JOINT STUDY SESSION MEMORANDUM

To: Members of the Colorado Chautauqua Association (CCA) Board Representatives and the Landmarks Board

From: Lesli Ellis, Comprehensive Planning Manager, PH&S, COB
Marcy Cameron, Historic Preservation Planner, PH&S, COB
Michael Matts, Director of Cultural Resources and Operations, CCA

Date: October 4, 2017

Subject: Joint CCA Board Representatives and Landmarks Board Discussion on the Revised Chautauqua Lighting Design Guidelines

PURPOSE OF STUDY SESSION
The purpose of the fourth Joint Study Session with the Colorado Chautauqua Association (CCA) Board Representatives and the Landmarks Board is to gather feedback on the Revised Chautauqua Park Historic District Lighting Design Guidelines. The Final Lighting Design Guidelines will be brought to CCA and the Landmarks Board for review and adoption in November. The City of Boulder has hired Bishop Mundus and Clanton and Associates to develop the design guidelines. For information on the background and process for the project, please reference the June 26, July 26 and September 11 Joint CCA/LB Study Session Memos.

JOINT BOARD DISCUSSION

1. Do the boards have feedback on the Revised Lighting Design Guidelines (Attachment B)?

2. Do the boards have feedback on the proposed images to illustrate appropriate and inappropriate fixtures? Note these images will be presented at the Joint Study Session and are not included in the packet materials.

PROJECT PURPOSE AND GOALS
The City of Boulder and the Colorado Chautauqua Association are jointly developing the Chautauqua Lighting Design Guidelines using the Collaborative Stewardship Framework. The purpose of this project is to aid in decision making for exterior lighting proposals within the boundaries of the Chautauqua Historic District, designated as a local historic district and as a National Historic Landmark. The document will provide a framework for decision-making
through the documentation of the historic use of lighting at Chautauqua, assessment of current needs, guiding principles, recommendations and the development of design guidelines.

REVISED DESIGN GUIDELINES

The Draft Design Guidelines were revised following the Sept. 11, 2017 CCA/LB Joint Study Session. In general, they include:

Background Document

- Revised for consistent use of:
  - “Navigation” rather than “wayfinding.”
  - “Lighting Areas” rather than “Character Areas”
  - “Lighting Principles” rather than “Guiding Principles”
  - “Historic” rather than “historical”
- Meeting notes, historic photographs and bibliography removed from the appendices; will be archived in the project folder.
- Acknowledgements section reordered to list adopting boards first; update CCA Board of Director members.
- Added an introduction paragraph to the Existing Conditions Assessment section.

Lighting Design Guidelines

- Renumbered from 1.1.a to 1.1.1 to reflect other city design guidelines.
- Changed “Dark Sky compliant” to “Dark Sky Friendly.”
- “General Lighting Design Guidelines” section revised to clarify direction on the style and scale of lighting fixtures.
- “Public Spaces” section revised to provide direction that in general, architectural lighting is not appropriate, but sensitive, limited lighting of the Auditorium towers may be appropriate.
- “Residential” section revised to state that landscape lighting is discouraged in front yards.
- “Park Areas” section revised to clarify direction on illumination of flags and lighting within the Centennial Garden.

All changes are documented in Attachment A: Track Change Version of the Revised Design Guidelines.

FEEDBACK ON THE REVISED DESIGN GUIDELINES

The fourth Core Team and Working Group meetings are planned to take place prior on Tuesday, October 3, 2017. Staff will summarize their comments at the Joint Study Session on Oct. 4, 2017.

LIGHTING PRINCIPLES

The Lighting Principles informed the recommendations and lighting design guidelines. They were developed through feedback from the interdepartmental staff team and community working
group, and revised to incorporate feedback from the community feedback and Joint Study Session on July 26. The principles are:

- Preserve the camp-like character and architectural and historical integrity of the Chautauqua Park Historic District/National Historic Landmark when proposing lighting for the district or surroundings.
- Respect a dark sky environment for Chautauqua that meets or exceeds local regulations and International Dark Sky Association (IDA) guidelines for light level, trespass, pollution and glare.
- Ensure energy efficiency and sustainability in all new and retrofitted lighting proposals.
- Provide lighting only where and when need is clearly identified for safety, security, programming, accessibility or wayfinding, using the basic approach of providing a balance or consistency of light through use of light color and levels, controls, and placement of fixtures.
- Maintain dark areas within Chautauqua and surroundings to protect wildlife, open spaces and park areas, and scenic viewsheds.

PROCESS AND NEXT STEPS
This Joint Study Session to review the Revised Design Guidelines is in the fourth and final phase of the project. Previous phases (1-3) are noted below as well.

