# OPERATIONAL PHOTOMETRIC ASSESSMENT PLAZA SAN CLEMENTE HOTEL SITE SAN CLEMENTE, CA

#### Submitted to:

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### On behalf of:

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ISE Project #16-012

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## **REPORT CONTENTS**

INTRODUCTION AND DEFINITIONS	1
Existing Site Characterization	1
Project Description	1
Photometric Definitions and Background	1
ENVIRONMENTAL SIGNIFICANCE THRESHOLDS	6
APPROACH AND METHODOLOGY	7
FINDINGS AND RECOMMENDATIONS	7
CERTIFICATION OF ACCURACY AND QUALIFICATIONS	9
APPENDICES AND SUPPLEMENTAL INFORMATION	10
ISE Lightmap v3.2 Input/Output Results – Plaza San Clemente (Hotel Site)	10
INDEX OF IMPORTANT TERMS	18



## **LIST OF TABLES**

TABLE 1: NATURALLY OCCURRING OUTDOOR LIGHT LEVELS	6

## LIST OF FIGURES / MAPS / ADDENDA

FIGURE 1: PROJECT STUDY AREA VICINITY MAP	2
FIGURE 2: PLAZA SAN CLEMENTE FULL PARCEL MAP	3
FIGURE 3: PLAZA SAN CLEMENTE HOTEL STUDY AREA DENOTED IN RECTANGLE	4
FIGURE 4: PROPOSED HOTEL SITE FREEWAY SIGNS ILLUMINATION LOCATIONS	5
FIGURE 5: PREDICTED HOTEL STUDY AREA ILLUMINATION LEVELS	8





### **INTRODUCTION AND DEFINITIONS**

#### **Existing Site Characterization**

The Plaza San Clemente Hotel site resides on an approximate two-acre parcel located in the northeast portion of the Outlets at San Clemente commercial center in the City of San Clemente (County of Orange) CA, as shown in Figures 1 through 3.<sup>1</sup>

Regional access to the site is obtained from Interstate 5 (I-5), which runs along the eastern edge of the site. The project site currently resides as developed and inprogress development. Surrounding land uses consist of single-family residential lots, mixed commercial, and educational uses. Elevations across the hotel site average approximately 180 feet above mean sea level (MSL).

### **Project Description**

The 'project' includes the proposed installation of illuminated freeway signs for the aforementioned hotel site consisting of five (5) wall-mounted, freeway-oriented and/or freeway-visible signs at the approved, but yet-to-be-built hotel. Three of the signs will be primary hotel identification signs, and two of the signs will be secondary identification signs, as depicted in Figure 4 on Page 5.

#### **Photometric Definitions and Background**

Light is radiant energy that is capable of exciting the retina of the eye and producing a visual sensation. Adequate, well-balanced levels of illumination are essential in establishing safe public thoroughfares and safe working conditions, as well as in promoting efficiency, productivity, and comfort in the workplace and at home. Typical naturally produced levels of illumination are shown in Table 1 for comparison purposes at the top of Page 6.

Common light sources in use today consist of Low Pressure Sodium (LPS) lamps that produce a yellowish tint, High Pressure Sodium (HPS) lamps producing a pinkish tint, Mercury Vapor and Metal Halide lamps yielding a bluish-white tint, Compact Fluorescent (CF) and Light Emitting Diode (LED) lamps which are primarily white in nature, and Incandescent light bulbs which produce tints ranging from yellow to dull-white depending on the power applied. Halo lights are essentially backlight illumination sources that can be generated by any combination of the above sources.

Physiological symptoms of poor lighting may include fatigue, eyestrain, headache, vertigo and digestive and psychological reactions. Overuse of illumination has been shown to produce a phenomenon known as *light pollution*.

<sup>&</sup>lt;sup>1</sup> The Outlets at San Clemente consists of 60.4 usable acres comprising an aggregate of 15 assessor's parcels and one unnumbered lot.



