RA-03 PROJECT FACILITY LIGHTING INVENTORY DRAFT REPORT

SKAGIT RIVER HYDROELECTRIC PROJECT FERC NO. 553

Seattle City Light

Prepared by:
HDR Engineering, Inc.

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Initial Study Report

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List of Acronyms and Abbreviations

AFF .....above finished floor

cd/m^2 .....candela per square meter

CCT.....correlated color temperature

CFL .....compact fluorescent lamp

City Light.....Seattle City Light

E_H .....Horizontal Illuminance

ELC .....Environmental Learning Center

fc .....footcandles

ft .....feet

FERC.....Federal Energy Regulatory Commission

HID .....high intensity discharge

IES.....Illuminating Engineering Society

IESNA.....Illuminating Engineering Society of North America

ISR .....Initial Study Report

LED.....light-emitting diode

mLux .....milli-Lux

MH .....mounting height

NEC.....National Electric Code

NRHP.....National Register of Historic Places

nm .....nanometers (measurement of wavelength)

NPS .....National Park Service

O&M.....operations and maintenance

PAD.....Pre-Application Document

Project .....Skagit River Hydroelectric Project

RLNRA .....Ross Lake National Recreation Area

RSP .....Revised Study Plan

SR.....State Route

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1.0 INTRODUCTION

The RA-03 Project Facility Lighting Inventory is being conducted in support of the relicensing of the Skagit River Hydroelectric Project (Project), Federal Energy Regulatory Commission (FERC) No. 553, as identified in the Revised Study Plan (RSP) submitted by Seattle City Light (City Light) on April 7, 2021 (City Light 2021). On June 9, 2021, City Light filed a "Notice of Certain Agreements on Study Plans for the Skagit Relicensing" (June 9, 2021 Notice)[1] that detailed additional modifications to the RSP agreed to between City Light and supporting licensing participants (which include the Swinomish Indian Tribal Community, Upper Skagit Indian Tribe, National Marine Fisheries Service, National Park Service [NPS], U.S. Fish and Wildlife Service, Washington State Department of Ecology, and Washington Department of Fish and Wildlife). The June 9, 2021 Notice proposed no changes to the Project Facility Lighting Inventory as described in the RSP.

In its July 16, 2021 Study Plan Determination, FERC approved the Project Facility Lighting Inventory without modification.

This study is complete and a draft report of the study efforts is being filed with FERC as part of City Light's Initial Study Report (ISR).

[1] Referred to by FERC in its July 16, 2021 Study Plan Determination as the "updated RSP."

2.0 STUDY GOALS AND OBJECTIVES

The goal of this study is to inventory Project facilities located within the Project Boundary and within Ross Lake National Recreation Area (RLNRA) that utilize lighting at night. The objectives are as follows:

- Identify Project facilities within the RLNRA that utilize outdoor nighttime lighting and describe characteristics of the luminaires.[2]
- Describe outdoor lighting needs at each Project facility and the operating periodicity, design, and intensity of lights being used.

2.1 Background and Existing Information

The natural cycles of light and dark have ecological value to park system resources, and recreational and aesthetic importance to park visitors, and are part of the natural and cultural aesthetic of the parks. NPS outlines the policy for protecting night skies in its Management Policies (NPS 2006) and as identified by the RLNRA General Management Plan (NPS 2012): "The NPS will complete an inventory of night sky conditions and will work with partners and adjacent land managers to protect night sky by reducing light pollution within RLNRA and on adjacent lands. For example, the NPS will work with Seattle City Light to reduce light pollution in Diablo and Newhalem."

Details about Project lighting and the night sky can be found in the City Light Pre-Application Document (PAD) (City Light 2020). The Project is located within the RLNRA within the North Cascades National Park Complex, where development is generally limited to City Light, NPS facilities, and State Route (SR) 20 (a Washington State Department of Transportation facility). The existing nighttime environment in the Project is dark, with very limited artificial nighttime lighting. The Stephen Mather Wilderness, designated in 1988, borders much of the Project Boundary in the RLNRA. NPS manages the nighttime photic environment as a resource. Stray light at night has the potential to affect wilderness character, qualities, and wildlife habitat.

NPS previously conducted ground-based photometric measurements in North Cascades National Park and the RLNRA and identified the Project to be a source of light pollution (Hoffman et al. 2015). Light sources are currently being used at Project hydroelectric facilities, housing and security structures, and City Light visitor service facilities. NPS identified Diablo Dam as having no shielding or other modifications to direct the light to where it is needed and reduce light disbursement and glare (Hoffman et al. 2015). An analysis of the light emitted from the post lamps on top of the dam showed a vertical illuminance value of 0.1 milli-Lux (mLux) at 3.29 miles away. Light is also introduced by vehicle traffic on SR 20.

[2] Luminaire definition: "A complete lighting unit consisting of a light source such as a lamp or lamps, together with the parts designed to position the light source and connect it to the power supply. It may also include parts to protect the light source or the ballast or to distribute the light" (Illuminating Engineering Society [IES] 1947; National Electrical Code (NEC), Article 100 [NEC 2017]).

3.0 STUDY AREA

The study area includes all Project facilities within the Project Boundary within the RLNRA that utilize lighting at night. A map of the study area is attached to this report as Attachment A.

The Project facilities include:

- Generating facilities (powerhouses and dams):
  - Ross Dam and Powerhouse;
  - Diablo Dam and Powerhouse; and
  - Gorge Dam and Powerhouse.
- Operations and maintenance support areas.
- Townsites, including housing, at:
  - Diablo townsite; and
  - Newhalem townsite.
- Transmission, transportation (vehicle and boat) and communications infrastructure, including:
  - High tension transmission towers;
  - Diablo and Ross Lake boathouses; and
  - Radio antennae and microwave repeaters.
- Visitor service and recreation areas:
  - Environmental Learning Center (ELC); and
  - Ladder Creek Falls Trail and Gardens.

4.0 METHODS

This study created an inventory of outdoor Project-related luminaires installed within the study area. Daytime and nighttime site visits were made to catalog the physical characteristics of existing lighting for lights that do not have existing documented information (e.g., building lighting plans). All outdoor luminaires in the study area were cataloged for the purpose of creating an "As Found" lighting inventory document (Attachment B) to serve as a record of existing luminaires. Representative luminaires were photographed, and data were recorded, including field notes with supplemental observations. Luminance and illuminance measurements were recorded for representative luminaires, and for luminaires that were easily accessible for accurate measurements. Data on luminaires were collected using a digital data collection tool (i.e., ESRI Collector for ArcGIS). In addition to the cataloging process, City Light Project operations staff were interviewed to assist with documenting the purpose of lighting for the study report.

This draft study report contains the data recorded during site visits and available information on use of the luminaire and lamp characteristics. Section 5.0 of this study report includes information on all outdoor Project lighting within the study area, including:

- Quantity (number of sources, lamps, or bulbs).
- Locations (including estimated height of luminaire from the ground).
- Condition of existing luminaires:
  - Qualitative description (e.g., broken, corrosion, requiring replacement, etc.); and
  - Age of luminaire (if available).
- Voltage.
- Lamp type (e.g., Light-Emitting Diode [LED], metal halide, incandescent, high pressure sodium, etc.).
- Color temperature of lamp (i.e., correlated color temperature [CCT]).
- Source wattage (information on lamp or luminaire).
- Lighting distribution (e.g., directional floodlight, light focused below luminaire, etc.).
- Nighttime lighting documentation.
- Shielding (is the lamp housed in a full cutoff luminaire or does the light produce direct glare and/or trespass outside the task area).
- Illuminance measured in footcandles (fc).
- Ballast information (electrical information, condition, part number).
- Luminaire control method (e.g., switch, individual photocell, central astronomical timeclock, centralized photocell, dimmer, timer, motion sensor, etc.).
- Hours of operation of the luminaire.
- Safety and security concerns and activities in the lit area.
- Purpose of the luminaire.

- Historic values of the luminaire.

Section 6.0 of this study report identifies potential opportunities for reducing light pollution while maintaining adequate illumination levels required for safe operations, visitor use, and Project functions. Electric light illumination reduction measures recommended by this study address five considerations and/or methods of minimizing the effect of light:

(1) Assessing if the light is required at a location – determine if the luminaire can be removed completely or replaced with a luminaire that is more appropriate for the use-case.

(2) Lowering Intensity – when less light is emitted into the environment there is less potential for that light to become light pollution.

(3) Controlling Direction of Illumination – when all light is directed down, light must interact with a surface where its intensity is reduced before it goes into the sky and becomes light pollution. Directing illumination down also creates a more efficient design.

(4) Limiting or changing the lighting spectrum emitted by electric lighting to a narrow band that is smaller than the full range visible spectrum (380-740 nm) can be used to create a lighting specification that provides functional lighting for humans while limiting other visual effects.

(5) Limiting Duration of Emitted Light – light cannot become light pollution when it is not emitted. By limiting the duration of emitted illumination to only the times when lighting is necessary, the effect of night lighting can be reduced. Possible measures include motion sensors to turn lights off and on as needed, or timers for lights that are needed only at certain times.

4.1 Consistency with Generally Accepted Scientific Practice

Field methods and reporting are consistent with the design and application standards specified in the Illuminating Engineering Society Lighting Handbook (Rea and IESNA 2000). The study followed these standards and was overseen by a professional electrical or architectural engineer who meets the National Council on Qualifications for the Lighting Professions Professional Qualification Standards for Lighting Certification.

5.0 RESULTS

This study report contains all the Project lighting facility inventory information gathered during the study. The "As Found" Project lighting inventory is summarized using photographic documentation along with tabular summaries of the lighting characteristics for each lighting feature (see Attachment B).

Of note, City Light determined during the field data collection effort that some of the facilities identified in the study area did not contain any exterior lighting. These included Gorge Dam, Ross Dam, Newhalem operations and maintenance (O&M) support areas without lighting, transmission towers, radio antennae, and microwave repeaters.

5.1 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 (National Register of Historic Places [NRHP] 2011).

The current exterior lighting associated with these site features is summarized in this section. 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, Project facility exterior entrance, or porch lighting.

Typical post-top light poles have LED sources, are generally low intensity, and are operated during dark hours. Typical post-top light poles have an estimated CCT of 4000 Kelvin. These typical post-top light poles have uplight shielding and would be considered full cut-off luminaires, meaning that they do not contribute to direct ambient sky glow. These luminaires are generally in good condition and have been upgraded within the last 10 years.

Residential and Project facility porch lighting varies from building to building. Many buildings have a mix of source types and luminaire types, including LED, compact fluorescent lamp (CFL), and incandescent wall packs and sconces. These luminaires are typically located next to building entrances to provide general illumination for visibility and security. The exterior lighting on residential, Project facility entrances, and porches varies in condition from broken and non-functional to brand new. Many of these exterior lighting luminaires are unshielded.

Refer to Attachment B for specific luminaire characteristic information, measurements, and photographs.

5.2 Gorge Switchyard and Maintenance Yard

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. 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 4000 Kelvin or higher. Many of these luminaires produce intense levels of light, are unshielded, and are operated for extended periods of time.

Refer to Attachment B for specific luminaire characteristic information, measurements, and photographs.

5.3 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.

Gorge Powerhouse has a variety of exterior luminaires including parking and area lighting, original architectural sconces, new adjustable flood lights, and wall packs. These luminaires have a variety of different source types including LED, CFL, and high intensity discharge (HID). The luminaires range in condition from broken and non-functional to brand new. Most of the lighting is used for safety and security. The CCT of the luminaires around the exterior of the powerhouse range from 2700 Kelvin to 5000 Kelvin. Some areas around the Gorge Powerhouse were completely dark upon site evaluation while others recorded illumination levels above recommended values.

Refer to Attachment B for specific luminaire characteristic information, measurements, and photographs.

5.4 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 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.

The colored lights and speakers were upgraded and reinstalled in the 1970s and again in 2009 with CFL luminaires and color changing LED flood light luminaires, respectively, 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.

Refer to Attachment B for specific luminaire characteristic information, measurements, and photographs.

5.5 Gorge Dam

Gorge Dam is located about 2.5 miles upstream of Gorge Powerhouse and 4 miles downstream from Diablo Dam near Gorge Creek. It is accessed via a spur road from SR 20, which is gated at a bridge over the Skagit River, and not open to the public. Gorge Dam does not have any functional exterior lighting (Attachment B, Figure 5.5-1). Refer to Attachment B for specific luminaire characteristic information, measurements, and photographs.

5.6 Diablo Townsite

The Diablo townsite is located approximately 6 miles north of the Newhalem townsite and 1 mile off SR 20. Diablo Powerhouse and switchyard are in the middle of the town, dividing the town into two sections: the first commonly known as Hollywood, sited on City Light-owned lands, and the other commonly known as Reflector Bar, sited on federal lands managed by NPS. The Hollywood area is primarily residential, with 23 houses, nearly all built in the 1950s. The Reflector Bar area consists of 12 similarly aged houses, a warehouse, several buildings used for administrative and maintenance purposes, a water tower, and the Incline Lift waiting station. The houses on Reflector Bar are not used by Project staff and are scheduled to be torn down in 2022. As such, there is no active exterior lighting associated with these structures and no lighting information for them is included in this study.

Most of the exterior lighting in Diablo can be categorized into two types: (1) typical post-top light poles; or (2) residential, Project facility exterior entrance, or porch lighting. Typical post-top light poles have LED sources, are generally low intensity, and are operated at appropriate times. Typical post-top light poles have an estimated CCT of 4000 Kelvin. These typical post-top light poles have up light shielding and would be considered full cut-off luminaires, meaning that they do not contribute to direct ambient sky glow. These luminaires are generally in good condition and their sources have been upgraded within the last 10 years.

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. These luminaires are typically located next to building entrances to provide general illumination for visibility and security. The exterior lighting on residential, Project facility entrances, and porches varies in condition from broken and non-functional to brand new. Many of these exterior lighting luminaires are unshielded.

Refer to Attachment B for specific luminaire characteristic information, measurements, and photographs.

5.7 Diablo Dam

Diablo Dam is located approximately 5 miles upstream of Gorge Dam and 4 miles downstream of Ross Dam. The concrete arch dam is 389 feet (ft) high with an Art Deco design and includes decorative arches over the spillways and lighting on the crest of the dam. The proper historical aesthetics of the dam include the warm color temperature of incandescent or low-pressure sodium light sources in the 30 Art Deco luminaires that line the driveway along the top of the dam (Ossa

2021). Access to Diablo Dam is gate-controlled near the junction with SR 20 and is only open to the public during the day.

Currently, the Art Deco luminaires are in good condition and have been well maintained over the last few decades. The original luminaire sources have been replaced with 4000 Kelvin LED sources. The shielding of the luminaires would not be considered full cut-off. The luminaires operate from dusk to dawn.

The adjacent valve house entrance facility has a variety of functional and non-functional HID, CFL, and LED wall packs and post top luminaires, only some of which match the Art Deco aesthetic of the dam.

Refer to Attachment B for specific luminaire characteristic information, measurements, and photographs.

5.8 Diablo Lake Facilities

Beyond Diablo Dam, the northern shoreline of Diablo Lake includes operational, recreational, and educational facilities accessed via Diablo Dam Road between Diablo Dam and the North Cascades ELC. Most of the facilities on Diablo Dam Road do not have functional exterior lighting. LED street lighting is provided intermittently and at intersections.

Refer to Attachment B for specific luminaire characteristic information, measurements, and photographs.

5.9 Environmental Learning Center (ELC)

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. Activities at the ELC include many school and youth programs; classes for adults, teachers, and families; and private events, such as conferences and corporate retreats. 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.