1. **Historic Context and Existing Conditions; Development of Project Goals and Draft Lighting Principles (May-June 2017).**
   The initial phase focused on evaluating existing conditions, researching the history of lighting at Chautauqua, assessing the appropriateness and need for lighting, and developing project goals and draft lighting principles.
   - Core Team Meeting #1 – May 23, 2017
   - Working Group Meeting #1 – May 25, 2017
   - Open House and Joint LB/CCA Study Session #1 – June 26, 2017

2. **Character Areas and Desired Qualities (July-August).** The second phase includes the development of lighting options, shaped by the historic research, lighting principles, and feedback from the working groups, boards and community members.
   - Core Team Meeting #2 – July 11, 2017
   - Working Group Meeting #2 – July 13, 2017
   - Open House and Joint LB/CCA Study Session #2 – July 26, 2017
   - Evening Walking Tour – August 8, 2017

3. **Draft Design Guidelines (August-September).** Following the development of the plan recommendations, the project team will develop specific design guidelines to aid in future decision-making related to exterior lighting within the boundaries of the historic district.
   - Core Team Meeting #3 – August 29, 2017
   - Working Group Meeting #3 – August 31, 2017
   - Public Comment and Joint LB/CCA Study Session #3 – September 11, 2017
4. **Finalize Lighting Design Guidelines (October - November 2017).**

The last phase will involve finalizing recommendations and design guidelines based on the consultant work, community, board and working group feedback. The design guidelines will be brought to the Colorado Chautauqua Association Board or Directors and the Landmarks Board for adoption.

- Core Team and Working Group Meeting #4 – Oct. 3, 2017 (Review Revised Design Guidelines)
- Public Comment and Joint LB/CCA Study Session #4 – Oct. 4, 2017
- Landmarks Board Public Hearing – Review and Adoption (conditioned on the adoption by the CCA Board of Directors) – November 1, 2017

Following the development and adoption of the design guidelines, Public Works staff will submit a Landmark Alteration Certificate application for the lighting component of the Community, Culture and Safety tax for review, using the developed design guidelines as a basis for the proposal. The application will be reviewed by the Landmarks Board and the Colorado Chautauqua Buildings and Grounds Committee.

In addition to the public comment prior to the Joint Study Session, community members may also provide input through our project webpage: [https://bouldercolorado.gov/historic-preservation/chautauqualightingplan](https://bouldercolorado.gov/historic-preservation/chautauqualightingplan).

Contact Marcy Cameron, City of Boulder Historic Preservation Planner, or Michael Matts, CCA Director of Cultural Resources and Operations with questions or comments on the process.
Marcy Cameron - cameronm@bouldercolorado.gov or (303) 441-3209.
Michael Matts - michael.matts@chautauqua.com or (303) 513-300-1512.

**ATTACHMENTS**

A: Track Change Version of the Revised Design Guidelines
B: Revised Lighting Design Guidelines – September 26, 2017
Revised Chautauqua Lighting Design Guidelines
Revisions made following the 3rd Working Group and Core Team Meetings and the Sept. 11, 2017 Joint CCA/LB Discussion on the Draft Design Guidelines

1.0 General Lighting Design Guidelines

1.1 Improve existing lighting by modifying or removing inappropriate luminaires.
   a. Ensure existing and new luminaires are properly installed so light is directed downwards and does not spill onto adjacent areas.
   b. Where vegetation obscures existing light, either sensitively trim vegetation or reposition luminaires so output is not obscured.
   c. Remove existing luminaires within the historic district that distract from the historic setting, obscure viewsheds, or provide a false sense of history.
   d. Eliminate up-lighting or directional lighting that is not Dark Sky Friendly-compliant.

1.2 Approach lighting holistically to avoid incremental change that may lead to a higher overall illumination of the historic district.
   a. In new lighting proposals, consider lighting either by building or area, taking into consideration the overall impact of existing and proposed illumination. Consider ambient light from adjacent buildings and fixtures.
   b. Provide a consistency of luminaire design and aesthetic within the historic district. Lighting qualities, including color temperature, should have a consistent warmth and appearance across the landscape.
   c. Consideration should be given to users with visual impairments, and the variety of users in age and ability.

1.3 Preserve the night sky, architectural character, views, and historic integrity of the historic district by only lighting areas and features when and where need has been demonstrated.
   a. Avoid lighting where and when it is not required, and illuminate only where need has been clearly established.
   b. Indiscriminately lighting or over-illuminating Lighting of building facades, or front yards, or park spaces is not appropriate.
   c. Avoid light spill onto adjacent properties outside of the historic district should be avoided.
   d. Turn on lights only when needed.
   e. Design lighting utilizing Dark Sky Friendly qualities, including the following.
      o Lights should be no brighter than necessary.
      o Fixtures should have no spill or limited spill, be Full Cut-off or have a B-U-G Rating with Uplight=0.
1.4 Design lighting to facilitate navigation and address safety concerns for pedestrians to find their way.
   a. **New fixtures may be appropriate at** locate new fixtures at destination points with points of light at the beginning and end of paths so a pedestrian may find their way.
      o **Consider** additional points of light may be appropriate where conflicts are identified, at points of conflict or around curves.
      o The greatest uniformity should not exceed 15:1.
   b. Consider ambient light from adjacent buildings and fixtures when designing new lighting.

1.5 Utilize **a programmable control systems** to turn off lights when they are not needed and to dim the output for the time of night and occasion.
   a. Recognize the varied use of the campus throughout the week and year and modify lighting times and locations as needed.
   a. Install a programmable control system with wireless communication capabilities.
   b. Luminaires should be compatible with the control system. Pole mounted luminaires should have addressable wireless nodes that are compatible. Luminaires should have addressable wireless control modules that communicate with the programmable control system.

1.6 Select new fixtures that **are simple in design and respect the utilitarian aesthetic character** of the historic district’s original lighting.
   a. New lighting in the historic district should generally be unobtrusive and compatible with the overall historic character of the buildings, sites, and streetscapes of the historic district.
   b. Select poles and luminaires that are neutral in design, and do not create a new aesthetic or ahistorical character.
   c. Select materials, colors, and finishes that are neutral simple and blend with the existing materials in the historic district.
   d. Reconstruction of missing fixtures or restoration of existing features from the historic district’s period of significance (1898-1930) is appropriate only if the materials and design, style and locations are clearly documented.
   e. It is not appropriate to introduce replica luminaires that mimic a time or place other than what is documented at Chautauqua, as these create a false sense of history.