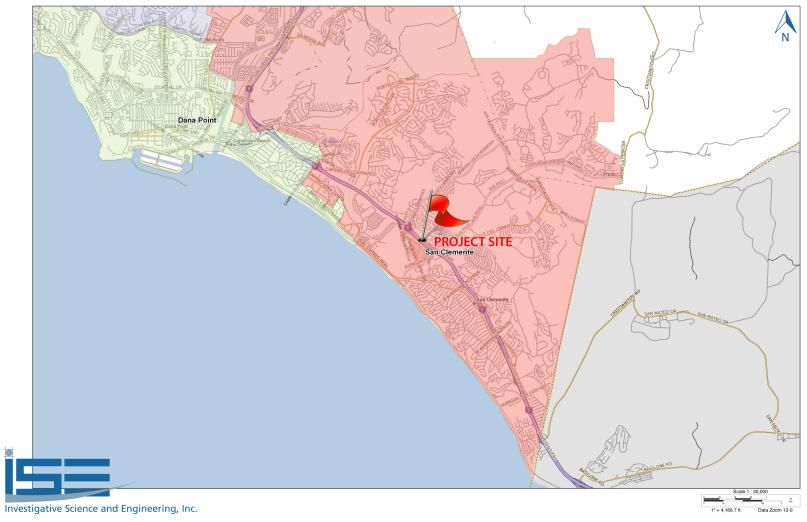


FIGURE 1: Project Study Area Vicinity Map (ISE 1/17)



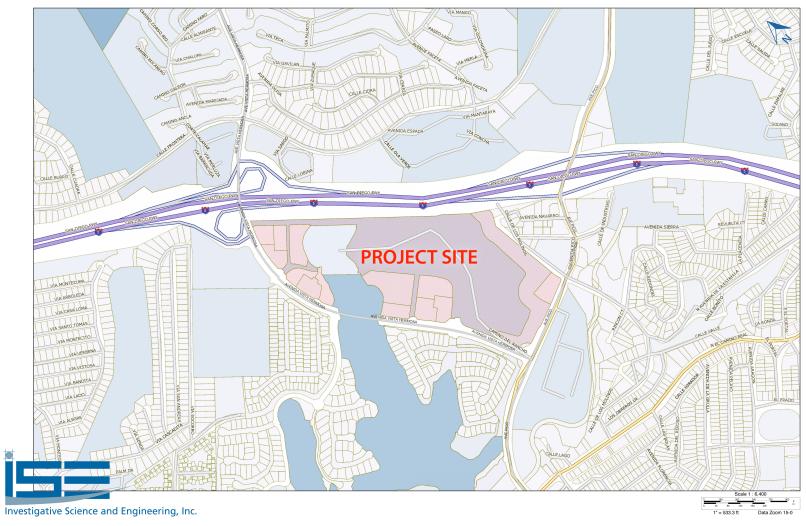


FIGURE 2: Plaza San Clemente Full Parcel Map (ISE 1/17)



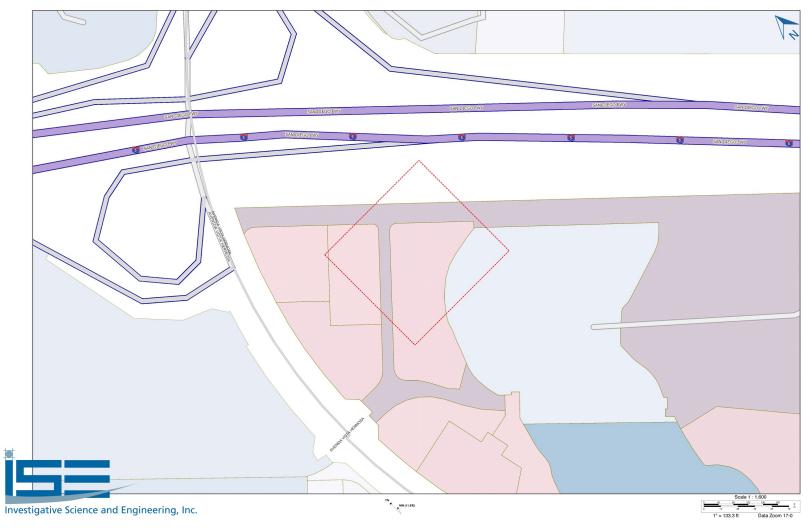


FIGURE 3: Plaza San Clemente Hotel Study Area Denoted in Rectangle (ISE 2/17)