The ELC was closed to the public during the field observation periods and therefore information was collected primarily through interviews with ELC operations staff. According to the ELC Director of Operations, exterior lighting in the ELC area can be categorized into three types: (1) trail lighting; (2) porch lighting; and (3) limited architectural lighting (Gilje 2021).

All the lighting in these three categories is LED, full cut-off, and on a timeclock control system that automatically turns the lights off at 11 pm when the ELC facility is in use. The trail lighting consists of about thirty 24-inch-tall bollards that emit low light levels to guide visitors along the trails between buildings on campus. The porch lighting on each facility is wall-mounted and aimed downward to provide general area lighting and visibility at the entrance to each facility. There are several limited architectural feature lights that are roughly 20 ft above the ground that accent some facility architecture.

Refer to Attachment B for specific luminaire characteristic information, measurements, and photographs.

5.10 Ross Powerhouse

Ross Powerhouse and boathouse are accessible by boat and trail access only at the upstream end of Diablo Lake. During the inventory observation period, only interior lighting and one exterior entrance luminaire were activated.

Refer to Attachment B for specific luminaire characteristic information, measurements, and photographs.

5.11 Ross Dam

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 access 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.

Refer to Attachment B for specific luminaire characteristic information, measurements, and photographs.

6.0 DISCUSSION AND FINDINGS

Most of the lighting utilized throughout facilities and locations within the Project is appropriate and necessary for operations, safety, and security. However, there are instances of luminaires within the Project that are inappropriate by current standards of technology and may be modified to better fit the surrounding context area or facility. Inappropriate luminaries with the following lighting characteristics were identified for potential improvements: unnecessary use of a luminaire; unnecessarily high intensity; inadequately aimed luminaires; or unnecessary prolonged activation of a luminaire. It should also be noted that the study area includes the Skagit River and Newhalem Creek Hydroelectric Project historic district. In total, there are 87 contributing resources in the historic district, including Ross, Diablo, and Gorge dams and powerhouses, and several structures in both Newhalem and Diablo. When applicable, the historic values of lighting and luminaires were also assessed.

Luminaries with the above characteristics were inventoried and noted in order to facilitate potential modifications to the luminaires that may have a positive impact on the functionality and aesthetics of the Project facilities.

The following possible strategies were identified as modifications to specific luminaries that were not fully compatible with the surrounding context area or facilities:

(1) Assessing if the light is required at a location – determine if the luminaire can be removed completely or replaced with a luminaire that is more appropriate for the use-case.

(2) Lowering intensity – when less light is emitted into the environment there is less potential for that light to become light pollution.

(3) Controlling direction of illumination – when all light is directed down, light must interact with a surface where its intensity is reduced before it goes into the sky and becomes light pollution. Directing illumination down also creates a more efficient design.

(4) Limiting or changing the lighting spectrum emitted by electric lighting to a narrow band that is smaller than the full range visible spectrum (380-740 nm) can be used to create a lighting specification that provides functional lighting for humans while limiting other visual effects.

(5) Limiting duration of emitted light – light cannot become light pollution when it is not emitted. By limiting the duration of emitted illumination to only the times when lighting is necessary the effect of night lighting can be reduced. Possible measures include motion sensors to turn lights off and on as needed, or timers for lights that are needed only at certain times.

6.1 Assess Lighting Needs

It is recommended that lighting documented at the following facilities be assessed by Project staff and determined whether the lighting is necessary for operations, safety, or security purposes:

- Newhalem administrative office entrance lighting:
  - Potentially reduce quantity of wall packs (Attachment B, Figures 5.1-14 and 5.1-15).

- Newhalem pesticide storage building exterior lighting (Attachment B, Figure 5.1-24):
  - Luminaires are left on 24 hours per day/7 days per week (24/7). Assess whether exterior lighting is necessary for this building at specific times or during specific use cases.
- Gorge Powerhouse pedestrian bridge lighting (Attachment B, Figure 5.3-3):
  - Potentially add luminaires or implement new lighting strategy to improve pedestrian safety on bridge.
- Gorge Powerhouse exterior lighting (Attachment B, Figure 5.3-9):
  - Assess if exterior lighting meets security needs.
- Ladder Creek Falls Trail and Garden in-grade tree uplighting (Attachment B, Figures 5.4-1, 5.4-2, and 5.4-3):
  - Assess if the newer installation of exterior uplighting lighting is necessary in this area; consider strategies for modification and downlighting to reduce unnecessary spill light and sky glow.

6.2 Lower Intensity

When less light is emitted into the environment there is less potential for that light to become light pollution. Modern lighting standards and recommended practices utilize lower illuminance levels than previous standards and recommended practices. Concurrently, lighting technology has advanced greatly over the last few decades and luminaires have become more efficient. This means that lighting standards and recommended practices can be met with lower illumination levels and it requires less energy to do so than it did several decades ago.

Many of the luminaires identified as inappropriate for the location or facility within the Project were originally installed several decades ago. This means that the lighting that is identified as inappropriate is providing too much light and is utilizing more energy than necessary to do so.

Some of the luminaires identified as inappropriate have already been upgraded to LED. However, many LED upgrades are one-to-one replacements that still emit more than enough light required to meet lighting standards and recommended practices.

Potential strategies to alter and reduce luminous intensity of a luminaire include the integration of a control or dimming device into the lighting system. Integration of luminaire-based dimming control devices or potentiometers are possible for some manufacturers. Other options could include circuit-based dimming control devices, depending on current control strategy, source types, and equipment connected to the circuit. Replacing sources in luminaires with lower intensity sources to eliminate the possibility of over-lighting an area is another acceptable strategy.

Lighting documented at the following facilities have the potential to be replaced or altered so that the amount of light emitted into the environment is reduced as much as possible.

- Newhalem administrative office:
  - Exterior wall pack flood light No. 1 and No. 2 (Attachment B, Figures 5.1-12 and5.1-13);

  - Entrance lighting (Attachment B, Figure 5.1-15);
  - Signage and flagpole lighting (Attachment B, Figure 5.1-19); and
  - Garage driveway lighting (flood wall pack) (Attachment B, Figures 5.1-21 and 5.1-22).
- Newhalem Fire Station (Attachment B, Figure 5.1-26).
- Newhalem shared garages (Attachment B, Figure 5.1-30).
- Newhalem Skagit General Store:
  - Covered walkway lighting (Attachment B, Figure 5.1-37); and
  - East side exterior lighting (Attachment B, Figure 5.1-40).
- Newhalem Train Exhibit:
  - Pole-mounted lighting (Attachment B, Figure 5.1-41).
- Newhalem Gorge Inn:
  - Exterior lighting (Attachment B, Figure 5.1-46).
- Newhalem Bunkhouses:
  - Exterior lighting (Attachment B, Figures 5.1-47, 5.1-48, and 5.1-49).
- Gorge Switchyard and Maintenance Yard:
  - Exterior lighting (Attachment B, Figure 5.2-1);
  - Exterior work area flood lighting (Attachment B, Figure 5.2-3);
  - Typical warehouse exterior entrance lighting (Attachment B, Figure 5.2-5); and
  - Typical warehouse exterior canopy lighting (Attachment B, Figure 5.2-6).
- Gorge Powerhouse:
  - Exterior lighting (Attachment B, Figure 5.3-9); and
  - Exterior lighting (east walkway) (Attachment B, Figure 5.3-13).
- Diablo Townsite:
  - Typical residential garage exterior lighting (Attachment B, Figure 5.6-3).
- Ross Powerhouse Boathouse and Dock:
  - Exterior lighting (Attachment B, Figure 5.10-1);
  - Interior lighting (Attachment B, Figure 5.10-2); and
  - Covered canopy lighting (Attachment B, Figure 5.10-3).
- Ross Dam Boathouse (Attachment B, Figure 5.11-1).

6.3 Control Direction

When all light is directed down, light must interact with a surface where its intensity is reduced before it goes into the sky and becomes light pollution. Directing illumination down reduces light pollution and provides more efficient lighting directed downward towards the specific area of use. Several instances of luminaires that were identified as inappropriate were unshielded or aimed outward or aimed upward. Lack of proper luminaire shielding, or lack of proper aiming can cause a luminaire to directly contribute to light pollution and sky glow, which may have negative wildlife impacts.

Lighting documented at the following facilities have the potential to be adjusted or replaced by adjustable luminaires to direct the emission of light downward toward the ground.

- Ross Powerhouse Boathouse:
  - Exterior lighting (Attachment B, Figure 5.10-1); and
  - Interior lighting (Attachment B, Figure 5.10-2).
- Ross Dam Boathouse (Attachment B, Figure 5.11-1).

6.4 Consider Visible Light Spectrum Emitted by Electric Sources

Functional lighting for human activity can be provided with a narrow band within the visible light spectrum that limits negative impacts on the surrounding environment. During future lighting system upgrades or replacements, visible light spectrum of sources should be considered to minimize impacts on circadian and biological rhythms of nearby wildlife and vegetation.

6.5 Limit Duration of Emitted Light

Light cannot become light pollution when it is not emitted. By limiting the duration of emitted illumination to only the times when lighting is necessary, the potentially negative effects of night lighting can be reduced. Possible measures include motion sensors to turn lights off and on as needed, or timers for lights that are needed only at certain times.

The control strategies have the potential to be altered so that the duration of emitted illumination is limited to only the times when lighting is necessary for the lighting documented at the following facilities:

- Newhalem Administrative Office:
  - Interior luminaires and monitors (Attachment B, Figures 5.1-16 and 5.1-17);
  - Garage covered walkway lighting (Attachment B, Figure 5.1-20); and
  - Garage driveway lighting flood wall pack (Attachment B, Figures 5.1-21 and 5.1-22).
- Newhalem pesticide storage building exterior lighting (Attachment B, Figure 5.1-24).
- Newhalem SR 20 Parking Area EV charging station (Attachment B, Figures 5.1-50).
- Gorge Switchyard and Maintenance Yard:

  - Typical wall pack exterior lighting (Attachment B, Figure 5.2-1);
  - Typical exterior work area flood lighting (Attachment B, Figure 5.2-3);
  - Typical warehouse exterior entrance lighting (Attachment B, Figure 5.2-5);
  - Typical warehouse exterior canopy lighting (Attachment B, Figure 5.2-6);
  - Gas station exterior canopy lighting (Attachment B, Figure 5.2-9); and
  - Typical exterior lighting (Attachment B, Figure 5.2-11).
- Gorge Powerhouse:
  - Exterior lighting (Attachment B, Figure 5.3-8);
  - Exterior lighting – employee entrance (Attachment B, Figure 5.3-9); and
  - Exterior lighting (Attachment B, Figure 5.3-10).
- Diablo Powerhouse exterior lighting (Attachment B, Figures 5.6-7 and 5.6-8).
- Diablo Townsite (Reflector Bar) Incline Waiting Station (Attachment B, Figure 5.6-9).
- Ross Powerhouse access tunnel entrance exterior lighting (Attachment B, Figure 5.10-9).

7.0 VARIANCES FROM FERC-APPROVED STUDY PLAN AND PROPOSED MODIFICATIONS

There are no variances or proposed modifications to the FERC-approved study plan for the Project Facility Lighting Inventory.

8.0 REFERENCES

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PROJECT FACILITY LIGHTING INVENTORY DRAFT REPORT

ATTACHMENT A

STUDY AREA MAP

PROJECT FACILITY LIGHTING INVENTORY STUDY AREA (RA-03)

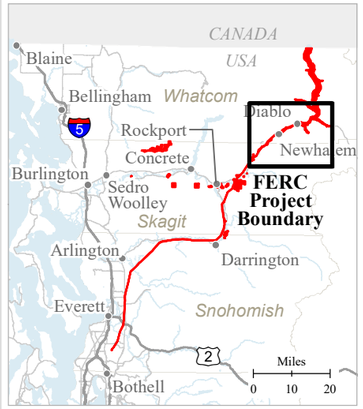
- FERC Project Boundary
- Mitigation Parcel
- Project River Miles (PRM)
- National Park Service
- National Recreation Area
- U.S. Forest Service
- Seattle City Light
- Transmission Lines

Project Facilities

- Recreation Facility
- Non-Recreation Facility

N

0 4,500 9,000 Feet



Seattle City Light

SKAGIT RIVER HYDROELECTRIC PROJECT (FERC NO. 553)

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City Light provides no warranty, expressed or implied, as to the accuracy, reliability or completeness of this data.
Data Source: Recreation Sites, Campsites, Transmission Lines, other Facilities - Seattle City Light.

Document Path: \\sac-srv01\GIS\Projects\Seattle_City_Light\Skagit_FERC_Relicensing\7.2_Working\1_mxd\1_MXD_SkgtStudyPlan\Recreation\FULLPAGE_RLNRA_Project_Facilities_11x17_L.mxd

PROJECT FACILITY LIGHTING INVENTORY DRAFT REPORT

ATTACHMENT B

'AS FOUND' LIGHTING INVENTORY

Note: The section and table numbering in this attachment are consistent with the Section 5.0 Results summary for ease of reference.

List of Figures

List of Tables

Reference: Section 5.1 Newhalem Townsite.

Figure 5.1-1. Newhalem development area typical post-top light pole.

Table 5.1-1. Newhalem development area typical post-top light pole characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Newhalem development area
Mounting / Height	post-top, 20 ft tall
Luminaire Condition	good condition
Source Voltage	277 V
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	Type V,[2] area lighting
Nighttime Lighting Documentation	See **Table 5.1-2**
Shielding	full cut-off, no uplight
Ballast / Driver Information[1]	--
Luminaire Control Method	individual photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	pedestrian path visibility / comfort
Purpose	pedestrian path illumination / general area lighting
Functionality	functioning properly
Historical Significance	N/A

1 Source wattage and driver information unavailable.
2 Type V defines how light is dispersed from the luminaire. Refer to IESNA Light Distribution Type definitions (Rea and IESNA 2000).

Table 5.1-2. Newhalem development area typical post-top light pole nighttime lighting measurements.[1]

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[2]
0 (Nadir)	0.25	--
15	0.19	--
30	0.12	4,208
45	0.10	--
60	0.06	--

1 As noted in Section 4, nighttime luminance and illuminance measurements were recorded for representative luminaires, and only for luminaires that were easily accessible for accurate measurements.
2 Lens luminance measurements only conducted at a distance of 30 ft.

Figure 5.1-2. Newhalem tennis court light pole.

Table 5.1-3. Newhalem tennis court light pole characteristics.

Category	Description
Source Quantity	2 luminaires mounted to 1 pole. 1 source per luminaire.
Locations	Newhalem
Mounting / Height	post-top, 30 ft tall
Luminaire Condition	good condition
Source Voltage	277 V
Source Type	LED
Estimated CCT	N/A
Source Wattage	--
Source Distribution	flood distribution, area lighting
Nighttime Lighting Documentation[1]	N/A
Shielding	N/A
Ballast / Driver Information	--
Luminaire Control Method	manual, remote switch
Hours of Operation	N/A
Safety and Security Concerns	N/A
Purpose	recreational use only
Functionality	N/A
Historical Significance	N/A

1 Newhalem tennis court light pole was off during nighttime lighting evaluation period. Measurements unavailable.

Figure 5.1-3. Newhalem wastewater treatment plant driveway light pole.

Table 5.1-4. Newhalem wastewater treatment plant driveway light pole characteristics.