1.7 Scale and size of luminaires should not overwhelm the historic setting and should be compatible with the scale of historic buildings and landscape.
   a. **Where possible, integrate lighting into the historic setting through low mounting-level light fixtures such as bollards, directional lights mounted in unobtrusive locations, and pedestrian scale pole mounted luminaires, and carefully located streetlights.** Pedestrian scale lighting at 10’-18’ mounting height.
   b. Provide a consistency of scale and size for luminaires throughout each lighting area, appropriate to the scale of the individual building or landscape, the historic district.
1.8 Lighting qualities should respect the historic character of the district.

a. Light color should be warm and evoke the camp-like character of the historic district.
   Brightness of lighting should create a balance between the darkest dark areas and the lightest light, by using fully shielded, low-glare fixtures.
   • In all areas except the residential area, light sources should have a CCT of 3000K CRI; light sources in residential areas should have a CCT of 2700K CRI.
   • Across lit areas, create a balance of lighting that eliminates glare.
   • Luminaires under XX-900 lumen output should have a maximum B-U-G rating of G=0
   • Luminaires over XX-900 lumen output should have a maximum B-U-G rating of G=1.

b. Light qualities, including brightness and color temperature, should be consistent throughout the historic district, providing a regular pattern of light.

1.9 Luminaires should be easy to maintain and energy efficient.

a. When existing lighting is replaced, select fixtures that are energy efficient, with appropriate light output per these guidelines.

b. Pedestrian scale luminaires should have modular lighting components for replacement if failure occurs.

c. Hardware should be standard tamper-proof.

1.10 Sign Lighting

a. Entrance signs at King’s Gate and Kinnikinic and select navigation signs may be illuminated to be legible. Design of sign lighting luminaires should be simple and unornamented, with no-minimal visibility by day.

b. Number of illuminated signs and illumination levels should be kept at a minimum, and should be provide only enough for signage visibility.
   • Ensure that all lighting is Dark Sky Friendly compliant with either a Full Cutoff classification or a B-U-G rating of U=0.
   • Illuminance on the face of the sign should be between 1.0 and 3.0 vertical footcandles with ≤4:1 uniformity.
   • Operation should be on from dusk to close of business, or utilize an automatic on/off schedule to meet daily, weekly, and seasonal needs.
   • The lighting should not cause glare at normal viewing angles, obstruct the sign, or create daytime shadows.
   • Light sources should have a CCT of 3000K CRI and a CRI of ≥80.
   • The light should be directed at the sign with minimal spill.
   • The light source shall be fully shielded.
2.0 Public Space
Public spaces include areas of most pedestrian traffic and are most frequently visited. They are usually adjacent to, or near public buildings including the Auditorium, Dining Hall, Academic Hall, and Community House. Lighting in public spaces should recognize the essential “camp-like” character of the historic district. Lighting in Public Spaces should be subdued while providing adequate navigation and illumination of potential tripping hazards, including steps and curbs.

2.1 In public spaces it is appropriate to light public entries to facilitate navigation:

a. Provide lighting at building entrances- to facilitate wayfinding and meet code requirements for emergency egress, but no additional architectural lighting.

b. Lighting should be programmed to reflect evening activities.

2.2 Architectural Lighting only for aesthetic purposes only, including accent, façade, graze lighting and wall-washing, is generally not appropriate, including accent, façade, and graze lighting and wall-washing.

a. If aesthetic lighting is combined with providing function or navigation, it may be acceptable.

b. In rare cases, subdued lighting of the Auditorium towers may be appropriate for very special events. The number of events should be determined on an annual basis, and used very selectively. The lights should be programmed to be on only immediately before, during and after the event.

- Allow temporary lighting for events, at specific buildings.

2.2 Where Lighting often in public spaces is appropriate, it should be subdued, warm, with minimal spill, glare, and light trespass.

a. Illuminance levels should be kept at a minimum, and should be only enough-the minimum to provide safety and navigation in areas of circulation.

- Ensure that all lighting is night-sky-compliant Dark Sky Friendly either with a Full Cutoff classification or a B-U-G rating of U=0.
- Ambient lighting in public areas should not exceed an average of 3.0 foot candles in a contiguous area and maintain 10:1 uniformity.
- Operation should be on from dusk to close of business, or utilize an automatic on/off schedule to meet daily, weekly, and seasonal needs.

b. Lighting should have a warm color.

- Remove existing lighting that produces harsh or bluish light.
- Light sources should have a CCT of 3000K CRI and a CRI of ≥80.
2.3 Consider replacing non-historic lighting over time, including acorn lights and globe lights, with elements more in keeping with the historic utilitarian aesthetic.
   a. In the interim, consider updating the acorn lights to have a consistent color temperature throughout and upgrade the fixture to be Dark Sky Friendly compliant.

