

**FINAL LICENSE APPLICATION
EXHIBIT E**

APPENDIX Y

LIGHTING MANAGEMENT PLAN

**LIGHTING MANAGEMENT PLAN
DRAFT**

**SKAGIT RIVER HYDROELECTRIC PROJECT
FERC NO. 553**

Seattle City Light

April 2023

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List of Acronyms and Abbreviations

ADA.....	American with Disabilities Act
BMP	best management practices
CCT.....	Correlated Color Temperature
CFL	compact fluorescent lamp
City Light.....	Seattle City Light
ELC	Environmental Learning Center
FERC.....	Federal Energy Regulatory Commission
HID	high intensity discharge
HPS	high pressure sodium
IDA	International Dark-Sky Association
IES.....	Illuminating Engineering Society
IESNA.....	Illuminating Engineering Society of North America
K.....	Kelvin
LED.....	light-emitting diode
LPS.....	low pressure sodium
NERC.....	North American Electric Reliability Corporation
NPS	National Park Service
NRHP	National Register of Historic Places
O&M.....	operation and maintenance
OSHA.....	Occupational Safety and Health Administration
Project	Skagit River Hydroelectric Project
RLNRA.....	Ross Lake National Recreation Area
SR.....	State Route
SRCC	Skagit Resource Coordinating Committee
WISHA	Washington Industrial Safety and Health Act
WSDOT	Washington State Department of Transportation

GLOSSARY

These defined key terms are utilized in the Lighting Management Plan (Lighting Plan).

Types of Lighting

There are four basic types of lighting which are utilized to varying degrees at Skagit River Hydroelectric Project facilities covered in this Lighting Plan. The lighting types include incandescent, fluorescent, high-intensity discharge (HID), and light-emitting diode (LED). Each of these is defined below.

Incandescent Lamp consists of a sealed glass bulb with a filament inside. When electricity is passed through the filament, the filament gets hot. Depending on the temperature of the filament, radiation is emitted from the filament. The principle of obtaining light from heat is called ‘incandescence.’ Standard incandescent bulbs are most common and yet are the most inefficient. Larger wattage bulbs have a higher efficiency than smaller wattage bulbs.

Compact Fluorescent Lamp (CFL) are a type of fluorescent lamp that are designed to replace traditional incandescent bulbs. CFLs are very energy efficient, using approximately one quarter of the energy compared to traditional incandescent bulbs. CFLs also have a very long lifespan compared to normal incandescent bulb.

High Intensity Discharge (HID) lamps are similar to fluorescents in that an arc is generated between two electrodes though the arc in an HID source is shorter, yet it generates much more light, heat, and pressure within the arc tube. Below are HID sources, listed in increasing order of efficiency.

- *Mercury Vapor Lamps* are widely used to light both indoor and outdoor areas. Mercury vapor lamps consist of an inner arc discharge tube constructed of quartz surrounded by an outer hard borosilicate glass envelope.
- *Metal Halide Lamps* are similar to mercury vapor lamps but use metal halide additives inside the arc tube along with the mercury and argon. These additives enable the lamp to produce more visible light per watt with improved color rendition. These lamps are sometimes used for general outdoor lighting, such as parking facilities.
- *High-pressure Sodium (HPS) and Low-pressure Sodium (LPS)* are specific types of gas-discharge lights. The principal difference between low- and high-pressure sodium lights is the operating pressure inside the lamp. As indicated by the name, HPS vapor lights operate at a higher internal pressure. The arc tube is made of aluminum oxide and the sodium metal is combined with several other elements like mercury which counterbalances the yellow glow with some white to light blue emissions.

Light-emitting Diodes (LED) pass an electrical current through a microchip, which illuminates the small light sources and results in visible light. Compared with conventional light sources that first convert electrical energy into heat, and then into light, LEDs convert electrical energy directly into light, delivering efficient light generation with little-wasted electricity. LEDs produce light up to 90 percent more efficiently than incandescent light bulbs.

Other Key Terms

Illuminating Engineering Society of North America (IES or IESNA) is a recognized technical and educational authority on illumination. For over 100 years its objective has been to communicate information on all aspects of good lighting practice to its members, to the lighting community, and to consumers through a variety of programs, publications, and services.

International Dark-Sky Association (IDA) is a recognized authority on light pollution and one of the leading organizations combating light pollution worldwide. Their mission includes preserving and protecting the nighttime environment and the heritage of dark skies through environmentally responsible outdoor lighting.

Lumen is a unit of measurement for the brightness from a light source.

Luminaire is a complete lighting unit consisting of a lamp or lamps together with the parts designed to distribute the light, to position and protect the lamps, and to connect the lamps to the power supply.

Correlated Color Temperature (CCT) is a measure in Kelvin (K) of light's warmness or coolness. Warm light sources which feature light in the red, orange, and yellow range of the visible spectrum have a lower CCT; cool light sources featuring bluish/whitish colors have a higher CCT. Historical "warm" HPS lighting can have a CCT of around 1,800 K, while first generation "white" LED lighting had 4,000 K – 6,000 K CCT. This Lighting Plan will focus on recommending night lighting with a warmer CCT, i.e., a maximum K of 2,700, which more closely mimics firelight in color and intensity and has no blue in the spectrum.