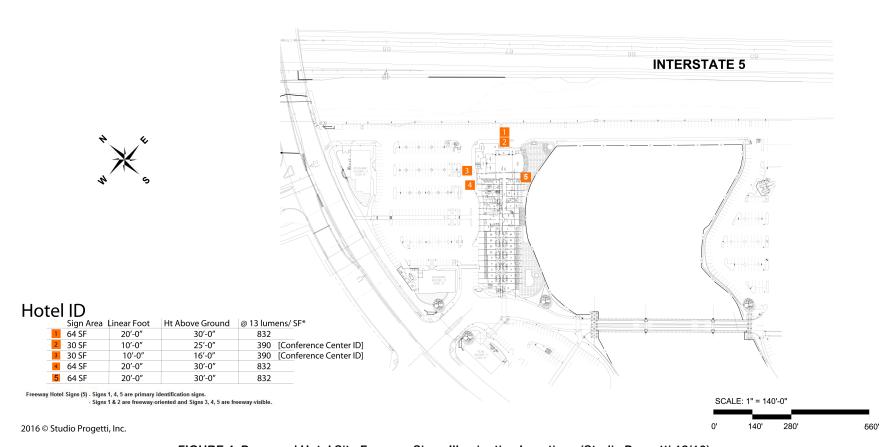


FIGURE 4: Proposed Hotel Site Freeway Signs Illumination Locations (Studio Progetti 12/16)



**TABLE 1: Naturally Occurring Outdoor Light Levels** 

Outdoor Condition	Average Illumination in Foot-Candles
Direct Sunlight	10,000
Full Daylight	1,000
Overcast Day	100
Dusk	10
Twilight	1
Deep Twilight	0.1
Full Moon	0.01
Quarter Moon	0.001
Moonless Night	0.0001
Overcast Night	0.00001

The common cause of light pollution is improperly positioned light fixtures or light fixtures without proper shielding (also known as 'cut-offs'). When non-cutoff fixtures are used, glare is usually present within an individual's field of view. Luminance is defined as the light we see reflected off an object being observed. When glare is present, an effect known as 'veiling luminance' takes place, which actually reduces the eye's ability to see all the radiant energy from the fixture. In effect, energy is expended on light that cannot be seen.

Components of light pollution include: *Light Trespass* which is defined as light radiating from another property in an unshielded manner; *Glare* which is excessive visible light, or unshielded light, that compromises visibility, increases the potential for accidents, and produces high contrast shadows through destructive interference; *Clutter* which is an excessive grouping of lights producing the physiological effect of confusion in some individuals; and, *Urban Sky Glow* which is excessive stray illumination over an urban area blocking out faint astronomical objects and distant terrestrial features.



### **ENVIRONMENTAL SIGNIFICANCE THRESHOLDS**

Outdoor lighting requirements for the proposed project are regulated by the City of San Clemente Lighting Ordinance Section 17.24.130 as well as Municipal Code Sections 17.16.250 and 17.16.260.<sup>2</sup> Thus, this photometric assessment was prepared to analyze the effect of onsite lighting due to the five (5) proposed wall-mounted, freeway-oriented hotel lights for compliance with the intent of Section 17.24.130, as well as identify any potential adverse effects to adjoining properties and public rights-of-ways.

<sup>&</sup>lt;sup>2</sup> The pertinent language states that, "Exterior lighting shall be energy-efficient and shielded or recessed so that direct glare and reflections are contained within the boundaries of the parcel, and shall be directed downward and away from adjoining properties and public rights-of-way. No lighting shall blink, flash, or be of unusually high intensity or brightness. All lighting fixtures shall be appropriate in scale, intensity and height to the use. Security lighting shall be provided at all entrances/exits."