3. Residential
The residential area includes cottages owned and leased by the CCA, those that are privately owned, and other buildings south of Clematis extending to the southern edge of the historic district. A conservative approach to lighting is recommended for the residential area, and the overall sense of brightness should remain lower than nearby residential areas. Lighting should be subdued and unobtrusive while providing navigation and illumination of potential tripping hazards, including swales and curbs. Lighting should be visually comfortable, with consistency in color temperature. Street lights should be designed to only illuminate the street, with minimal light trespass onto lawns and into buildings. The goal of residential lighting is to provide pools of light that serve as wayfinding lights, rather than a uniform, consistent background.

3.1 Maintain a camp-like neighborhood character through a combination of porch/entry light and street lighting.
   a. Lighting should provide a sense of safety and provide navigation to minimize tripping hazards.
   b. Permanent landscape lighting in front yards and lighting that is visible from the public right of way is discouraged. Landscape lighting includes illumination of trees, shrubs, and other garden and landscape features. Minimal path lighting may be appropriate to illuminate tripping hazards.
   c. Selective landscape lighting in the backyard that is not visible from the public right of way may be appropriate, if it is Dark Sky Friendly.

   Landscape lighting should be minimal. If used, it should be Dark Sky Friendly compliant:
   a. Landscape luminaires over 500 lumen output should be Full Cutoff classification or a B-U-G rating of U=0.
   b. Light sources should be 2700 - 3000K CRI and shielded so that the source is not visible

   b. Consider uniform address number lighting.

3.2 Porch lighting should have low light levels, with a consistent warm color, and limited light trespass and glare.
a. To facilitate navigation and reduce the number of necessary fixtures in the district, porch lights should be located to light the entry and address number, with minimal spill and light trespass. Porch lights should only light the porch and building entry.

b. Porch lights should have 2700 - 3000K CRI light sources which should be shielded so that the source is not visible and with maximum lumen output ≤900 lumens.

c. Consider automatic timers for porch lights on cottages are encouraged. Lighting may be connected to devices that automatically shut off when not needed.

d. To facilitate navigation and reduce the number of necessary fixtures in the district, porch lights can serve three functions: lighting the entry, the address number, and the walkway. The style of fixtures on a residential cottage should reflect the individual character of the building.

b. Select residential fixtures that are simple and do not create a false sense of history.

3.3 Street lights should provide pools of light to aid in navigation, with limited glare and light trespass.

a. When replaced, manage streetlights so they can be dimmed significantly late at night, while still providing navigation and energy efficiency.

b. Street lights in residential areas should provide light for the streets and swales, not for the cottages and lawns.

c. Streetlights should have consistent levels across the lighting area, 3000K CRI or warmer, Type II or III distribution and employ a House Side Shield (HSS) when in front of a cottage to minimize light trespass. Maximum lumen output ≤4000, maximum bug rating of B1-U0-G1 (without HSS). The luminaire should be installed plumb for Dark Sky Friendly operation with the distribution aligned with the street.

4.0 Parking/Vehicular Circulation

Parking/Vehicular Circulation includes areas along major roadways and parking areas utilized primarily by visitors and staff during evening hours. These include the parking areas at the tennis court and Academic Hall, major intersections, and 12th Street between the picnic shelter and tennis court parking. This does not include parking for cottages or on-street parking. Where appropriate, lighting in parking areas should be adequate for navigation, and to address safety and security concerns.

4.1 Lighting in parking/vehicular areas should be appropriate to provide a sense of security and navigation.

a. Lighting of vehicular circulation should be limited to major intersections, and should be designed to have limited spill light outside the intersection.

4.2 If appropriate, parking areas should only be lit with low intensity lighting and have no spill light outside of the parking area with low intensity levels within the parking area.
a. Maximum average approximately 0.2 footcandles with 20:1 uniformity. Use house side shields to minimize spill light.

4.3 Lighting in parking areas should be managed according to the varied activities occurring within the historic district.
   a. Parking area luminaires should be 3000K CRI, Type III distribution and employ a House Side Shield (HSS) to minimize spill light. Maximum lumen output ≤ xxx, maximum BUG rating of B1-U0-G1 (without HSS). The luminaire should be installed plumb for Dark Sky Friendly operation with the distribution aligned with the street parking area, and no higher than 20’.
   b. Manage lights for different night uses. Operation should be dusk to dawn with curfew setback. Parking lot lighting controls should be adjusted programmed to meet needs for different night uses.

4.4 Provide light for vehicular circulation at major vehicular and pedestrian conflict points.

4.5-a Lighting may be appropriate in the following areas:
   • Street intersections to reduce potential conflicts.
   • Pick-up/drop-off locations.
   • Vehicular entrances at Kinnikinic and 12th Street.
   • Parking areas at the Academic Hall; Ranger Cottage; 12th Street; and Tennis Court.

5.0 Primary Pedestrian

Primary pedestrian routes are major pedestrian circulation routes, sidewalks, and pedestrian crossings. These include the route between the Auditorium and King’s Gate; the route from the Dining Hall to the Tennis Court parking; King’s Gate; the Arbor; the south side of Clematis Drive; and along Kinnikinic from Clematis to the Baseline entrance. Lighting along primary pedestrian routes should be visually comfortable, without glare, and should provide lighting for navigation and to illuminate tripping hazards. The use of wayfinding lighting may be appropriate encouraged to direct pedestrians to their destination with intermittent pools of light and beginning and ending points along paths.

