Reference	Recommended Environmental Protection Measures/ Mitigation Measures	Who to implement the measures?	When to implement the measures?
S3.5	EP Condition 2.35	In accordance with the EP Condition 2.35, a specialist with training and practical experience in outdoor sport lighting and illumination had be employed to design, manage and oversee the implementation and maintenance of the illumination requirements and system for the show.	OPC	Operation
S3.5	<i>GIA 2010 & GIA 2020</i>	<p>Although the assessment results indicate no significant glare impact at the representative sensitive receivers, it is still recommended to undertake at least two times of monitoring during the show test and the performance after commencement by the specialist. During each monitoring, the Lux levels should be measured with a Lux Meter or Light Meter at one of the mostly affected sensitive receivers before and during the show. The increase in the Lux level with the show should be compared with that before the show. The Lux level measured during the show should also be compared with the recommended CIBSE’s requirement of 10 Lux.</p> <p>In case the monitoring results indicate measured Lux level higher than 10 Lux, an investigation on the exceedance is required to be conducted by the specialist. Recommendations should be given on any need to adjust the lighting schedule of the show.</p>	OPC	Operation
S3.6	<i>GIA 2010 & GIA 2020</i>	The specialist is also required to conduct regular checks, at least once a month, on the lights for the show to ensure all lights are fixed at not more than 70 degree vertical beam angle and all lights being used are under the lighting schedule.	OPC	Operation



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