#### APPROACH AND METHODOLOGY

Lighting levels are measured in foot-candles per square foot (referred to simply as foot-candles). Thus, the unit of measurement is typically denoted as a horizontal foot-candle. One foot-candle is equal to the amount of light produced by a single candle at a distance of one foot, and is numerically equal to one Lumen per square-foot (Im/ft²).<sup>3</sup>

For the analysis of the five (5) wall-mounted, freeway-oriented and/or freeway-visible signs at the proposed hotel site, ISE tabulated the total radiant output of each source (in Lumens), and the height of the fixture above ground level (AGL). The site was then modeled using the ISE *LightMap v3.2* computer model.<sup>4</sup> For completeness, the model also included all 376 discrete structural elements comprising the entire Outlets at San Clemente footprint at full build-out. Modeled ground illumination levels, taken at five (5) feet above the ground, were propagated to surrounding offsite areas and examined for applicability with the previously identified by City ordinance.



#### FINDINGS AND RECOMMENDATIONS

The results of the photometric modeling are shown in Figure 5 on the following page. The LightMap v3.2 model input file and output plot are attached at the end of this report. As can be seen, onsite levels immediately adjacent to the proposed hotel signage range from one (1) to three (3) foot-candles, at five (5) feet above the ground. This is equivalent to a 'twilight' to 'dusk' condition as shown in Table 1. Offsite levels due to the proposed signage are predicted to be zero (0.0) foot-candles producing no environmental changes.

As a result of these findings, no excessive offsite light spillage {glare} to any adjoining properties, and public rights-of-ways, pursuant to Section 17.24.130, is anticipated, and the lighting plan is otherwise consistent with the requirements of Sections 17.16.250 and 17.16.260. No residual lighting impacts are expected upon implementation of the proposed project. No additional recommendations are identified at this time.

<sup>&</sup>lt;sup>4</sup> The ISE *LightMap* model is an effective tool in identifying artificial and natural light distribution across an area of interest and is capable of capturing minute details of shadow and glare. The program can calculate the dispersion pattern of light across the entire visible spectrum (roughly 700 nm to 400 nm), as well as for any non-ionizing radiation source (i.e., wavelengths from 1 mm to approximately 750 nm – the boundary of the near infrared).



<sup>&</sup>lt;sup>3</sup> In strict scientific terms, a lumen is 'a unit of luminous flux equal to the amount of light given out through a solid angle of one-steradian by a point source of one-candela'. It is in essence a measure of the perceived power of light adjusting for the varying sensitivity of the human eye to different frequencies (colors).

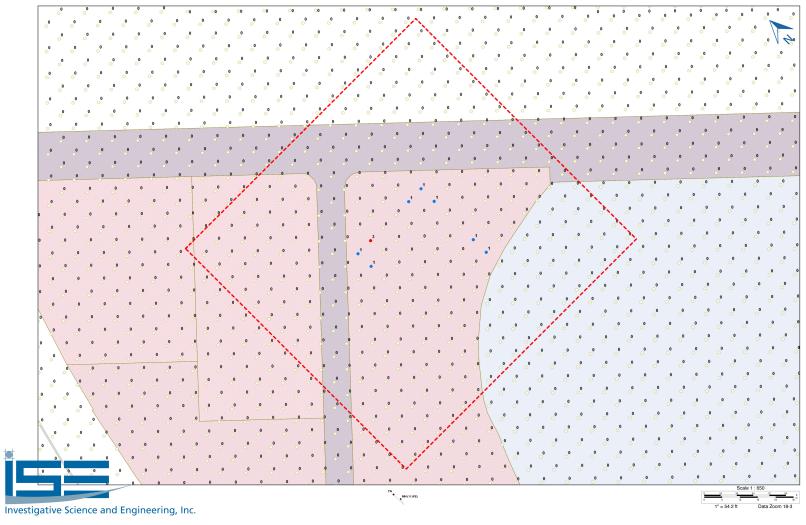


FIGURE 5: Predicted Hotel Study Area (5 Hotel Freeway Signs) Illumination Levels, 20-Ft Increments (ISE 2/17)





### **CERTIFICATION OF ACCURACY AND QUALIFICATIONS**

This report was prepared by Investigative Science and Engineering, Inc. (ISE). The members of its professional staff contributing to the report are listed below:

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M.S. Mechanical Engineering

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B.S. Electrical Engineering

ISE affirms to the best of its knowledge and belief that the statements and information contained herein are in all respects true and correct as of the date of this report. Content and information contained within this report is intended only for the subject project and is protected under 17 U.S.C. §§ 101 through 810.