5.1 Where appropriate, provide pedestrian lighting for navigation, to guide users to destinations.
   a. Lighting should be visually comfortable without glare.
   b. Lighting should be wayfinding lighting only occur at intervals sufficient enough to provide adequate navigation, to see from one light location to another, whether a bollard.
pole, lit building, or combination. Nominal spacing of 100’ while maintaining maximum 45:1 uniformity, to provide intermittent pools of light. c. These routes Where appropriate, paths may be illuminated with pedestrian scale pole mounted luminaires. The Pole mounted luminaires should be Type II Distribution, Dark Sky Friendly, either with a Full Cutoff classification or a B-U-G rating of U=0, and 3000K CRI.

5.2 Operation of pedestrian lighting should be programmed to meet operational needs, based upon business and event hours.

5.3 Sensitively designed lighting may be appropriate in these areas:
- Interior of the Arbor and King’s Gate bus shelter, taking care to protect historic fabric and integrate fixtures to be minimally visible.
- The pedestrian path between the Dining Hall, Auditorium and Tennis Court Parking area, and the stairs near the Tennis Court Parking area.
- The pedestrian path from the Auditorium to King’s Gate.
- Clematis Drive.

6.0 Park Areas

Park lighting areas include Chautauqua Green, Waterwise Garden and the Centennial Garden. The desire for lighting in the park areas is for these areas to remain dark, particularly within Chautauqua Green. In other park areas, it may be desirable for low level wayfinding light with minimal spill light.

6.1 Park areas should remain dark within the interior of the space.
- Eliminate the use of up-lighting or directional lighting that is not Dark Sky Friendly compliant and or produces glare.
- It is not appropriate to introduce new fixtures into the Waterwise Garden or the Chautauqua Green.
- It may be appropriate to provide lighting within the Centennial Garden for pedestrian navigation through the interior of the space. Existing lighting may remain but should be upgraded to meet these design guidelines. Remove uplighting in the Centennial Garden.

6.2 Preserve the character of a dark night sky within the interior space of the Chautauqua Green.

6.3 In some cases, it may be appropriate to provide adequate lighting for vehicular safety and navigation at the perimeter of park areas to facilitate navigation.

6.4 American flags should be taken down at night. If flown at night, American flags should be illuminated to meet the Flag Code.

a. If a direct light is desired, use only a single well shielded adjustable spotlight, located as close to the base of the flagpole as possible; Maximum output of the spotlight should not exceed 3500 lumens and be 3000K CCT and ≥80 CRI.

b. Place the spotlight as close to the base of the flagpole as reasonable possible.

7.0 Open Space

Open Space includes the perimeter of the historic district boundary which borders the City of Boulder Open Space and Mountain Parks (OSMP) land. This includes the west, south, and southeast edges and perimeter of the historic district. These areas should remain dark in order to protect wildlife and scenic viewsheds. Lighting at trails is not appropriate, and the transition areas should remain unlit with minimal light trespass from other areas.

7.1 The interface with the Open Space and Mountain Parks should remain unlit with a minimum of light trespass from other areas in the historic district, park/NHL/etc.

7.2 Efforts to minimize or eliminate spill light and light trespass should be employed when lighting adjacent areas.

a. Pole mounted luminaires should be oriented into the adjacent area and away from open space.

b. House side shields should be used with the Open Space on the house side.

c. No light should be directed into Open Space.

7.3 Allow minimal lighting at the Ranger Cottage and parking for OSMP evening events.

a. Provide porch lighting at the Ranger Cottage and low light level streetlights within the parking area lighting meeting 4.0 above, may be appropriate immediately before, during and after an event. Design these lights to be subdued and only illuminate the immediate area, with limited spill light into the adjacent Open Space.

8.0 Baseline Road

Baseline Road includes the interface between the historic district and Baseline Road. Pedestrian crossings, intersections, and street parking at Baseline Road are included. Currently cobrahead-style streetlights are at each Baseline crosswalk. Within the historic district boundary, lighting should be provided may be appropriate at bus stops and at the vehicular entrance into the historic district from Baseline. While outside of the historic district boundary, these guidelines recommend acknowledge that sufficient lighting may be necessary to facilitate safe pedestrian crossings at Baseline crosswalks and King’s Gate.
**8.1 Baseline Road should have sufficient lighting to provide safe pedestrian crossing and vehicular access.**

a. When upgraded, the streetlights should maintain the current nominal height, 3000K CRI, Type III distribution and employ a House Side Shield (HSS) when in front of a residence to minimize light trespass.
   
   - Maximum lumen output ≤4000, maximum bug rating of B1-U0-G1 (without HSS).
   - The luminaire should be installed plumb for Dark Sky Friendly operation with the distribution aligned with the street.

b. Maximum lumen output ≤4000, maximum bug rating of B1-U0-G1 (without HSS). The luminaire should be installed plumb for Dark Sky Friendly operation with the distribution aligned with the street.

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**8.2 It may be appropriate to locate streetlights at vehicular and pedestrian conflict points.**

a. Provide adequate lighting may be necessary at intersections along primary streets, chiefly at King’s Gate, and the Baseline / Kinnikinic entrance to the historic district.

b. A single streetlight before or at a crosswalk that meets minimum lighting requirements may be appropriate. Using two streetlights, each one a half-mounting height before the crosswalk in the direction of oncoming traffic, provides maximum pedestrian visibility.
Chautauqua Park Historic District
Lighting Design Guidelines

Revised Draft
September 26, 2017
Acknowledgements
Thanks to the collaborative efforts of the Colorado Chautauqua Association, City of Boulder staff, working group and core team members, and community members who provided input into the guidelines. Historic photographs provided by CCA and the Carnegie Branch Library for Local History.