1.0 INTRODUCTION

This document describes Seattle City Light’s (City Light) proposed Lighting Management Plan (Lighting Plan) for the Skagit River Hydroelectric Project (Project or Skagit River Project), Federal Energy Regulatory Commission (FERC) No. 553. This Lighting Plan provides guidance for the management of Project facilities with exterior lighting elements within the Project Boundary.

City Light will coordinate the efforts required under this Lighting Plan with other license article requirements and resource management plans included in the new license. Specifically, resources with related guidance measures are designed to work in tandem to meet comprehensive management goals through the implementation of the suite of City Light’s proposed resource measures.

1.1 Background

The Skagit River Project is located in a remote area, with steep terrain, approximately 120 miles northeast of Seattle and 60 miles east of Sedro-Woolley along State Route (SR) 20. The Project is unique in that the generation facilities are almost entirely within a national recreation area, the Ross Lake National Recreation Area (RLNRA), which was established in 1968—decades after the initial licensing and development of the Project—and is managed by the National Park Service (NPS) as part of the North Cascades National Park Complex.

The Project includes numerous Project facilities within the Project Boundary that support the operations and maintenance (O&M) of the Project, which include a variety of exterior lighting elements, primarily for safety, security, and efficient operation of the facilities. Project facilities with exterior lighting elements exist at Ross Dam, Diablo Lake, Diablo Dam, Gorge Lake, Gorge Powerhouse, and at the two Project townsites (Diablo and Newhalem). These Project facilities support hydropower operations, as well as public access and recreational uses.

In the broader context, the RLNRA provides numerous and varied non-Project recreation facilities at Ross Lake, Diablo Lake, Gorge Lake, and along the Skagit River downstream of Gorge Powerhouse. While the Project provides recreation facilities located on City Light and federal land and managed by either City Light or the NPS, most of the recreation facilities within or adjacent to the Project Boundary are non-Project recreation facilities located on federal land and managed by the NPS as part of the RLNRA. NPS reports annual use for RLNRA ranging from approximately 700,000 to 1,100,000 visitors annually from 2010 to 2022.

1.2 Project Facility Lighting Context

This section describes the existing needs, types, and areas of Project facility lighting within the Project Boundary. Notably, Project transmission lines do not include exterior lighting.

1.2.1 Ross Dam

Project facilities in the Ross Dam area include Ross Dam, Ross Dam Boathouse, Ross Powerhouse, and Ross Powerhouse Boathouse.

Ross Dam is located just upstream of Ross Powerhouse and includes a boathouse on the upstream face of the dam. Ross Dam is accessible by boat and trail only; vehicle use of the road atop the dam is not available to the public. The only exterior lighting on the dam is associated with the boathouse and a single light along a stairwell on the upstream face of the dam. The exterior lighting can be categorized into two types: (1) covered canopy lighting or (2) wall packs (City Light 2023).

In general, these facilities require minimal amounts and levels of ambient light for Project operations and safety and are located in areas with limited development where the natural environment could be affected by small amounts of electric lighting at night. The non-Project Ross Lake Resort is also located in this area upstream of Ross Dam, which includes exterior lighting on the resort administration buildings and cabins.

1.2.2 Diablo Lake

Project facilities in the Diablo Lake area occur along the northwest portion of the reservoir along Diablo Dam Road. The Project facilities include Diablo Dam, Diablo Dam Parking Area, Skagit Tour Dock, West Ferry Landing, Diablo Lake Boathouse, and the North Cascades Environmental Learning Center (ELC).

Completed in 1930, Diablo Dam is a concrete arch dam with two gravity abutments that have Art Deco/Moderne stylistic features. This architectural style is seen in the concrete detailing, centrally placed concrete arches supporting the roadway on top of the dam, and the low concrete walls along the crest of the dam. It is also seen in the 30 ornamental lighting standards—the tall, tapered metal piers/posts, each having a single glass octagonal luminaire—that are equidistantly spaced along and on each side of the entire roadway. The historic period lighting aesthetics of the dam include the warm color temperature of the incandescent lamps used at the time of the dam’s construction, and later, LPS lamps. The earlier luminaire sources have been replaced with 4,000 K LED sources, lack full cut-off shielding, and operate from dusk to dawn (City Light 2023). The adjacent gate house/intake tower has a variety of HID, CFL, and LED wall packs and post top luminaires, only some of which match the Art Deco/Moderne aesthetic of the dam.

The roadway along the top of Diablo Dam is open to the public and provides access to the northern shoreline of Diablo Lake, which includes operational, recreational, and educational facilities accessed via Diablo Dam Road between Diablo Dam and the ELC. Most of the facilities on Diablo Dam Road (excluding the ELC) do not have functional exterior lighting. LED street lighting (4,000 K and unshielded) is provided intermittently and at intersections, including in the vicinity of Diablo Dam Parking Area, Skagit Tour Dock, and West Ferry Landing (City Light 2023).