Should the reader have any questions regarding the findings and conclusions presented in this report, please do not hesitate to contact ISE at (760) 787-0016.

Approved as to Form and Content:

Rick Tavares, Ph.D.

Project Principal

Investigative Science and Engineering, Inc. (ISE)





#### APPENDICES AND SUPPLEMENTAL INFORMATION

#### ISE Lightmap v3.2 Input/Output Results – Plaza San Clemente (Hotel Site)

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LIGHTMAP PROGRAM INPUT DECK - (C) 2017 INVESTIGATIVE SCIENCE & ENGINEERING INC.
GLOBAL VARIABLE DECLARATION
   PROBLEM STATEMENT: PSC HOTEL SITE - SAN CLEMENTE CA (HOTEL-ONLY SCENARIO)
   STARTING POINT (XY IN FEET): 6139090.5,2106523.7
   ENDING POINT (XY IN FEET): 6141830.0,2108708.9
   FREQUENCY OF LIGHT SOURCE (HZ): 6.2509E13
   REFERENCE DISTANCE FOR LIGHT INTENSITY (D IN FEET): 1
   PHYSICAL PROPAGATION COEFF XLOG10 (DB): 20
   EXCESS ATTENUATION (DB): 0
   COMPUTATIONAL STEP DISTANCE (IN FEET): 20
   RECEPTOR ELEVATION (IN FEET): 5
LIGHT SOURCE DECLARATION (XYZ - LEVEL in dB FC re. 1 FC - LABEL)
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   6140578.5,2107747,25,25.9,SOURCE HID-2
   6140515,2107759.75,16,25.9,SOURCE HID-3
   6140503,2107745,30,29.2,SOURCE HID-4
   6140585.5,2107673.75,30,29.2,SOURCE HID-5
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6141484.5,2106756.3,6141490.5,2106765.5,30.0,100.0,BLDG 17-39
6141490.5,2106765.5,6141549.0,2106826.5,30.0,100.0,BLDG 17-40
6141423.5,2106942.0,6141449.0,2106917.0,30.0,100.0,BLDG 18-1
6141449.0,2106917.0,6141451.5,2106919.3,30.0,100.0,BLDG 18-2
6141451.5,2106919.3,6141519.0,2106857.0,30.0,100.0,BLDG 18-3
6141519.0,2106857.0,6141455.0,2106794.8,30.0,100.0,BLDG 18-4
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6141430.5,2106794.3,6141354.0,2106869.5,30.0,100.0,BLDG 18-6
6141354.0,2106869.5,6141423.5,2106942.0,30.0,100.0,BLDG 18-7
6141385.0,2106238.5,6141532.5,2106198.5,30.0,100.0,BLDG 19-1
6141532.5,2106198.5,6141553.0,2106160.5,30.0,100.0,BLDG 19-2
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6141564.5,2106144.0,6141569.5,2106137.8,30.0,100.0,BLDG 19-5
6141569.5,2106137.8,6141574.0,2106133.3,30.0,100.0,BLDG 19-6
6141574.0,2106133.3,6141579.0,2106128.3,30.0,100.0,BLDG 19-7
6141579.0,2106128.3,6141584.0,2106123.5,30.0,100.0,BLDG 19-8
6141584.0,2106123.5,6141589.5,2106119.5,30.0,100.0,BLDG 19-9
6141589.5,2106119.5,6141560.5,2105993.5,30.0,100.0,BLDG 19-10