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**Project Goals:**

- Provide context for the historic intent and use of lighting at Chautauqua;
- Identify and assess the need for lighting at Chautauqua;
- Utilize feedback from the Staff Core Team, Community Working Group, Boards, and members of the public in making recommendations;
- Provide performance-based design guidelines that are broad, direction based, to aid in the decision-making process for exterior lighting at Chautauqua.

**Project Objectives:**

- Determine the range of acceptable lighting approaches;
- Determine the appropriate amount of exterior lighting;
- Determine appropriate lighting levels.

**DEVELOPMENT OF THE LIGHTING DESIGN GUIDELINES**

The Colorado Chautauqua was founded in 1898 as an educational, artistic and cultural retreat as part of the national Chautauqua movement. In 1978, the 40-acre site was designated as a National Register and local historic district, and in 2006, it was designated as a National Historic Landmark.

In 2017, the Colorado Chautauqua Association (CCA) and the City of Boulder undertook the development of lighting design guidelines for Chautauqua, guided by the Guiding Principles for Collaborative Place Management and Fiscal Sustainability (2012). The development of these guidelines was led by consultants Mundus Bishop and Clanton and Associates and was informed by input from a Community Working Group, Staff Core Team, public open houses, and joint study sessions between representatives of the CCA and the City of Boulder Landmarks Board.

The Lighting Design Guidelines are intended to assist applicants in planning for changes to exterior lighting within the Chautauqua Park Historic District and to provide the City of Boulder’s Landmarks Board and the CCA’s Building and Grounds Committee with a framework for making informed decisions that will ensure that lighting improvements are appropriate to the special character of the place, while providing reasonable safety, security and wayfinding for its stewards and users. This document provides a history of lighting within Chautauqua, an assessment of current lighting conditions, expressed needs for lighting from a variety of users, guiding principles and desired lighting qualities that were used to inform the design guidelines.

This work builds upon prior research and planning documents for the Chautauqua Historic District including the National Register Nomination (1978); National Historic Landmark Nomination (2006); Chautauqua Park Historic District Cultural Landscape Assessment and Plan (2004); the Chautauqua Park Historic District Design Guidelines (1989); and the Chautauqua Landscape Design Guidelines (2012). In 2012, a Master Exterior Lighting Plan (MELP) was created by the CCA to establish an exterior lighting system at Chautauqua; however this plan did not fully examine the historic context or appropriateness of lighting. It is these issues that this document seeks to fully address.
Development of the Lighting Design Guidelines

Process

In early 2017, the Staff Core Team and Community Working Group were formed. The Staff Core Team was composed of representatives from the CCA, as well as from Public Works, Open Space and Mountain Parks, Parks and Recreation, Planning, Housing and Sustainability, Finance, and Communications. The Community Working Group was composed of representatives of Friends of Chautauqua, Historic Boulder, Inc., History Colorado, Chautauqua Cottagers, and the Sierra Club – Indian Peaks Chapter. Both groups met regularly through the process, and their input was integrated into the design guidelines. Four Joint Study Sessions between representatives of the CCA and the City of Boulder Landmarks Board were held over the course of the project.

Two open houses were held in tandem with the first two Joint Study Sessions. Additionally, the project team reached out to Dining Hall staff and concert-goers to gather input from different user groups. An online survey collected additional input.

The Lighting Design Guidelines were developed in four phases:

1. **History of Lighting and Existing Conditions; Development of Project Goals and Draft Lighting Principles.**
   
   The initial phase focused on evaluating existing conditions, researching the history of lighting at Chautauqua, assessing the appropriateness and need for lighting, developing project goals and draft lighting principles.

2. **Development of Character Areas and Desired Qualities.**

   The second phase included the development of draft character areas and draft desired lighting qualities, shaped by the lighting principles and feedback from the working groups, boards and community members.

3. **Draft Design Guidelines**

   Following the development of the lighting principles and desired qualities, the consultant created specific design guidelines to aid in future decision-making related to exterior lighting within the boundaries of the historic district.

4. **Finalize Plan and Design Guidelines**

   The last phase involved finalizing design guidelines document based on the consultant work, community, board and working group feedback. The Lighting Design Guidelines was brought to the Colorado Chautauqua Association Board of Directors and the Landmarks Board for adoption.
Study Area - Chautauqua Park Historic District
Development of the Lighting Design Guidelines

Study Area and Surroundings

The Chautauqua Historic District is located in Boulder, Colorado, at the foot of Green Mountain. It was established in 1898 as an educational, artistic and cultural retreat as part of the national chautauqua movement. The Chautauqua Historic District is one of a few remaining chautauquas in the United States. Its grounds, roads, cottages, and public buildings comprise an area of 40 acres bordered on three sides by City of Boulder Open Space and Mountain Parks. The Chautauqua Historic District is listed in the National Register of Historic Places (1978), designated as a local historic district (1978), and as a National Historic Landmark (2006). It has been in continuous operation since its founding, under the joint stewardship of the Colorado Chautauqua Association (CCA) and the City of Boulder, and retains historic integrity with its historic buildings, structures, and grounds intact.