The Diablo Boathouse is located between the West Ferry Landing and the ELC along Diablo Dam Road. The boathouse is used primarily during daytime hours, but occasional Project O&M requires nighttime use. Most of the exterior lighting at the boathouse can be categorized into three types: (1) typical post-top light poles; (2) exterior entrance lighting; and (3) covered canopy lighting (City Light 2023). The post-top lighting provides general area lighting in the driveway and parking area and is unshielded. Lighting is also located at the entrance ramp and doorway to the boathouse and is partially recessed under a canopy. The interior and exterior walkway facing out onto Diablo Lake have a combination of covered and uncovered canopy lighting (City Light 2023).

The ELC is an educational and residential campus located on the northern shore of Diablo Lake operated by the North Cascades Institute in partnership with City Light and NPS. It was constructed by City Light as required by the current FERC license. The campus is comprised of 16 buildings including multi-media classrooms, a library, aquatic and terrestrial labs, a dining hall, a recycling and compost center, an amphitheater, outdoor learning shelters and trails, and overnight lodging for up to 92 visitors. Exterior lighting in the ELC area can be categorized into three types: (1) pathway/bollard lighting; (2) exterior entrance or porch lighting; and (3) lighting to accentuate the buildings' architecture including some up lighting (City Light 2023). The ELC has the highest quantity and density of exterior lighting in the Diablo Lake area. All of the lighting in these three categories is LED and on a timeclock control system that automatically turns the lights off at 11 p.m. when the ELC facility is in use. The pathway lighting is used to guide visitors and staff along the trails between buildings on campus and consists of approximately thirty, 24-inch-tall bollards with partial shielding (not full cut-off). The porch lighting on each facility provides general area lighting and visibility at the entrance to each facility. The luminaires are wall-mounted and aimed downward but lack full shielding. There are several architectural feature lights that are roughly 20 feet above the ground that accent building architecture, including utilizing up-lighting without shielding.

Overall, the Project facilities in this area require minimal to moderate levels of ambient light for Project operations, safety, or historical aesthetics and are located in an area with increased development and human activity but still within a natural environment.

1.2.3 Gorge Lake

1.2.3.1 Diablo Townsite

The Diablo townsite is located approximately 6 miles north of the Newhalem townsite and 1 mile off of SR 20. The townsite is divided into two areas, including the Hollywood area, located on City Light-owned lands, and the other area commonly known as Reflector Bar, located on federal lands managed by NPS. The Hollywood area is primarily residential, with 23 houses, nearly all built in the 1950s. The residential portion of the Reflector Bar area previously consisted of 12 residential buildings which were removed in 2022. Most of the exterior lighting in the Diablo townsite can be categorized into three types: (1) typical post-top light poles; (2) residential exterior entrance or porch lighting; and (3) covered canopy lighting (City Light 2023).

Residential porch lighting varies from building to building. Many buildings have a mix of source types and luminaire types, including LED, CFL, and incandescent wall packs and sconces. These luminaires are typically located next to building entrances or over garages/driveways to provide general illumination for visibility and security. Most of these exterior lighting luminaires are unshielded.

Overall, the townsite requires continuous and moderate amounts of ambient light for residential uses, safety and security. In general, nighttime human activity in this area is predominantly residential.

1.2.3.2 Diablo Powerhouse, Switchyard and O&M Buildings

The Diablo Powerhouse and switchyard are located in between the Hollywood and Reflector Bar areas of the Diablo townsite, essentially dividing the townsite into the two separate areas. City

Light administration/maintenance buildings are located nearby to the Diablo Powerhouse/switchyard in the Reflector Bar area of the townsite. Most of the exterior lighting at these facilities can be categorized into two types: (1) typical post-top light poles; (2) wall packs; and (3) covered and uncovered canopy lighting (City Light 2023).

Overall, the Project facilities in this area require continuous and moderate amounts of ambient light for Project operations, safety, and security. In general, nighttime human activity in this area is predominantly City Light staff related to O&M of these Project facilities.

1.2.4 Newhalem

1.2.4.1 Newhalem Townsite

The Newhalem townsite includes 28 houses, two bunkhouses, garages, administrative offices, a meeting hall, dining hall, playground, firehouse, helipad, wastewater treatment plant, general store, information center, parking areas, and public restrooms. The Newhalem townsite, particularly the Main Street area, historically had ornamental light standards that gave the townsite a unique feel that visitors and Project facility operations teams appreciated (NRHP 2011). Much of the exterior lighting found in the Newhalem townsite can be categorized into two types: (1) typical post-top light poles; or (2) residential exterior entrance, or porch lighting (City Light 2023).

Typical post-top light poles have LED sources, an estimated CCT of 4,000 K, and some up light shielding, but many are unshielded (i.e., globes) (City Light 2023). Residential and Project facility porch lighting varies from building to building. Many buildings have a mix of source types and luminaire types, including LED, CFL, and incandescent wall packs and sconces (City Light 2023). These luminaires are typically located next to building entrances and driveways to provide general illumination for visibility and security. Most of the exterior lighting on residential, Project facility entrances, and porches are unshielded (City Light 2023).