Category	Description
Source Quantity	1 luminaire per pole, 1 source per luminaire
Locations	Newhalem
Mounting / Height	streetlight, 20 ft tall
Luminaire Condition	good condition
Source Voltage	277 V
Source Type	LED
Estimated CCT	--
Source Wattage[1]	--
Source Distribution	Type IV,[2] area lighting
Nighttime Lighting Documentation[3]	N/A
Shielding	full cut-off, no uplight
Ballast / Driver Information[1]	--
Luminaire Control Method	--
Hours of Operation	--
Safety and Security Concerns	utility building driveway visibility
Purpose	general area lighting
Functionality	--
Historical Significance	N/A

1 Source wattage and driver information unavailable.
2 Type IV defines how light is dispersed from the luminaire. Refer to IESNA Light Distribution Type definitions (Rea and IESNA 2000).
3 Wastewater treatment plant light pole was off during nighttime lighting evaluation period. Measurements unavailable. Other exterior luminaires shown in photograph of the wastewater treatment plant were off during nighttime evaluation period. These other luminaires appear to be non-functional.

Figure 5.1-4. Newhalem helipad windsock flagpole lighting.

Figure 5.1-5. Newhalem helipad windsock flagpole lighting (close-up view).

Figure 5.1-6. Newhalem helipad windsock flagpole lighting (nighttime lighting evaluation).

Table 5.1-5. Newhalem helipad windsock flagpole lighting characteristics.

Category	Description
Source Quantity	4 luminaires per pole, 1 source per luminaire
Locations	Newhalem
Mounting / Height	post-top, 25 ft tall
Luminaire Condition	1 luminaire broken/missing, replacement required
Source Voltage	--
Source Type	LED
Estimated CCT	3000 K
Source Wattage[1]	--
Source Distribution	flood distribution
Nighttime Lighting Documentation	See **Figure 5.1-6**
Shielding	None
Ballast / Driver Information[1]	--
Luminaire Control Method	manual, remote switch
Hours of Operation	N/A
Safety and Security Concerns	helipad landing zone safety requirements
Purpose	illuminate windsock flag to aid helicopter pilots in safe landings
Functionality	inadequate, adjustable luminaires appear to be improperly aimed
Historical Significance	N/A

1 Source wattage and driver information unavailable.

Figure 5.1-7. Newhalem helipad lighting.

Figure 5.1-8. Newhalem helipad lighting (close-up views).

Figure 5.1-9. Newhalem helipad lighting (nighttime lighting evaluation).

Figure 5.1-10. Newhalem helipad lighting nighttime lighting evaluations (close-up views).

Table 5.1-6. Newhalem helipad lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire, 12 luminaires around helipad perimeter
Locations	Newhalem
Mounting / Height	surface/ground-mounted to concrete around perimeter of helipad
Luminaire Condition	variable conditions – see **Figures 5.1-8, 5.1-10**
Source Voltage	--
Source Type	LED
Estimated CCT	N/A – yellow color indicators
Source Wattage[1]	--
Source Distribution	indicator lighting
Nighttime Lighting Documentation	see **Figures 5.1-8, 5.1-10**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	manual, remote switch
Hours of Operation	N/A
Safety and Security Concerns	helipad landing zone safety requirements
Purpose	helipad landing zone safety requirements
Functionality	functioning properly when activated
Historical Significance	N/A

1 Source wattage and driver information unavailable.

Figure 5.1-11. Newhalem administrative office exterior wall pack flood light No. 1.

Figure 5.1-12. Newhalem administrative office exterior wall pack flood light No. 2.

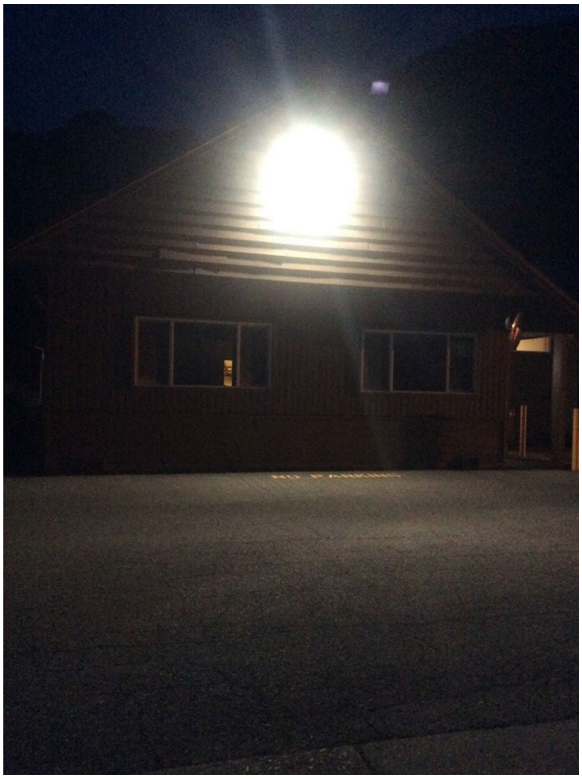

Figure 5.1-13. Newhalem administrative office exterior wall pack flood light No. 1 (nighttime lighting evaluation).

Table 5.1-7. Newhalem administrative office exterior wall pack flood light characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	City Light administration office exterior
Mounting / Height	wall pack, 15 ft above ground
Luminaire Condition	good condition
Source Voltage	277 V
Source Type	LED
Estimated CCT	4000 K
Source Wattage	--
Source Distribution	flood distribution, area lighting
Nighttime Lighting Documentation	see **Table 5.1-8**
Shielding	none
Ballast / Driver Information	--
Luminaire Control Method	individual photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	driveway and parking lot visibility
Purpose	driveway/parking lot visibility, general area lighting
Functionality	functioning properly
Historical Significance	N/A

1 Source wattage and driver information unavailable.

Table 5.1-8. Newhalem administrative office exterior wall pack flood light nighttime lighting measurements.

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
0 (Nadir)	8.0	--
15	3.5	--
30	1.0	10,170
45	0.4	--
60	0.1	--

1 Source lens luminance measurements only conducted at a distance of 30 ft.

Figure 5.1-14. **Newhalem administrative office entrance (typical pedestrian scale exterior wall pack luminaires).**

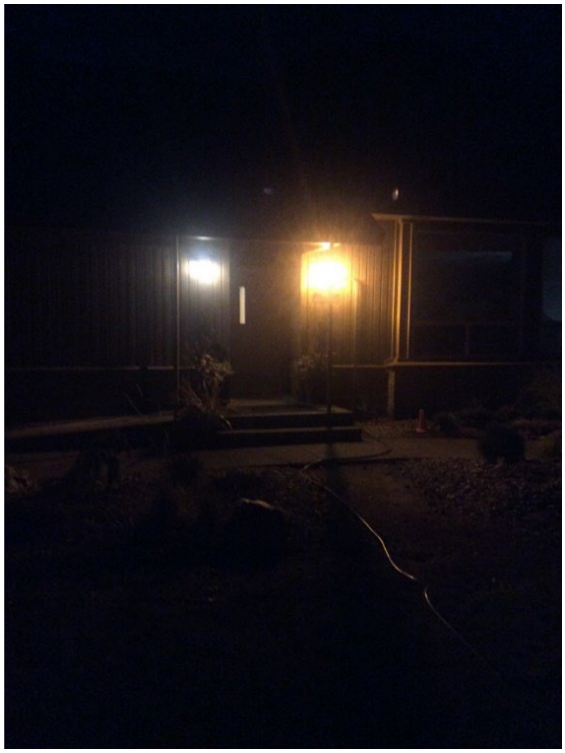

Figure 5.1-15. **Newhalem administrative office entrance – typical pedestrian scale exterior wall pack luminaires (nighttime lighting evaluation).**

Table 5.1-9. Newhalem administrative office entrance typical pedestrian scale exterior wall pack luminaires characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	City Light administration office exterior
Mounting / Height	wall pack, 8 ft above finished floor (AFF)
Luminaire Condition	conditions vary
Source Voltage	--
Source Type	varies - LED, HPS, incandescent
Estimated CCT	varies – 2700-5000k
Source Wattage[1]	--
Source Distribution	flood distribution, area lighting
Nighttime Lighting Documentation	see **Table 5.1-10**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	centralized photocell or astronomical timeclock.
Hours of Operation	dusk to dawn
Safety and Security Concerns	entrance visibility
Purpose	entrance visibility, general area lighting, apparent redundancy
Functionality	several luminaires not functioning
Historical Significance	N/A

1 Source wattage and driver information unavailable.

Table 5.1-10. Newhalem administrative office exterior wall pack flood light nighttime lighting measurements.

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
0 (Nadir)	5.5	--
5	1.1	--
10	0.42	--
15	0.2	--
20	0.1	2,054

1 Source lens luminance measurements only conducted at a distance of 20 ft.

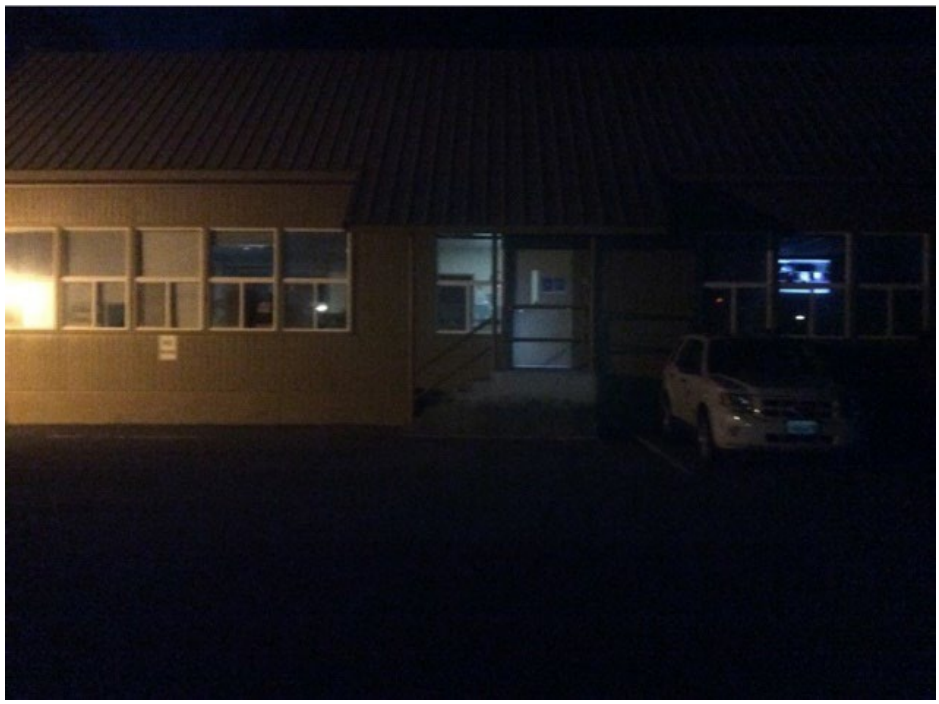

Figure 5.1-16. Newhalem administrative office – interior luminaires and monitors left on all night.

Figure 5.1-17. Newhalem administrative office – interior luminaires and monitors left on all night.

Figure 5.1-18. Newhalem administrative office signage and flagpole lighting.

Figure 5.1-19. Newhalem administrative office signage and flagpole lighting (nighttime lighting evaluation).

Table 5.1-11. Newhalem administrative office signage and flagpole lighting characteristics.

Category	Description
Source Quantity	3 luminaires. 1 source per luminaire
Locations	City Light administration office exterior
Mounting / Height	surface/ground-mounted
Luminaire Condition	conditions vary
Source Voltage	--
Source Type	varies, LED
Estimated CCT	varies, 5000 K – 4000 K
Source Wattage[1]	--
Source Distribution	flood distribution
Nighttime Lighting Documentation	see **Figure 5.1-19**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	centralized photocell or astronomical timeclock
Hours of Operation	dusk to dawn
Safety and Security Concerns	signage visibility
Purpose	signage visibility, flagpole lighting
Functionality	flagpole luminaire not functioning
Historical Significance	N/A

1 Source wattage and driver information unavailable.

Figure 5.1-20. Newhalem administrative office garage covered walkway lighting.

Table 5.1-12. Newhalem administrative office garage covered walkway lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	City Light administration office exterior
Mounting / Height	recessed into covered walkway – 9 ft AFF
Luminaire Condition	poor – filled with bugs
Source Voltage	--
Source Type	incandescent
Estimated CCT	2,700 K
Source Wattage[1]	--
Source Distribution	flood distribution
Nighttime Lighting Documentation	see **Figure 5.1-20**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	none
Hours of Operation	on 24/7
Safety and Security Concerns	driveway visibility
Purpose	driveway visibility
Functionality	functional
Historical Significance	N/A

1 Source wattage and driver information unavailable.

Figure 5.1-21. Newhalem administrative office garage driveway lighting – flood wall pack.

Figure 5.1-22. Newhalem administrative office garage driveway lighting – flood wall pack (nighttime lighting evaluation).

Table 5.1-13. Newhalem administrative office garage driveway lighting – flood wall pack characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	City Light administration office exterior
Mounting / Height	surface, wall-mount, 15 ft AFF
Luminaire Condition	good
Source Voltage	--
Source Type	HID
Estimated CCT	5000 K
Source Wattage[1]	--
Source Distribution	flood distribution
Nighttime Lighting Documentation	see **Table 5.1-14**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	centralized photocell or astronomical timeclock
Hours of Operation	dusk to dawn
Safety and Security Concerns	driveway visibility
Purpose	driveway visibility
Functionality	functioning
Historical Significance	N/A

1 Source wattage and driver information unavailable.

Table 5.1-14. Newhalem administrative office garage driveway lighting – flood wall pack lighting measurements.

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
0 (Nadir)	30	--
15	10	--
30	2.0	47,170
45	1.0	--
60	0.5	--

1 Source lens luminance measurements only conducted at a distance of 30 ft.

Figure 5.1-23. Newhalem pesticide storage building exterior lighting.

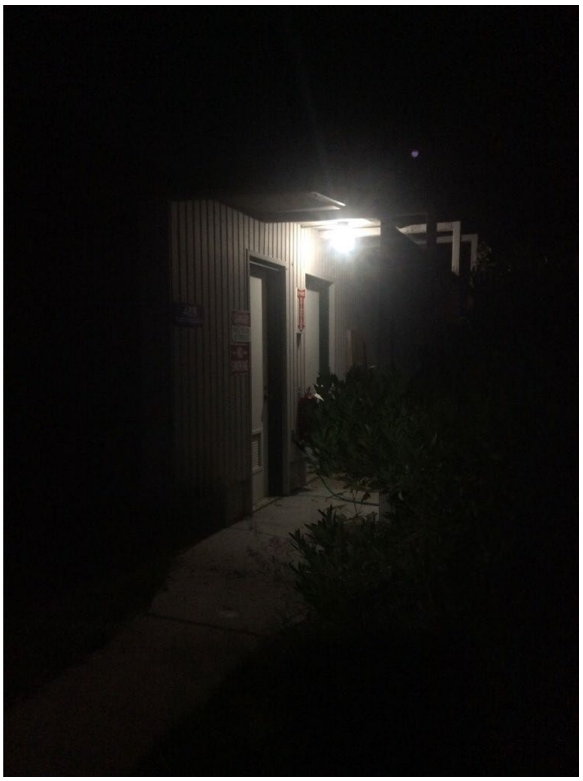

Figure 5.1-24. Newhalem pesticide storage building exterior lighting (nighttime lighting evaluation).

Table 5.1-15. Newhalem pesticide storage building exterior lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Newhalem pesticide storage building – east side canopy
Mounting / Height	10 ft AFF
Luminaire Condition	good condition
Source Voltage	--
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	flood distribution, area lighting
Nighttime Lighting Documentation	see **Figure 5.1-24, Table 5.1-16**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	none
Hours of Operation	24/7
Safety and Security Concerns	pesticide storage building entrance
Purpose	general area lighting
Functionality	functioning
Historical Significance	N/A

1 Source wattage and driver information unavailable.

Table 5.1-16. Newhalem pesticide storage building exterior lighting measurements.