The City of Boulder owns the 40-acre parcel that encompasses the Chautauqua Historic District and also the Auditorium, Dining Hall and Academic Hall. CCA leases those three buildings and 28 acres of grounds from the City, and owns 60 cottages and two lodges, which it makes available for nightly lodging or longer term rental. CCA also owns the Community House which is made available for various public and private events and meetings. CCA holds sub-lease agreements with 40 privately-owned cottages located throughout the leasehold. CCA manages the Dining Hall, the Auditorium and Academic Hall; the City manages the public park and open space. The Chautauqua Historic District is home to summer and, increasingly, winter residents who reside in its cottages, most of which are historic.

For purposes of this document the Chautauqua Historic District is divided into the Study Area and Context Area:

The **Study Area** (page 6) includes the CCA leasehold area, Chautauqua Green, and portions of Chautauqua Open Space. The study area includes the 40 acre parcel roughly triangular in shape that extends from Baseline Road on the north into the City of Boulder Open Space and Mountain Parks on the south.

The **Context Area** (page 8) is the transition area around the study area that influences or could be influenced by lighting within the study area. The transition area is generally defined as the neighborhoods or public lands immediately adjacent to Chautauqua Historic District (Baseline Road, east and west of the study area; 12th Street; and neighborhoods to the north; and the edge at Chautauqua Open Space). This area provides a context for guidelines and recommendations for the Chautauqua Historic District but no specific guidelines are developed for this context area.
Context Area, Chautauqua Park Historic District.
History of Lighting at Chautauqua
Horse and buggy parking area, with hanging light at center background, circa 1898

Pendant light at Wildrose Road and Academic Hall Fountain, circa 1900
HISTORY OF LIGHTING AT CHAUTAUQUA

The Colorado Chautauqua was founded in 1898 as the Texas-Colorado Chautauqua. The founders established the property and the program with great attention to the “Chautauqua Idea”: learning for all, cultural entertainment, and leisure in a natural and inspiring setting. Chautauqua was originally established as a seasonal camp for teachers from Texas and their families, among others. At a time when primary and secondary teacher training was rudimentary or non-existent, chautauquas brought post-secondary education to millions and teacher training to thousands. Chautauquas brought prominent speakers, high culture, and popular entertainments to non-urban areas. While cities were growing more congested, chautauquas emphasized the benefits of outdoor life.¹

Its location on the eastern edge of the Rocky Mountains represents the westward spread of the movement, and today it remains the only independent assembly in continuous operation in the Western United States, with grounds always having been open and free for public enjoyment.

The setting of Boulder’s Chautauqua has remained essentially as it was in 1898. Its sites, buildings, and structures are intact, the property tells a cohesive narrative, and its grounds are open to the general public. Today, visitors experience the Colorado Chautauqua much as it was at the height of the Chautauqua Movement.² It continues to be home for summer and winter residents whom reside in its historic cottages. The Chautauqua Green is an important and popular Boulder park.

The architectural and historic significance of the Colorado Chautauqua has been recognized through local historic landmark and National Historic Landmark designation. The identified period of significance from 1898 to 1930 marks the foundation of the Colorado Chautauqua through its height and subsequent decline of the Chautauqua Movement as a whole.

History of Lighting at the Colorado Chautauqua

The introduction of electric lighting at Chautauqua in 1898 followed the development of lighting in Boulder. Electric lights were first installed in downtown Boulder in 1886, through funding by private business owners, who sought to reduce the need to carry personal lanterns “to avoid falling in mud-holes or irrigation ditches.”³

¹ Colorado Chautauqua NHL Registration Form, 46.
² Colorado Chautauqua NHL Registration Form, 60.
Chautauqua Lighting Design Guidelines

Lighting at Dining Hall at left side of photograph, circa 1898

Lighting outside of Mariposa Cottage (34), circa 1900
History of Lighting at Chautauqua

In 1890, the Boulder City Council passed a motion to build 27 street lights in collaboration with the Electric Light Company. The Boulder County HERALD reported on this development in an article entitled “Splendidly Lighted: Boulder to Have Twenty-Seven Arc Lights on the Streets,” in which they describe security as being an “important element” of the lighting installation, as well as the experiential quality of arriving to a lit town, which they considered to be impressive, grand, friendly and warm. The paper considered “the move a grand, good one.” These sources indicate that electric street lighting was viewed as mainly utilitarian in nature and also signified safety, comfort, and enjoyment of a place at night time.

Lighting at Chautauqua was also regarded as adding to the beauty of the place: “There were few buildings or trees between the University and the Chautauqua grounds, and the ‘brilliant cluster’ of the lights glittered, according to one reporter, ‘like so many gems in the distance.’”

The Boulder County HERALD reported in June of 1899 that the “The Chautauqua grounds were lighted up last night with arc lights for the first time this year. They looked exceedingly beautiful.” The original lighting fixtures were mounted to tall wood electrical poles and supplied lighting to key locations within the campus, including the Dining Hall, Auditorium, and parking area. The lighting poles and fixtures appear to have been utilitarian in style, and did not provide any daytime aesthetic or decorative purpose.

Historic photographs show utility poles with suspended luminaires and literature refers to arc lights at the Chautauqua. Arc lamps were astringent and brilliant, with a very high color temperature and a very small source. They were much more powerful than the contemporary incandescent lamps of the time. The lit areas directly below an arc lamp would have been very bright with distinct shadows. The wide spacing of the lights would have had very high ratios of uniformity so that spaces between lit areas would seem very dark. The surrounding context was dark, with the night sky and foothills as a background, so the contrast between illuminated and dark areas would have been very great. Photographs indicate little or no shielding to the lights, so the output was not controlled but cast an even amount of light in most directions. Overall, the original lighting at Chautauqua would have been glary and the uniformity very wide.