Overall, the townsite requires continuous and moderate amounts of ambient light for residential and public uses, safety and security. In general, nighttime human activity in this area is predominantly related to residential use as well as Project O&M.

1.2.4.2 Gorge Powerhouse

Gorge Powerhouse is located on the left bank (facing downstream) of the Skagit River just upstream of the Newhalem townsite and is reached via a vehicular bridge over the river that connects to SR 20. In addition to the vehicular bridge to Gorge Powerhouse, there is a pedestrian bridge from a public parking area that provides access to interpretive signage and the adjacent Ladder Creek Falls Trail and Gardens (see below). Gorge Powerhouse has a variety of exterior luminaires including parking and area lighting, original architectural sconces, adjustable flood lights, and wall packs with a variety of different source types including LED, CFL, and HID (City Light 2023). The CCT of the luminaires around the exterior of the powerhouse range from 2,700 K to 5,000 K.

The Gorge switchyard is located on the eastern portion of the Newhalem townsite and is adjacent to a maintenance yard with warehouses, storage buildings, and workshops. The Gorge switchyard and maintenance yard exterior lighting can be classified as utilitarian and is used only for facility operations within the Gorge switchyard and maintenance yard. The majority of luminaires found

in this area are wall packs around exterior building perimeters, flood lights in driveways and work zones, and various types of general area lighting under the canopies of maintenance areas. These luminaires are primarily LED and CFL sources. Many of these luminaires are in good condition and have been upgraded within the last 10 years. All these luminaires have a CCT of 4,000 K or higher. Many of these luminaires produce intense levels of light, are unshielded, and are operated for extended periods of time.

Overall, the Project facilities in this area require continuous and moderate amounts of ambient light for Project safety and security. Most of the nighttime use in this area is related to Project O&M and visitors to the adjacent Ladder Creek Falls Trail and Garden.

1.2.4.3 Gorge Switchyard and Maintenance Yard

The Gorge Switchyard is located on the eastern portion of the Newhalem townsite and is adjacent to a large maintenance yard with warehouses, storage buildings, shops, and a water tower. The Gorge switchyard and maintenance yard exterior lighting can be classified as utilitarian and is used only for Project facility operations within the Gorge switchyard and maintenance yard. The majority of luminaires found in this area are wall packs around exterior building perimeters, flood lights in driveways and work zones, and various types of general area lighting under the canopies of maintenance areas (City Light 2023). These luminaires are primarily LED and CFL sources, have been upgraded within the last 10 years, and have a CCT of 4,000 K or higher (City Light 2023). Many of these luminaires produce intense levels of light, are unshielded, and are operated for extended periods of time.

Overall, these Project facilities require continuous and moderate to high amounts of ambient light for Project safety and security. The nighttime use in this area is related to Project O&M.

1.2.4.4 Ladder Creek Falls Trail and Garden

Ladder Creek Falls Trail starts next to Gorge Powerhouse and winds alongside the creek through a garden developed on the adjacent hillside. The trail includes interpretive signs and provides access along Ladder Creek Falls, a dramatic series of waterfalls and pools located in a slot canyon and which are illuminated at night with colored lights. This area is a historic contributing resource within the Skagit River and Newhalem Creek Hydroelectric Project historic district. It was planned and established in the 1920s and 1930s by J.D. Ross, superintendent of the City's Lighting Department, as an attraction for visitors to the Project and to garner public support for the Project (NRHP 2011). The original installation of colored lights and speakers that led visitors along the trails to the waterfalls in the slot canyon were attached to tree trunks. Remnants of the original installation can still be seen today hanging from tree branches and tree trunks, weathered by time and the elements.

City Light upgraded and reinstalled the colored lights in the 1970s with CFL luminaires and again in 2009 with color changing LED flood light luminaires aimed at the waterfalls. These color changing LED luminaires are built into the side of the slot canyon and under one of the trail bridges hidden from view. This new system of trail lights and color changing luminaires has a modern control system that can be altered for different events or times of year, as needed. Many of these luminaires are unshielded or provide up lighting (City Light 2023). Post-top lighting is provided

intermittently throughout the length of the trail and stairs which included full shielding (City Light 2023).

1.3 Night Skies and Light Pollution

This section introduces the relevant nighttime dark sky resources of interest related to Project facility lighting, including night skies and light pollution.

1.3.1 Night Skies

Per the NPS, the protection of night skies has only recently been recognized as an important cultural and natural resource by the NPS and more broadly in the United States (NPS 2023). The NPS strives to preserve dark sky viewsheds for the enjoyment of park visitors, and the well-being of wildlife and habitat. The NPS also states that an essential management action is to work with neighboring communities to ensure that the protection of natural lightscapes is integrated into park and community planning. Basic principles such as following best management practices (BMP) and tracking progress can protect and even restore natural lightscapes (NPS 2023). This Lighting Plan aims to support these NPS principles through implementation of BMPs and monitoring at Project facilities.