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
0 (Nadir)	5.5	--
5	2.4	--
10	0.9	--
15	0.1	--
20	0.1	5,399

1 Source lens luminance measurements only conducted at a distance of 20 ft.

Figure 5.1-25. Newhalem fire station / security office / quadriplex exterior lighting (typical project LED flood lights and unshielded LED wall packs.)

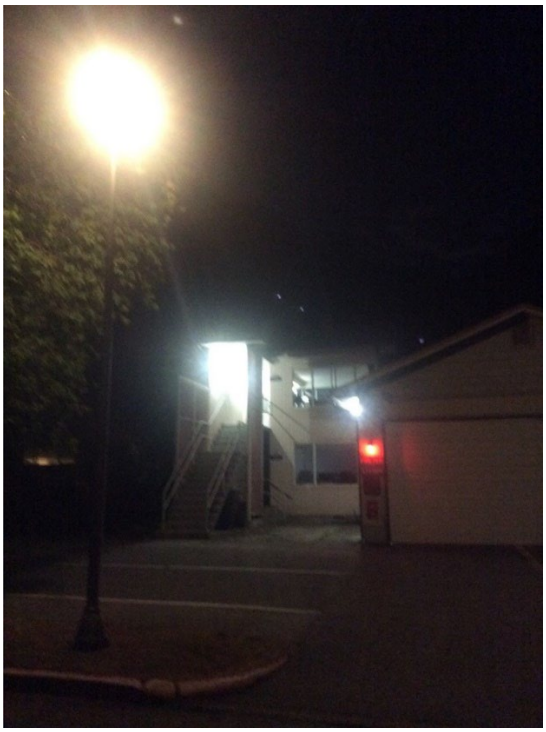

Figure 5.1-26. Newhalem fire station / security office / quadriplex exterior lighting (typical project LED flood lights and unshielded LED wall packs).

Table 5.1-17. Newhalem fire station / security office / quadriplex exterior lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Newhalem Fire Station / Security Office / Quadriplex
Mounting / Height	varies – 10-14 ft AFF
Luminaire Condition	good condition
Source Voltage	--
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	flood distribution, area lighting
Nighttime Lighting Documentation	see **Figure 5.1-26**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	centralized photocell or astronomical timeclock
Hours of Operation	dusk to dawn
Safety and Security Concerns	fire station / security office
Purpose	general area lighting
Functionality	functioning
Historical Significance	N/A

1 Source wattage and driver information unavailable.

Figure 5.1-27. Newhalem and Diablo townsite typical residential unit entrance exterior lighting.

Table 5.1-18. Newhalem and Diablo townsite typical residential unit entrance exterior lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Newhalem and Diablo Townsite typical residential unit entrances
Mounting / Height	varies – 8-10 ft AFF
Luminaire Condition	varies - good condition
Source Voltage	--
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	flood distribution, area lighting
Nighttime Lighting Documentation	**measurements not taken on private properties**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	manual – interior switch
Hours of Operation	dusk to dawn
Safety and Security Concerns	residential property visibility
Purpose	general area lighting
Functionality	functioning
Historical Significance	N/A

1 Source wattage and driver information unavailable.

Figure 5.1-28. Newhalem SR 20 parking area EV charging station lighting.

Figure 5.1-29. Newhalem SR 20 parking area EV charging station lighting (nighttime lighting evaluation).

Table 5.1-19. Newhalem SR 20 parking area EV charging station lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Newhalem SR 20 parking area EV charging stations
Mounting / Height	15 ft Poles
Luminaire Condition	good condition
Source Voltage	--
Source Type	HPS
Estimated CCT	2700 K
Source Wattage[1]	--
Source Distribution	Type IV,[2] area lighting
Nighttime Lighting Documentation	**see Figure 5.1-29, Table 5.1-20**
Shielding	full cut-off
Ballast / Driver Information[1]	--
Luminaire Control Method	photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	charging station equipment operation and safety
Purpose	general area lighting
Functionality	1 of 2 luminaires functioning
Historical Significance	N/A

1 Source wattage and driver information unavailable.
2 Type IV defines how light is dispersed from the luminaire. Refer to IESNA Light Distribution Type definitions (Rea and IESNA 2000).

Table 5.1-20. Newhalem SR 20 parking area EV charging station lighting measurements.

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
0 (Nadir)	1.1	--
5	0.62	--
10	0.25	--
15	0.1	--
20	0	--

1 Source lens luminance measurements not conducted. Nighttime luminance and illuminance measurements were recorded for representative luminaires, and only for luminaires that were easily accessible for accurate measurements.

Figure 5.1-30. Newhalem shared garages (nighttime lighting evaluation).

Table 5.1-21. Newhalem shared garages lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Newhalem shared garages
Mounting / Height	12 ft AFF
Luminaire Condition	good condition
Source Voltage	--
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	flood distribution, area lighting
Nighttime Lighting Documentation	**see Figure 5.1-30, Table 5.1-22**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	garage driveway area visibility
Purpose	general area lighting
Functionality	functioning properly
Historical Significance	N/A

1 Source wattage and driver information unavailable.

Table 5.1-22. Newhalem shared garages lighting measurements.

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
0 (Nadir)	20	--
5	8	--
10	1	--
15	0.1	--
20	0	43,550

1 Source lens luminance measurements only conducted at a distance of 20 ft.

Figure 5.1-31. Newhalem – "The Hotel" typical exterior lighting.

Table 5.1-23. Newhalem – "The Hotel" typical exterior lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	114 Commissary building exterior entrances
Mounting / Height	10 ft AFF
Luminaire Condition	good condition
Source Voltage	--
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	area lighting
Nighttime Lighting Documentation	luminaires off during nighttime lighting evaluations
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	--
Hours of Operation	--
Safety and Security Concerns	entrance visibility
Purpose	general area lighting
Functionality	--
Historical Significance	N/A

1 Source wattage and driver information unavailable.

Figure 5.1-32. Newhalem visitor restroom building – exterior entrance lighting.

Figure 5.1-33. Newhalem visitor restroom building – interior lighting on all night (nighttime lighting evaluation).

Table 5.1-24. Newhalem visitor restroom building characteristics.

Category	Description
Source Quantity	0 sources per exterior luminaire
Locations	over entrance of visitor restroom building
Mounting / Height	10 ft AFF
Luminaire Condition	good condition – no source
Source Voltage	--
Source Type	--
Estimated CCT	--
Source Wattage[1]	--
Source Distribution	area lighting
Nighttime Lighting Documentation	interior luminaires on during nighttime lighting evaluation.
Shielding	full cut-off
Ballast / Driver Information[1]	--
Luminaire Control Method	--
Hours of Operation	--
Safety and Security Concerns	entrance visibility
Purpose	general area lighting
Functionality	--
Historical Significance	N/A

1 Source wattage and driver information unavailable

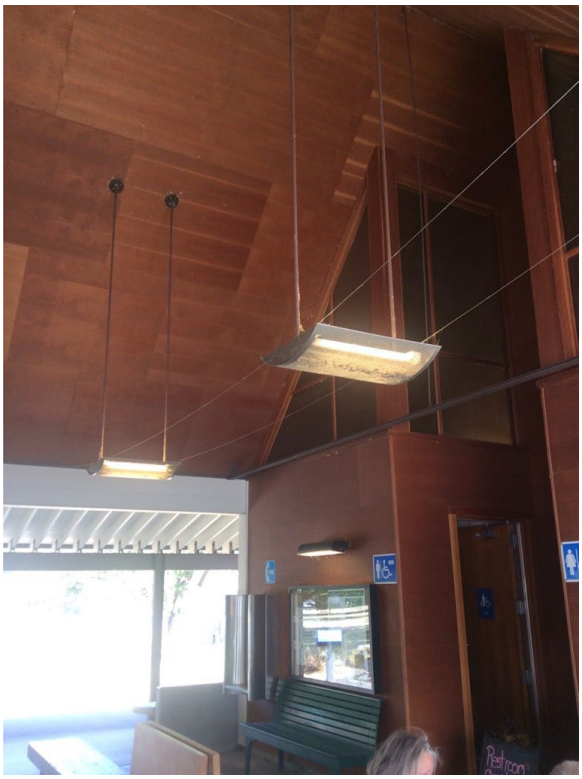

Figure 5.1-34. Newhalem Skagit Information Center lighting.

Figure 5.1-35. Newhalem Skagit Information Center lighting – typical adjustable flood lighting.

Table 5.1-25. Newhalem Skagit Information Center lighting characteristics.

Category	Description
Source Quantity	4 sources per suspended general illumination luminaire
Locations	Skagit Information Center pavilion
Mounting / Height	10 ft AFF
Luminaire Condition	old, dirty, full of bugs
Source Voltage	--
Source Type	suspended baskets – CFL / adjustable floods - LED
Estimated CCT	4000 K / 3000 K
Source Wattage[1]	--
Source Distribution	area lighting
Nighttime Lighting Documentation	luminaires off during nighttime lighting evaluation
Shielding	none – covered canopy pavilion
Ballast / Driver Information[1]	--
Luminaire Control Method	manual / switch
Hours of Operation	24/7
Safety and Security Concerns	visitor center visibility and safety
Purpose	general area lighting
Functionality	functioning
Historical Significance	N/A

1 Source wattage and driver information unavailable.

Figure 5.1-36. Newhalem – Skagit General Store covered walkway lighting.

Figure 5.1-37. Newhalem – Skagit General Store covered walkway lighting (nighttime lighting evaluation).

Table 5.1-26. Newhalem – Skagit General Store covered walkway lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Skagit General Store covered walkway
Mounting / Height	10 ft AFF
Luminaire Condition	old, dirty, full of bugs, water damage
Source Voltage	--
Source Type	HID
Estimated CCT	4500 K
Source Wattage[1]	--
Source Distribution	area lighting
Nighttime Lighting Documentation	see **Figure 5.1-37, Table 5.1-27**
Shielding	none – covered walkway
Ballast / Driver Information[1]	--
Luminaire Control Method	photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	store customer visibility and safety
Purpose	general area lighting
Functionality	functioning
Historical Significance	N/A

1 Source wattage and driver information unavailable.

Table 5.1-27. Newhalem – Skagit General Store covered walkway lighting measurements.

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
0 (Nadir)	6	--
Midpoint Between Luminaires (10)	1.5	2,879

1 Source lens luminance measurements conducted between luminaires.

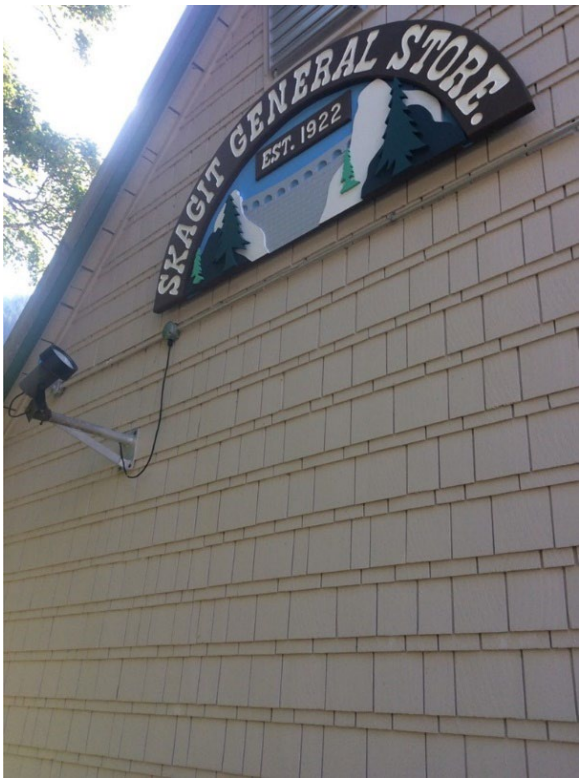

Figure 5.1-38. Newhalem – Skagit General Store exterior signage lighting (facing SR 20).

Table 5.1-28. Newhalem Skagit General Store exterior signage lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Corner of Main Street and SR 20
Mounting / Height	15 ft mounting height (MH)
Luminaire Condition	good condition
Source Voltage	--
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	flood distribution
Nighttime Lighting Documentation	luminaire not on during nighttime lighting evaluation
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	--
Hours of Operation	--
Safety and Security Concerns	N/A
Purpose	Skagit General Store signage visibility
Functionality	--
Historical Significance	--

1 Source wattage and driver information unavailable.

Figure 5.1-39. Newhalem Skagit General Store east side exterior lighting.

Figure 5.1-40. Newhalem – Skagit General Store east side exterior lighting (nighttime lighting evaluation).

Table 5.1-29. Newhalem – Skagit General Store east side exterior lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Near rear entrance
Mounting / Height	8’ MH
Luminaire Condition	good condition
Source Voltage	--
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	flood distribution
Nighttime Lighting Documentation	see **Figure 5.1-40, Table 5.1-30**
Shielding	None
Ballast / Driver Information[1]	--
Luminaire Control Method	photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	N/A
Purpose	Dumpster area visibility
Functionality	functioning
Historical Significance	--

1 Source wattage and driver information unavailable.

Table 5.1-30. Newhalem – Skagit General Store east side exterior lighting measurements.

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
0 (Nadir)	8.1	--
5	4.5	--
10	2.2	--
15	0.5	--
20	0.2	3,079

1 Source lens luminance measurements only conducted at distance of 20 ft.

Figure 5.1-41. Newhalem – City Light train exhibit pole-mounted lighting (nighttime lighting evaluation).

Table 5.1-31. Newhalem – City Light train exhibit pole-mounted lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	corner of Main Street and SR 20
Mounting / Height	30 ft MH
Luminaire Condition	good condition
Source Voltage	--
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	flood distribution
Nighttime Lighting Documentation	see **Figure 5.1-41, Table 5.1-32**
Shielding	None
Ballast / Driver Information[1]	--
Luminaire Control Method	photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	N/A
Purpose	train exhibit visibility
Functionality	functioning
Historical Significance	--

1 Source wattage and driver information unavailable.

Table 5.1-32. Newhalem – City Light train exhibit pole-mounted lighting measurements.

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
Around Train Exhibit	11(avg)	31,240
On Train Exhibit	3 (avg)	--

1 Source lens luminance measurements conducted from train exhibit.

Figure 5.1-42. Newhalem – Currier Hall – typical exterior lighting.

Figure 5.1-43. **Newhalem – Currier Hall – typical exterior lighting (many luminaires are missing sources or have been replaced by new adjacent luminaires).**

Figure 5.1-44. **Newhalem – Currier Hall – typical exterior lighting (many luminaires are missing sources or have been replaced by new adjacent luminaires).**

Table 5.1-33. Newhalem – Currier Hall – typical exterior lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Currier Hall
Mounting / Height	12 ft MH
Luminaire Condition	condition varies
Source Voltage	--
Source Type	CFL, MH, incandescent, LED
Estimated CCT	varies – 2700 K - 5000 K
Source Wattage[1]	150W max
Source Distribution	general area lighting
Nighttime Lighting Documentation	exterior luminaires not on during nighttime lighting evaluation
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	--
Hours of Operation	many exterior luminaires in building soffit on during day, off at night
Safety and Security Concerns	N/A
Purpose	general area lighting, building entrance lighting
Functionality	--
Historical Significance	--

1 Source wattage and driver information unavailable.

Figure 5.1-45. Newhalem – Gorge Inn building – typical exterior lighting.