6141560.5,2105993.5,6141527.5,2106004.0,30.0,100.0,BLDG 19-11
6141527.5,2106004.0,6141454.5,2106076.8,30.0,100.0,BLDG 19-12
6141454.5,2106076.8,6141480.5,2106104.0,30.0,100.0,BLDG 19-13
6141480.5,2106104.0,6141413.0,2106169.8,30.0,100.0,BLDG 19-14
6141413.0,2106169.8,6141415.0,2106175.5,30.0,100.0,BLDG 19-15
6141415.0,2106175.5,6141387.5,2106201.5,30.0,100.0,BLDG 19-16
6141387.5,2106201.5,6141375.5,2106205.3,30.0,100.0,BLDG 19-17
6141375.5,2106205.3,6141385.0,2106238.5,30.0,100.0,BLDG 19-18
6141478.5,2106683.5,6141629.0,2106537.5,30.0,100.0,BLDG 20-1
6141629.0,2106537.5,6141630.0,2106524.3,30.0,100.0,BLDG 20-2
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6141630.5,2106516.3,6141631.0,2106505.3,30.0,100.0,BLDG 20-4
6141631.0,2106505.3,6141634.0,2106494.8,30.0,100.0,BLDG 20-5
6141634.0,2106494.8,6141636.5,2106484.3,30.0,100.0,BLDG 20-6
6141636.5,2106484.3,6141644.5,2106467.5,30.0,100.0,BLDG 20-7
6141644.5,2106467.5,6141648.0,2106457.3,30.0,100.0,BLDG 20-8
6141648.0,2106457.3,6141652.0,2106450.3,30.0,100.0,BLDG 20-9
6141652.0,2106450.3,6141657.5,2106440.8,30.0,100.0,BLDG 20-10
6141657.5,2106440.8,6141622.0,2106321.5,30.0,100.0,BLDG 20-11
6141622.0,2106321.5,6141543.5,2106240.8,30.0,100.0,BLDG 20-12
6141543.5,2106240.8,6141495.5,2106233.3,30.0,100.0,BLDG 20-13
6141495.5,2106233.3,6141475.5,2106239.5,30.0,100.0,BLDG 20-14
6141475.5,2106239.5,6141424.0,2106247.5,30.0,100.0,BLDG 20-15
6141424.0,2106247.5,6141390.0,2106259.0,30.0,100.0,BLDG 20-16
6141390.0,2106259.0,6141366.5,2106275.3,30.0,100.0,BLDG 20-17
6141366.5,2106275.3,6141305.0,2106359.3,30.0,100.0,BLDG 20-18
6141305.0,2106359.3,6141286.5,2106389.3,30.0,100.0,BLDG 20-19
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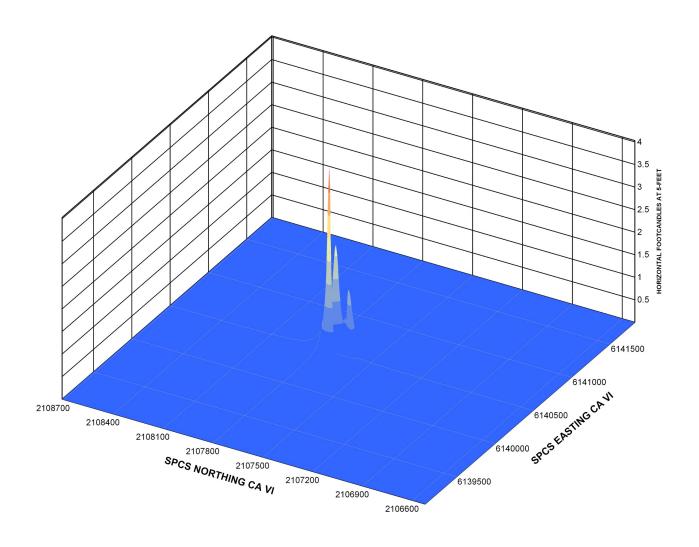


Operational Photometric Assessment Plaza San Clemente Hotel Site – San Clemente, CA ISE Project #16-012 February 15, 2017 (Revised) Page 16

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Operational Photometric Assessment Plaza San Clemente Hotel Site – San Clemente, CA ISE Project #16-012 February 15, 2017 (Revised) Page 17







## **INDEX OF IMPORTANT TERMS**

Clutter, 6 Compact Fluorescent, 1

footcandle, 7

Glare, 6, 7

High Pressure Sodium, 1

Incandescent light, 1 ISE, 1, 2, 9

Light, 3, 1, 6 light pollution, 1, 6

LightMap, 7 Low Pressure Sodium, 1 lumen, 7 Luminance, 6

Mercury Vapor, 1 Metal Halide, 1

shielding, 6

Urban Sky Glow, 6

veiling luminance, 6