The night sky is a combination of both natural and anthropogenic sources of light. Natural light sources include moonlight, starlight from stars and planets, the zodiacal light (i.e., hazy light in the sky just after evening twilight ends or before twilight begins at dawn), and airglow. The predominant anthropogenic source of light is outdoor electrical lighting.

1.3.2 Light Pollution

Light pollution is the combination of all the adverse or obtrusive effects of electric light that produce artificial sky glow, including (1) unnecessary, unwanted, or wasted light; (2) light that damages or degrades the nighttime environment; and (3) light that negatively impacts humans and other species (IES 2020). Light pollution includes both direct glare and skyglow (human-caused light scattered through the atmosphere). Sky glow is the brightening of the night sky that results from the scattering and reflection of light from the constituents of the atmosphere (gaseous molecules and aerosols) in the direction of the observer and has two components: natural sky glow and artificial sky glow (IES 2020). Electric lighting increases sky glow above natural background levels through a combination of direct (i.e., light emitted above the horizontal) and reflected light (i.e., light reflected from the ground or vertical surfaces, depending on the ground cover conditions, such as snow or water) (IES 2020).

Light pollution created by an anthropogenic source can be recognized in several forms, including:

- *Glare* – undue brightness of a light source shining horizontally. The luminance produced by the light source is sufficiently greater than the natural luminance to which the eyes are adapted, causing annoyance, discomfort, or loss in visibility.
- *Light clutter* – excessive grouping of light sources.
- *Light trespass* – unwanted lighting of an area. For instance, a floodlight or streetlight spills onto an adjacent property, lighting an area that would otherwise be dark.

- *Over-illumination* – the use of artificial light well beyond what is required for a specific activity, such as streetlights turning on too early or offices in a building not turning off their lights at night.
- *Skyglow* – the increased night sky brightness that is produced by upwardly emitted and reflected electric light being scattered by water, dust, and gas molecules in the atmosphere.

Implementation of this Lighting Plan is anticipated to have a myriad of benefits, including balancing the need for safety and security, conserving energy and resources, minimizing O&M costs, reducing adverse effects on biological species active at nighttime, exploration of recreational opportunities in a nighttime environment, and general public health.

2.0 PURPOSE AND SCOPE OF THE PLAN

City Light proposes this Lighting Plan to provide BMPs and procedures to guide City Light's actions related to the management of light pollution and to preserve natural darkness under the new license. The regulation of artificial light use at night will be done in a way that prioritizes the safety of visitors and staff while minimizing the impact of such light on protected outdoor spaces, viewsheds, and wildlife. The Lighting Plan will be effective for the term of the new license and is subject to periodic updates in consultation with the Skagit Resource Coordinating Committee (SRCC).¹

2.1 Goals and Objectives

The primary goals for the Lighting Plan are to:

- Enhance nighttime dark-sky resources by preventing or minimizing light pollution from existing and future Project facilities;
- Balance attempts to prevent or minimize light pollution against the need for lighting for safety, security, historic values, and other Project purposes; and
- Coordinate lighting conditions with the NPS to ensure a consistent management approach within the RLNRA.

The implementation actions included in this Lighting Plan are designed to meet the following objectives:

- Conduct a site-specific lighting evaluation to develop a road map for implementation of lighting BMPs at Project facilities;
- Periodically inspect Project lighting and provide employee education on lighting BMPs to track compliance with the Lighting Plan; and
- Communicate with the SRCC on a regular interval to provide implementation updates and collaboratively update management strategies.

2.2 Geographic Area

The geographic scope includes the current Project facilities listed below and lands within the Project Boundary. This scope includes external luminaires on Project facilities with lighting which escapes to the night sky. The Project facilities with exterior lighting included in the geographic scope of this Lighting Plan are listed below. Notably, highway lighting along SR 20 is managed by Washington Department of Transportation (WSDOT). Any new facilities that are developed as part of the new license will be included in this geographic scope.

¹ The SRCC includes agency representatives that will collaborate regarding implementation and monitoring of this Lighting Management Plan and contribute to adaptive management decisions.

Ross Dam

- Ross Dam
- Ross Powerhouse
- Ross Dam Boathouse
- Ross Powerhouse Boathouse

Diablo Lake

- Diablo Dam
- Diablo Boathouse
- Diablo Dam Parking Area
- Skagit Tour Dock
- West Ferry Landing
- ELC

Gorge Lake

- Diablo Powerhouse
- Diablo Switchyard
- Maintenance/Administrative facilities
- Diablo townsite

Newhalem

- Gorge Powerhouse
- Gorge Switchyard/Maintenance Yard
- Maintenance/Administrative facilities
- Newhalem townsite
- Ladder Creek Falls Trail and Garden

3.0 BEST MANAGEMENT PRACTICES

This section details the BMPs, specific light tasks and appropriate luminaires, exemptions to the BMPs, and other Project-specific lighting considerations.

3.1 Lighting Best Management Practices

City Light will implement the following BMPs at Project facilities to meet the goals and objectives of the Lighting Plan. These BMPs are consistent with NPS sustainable outdoor lighting specifications (NPS 2023).