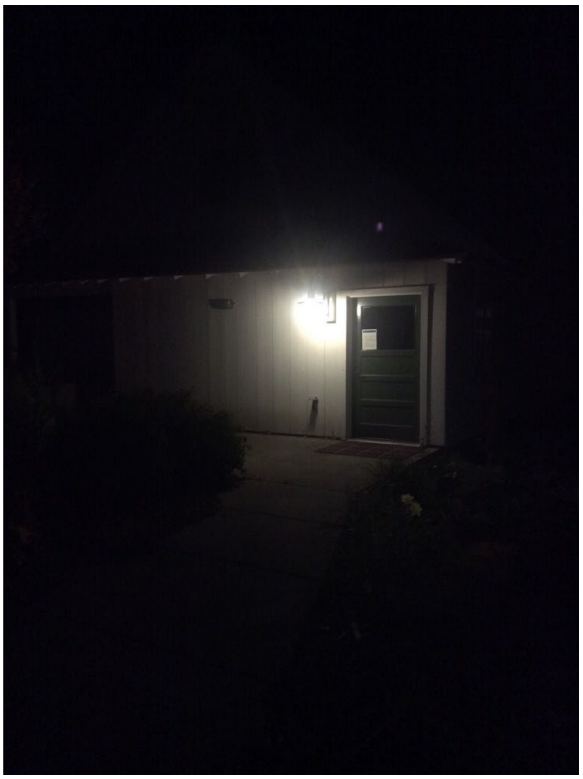

Figure 5.1-46. Newhalem – Gorge Inn building – typical exterior lighting (nighttime lighting evaluation).

Table 5.1-34. Newhalem – Gorge Inn building – typical exterior lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Gorge Inn (Main Street)
Mounting / Height	6 ft MH
Luminaire Condition	good condition
Source Voltage	--
Source Type	CFL
Estimated CCT	varies – 4000 K
Source Wattage[1]	--
Source Distribution	general area lighting
Nighttime Lighting Documentation	see **Figure 5.1-46, Table 5.1-35**
Shielding	full cut-off
Ballast / Driver Information[1]	--
Luminaire Control Method	--
Hours of Operation	dusk to dawn
Safety and Security Concerns	building entrance safety
Purpose	general area lighting, building entrance lighting
Functionality	--
Historical Significance	--

1 Source wattage and driver information unavailable.

Table 5.1-35. Newhalem – Gorge Inn building – typical exterior lighting measurements.

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
0 (Nadir)	15	--
5	7.2	--
10	2.1	--
15	0.5	--
20	0.2	2,903

1 Source lens luminance measurements only conducted at distance of 20 ft.

Figure 5.1-47. Newhalem – Bachelor Lane typical exterior lighting.

Figure 5.1-48. Newhalem – Bachelor Lane typical exterior lighting.

Figure 5.1-49. Newhalem – Bachelor Lane typical exterior lighting.

Table 5.1-36. Newhalem – Bachelor Lane typical exterior lighting characteristics.

Category	Description
Source Quantity	varies, 1 or 2 sources per luminaire
Locations	bunkhouses on Bachelor Lane
Mounting / Height	varies, 8-18 ft MH
Luminaire Condition	good condition
Source Voltage	--
Source Type	varies - CFL, LED
Estimated CCT	varies – 4000 K
Source Wattage[1]	varies – 13 W
Source Distribution	general area lighting
Nighttime Lighting Documentation	see **Figure 5.1-49**
Shielding	varies – no shielding on LED wall packs
Ballast / Driver Information[1]	--
Luminaire Control Method	manual / interior switch
Hours of Operation	dusk to dawn
Safety and Security Concerns	building entrance safety, parking lot visibility
Purpose	general area lighting, building entrance lighting
Functionality	functioning properly
Historical Significance	--

1 Source wattage and driver information unavailable.

Figure 5.1-50. Gorge Switchyard and Maintenance Yard – City Light facility EV charging station (exterior lighting).

Table 5.1-37. Gorge Switchyard and Maintenance Yard – City Light facility EV charging station (exterior lighting characteristics).

Category	Description
Source Quantity	1 source per luminaire
Locations	west side of Newhalem Compound
Mounting / Height	6 ft MH
Luminaire Condition	dirty, water damage likely
Source Voltage	--
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	13 W
Source Distribution	general area lighting
Nighttime Lighting Documentation	--
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	none
Hours of Operation	24/7
Safety and Security Concerns	EV charging station visibility and safety
Purpose	EV charging station visibility
Functionality	functioning
Historical Significance	--

1 Source wattage and driver information unavailable.

Reference: Section 5.2 Gorge Switchyard and Maintenance Yard.

Figure 5.2-1. Gorge Switchyard and Maintenance Yard – typical wall packs (exterior lighting).

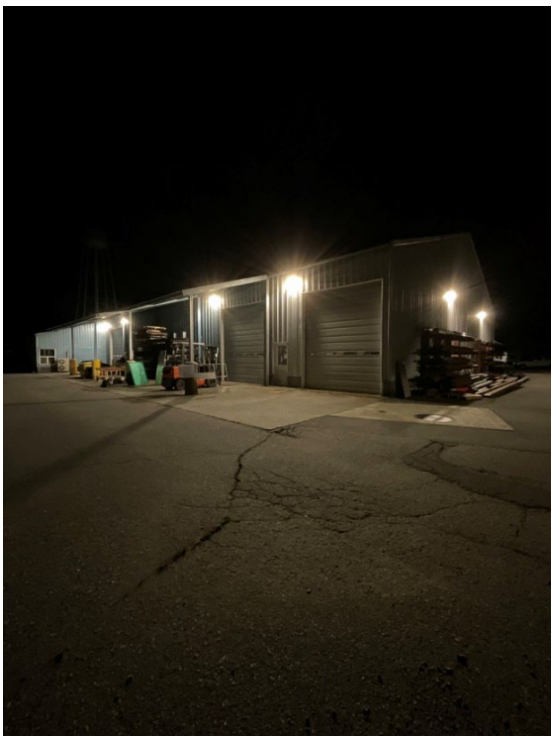

Figure 5.2-2. Gorge Switchyard and Maintenance Yard – typical wall pack (nighttime lighting evaluation).

Table 5.2-1. Gorge Switchyard and Maintenance Yard – typical wall pack (exterior lighting characteristics).

Category	Description
Source Quantity	1 source per luminaire
Locations	typical wall pack used in Newhalem Maintenance Yard
Mounting / Height	varies - 14 ft MH
Luminaire Condition	good condition
Source Voltage	--
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	general area lighting
Nighttime Lighting Documentation	see **Figure 5.2-2, Table 5.2-2**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	compound work area safety and visibility
Purpose	general area lighting
Functionality	functioning
Historical Significance	--

1 Source wattage and driver information unavailable.

Table 5.2-2. Gorge Switchyard and Maintenance Yard – typical wall pack (exterior lighting measurements).

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
0 (Nadir)	7.2	--
5	8.1	--
10	5.1	--
15	2.3	--
20	1.1	5,232

1 Source lens luminance measurements only conducted at a distance of 20 ft.

Figure 5.2-3. **Gorge Switchyard and Maintenance Yard – typical exterior work area flood lighting.**

Figure 5.2-4. **Gorge Switchyard and Maintenance Yard – typical exterior work area flood lighting (nighttime lighting evaluation).**

Table 5.2-3. Gorge Switchyard and Maintenance Yard – typical exterior work area flood lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	typical flood light used in Newhalem Maintenance Yard
Mounting / Height	varies, 40 ft+ MH
Luminaire Condition	good condition
Source Voltage	--
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	general area lighting
Nighttime Lighting Documentation	see Figure 5.2-4, Table 5.2-4
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	compound work area safety and visibility
Purpose	general area lighting
Functionality	functioning
Historical Significance	--

1 Source wattage and driver information unavailable.

Table 5.2-4. Gorge Switchyard and Maintenance Yard – typical exterior work area flood lighting measurements.

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
0 (Nadir)	2.8	--
15	5.1	--
30	10.8	--
45	7.6	--
60	3.1	8,411

1 Source lens luminance measurements only conducted at a distance of 60 ft.

Figure 5.2-5. **Gorge Switchyard and Maintenance Yard – typical warehouse exterior entrance lighting.**

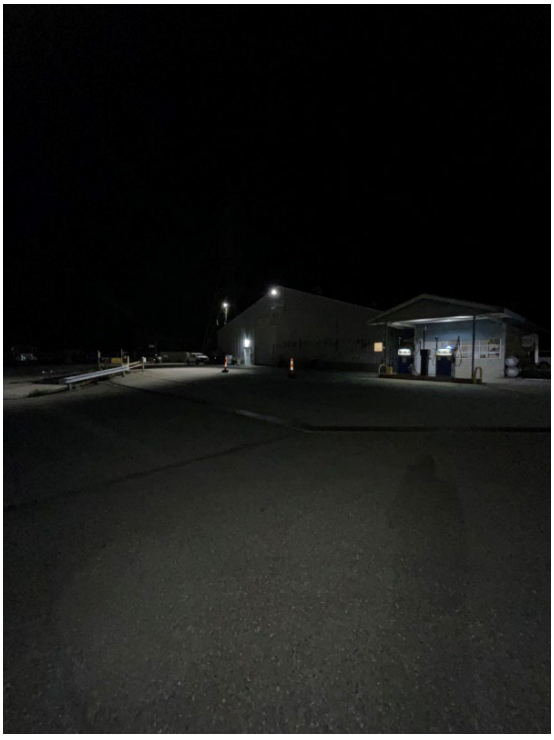

Figure 5.2-6. **Gorge Switchyard and Maintenance Yard – typical warehouse exterior entrance lighting (nighttime lighting evaluation).**

Table 5.2-5. Gorge Switchyard and Maintenance Yard – typical warehouse exterior entrance lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	typical entrance light used in Newhalem Maintenance Yard
Mounting / Height	varies, 8 ft MH
Luminaire Condition	good condition
Source Voltage	--
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	general area lighting
Nighttime Lighting Documentation	see **Table 5.2-6**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	manual / switch
Hours of Operation	--
Safety and Security Concerns	compound work area safety and visibility
Purpose	general area lighting
Functionality	functioning
Historical Significance	--

1 Source wattage and driver information unavailable.

Table 5.2-6. Gorge Switchyard and Maintenance Yard – typical warehouse exterior entrance lighting measurements.

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
0 (Nadir)	4.4	--
5	3.1	--
10	1.1	--
15	0.5	--
20	0.2	4,215

1 Source lens luminance measurements only conducted at a distance of 20 ft.

Figure 5.2-7. **Gorge Switchyard and Maintenance Yard – typical warehouse exterior canopy lighting.**

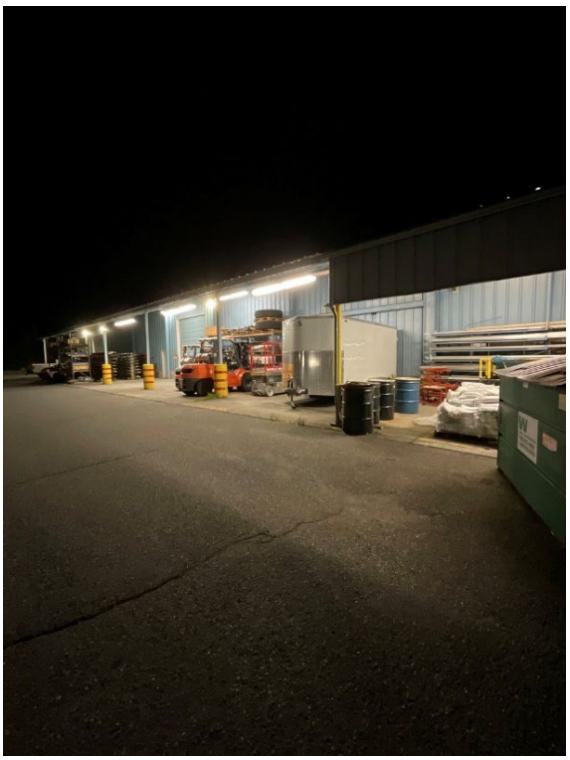

Figure 5.2-8. **Gorge Switchyard and Maintenance Yard – typical warehouse exterior canopy lighting (nighttime lighting evaluation).**

Table 5.2-7. Gorge Switchyard and Maintenance Yard – typical warehouse exterior canopy lighting characteristics.

Category	Description
Source Quantity	2 sources per luminaire
Locations	typical work area canopy light used in Newhalem Maintenance Yard
Mounting / Height	varies, 14 ft MH
Luminaire Condition	good condition
Source Voltage	--
Source Type	fluorescent
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	general area lighting
Nighttime Lighting Documentation	see **Figure 5.2-8, Table 5.2-8**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	manual / switch
Hours of Operation	--
Safety and Security Concerns	compound work area safety and visibility
Purpose	general area lighting
Functionality	functioning
Historical Significance	--

1 Source wattage and driver information unavailable.

Table 5.2-8. Gorge Switchyard and Maintenance Yard – typical warehouse exterior canopy lighting measurements.

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
0 (Nadir)	12.2	--
5	10.5	--
10	6.1	--
15	1.5	--
20	0.7	9,455

1 Source lens luminance measurements only conducted at a distance of 20 ft.

Figure 5.2-9. **Gorge Switchyard and Maintenance Yard – gas station exterior canopy lighting.**

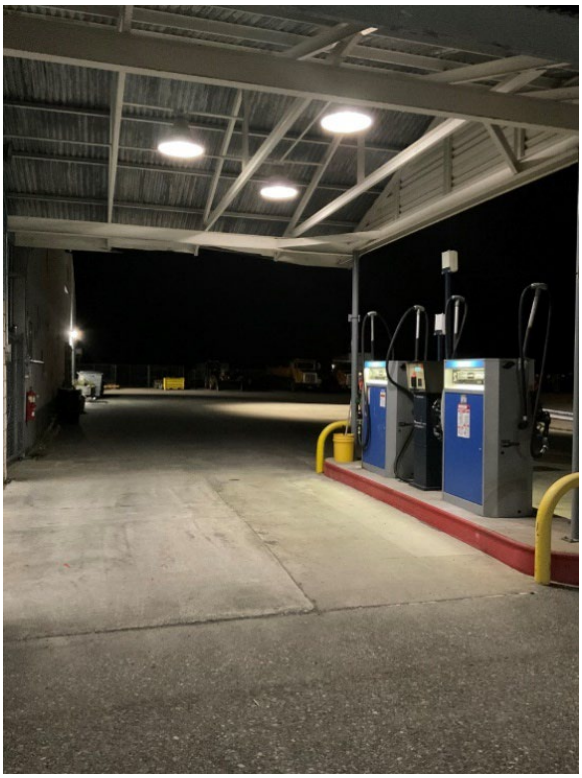

Figure 5.2-10. **Gorge Switchyard and Maintenance Yard – gas station exterior canopy lighting (nighttime lighting evaluation).**

Table 5.2-9. Gorge Switchyard and Maintenance Yard – gas station exterior canopy lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	gas station canopy light in Newhalem Maintenance Yard
Mounting / Height	14 ft MH
Luminaire Condition	good condition
Source Voltage	--
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	general area lighting
Nighttime Lighting Documentation	see **Figure 5.2-10, Table 5.2-10**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	manual / switch
Hours of Operation	--
Safety and Security Concerns	compound gas station operation and visibility
Purpose	general area lighting
Functionality	functioning
Historical Significance	--

1 Source wattage and driver information unavailable.

Table 5.2-10. Gorge Switchyard and Maintenance Yard – gas station exterior canopy lighting measurements.