- No lighting – Initial screening of lighting at Project facilities should determine if the light is needed.
- LEDs in warm colors – Maximum of 2,700 K. Use energy efficient LEDs that have a warm color hue (e.g., yellow or amber) and not blue or white. Notably, the most highly efficient LEDs are not preferable because they have significant amount of blue color, which generates more glare/blind spots, have potential adverse health effects, and are not considered wildlife friendly.
- Recessed and fully shielded – Hockey puck style lights that can be inserted under a soffit or architectural feature are very useful. Avoid globes or diffusers that hang below the light fixture. Use “full cut-off” shielding which allows excess light to be directed downward and not upward.
- No upward facing lights – Outdoor lighting should be designed and installed to be downward facing (e.g., park signs and flags often have upward-facing lighting that can be easily made to point downward). Avoid lights that are directed laterally as well.
- Fixtures that include or can accommodate timers, motion detectors, hue adaptors, and dimmers – These adaptive technologies can increase energy efficiency and reduce impacts to natural and cultural resources substantially. Further, they can enhance visitor health and safety.
- Lowest lumens possible – Lumens are the unit of measurement used to specify the intensity or brightness of LED bulbs. The number of lumens needed to safely light an area is usually much lower than most people think, especially outdoors. LEDs are much brighter and more energy efficient than other types of lighting so it is possible to utilize a much lower wattage LED and still have the same level of brightness. For example, a 250-watt incandescent bulb has the same lumens as a 30-watt LED bulb. Field adjustable wattage selectors may also reduce impacts, increase cost savings, and extend product life.
- Proper installation – Lights should be installed with proper angle and height as designed. Another benefit of using LEDs for outdoor lighting is that LED luminaires allow for very specific control of the beam spread. The size of the lighted area will change depending on the height of the fixture or pole so the beam spread should be accounted for during installation to avoid lighting a greater area than needed. For example, a Type I beam spread is typically used for roads while Type V may be more appropriate for a parking lot. Proper installation and spread angle can also reduce the number of lights needed in general.

In addition to the NPS sustainable outdoor lighting specifications, the IES Lighting Practice document (IES 2020) is a resource for City Light during implementation of BMPs.

3.2 Light Tasks and Appropriate Luminaires

This section highlights typical light tasks and the suitable luminaires based on the type of task/Project facility where lighting is provided. In general, this section is consistent with suggestions from the IDA (2002). There are various practices and placements of outdoor lighting, which require certain luminaires to provide lighting for a specific task. This section highlights some typical examples of light tasks and suitable luminaires and provides BMPs for making these luminaires compliant. This section highlights tasks such as building exteriors, residential lighting, parking area lighting, roadway lighting, pathways, historical lighting, flag lighting, and exterior lighted signs.

3.2.1 Building Exterior

Whether utilizing fixtures for security, landscape or illuminating pathways, exterior lights can transform how the nocturnal environment is perceived and utilized. One major component of exterior lighting is the safety and monitoring of property. However, security lighting where no patrols exist (e.g., remote storage yard, parking areas) is often counterproductive, inviting crime without the opportunity to intercede. A prevalent light source for this task is the wall pack: wall-mounted luminaires with optical elements (e.g., reflectors, refractors) that usually direct a large portion of their light at angles near the horizontal plane. Wall packs are unfortunately commonly used in inappropriate ways, often in attempts to minimize hardware expenses under swiveled luminaires, giving rise to glare and poor lighting. An uncompliant wall pack cannot simply be fixed by installing an “add-on” shield, as these accessories rarely, if ever, provide true full shielding.

3.2.2 Residential Lighting

The majority of lighting fixtures available on the homeowner market are inherently unshielded or swiveled and rarely used pointed straight down, essentially contributing to light trespass to anything in the near vicinity. A productive way to improve lighting used in residential areas is to find which local retailers carry shielded products, such as wall sconces. These fixtures need to abide by the lighting BMPs while illuminating narrow tasks, such as doorways, small walkways, or other point targets.

3.2.3 Parking Lots

Parking lot lighting is provided to allow automobile drivers to see pedestrians and other hazards. Additionally, they provide pedestrians visibility to navigate and avoid any hazards once they exit their automobiles and the ability to find their vehicles when they return. Correctly spaced lighting will create an even distribution of light, providing a clear pathway for pedestrians to navigate without creating glare or potentially dangerous shadows. The size of the parking lot will dictate the height, distribution, and pattern of lights required to effectively light the area. After a certain hour, it is suggested to incorporate lighting controls to not waste light and energy if a parking lot is no longer being used.

3.2.4 Roadway Lighting

Although SR 20 runs through RLNRA and affects visitor experience, especially in Newhalem, the lighting management of SR 20 is under WSDOT jurisdiction. City Light operates streetlights in Newhalem and Diablo townsites.