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
0 (Nadir)	6.1	--
5	2.8	--
10	1.0	--
15	0.5	--
20	0.1	7,543

1 Source lens luminance measurements only conducted at a distance of 20 ft.

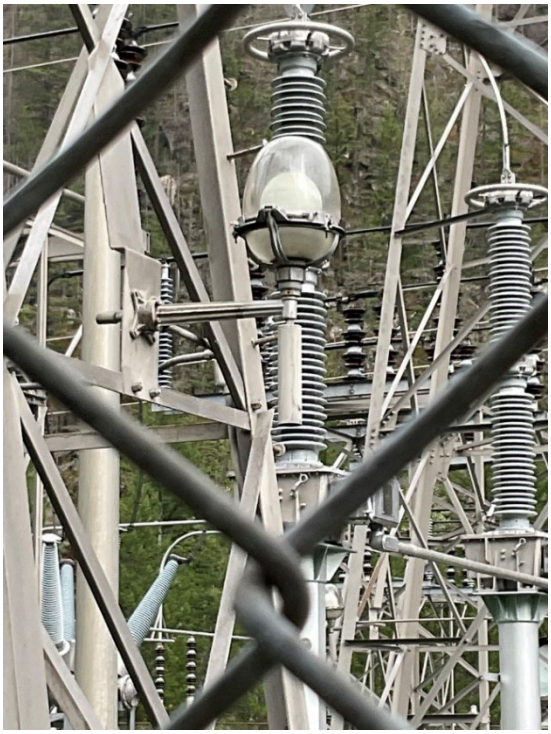

Figure 5.2-11. Gorge Switchyard – typical exterior lighting.

Figure 5.2-12. Gorge Switchyard – typical exterior lighting (nighttime lighting evaluation).

Table 5.2-11. Gorge Switchyard – typical exterior lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Gorge Powerhouse Switchyard
Mounting / Height	14 ft MH
Luminaire Condition	good condition
Source Voltage	--
Source Type	LED
Estimated CCT[1]	4000 K
Source Wattage[2]	--
Source Distribution	general area lighting
Nighttime Lighting Documentation	see **Figure 5.2-12**
Shielding	none
Ballast / Driver Information[2]	--
Luminaire Control Method	manual / switch
Hours of Operation	24/7
Safety and Security Concerns	switchyard maintenance, operation, and visibility
Purpose	general area lighting
Functionality	functioning
Historical Significance	--

1 No access to switchyards for lighting measurements.
2 Source wattage and driver information unavailable.

Reference: Section 5.3 Gorge Powerhouse.

Figure 5.3-1. Gorge Powerhouse vehicle access bridge – typical exterior lighting.

Table 5.3-1. Gorge Powerhouse vehicle access bridge – typical exterior lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Gorge Powerhouse vehicle access bridge, 1 luminaire on each end
Mounting / Height	25 ft+ MH
Luminaire Condition	good condition
Source Voltage	--
Source Type	LPS
Estimated CCT	2700 K
Source Wattage[1]	--
Source Distribution	general area lighting
Nighttime Lighting Documentation	luminaires off during nighttime lighting evaluation
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	bridge access and visibility
Purpose	general area lighting
Functionality	functioning
Historical Significance	--

1 Source wattage and driver information unavailable.

Figure 5.3-2. Gorge Powerhouse pedestrian bridge lighting.

Figure 5.3-3. Gorge Powerhouse pedestrian bridge lighting (nighttime lighting evaluation).

Table 5.3-2. Gorge Powerhouse pedestrian bridge lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Gorge Powerhouse area pedestrian bridge, 1 luminaire on each end
Mounting / Height	25 ft+ MH
Luminaire Condition	good condition
Source Voltage	--
Source Type	LED
Estimated CCT	3000 K
Source Wattage[1]	--
Source Distribution	general area lighting
Nighttime Lighting Documentation	see **Figure 5.3-3, Table 5.3-3**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	bridge access and visibility
Purpose	general area lighting
Functionality	functioning
Historical Significance	--

1 Source wattage and driver information unavailable.

Table 5.3-3. Gorge Powerhouse – pedestrian bridge lighting measurements.

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
0 (Nadir)	1.5	--
15	0.47	--
30	0.2	--
45	0.1	--
60	0	5,581

1 Source lens luminance measurements only conducted at a distance of 60 ft.

Figure 5.3-4. Gorge Powerhouse parking area lighting No. 1.

Figure 5.3-5. Gorge Powerhouse parking area lighting No. 2.

Figure 5.3-6. Gorge Powerhouse parking area lighting No. 1 – nighttime lighting evaluation.

Figure 5.3-7. Gorge Powerhouse parking area lighting No. 2 – nighttime lighting evaluation.

Table 5.3-4. Gorge Powerhouse Parking Area lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Gorge Powerhouse Parking Area
Mounting / Height	25 ft MH
Luminaire Condition	good condition
Source Voltage	--
Source Type	varies – LPS, LED
Estimated CCT	varies - 2700 K – 4000 K
Source Wattage[1]	--
Source Distribution	Type IV and V,[2] general area lighting
Nighttime Lighting Documentation	see **Figures 5.3-6, 5.3-7**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	parking area visibility
Purpose	general area lighting
Functionality	functioning
Historical Significance	--

1 Source wattage and driver information unavailable.
2 Type IV and V defines how light is dispersed from the luminaire. Refer to IESNA Light Distribution Type definitions (Rea and IESNA 2000).

Figure 5.3-8. Gorge Powerhouse building exterior lighting.

Figure 5.3-9. Gorge Powerhouse building exterior lighting – employee entrance.

Figure 5.3-10. Gorge Powerhouse building exterior lighting (nighttime lighting evaluation).

Figure 5.3-11. Gorge Powerhouse building exterior lighting – south walkway.

Table 5.3-5. Gorge Powerhouse building exterior lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Gorge Powerhouse - building mounted
Mounting / Height	varies - 12 ft MH
Luminaire Condition	old, water damage, some broken
Source Voltage	--
Source Type	varies – HID, mercury vapor
Estimated CCT	varies – 2700 K, 5000 K
Source Wattage[1]	--
Source Distribution	general area lighting
Nighttime Lighting Documentation	see **Figures 5.3-10, 5.3-14,** and **5.3-16; Table 5.3-7**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	none
Hours of Operation	24/7
Safety and Security Concerns	building perimeter safety
Purpose	general area lighting
Functionality	mostly functioning
Historical Significance	--

1 Source wattage and driver information unavailable.

Figure 5.3-12. Gorge Powerhouse building exterior lighting – east walkway.

Figure 5.3-13. Gorge Powerhouse building exterior lighting – east walkway (close-up view).

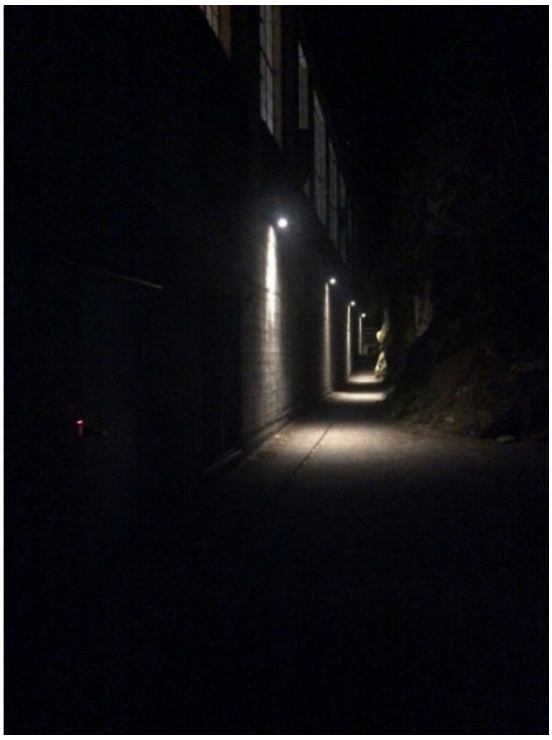

Figure 5.3-14. Gorge Powerhouse building exterior lighting – east walkway (nighttime lighting evaluation).

Table 5.3-6. Gorge Powerhouse building exterior lighting – east walkway characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Gorge Powerhouse - building mounted
Mounting / Height	varies - 12 ft MH
Luminaire Condition	good condition
Source Voltage	--
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	150 W max par lamp – LED replacement
Source Distribution	flood distribution
Nighttime Lighting Documentation	see **Table 5.3-7**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	building perimeter safety
Purpose	north walkway path lighting
Functionality	mostly functioning
Historical Significance	--

1 Source wattage and driver information unavailable.

Table 5.3-7. Gorge Powerhouse building exterior lighting – east walkway lighting measurements.

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
Directly Below Luminaires - 0 (Nadir)	25	--
Midpoint Between Luminaires – 15	0.15	--

1 Illuminance measurements not conducted. Nighttime luminance and illuminance measurements were recorded for representative luminaires, and only for luminaires that were easily accessible for accurate measurements.

Figure 5.3-15. Gorge Powerhouse building exterior – west facade.

Figure 5.3-16. Gorge Powerhouse building exterior – west façade (nighttime lighting evaluation).

Table 5.3-8. Gorge Powerhouse building exterior lighting – west facade characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Gorge Powerhouse - building mounted
Mounting / Height	varies – 20 ft+
Luminaire Condition	varies – spill zone lighting is nonfunctional; signage is in good condition
Source Voltage	--
Source Type	incandescent
Estimated CCT	2700 K
Source Wattage[1]	--
Source Distribution	spill zone lighting - unknown signage lighting - flood distribution
Nighttime Lighting Documentation	see **Table 5.3-9**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	none
Purpose	signage illumination
Functionality	functioning
Historical Significance	powerhouse originally completed in 1924

1 Source wattage and driver information unavailable.

Table 5.3-9. Gorge Powerhouse building exterior lighting – west facade measurements.

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
0 - Signage Letters	--	5

1 Illuminance measurements not conducted. Nighttime luminance and illuminance measurements were recorded for representative luminaires, and only for luminaires that were easily accessible for accurate measurements.

Reference: Section 5.4 Ladder Creek Falls Trail and Garden.

Figure 5.4-1. Ladder Creek Falls Trail and Garden in-grade tree uplighting.

Figure 5.4-2. Ladder Creek Falls Trail and Garden in-grade tree uplighting (closeup).

Figure 5.4-3. Ladder Creek Falls Trail and Garden in-grade tree uplighting (nighttime lighting evaluation).

Table 5.4-1. Ladder Creek Falls Trail and Garden in-grade tree uplighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Ladder Creek Falls Trail and Garden area
Mounting / Height	in-grade
Luminaire Condition	good condition
Source Voltage	--
Source Type	LED
Estimated CCT	3000 K
Source Wattage[1]	--
Source Distribution	flood – uplight
Nighttime Lighting Documentation	see **Table 5.4-3**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	none
Purpose	vegetation accent illumination
Functionality	functioning
Historical Significance	--

1 Source wattage and driver information unavailable.

Figure 5.4-4. Ladder Creek Falls Trail and Garden lighting visitor information sign No. 1.

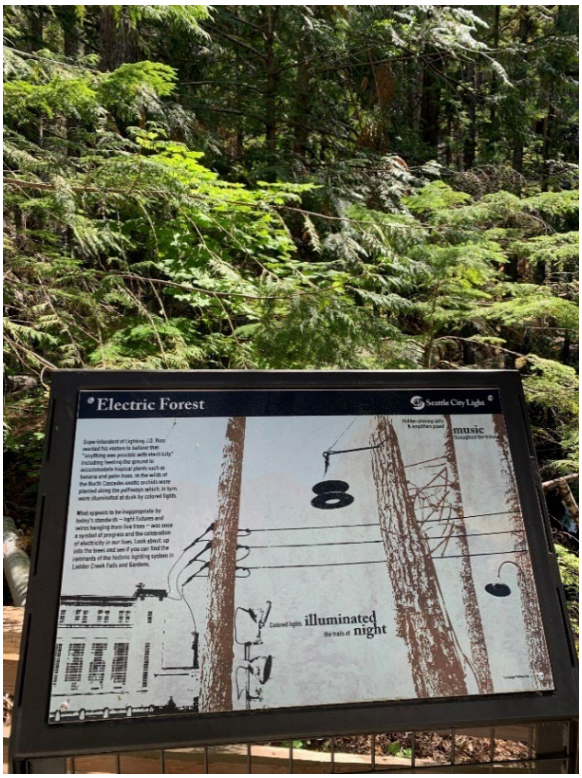

Figure 5.4-5. Ladder Creek Falls Trail and Garden lighting visitor information sign No. 2.

Figure 5.4-6. Ladder Creek Falls Trail and Garden entrance lighting.

Figure 5.4-7. Ladder Creek Falls Trail and Garden entrance (nighttime lighting evaluation).

Table 5.4-2. Ladder Creek Falls Trail and Garden entrance lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Ladder Creek Falls Trail and Garden area
Mounting / Height	20 ft MH
Luminaire Condition	varies – mostly good condition
Source Voltage	--
Source Type	CFL
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	Type V,[2] general area lighting
Nighttime Lighting Documentation	See **Table 5.4-3**
Shielding	full cut-off
Ballast / Driver Information[1]	--
Luminaire Control Method	photocell or astronomical timeclock
Hours of Operation	dusk to dawn
Safety and Security Concerns	trail visibility
Purpose	trail illumination
Functionality	functioning
Historical Significance	original lighting designed and installed by J.D. Ross in 1920s-1930s; lighting upgraded in 2011; original luminaires and equipment left in place

1 Source wattage and driver information unavailable.
2 Type V defines how light is dispersed from the luminaire. Refer to IESNA Light Distribution Type definitions (Rea and IESNA 2000).

Table 5.4-3. Ladder Creek Falls Trail and Garden entrance lighting characteristics measurements.

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
Directly Under Lamps – 0 (Nadir)	1.45	--
Between Lamps – 20	0.2	--

1 Luminance measurements not conducted. Nighttime luminance and illuminance measurements were recorded for representative luminaires, and only for luminaires that were easily accessible for accurate measurements.

Figure 5.4-8. **Ladder Creek Falls Trail and Garden original lighting – colored lamps, electrical equipment attached to tree trunks.**

Figure 5.4-9. **Ladder Creek Falls Trail and Garden – new trail lighting installed on 20 poles (left) next to original trail lighting (right).**

Figure 5.4-10. Ladder Creek Falls Trail and Garden – three color-changing adjustable luminaires aimed at waterfall.

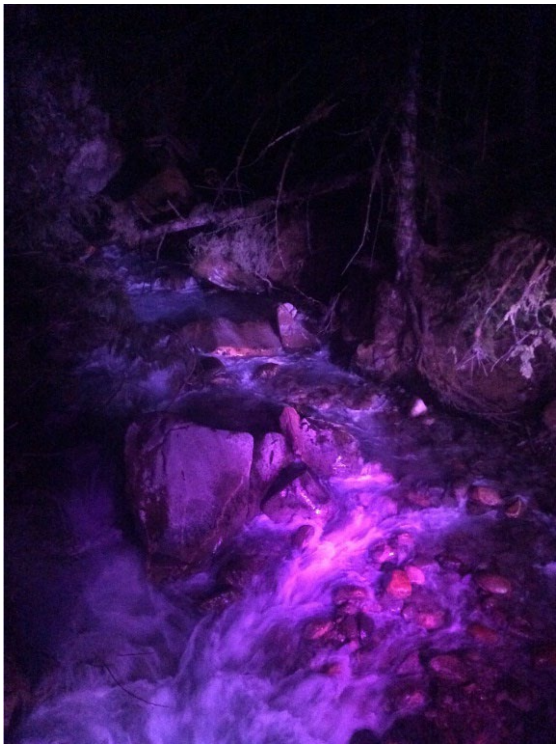

Figure 5.4-11. Ladder Creek Falls Trail and Garden – three color-changing adjustable luminaires aimed at waterfall.

Table 5.4-4. Ladder Creek Falls Trail and Garden – color changing waterfall lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Ladder Creek Falls Trail and Garden area
Mounting / Height	in-grade, on a cliff
Luminaire Condition	good condition
Source Voltage	--
Source Type	LED
Estimated CCT	color changing
Source Wattage[1]	--
Source Distribution	flood distribution
Nighttime Lighting Documentation	see **Figure 5.4-11**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	none
Purpose	waterfall accent illumination / visitor experience lighting
Functionality	functioning
Historical Significance	--

1 Source wattage and driver information unavailable.

Reference: Section 5.5 Gorge Dam.

Figure 5.5-1. Gorge Dam (no functional exterior lighting).

Reference: Section 5.6 Diablo Townsite.

Figure 5.6-1. **Diablo Townsite (Hollywood) – typical post-top light pole.**

Figure 5.6-2. **Diablo Townsite (Hollywood) – typical post-top light pole (nighttime lighting evaluation).**

Table 5.6-1. Diablo Townsite (Hollywood) – typical post-top light pole characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Diablo Townsite (Hollywood)
Mounting / Height	post-top, 20 ft tall
Luminaire Condition	good condition
Source Voltage	277 V
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	Type V,[2] area lighting
Nighttime Lighting Documentation	see **Table 5.6-2**
Shielding	full cut-off, no uplight
Ballast / Driver Information[1]	--
Luminaire Control Method	individual photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	pedestrian path visibility, comfort
Purpose	pedestrian path illumination, general area lighting
Functionality	functioning properly
Historical Significance	N/A

1 Source wattage and driver information unavailable.
2 Type V defines how light is dispersed from the luminaire. Refer to IESNA Light Distribution Type definitions (Rea and IESNA 2000).

Table 5.6-2. Diablo Townsite (Hollywood) – typical post-top light pole nighttime lighting measurements.

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
0 (Nadir)	0.41	--
15	0.15	--
30	0.09	--
45	0.02	--
60	0.01	--

1 Source lens luminance measurements not conducted. Nighttime luminance and illuminance measurements were recorded for representative luminaires, and only for luminaires that were easily accessible for accurate measurements.

Figure 5.6-3. Diablo Townsite (Hollywood) – typical residential garage exterior luminaire.

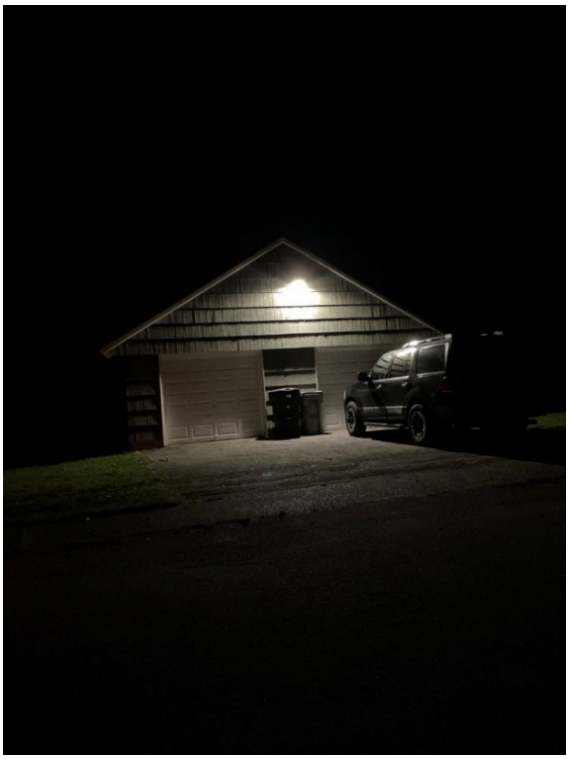

Figure 5.6-4. Diablo Townsite (Hollywood) – typical residential garage exterior luminaire (nighttime lighting).

Table 5.6-3. Diablo Townsite (Hollywood) – typical residential garage exterior luminaire characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Diablo Townsite (Hollywood)
Mounting / Height	varies - surface / wall-mounted
Luminaire Condition	good condition
Source Voltage	277 V
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	Type V,[2] area lighting
Nighttime Lighting Documentation	see **Figure 5.6-4**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	varies - photocell or manual or astronomical timeclock
Hours of Operation	dusk to dawn
Safety and Security Concerns	residential property visibility
Purpose	general area lighting
Functionality	functioning
Historical Significance	N/A

1 Source wattage and driver information unavailable.
2 Type V defines how light is dispersed from the luminaire. Refer to IESNA Light Distribution Type definitions (Rea and IESNA 2000).

Figure 5.6-5. Diablo Townsite (Hollywood) tennis court lighting.

Table 5.6-4. Diablo Townsite (Hollywood) tennis court lighting characteristics.

Category	Description
Source Quantity	3 luminaires, 1 source per luminaire
Locations	Diablo Townsite (Hollywood)
Mounting / Height	30 ft pole
Luminaire Condition	good condition
Source Voltage	--
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	flood distribution, area lighting
Nighttime Lighting Documentation	tennis court lighting off during nighttime lighting evaluation period.
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	--
Hours of Operation	manual / remote switch
Safety and Security Concerns	N/A
Purpose	recreational use
Functionality	--
Historical Significance	N/A

1 Source wattage and driver information unavailable.

Figure 5.6-6. Diablo Townsite (Hollywood) volunteer fire department garage lighting.

Table 5.6-5. Diablo Townsite (Hollywood) volunteer fire department garage lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Diablo Townsite (Hollywood)
Mounting / Height	15 ft MH
Luminaire Condition	good condition
Source Voltage	--
Source Type	LPS
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	flood distribution, area lighting
Nighttime Lighting Documentation	fire department garage lighting off during nighttime lighting evaluation
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	manual / remote switch
Hours of Operation	--
Safety and Security Concerns	N/A
Purpose	driveway visibility
Functionality	--
Historical Significance	N/A

1 Source wattage and driver information unavailable.

Figure 5.6-7. Diablo Powerhouse and Switchyard.

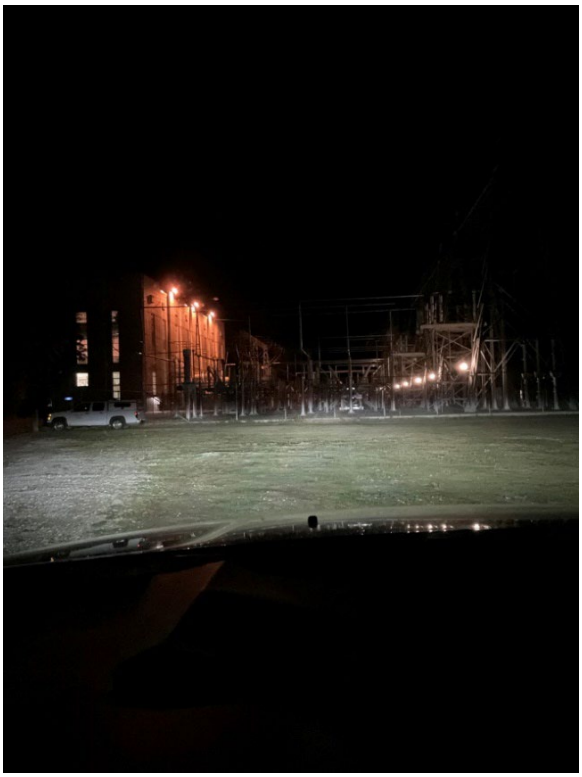

Figure 5.6-8. Diablo Powerhouse and Switchyard (nighttime lighting evaluation).

Table 5.6-6. Diablo Powerhouse and Switchyard lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Diablo Powerhouse and Switchyard
Mounting / Height	varies – 10-45 ft MH
Luminaire Condition	good condition
Source Voltage	--
Source Type	varies – HID / LED
Estimated CCT	varies – 2700 - 4000 K
Source Wattage[1]	--
Source Distribution	flood distribution /area lighting
Nighttime Lighting Documentation	**see Figure 5.6-8**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	centralized photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	powerhouse and switchyard operation and visibility
Purpose	general area lighting
Functionality	--
Historical Significance	powerhouse original construction completed in 1936

1 Source wattage and driver information unavailable.

Figure 5.6-9. Diablo Townsite (Reflector Bar) Incline Waiting Station.

Table 5.6-7. Diablo Townsite (Reflector Bar) Incline Waiting Station

Category	Description
Source Quantity	1 source per luminaire
Locations	Diablo Townsite (Reflector Bar)
Mounting / Height	12 ft MH
Luminaire Condition	dirty, unshielded
Source Voltage	--
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	13W
Source Distribution	general area lighting
Nighttime Lighting Documentation	Diablo Incline Waiting Station lighting off during nighttime evaluation
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	manual / remote switch
Hours of Operation	24/7
Safety and Security Concerns	porch / walkway visibility
Purpose	general area lighting
Functionality	functioning
Historical Significance	N/A

1 Source wattage and driver information unavailable.

Reference: Section 5.7 Diablo Dam.

Figure 5.7-1. Diablo Dam entrance gate from SR-20 (nighttime lighting evaluation).

Table 5.7-1. Diablo Dam entrance gate from SR-20 lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Diablo Dam entrance from SR 20
Mounting / Height	20 ft MH
Luminaire Condition	good
Source Voltage	--
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	general area lighting
Nighttime Lighting Documentation	see **Figure 5.7-1**
Shielding	full cut-off
Ballast / Driver Information[1]	--
Luminaire Control Method	photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	entrance gate security cameras
Purpose	general area lighting, gate visibility
Functionality	functioning
Historical Significance	N/A

1 Source wattage and driver information unavailable.

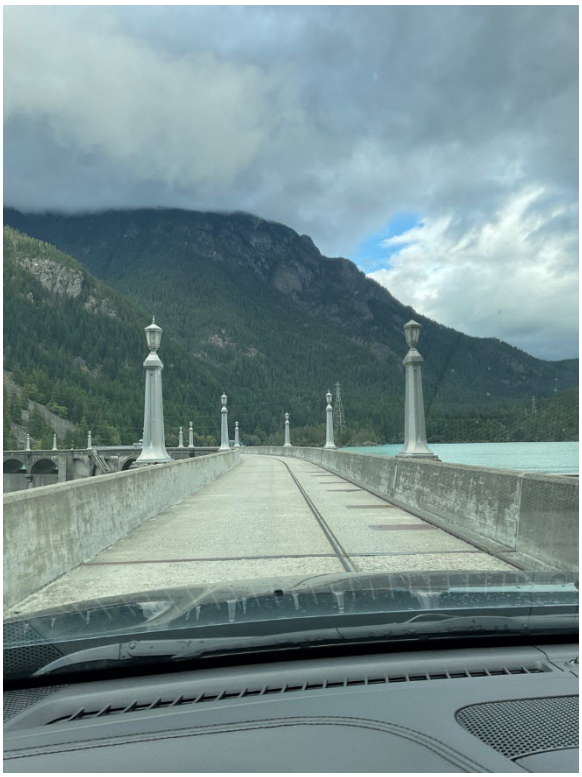

Figure 5.7-2. Diablo Dam Road – Art Deco historic luminaires.

Figure 5.7-3. Diablo Dam Road – typical Art Deco historic luminaire.

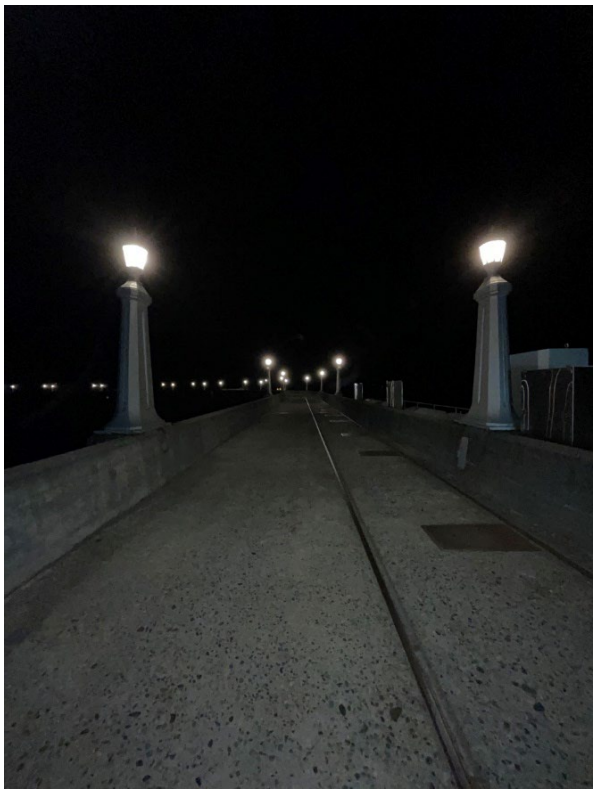

Figure 5.7-4. Diablo Dam Road – Art Deco historic luminaires (nighttime lighting evaluation).

Table 5.7-2. Diablo Dam Road – Art Deco Historic luminaires lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	30 total, 15 pairs 75 ft on-center along Diablo Dam
Mounting / Height	20 ft MH
Luminaire Condition	good condition
Source Voltage	277 V
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	Type IV,[2] general area lighting
Nighttime Lighting Documentation	see **Figure 5.7-4, Table 5.7-3**
Shielding	art deco post-top shielding
Ballast / Driver Information[1]	--
Luminaire Control Method	centralized photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	diablo dam road driveway visibility
Purpose	general area lighting / driveway visibility
Functionality	functioning
Historical Significance	Luminaires are character-defining features of the historic Diablo Dam as described in the National Register nomination and Skagit Project Historic Resources Mitigation and Management Plan

1 Source wattage and driver information unavailable.
2 Type IV defines how light is dispersed from the luminaire. Refer to IESNA Light Distribution Type definitions (Rea and IESNA 2000).

Table 5.7-3. Diablo Dam Road – Art Deco historical luminaires nighttime lighting measurements.

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
Center of Road Even with Luminaires – 0 ft	1.01	--
Center of Road Between Luminaires - 37.5 ft	0.15	4,125

1 Source lens luminance measurements only conducted at a distance of 37.5 ft.

Figure 5.7-5. Diablo Dam – valve house entrance exterior lighting.

Figure 5.7-6. Diablo Dam – valve house entrance exterior lighting.

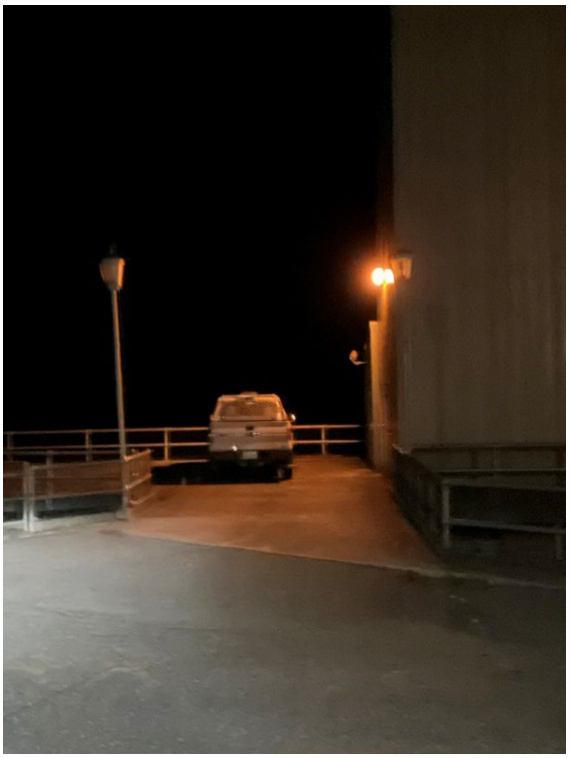

Figure 5.7-7. Diablo Dam – valve house entrance exterior lighting (nighttime lighting evaluation).