3.2.5 Pathways

Areas that direct visitor navigation and are not nearby parking lots or other existing luminaires can be illuminated by bollards. Not only do bollards help direct the flow of traffic, but they can also be utilized to provide an evenly lit pathway without shining light into the natural lightscape. The placement and utility of bollards should serve the purpose of providing a clearly lit pathway for highly visited or emergency evacuation routes that require additional light that is not provided by the use of personal flashlights. Areas on trails or near facilities that require supplemental visual aids (e.g., stairways) could be lined with reflective tape.

3.2.6 Historical Lighting

Cultural and historic resources will be supported, not degraded, by outdoor lighting. The use of period light fixtures represents a special challenge, as these are generally more decorative and less efficient than their modern equivalents. Successfully preserving the cultural and historic integrity of resources may require additional expense and creative solutions, as well as tolerating lower task area illumination typical of decorative fixtures. Historic unshielded luminaires can be effective and attractive if they are used with very low output lamps (no more than about 300 lumens each) simulating the low output gas flames originally held by such fixtures.

3.2.7 Flag Lighting

Flag lighting is almost always up-directed and driven by the traditional practice that any flag flying at night must be properly illuminated. If flags are not lowered and night lighting is required, replacement lighting at flagpoles will be shielded or down-directed.

3.2.8 Externally Illuminated Signs

Signs should only be lit if they include pertinent emergency information that should be available at any time. Casual information (e.g., programs, building hours, outreach agendas) that can be accessed during the day should not be illuminated after sunset. If the information needs to be accessible, a down-directed fixture is the preferred installation.

3.2.9 Lighting Over Water

At Project facilities with exterior lighting over water surfaces (e.g., Ross and Diablo Lake boathouses, Gorge Powerhouse), City Light will first assess if downward facing lights are necessary for Project operations and safety or have other resource/historic values and modify or remove them as appropriate. Where downward facing lights are deemed necessary, City Light will utilize LEDs in warm colors (preferably red) and, as feasible, fixtures will include adaptive/control measures (e.g., timers, motion detectors, hue adaptors, and/or dimmers) to minimize their use during nighttime hours.

3.2.10 Other Considerations

3.2.10.1 Accessibility Standards

It is a requirement to provide accessible routes which meet standards set by the Americans with Disabilities Act (ADA). However, the ADA does not give guidelines on appropriate lighting levels for accessible routes. Lighting on accessible routes should follow the general guidelines stated in

this Lighting Plan. In order to accommodate people with impaired vision, lighting should maintain a continuous illumination, minimize glare, and not create a spotty effect.

3.2.10.2 Retrofit Existing Lights

Retrofitting or replacing an existing light source with a new one can be an extremely cost-effective option. Existing light poles, electric wiring, and appropriate fixtures can be modified to become dark-sky compliant. For example, parking lot lights can have the lamps replaced, allowing continuous use of standing poles. If a fixture is fully shielded but has the inappropriate color temperature, exchanging the existing lightbulb with a ‘warm’ colored LED is an option. For the procedure and examples for retrofitting lights, refer to the NPS Outdoor Lighting Retrofits Guide (NPS 2014).

3.2.10.3 Pursue Alternatives

Consider methods for providing safety other than permanent illumination. If the problem is lack of pathway visibility at night, determine if non-illumination solutions are adequate, such as painting curbs or steps, retroreflective markers, luminescent markers, using light colored pavement and surfaces, providing flashlights, trimming vegetation to minimize deep shadows, or smoothing out walkway tripping hazards. Signs and markers may be made visible with retroreflective or photo-luminescent coating. The minimum impact solution that best aligns with NPS guidelines should be chosen.

3.3 Exemptions and Other Considerations

This section includes any areas or uses that qualify for exemptions from the implementation requirements of this Lighting Plan. The following types of outdoor lighting installations shall be allowed and are not subject to the implementation requirements of this Lighting Plan. However, where possible and practical, measures outlined in this Lighting Plan should be taken to exercise best energy practices and shield the light from the surrounding environment.

- Codes – Any existing lighting codes or regulations are not affected by this Lighting Plan and take precedence.
- North American Electric Reliability Corporation (NERC) standards – Where NERC standards require specific lighting at electrical grid facilities, these facilities are considered exempt from the Lighting Plan.
- Occupational Safety and Health Administration (OSHA) / Washington Industrial Safety and Health Act (WISHA) – Where OSHA or WISHA states that specific lighting levels are necessary for work situations these are considered exempt from the Lighting Plan.
- Temporary/Construction Lighting – Allowable installations of outdoor lighting for temporary or construction purposes shall be limited to the minimum number of nights required to complete the task that the lighting illuminates. Staff responsible for such installations will follow these guidelines to the greatest practical extent and will endeavor to limit as much as possible off-site impacts of such lighting.
- Emergency Lighting – Temporary emergency lighting is exempt from these lighting guidelines, with the understanding that any such lights will be turned off or returned to their usual method of control when the emergency has ended (this responsibility will fall to the

onsite incident leader). Typically, emergency lighting is necessary for human safety in emergency or unforeseen circumstances.