Table 5.7-4. Diablo Dam – valve house entrance exterior lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Diablo Dam - north side maintenance entrance
Mounting / Height	varies – 8-20 ft
Luminaire Condition	varies – dirty, water damaged, broken, yellowed, functional
Source Voltage	277 V
Source Type	varies – HID, LED
Estimated CCT	varies – 2700 K - 4000 K
Source Wattage[1]	--
Source Distribution	general area lighting
Nighttime Lighting Documentation	see **Figure 5.7-7**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	Diablo Dam maintenance entry visibility
Purpose	general area lighting
Functionality	functioning
Historical Significance	N/A

1 Source wattage and driver information unavailable.

Reference: Section 5.8 Diablo Lake Facilities.

Figure 5.8-1. Diablo Dam Road – typical roadway lighting.

Figure 5.8-2. Diablo Dam Road – typical roadway lighting.

Figure 5.8-3. Diablo Dam Road – typical roadway lighting (nighttime lighting evaluation).

Table 5.8-1. Diablo Dam Road – typical roadway lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Diablo Dam Road
Mounting / Height	varies – 25-30
Luminaire Condition	good condition
Source Voltage	277 V
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	Type III,[2] roadway lighting
Nighttime Lighting Documentation	see **Figure 5.8-3**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	Diablo Dam Road visibility
Purpose	roadway lighting
Functionality	functioning
Historical Significance	N/A

1 Source wattage and driver information unavailable.
2 Type III defines how light is dispersed from the luminaire. Refer to IESNA Light Distribution Type definitions (Rea and IESNA 2000).

Figure 5.8-4. Diablo Lake Boathouse driveway entrance.

Figure 5.8-5. Diablo Lake Boathouse driveway entrance (nighttime lighting evaluation).

Table 5.8-2. Diablo Lake Boathouse driveway entrance lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Diablo Dam Boathouse
Mounting / Height	25 ft MH
Luminaire Condition	good condition
Source Voltage	--
Source Type	LPS
Estimated CCT	2700 K
Source Wattage[1]	--
Source Distribution	general area lighting
Nighttime Lighting Documentation	see **Figure 5.8-5**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	Boathouse entrance visibility
Purpose	general area lighting
Functionality	functioning
Historical Significance	N/A

1 No access to Diablo Lake Boathouse facility. Source wattage and driver information unavailable.

Reference: Section 5.9 North Cascades Environmental Learning Center (ELC).

Figure 5.9-1. ELC driveway entrance (nighttime lighting evaluation).

Figure 5.9-2. ELC pathway bollard.

Table 5.9-1. ELC pathway bollard characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	ELC
Mounting / Height	2 ft, 6 inches MH – bollard
Luminaire Condition	good condition
Source Voltage	--
Source Type	LED
Estimated CCT	3000 K
Source Wattage[1]	--
Source Distribution	general area lighting
Nighttime Lighting Documentation	see **Figure 5.9-1**
Shielding	full cut-off
Ballast / Driver Information[1]	--
Luminaire Control Method	photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	ELC pedestrian trail entrance visibility
Purpose	general area lighting
Functionality	functioning
Historical Significance	N/A

1 ELC facility shut down during field observation period.

Reference: Section 5.10 Ross Powerhouse.

Figure 5.10-1. Ross Powerhouse Boathouse and dock – Boathouse exterior lighting.

Figure 5.10-2. Ross Powerhouse Boathouse (interior lighting).

Table 5.10-1. Ross Powerhouse Boathouse lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Diablo Lake – Ross Powerhouse Boathouse
Mounting / Height	10-12 ft MH
Luminaire Condition	good condition
Source Voltage	--
Source Type	LED
Estimated CCT	3000 K
Source Wattage[1]	--
Source Distribution	general area lighting
Nighttime Lighting Documentation	see **Tables 5.10-2 and 5.10-3**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	exterior – photocell, interior - manual switch
Hours of Operation	dusk to dawn, on 24/7
Safety and Security Concerns	boathouse and ferry dock visibility, operation
Purpose	general area lighting
Functionality	functioning
Historical Significance	N/A

1 Source wattage and driver information unavailable.

Table 5.10-2. Ross Powerhouse Boathouse exterior lighting (nighttime lighting measurements).

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
Directly Under Source – 0 (Nadir)	9.8	--
Between Sources – 10	5.4	4,112

1 Source lens luminance measurements taken from dock.

Table 5.10-3. Ross Powerhouse Boathouse interior lighting (nighttime lighting measurements).

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
Directly Under Source – 0 ft (Nadir)	17.3	--
Between Sources – 5 ft	8.1	5,211

1 Source lens luminance measurements taken from across boathouse.

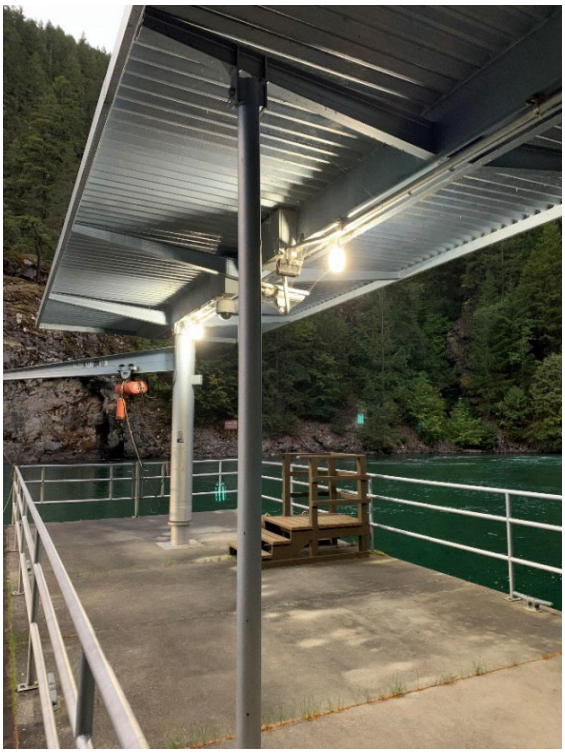

Figure 5.10-3. Ross Powerhouse Boathouse and dock (covered canopy lighting).

Table 5.10-4. Ross Powerhouse Boathouse and dock (covered canopy lighting characteristics).

Category	Description
Source Quantity	1 source per luminaire
Locations	Diablo Lake – boathouse
Mounting / Height	12 ft MH
Luminaire Condition	dirty, unshielded
Source Voltage	--
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	general area lighting
Nighttime Lighting Documentation	see **Table 5.10-5**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	ferry dock visibility, operation
Purpose	general area lighting
Functionality	functioning
Historical Significance	N/A

1 Source wattage and driver information unavailable.

Table 5.10-5. Ross Powerhouse Boathouse and dock (covered canopy lighting nighttime lighting measurements).

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
Directly Under Source – 0 (Nadir)	5.1	--
Between Sources – 10	2.5	6,111

1 Source lens luminance measurements taken from dock.

Figure 5.10-4. Ross Powerhouse facility overview.

Figure 5.10-5. Ross Powerhouse – typical exterior lighting (off during nighttime lighting evaluation).

Figure 5.10-6. Ross Powerhouse – typical exterior lighting (off during nighttime lighting evaluation).

Figure 5.10-7. **Ross Powerhouse – typical exterior lighting (off during nighttime lighting evaluation).**

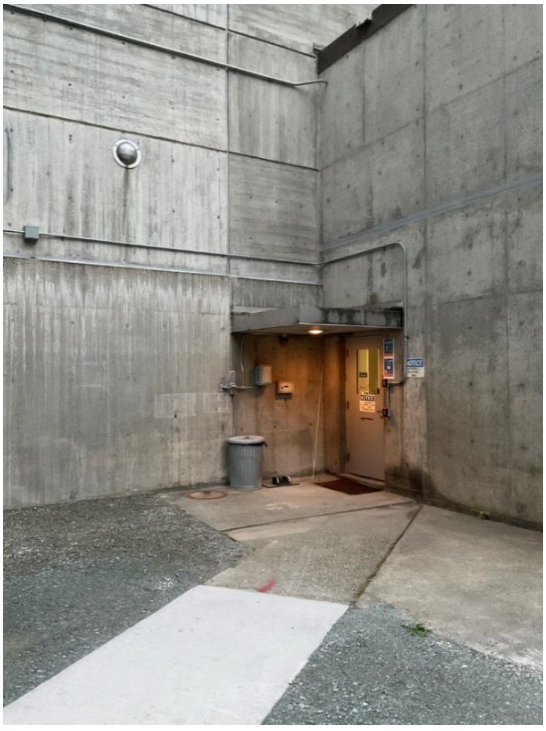

Figure 5.10-8. **Ross Powerhouse employee entrance (exterior lighting).**

Table 5.10-6. Ross Powerhouse exterior entrance lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Ross Powerhouse
Mounting / Height	8 ft MH
Luminaire Condition	good condition
Source Voltage	--
Source Type	HID
Estimated CCT	2700 K
Source Wattage[1]	--
Source Distribution	general area lighting
Nighttime Lighting Documentation	see **Figures 5.10-5, 5.10-6 and 5.10-7**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	--
Hours of Operation	--
Safety and Security Concerns	powerhouse entrance visibility
Purpose	general area lighting
Functionality	functioning
Historical Significance	N/A

1 Majority of Ross Dam Powerhouse exterior lighting was off during nighttime lighting evaluation.

Figure 5.10-9. Ross Powerhouse access tunnel entrance (exterior lighting).

Table 5.10-7. Ross Powerhouse access tunnel entrance exterior lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Ross Dam Powerhouse
Mounting / Height	10 ft MH
Luminaire Condition	dirty, full of bugs
Source Voltage	--
Source Type	LED
Estimated CCT	4000 K
Source Wattage	13 W
Source Distribution	general area lighting
Nighttime Lighting Documentation	see **Figure 5.10-9**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	--
Hours of Operation	--
Safety and Security Concerns	garage / storage building visibility
Purpose	general area lighting
Functionality	functioning
Historical Significance	N/A

1 Driver information unavailable.

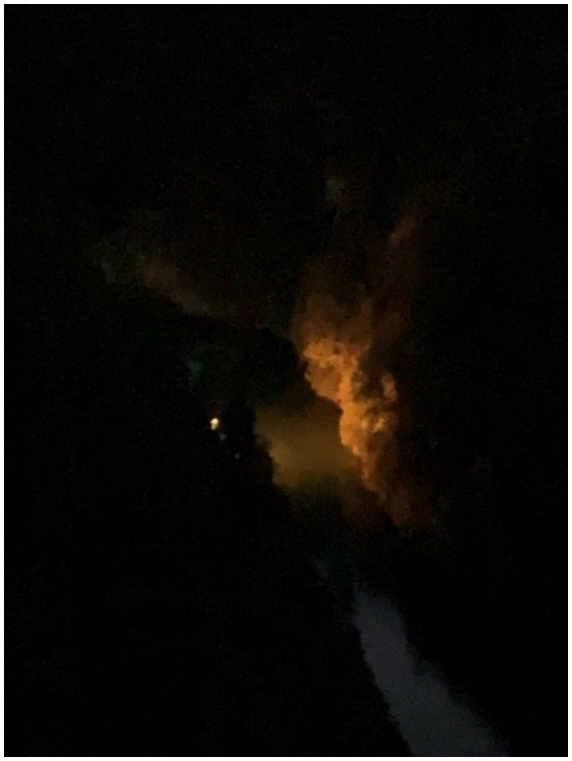

Figure 5.10-10. Ross Powerhouse interior lighting shining through windows to exterior, illuminating Diablo Lake and opposite shore (photo taken from Ross Dam).

Table 5.10-8. Ross Powerhouse lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Ross Dam Powerhouse
Mounting / Height	interior lighting, varies
Luminaire Condition	--
Source Voltage	--
Source Type	--
Estimated CCT	2700-4000K
Source Wattage[1]	--
Source Distribution	interior lighting, varies
Nighttime Lighting Documentation	see **Figure 5.10-10**
Shielding	interior lighting, varies
Ballast / Driver Information[1]	--
Luminaire Control Method	--
Hours of Operation	24/7
Safety and Security Concerns	powerhouse operation and visibility
Purpose	interior lighting, varies
Functionality	functioning
Historical Significance	N/A

1 Source wattage and driver information unavailable.

Table 5.10-9. Ross Powerhouse (nighttime lighting measurements).

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
1,400	--	0.15

1 Water surface luminance measurements taken from Ross Dam. Nighttime luminance and illuminance measurements were recorded for representative luminaires, and only for luminaires that were easily accessible for accurate measurements.

Reference: Section 5.11 Ross Dam.

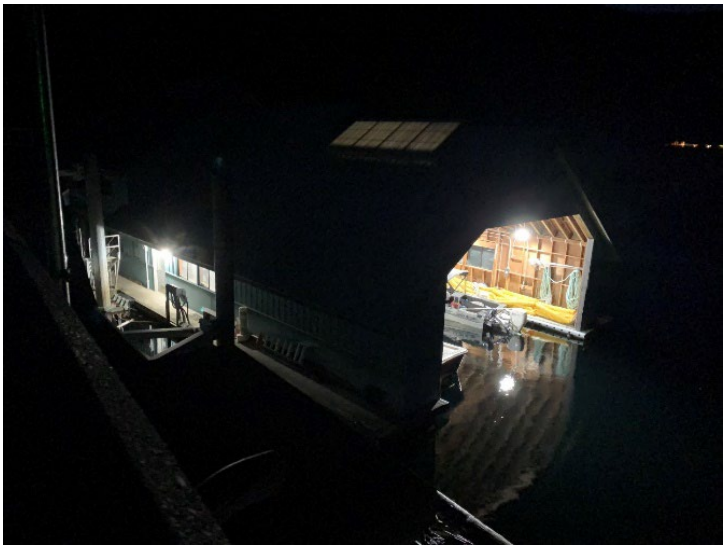

Figure 5.11-1. Ross Dam Boathouse (nighttime lighting evaluation).

Table 5.11-1. Ross Dam Boathouse lighting characteristics.

Category	Description
Source Quantity	1 source per luminaire
Locations	Ross Lake – Ross Dam Boathouse
Mounting / Height	10-12 ft MH
Luminaire Condition	unshielded
Source Voltage	--
Source Type	LED
Estimated CCT	4000 K
Source Wattage[1]	--
Source Distribution	general area lighting
Nighttime Lighting Documentation	see **Table 5.11-2**
Shielding	none
Ballast / Driver Information[1]	--
Luminaire Control Method	photocell
Hours of Operation	dusk to dawn
Safety and Security Concerns	boathouse visibility / operation
Purpose	general area lighting
Functionality	functioning
Historical Significance	N/A

1 Source wattage and driver information unavailable.

Table 5.11-2. Ross Dam Boathouse (nighttime lighting measurements).

Distance from Source (ft)	Horizontal Illuminance (E_H) (FC)	Source Lens Luminance (cd/m^2)[1]
--	--	--
--	--	4,005

1 Source lens luminance measurements taken from Ross Dam (distance unknown); boathouse access unavailable. Nighttime luminance and illuminance measurements were recorded for representative luminaires, and only for luminaires that were easily accessible for accurate measurements.