- Interpretive Programs – Evening interpretive programs typically start at or after sunset, necessitating some lighting to allow visitors to walk to and from select Project facilities (e.g., Ladder Creek Falls Trail and Garden).
- Traffic Safety – Color spectrum restrictions do not apply to traffic signal lights that may be installed in the park.
- Helipad Lighting – Lighting for any helipads is exempt from this Lighting Plan and will meet requisite standards for this specialized feature.
- Campfires – Campfires are not considered artificial lighting for the purpose of this Lighting Plan and are thus not addressed here.

4.0 PLAN IMPLEMENTATION

Upon approval by FERC, the Lighting Plan will be implemented in consultation with the SRCC. City Light will continue to implement lighting-related measures for routine O&M and new construction and will incorporate additional measures if new data indicates they are necessary.

4.1 Develop Lighting Plan Implementation Guidance Document

City Light will develop a Lighting Plan Implementation Guidance Document that will include a site-specific evaluation of exterior lighting types and tasks associated with different types of Project facilities and provide a road map for BMP implementation at each facility using best-available lighting technologies and practices. As a resource in developing the Lighting Plan Implementation Guidance Document, City Light will refer to the general and specific actions identified by Licensing Participants in the Project Lighting Settlement Topic Form. This document will be informed by a Project-wide facility lighting engineering assessment.

This document will enable City Light staff to apply BMPs consistently and efficiently at Project facilities with exterior lighting over the term of the new license. City Light will develop this document in collaboration with the SRCC, including the NPS and its dark sky/lighting specialists, as feasible. Once developed, City Light will apply the BMPs outlined in the Lighting Plan Implementation Guidance Document.

City Light anticipates updating the guidance document periodically throughout the license as detailed in Table 4.3-1, primarily in response to emerging lighting technologies.

4.2 Employee Education Program

City Light will provide Project facility lighting awareness training to City Light staff to enhance the implementation of lighting BMPs consistently at all Project facilities.

4.3 Implementation Schedule

This section provides a schedule for City Light's implementation of the lighting BMPs outlined in this Lighting Plan, including a timeline for the development of the Lighting Plan Implementation Guidance Document and the implementation of specific measures identified therein, as well as a schedule for periodic review and monitoring actions. Table 4.3-1 describes City Light's preliminary implementation schedule for the Lighting Plan.

Table 4.3-1. Lighting Plan implementation schedule.

Timeline	Implementation Activity
Annual Activities	City Light employee education program.
Year 1 following license issuance	Project-wide Lighting Plan implementation engineering assessment, including Diablo Dam historic lighting.
Year 2 following license issuance	Complete Project Lighting Plan Implementation Guidance Document.
Year 2 through 5 following license issuance	Implement BMPs for all Project facilities with exterior lighting.

5.0 MONITORING, REPORTING, AND COMMUNICATIONS

This section describes the monitoring efforts that will document progress towards Lighting Plan goals and objectives. Monitoring is an extension of City Light’s protection and enhancement implementation and will use baseline information from City Light relicensing study efforts. The goals of monitoring are to track long-term compliance with exterior lighting enhancement BMPs, and to inform periodic updates to this Lighting Plan.

5.1 Monitoring Activities

City Light will inspect Project facility lighting at regular intervals during the new license term to assess compliance with the Lighting Plan. City Light will modify non-compliant lighting according to the BMPs and the Lighting Plan Implementation Guidance Document. City Light will begin these periodic inspections in Year 6 following license issuance following implementation of the Lighting Plan’s BMPs at Project facilities (Table 5.1-1).

Table 5.1-1. Timeline of Lighting Plan monitoring activities.

Timeline	Protection Monitoring Activity
Year 6 following license issuance, then every 5 th year of the new license	Project facility lighting inspections

5.2 Reporting Schedule

Every fifth year of the new license starting in Year 6, City Light will file a lighting inspection report with FERC. A component of the report will be to review current BMPs and technologies with the SRCC and make recommendations for potential updates to the Lighting Plan and/or Lighting Plan Implementation Guidance Document.

5.3 Communications

This section describes a process for making coordinated, timely, and informed decisions while implementing the Lighting Plan, including how City Light will coordinate and communicate its Lighting Plan implementation actions with the SRCC. Because of simultaneous implementation of multiple resource management plans (i.e., cultural, wildlife, fish and aquatics), cross-resource communication will be necessary. An important goal of this communication will be to achieve a balanced integration of resource goals in the Project Boundary. Coordination processes may include:

- Clarifying resource goals, objectives, and priorities;
- Ongoing consultation with NPS and other entities;
- Sharing information used to make resource decisions; and
- Solving problems and resolving issues.

If City Light and the SRCC collaboratively determine that revisions to this Lighting Plan should be made, City Light will make any revisions in coordination and consultation with the SRCC. Any revisions to this Lighting Plan shall be filed with FERC for approval prior to implementation.

6.0 REFERENCES

- Illuminating Engineering Society (IES). 2020. ANSI/IES LP-11-20, Lighting Practice: Environmental Considerations for Outdoor Lighting – An American National Standard. Prepared by the IES Outdoor Environmental Lighting Committee. New York, New York.
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