4 “Splendidly Lighted: Boulder to Have Twenty-Seven Arc Lights on the Streets.” Boulder County HERALD, November 19, 1890.
5 Pettem, Silvia. Chautauqua Centennial: A Hundred Years of Program. 4.
6 Boulder County HERALD, June 28, 1899.
Chautauqua Lighting Design Guidelines

Historic lighting locations, 1920 to 1928

Cone shaped fixture amidst buggy parking, location approximated per 1898 period plan, 1899.

Cone shaped fixture along Kinnikinic Road, next to Mariposa Cottage (34), 1900.

Fixture east of Kiosk, 1898.

Fixture on southeast side of Dining Hall, post-veranda addition, 1903.

Fixture along Wild Rose Road, next to Academic Hall fountain, date unknown.

Pendant fixture on northeast side of Dining Hall, approximate date 1911-1912.

The Colorado Chautauqua Sanborn Map, 1928

Fixture along Wild Rose Road, just south of the intersection with Primrose Road, near Cottage 501, circa 1900.

Pendant fixture on northeast side of Auditorium, not visible in earlier photographs, approximate date 1914.
History of Lighting at Chautauqua

**1898**
1898 Newspaper accounts confirm that there were lights and electricity to the camp since the inaugural season. Electrical poles with areas of tents are visible in 1898 historic photographs. These appear to be tall poles that provide lighting for specific areas at the interior of the campus. The fixtures appear as cone-shaped pendants. Not all poles had a light. Light fixtures appear at major points of interest and gathering (parking area, Dining Hall).

**c. 1900**
1900 Photograph indicates a pole with simple light fixture for area lighting on Wildrose Road. A view of the buggy parking shows a single wood pole with a simple pendant, along with other electrical poles (not all had lighting, but there were at least 2 along this road).

A series of poles line both sides of the entry drive from Baseline Road to the Dining Hall. These appear to be for electricity, but it is unconfirmed how many of them may have incorporated lighting.

**1903**
A photograph from August 1900 shows a pendant light north of the Academic Hall adjacent to the Academic Hall Fountain.

**c. 1910**
1903 -Photograph shows electrical poles visible at Tennis Court, within tent and cottage areas, and at edges of the campus. These poles appear to be electric poles only and likely did not provide exterior lighting to these areas.

Photograph indicates a painted wood pole with a pendant light located between the Dining Hall and the Auditorium. Another photograph from the same time shows a pendant light on Clematis Drive. There does not appear to have been any lighting on the east side of the campus.

**1911**
King’s Gate was built with columns, topped by open air ‘lights.’ There is no evidence that these had electricity or were ever lit; they were likely just decorative caps.

**1914**
Photograph of the Auditorium shows a pendant light on the northeast side of the building.

**1918**
Sanborn map indicates “lights, electrical” for the Auditorium and Dining Hall.

**c. 1920**
Lighting was expanded in select spaces. Pendant lights changed to a hanging globe light, but lights were still located on tall electrical poles, which were unornamented and functional.
Chautauqua Lighting Design Guidelines

1940s
Repair and infrastructure improvements included winterization of many cottages, and the installation of plumbing and heating. Electrical service was upgraded and exterior lighting was replaced, including the addition of the globe lighting fixtures at the northwest entrance to the Auditorium. It is uncertain as to whether these fixtures (remaining) were viewed as decorative at the time, or simply beacons to welcome visitors to the Auditorium. Photographs show wood posts with double or singular cross bars for the electrical system, indicating that in general lighting continued to be utilitarian, with fixtures mounted to electrical poles.

1960s
Photographs indicate cobrahead lighting was installed in this period and continues to be used at Chautauqua.

1976 – The Auditorium was rehabilitated, and electrical service was upgraded. Modern street lights were installed.

1998 – Pedestrian-scaled, acorn shaped fixtures added at Auditorium, Dining Hall and along Clematis Drive.

Chautauqua Park postcard. Photo courtesy of Leland Rucker and Billie Gutgsell.
Existing Conditions Assessment
Existing Lighting, Chautauqua Park Historic District.
EXISTING CONDITIONS ASSESSMENT

Lighting currently at Chautauqua varies from area to area and application to application. Installed and upgraded sporadically over time as technology advanced and needs were recognized there is now an eclectic mix of a few different luminaires and poles. Concentrated at the more frequently visited destinations by the general public, the Dining Hall and Auditorium have the most instances of light fixtures and highest illumination levels. Pathlighting aids navigation erratically to some destinations which are dark, such as parking areas or exiting the park. The light sources are fairly consistent from very warm color high pressure sodium sources in the streetlights to warm color retrofit compact fluorescent (CFL) and light emitting diode (LED) lamps in pedestrian scale and building mounted luminaires. Controls are basic as the streetlighting is dusk-to-dawn operated on photocells, to local control of building mounted luminaires. These are all moderately energy efficient light sources with good life expectancy. Except for the streetlights, most of the luminaires are not Dark Sky Friendly. The Chautauqua character is partially defined by the lighting currently installed. There are comfortably illuminated, inviting spaces and poorly or non-illuminated areas and different needs for different types of areas and experiences.

Public Spaces

- The brightest areas on the campus, by comparison, are created in these areas with acorn and globe style luminaires mounted on decorative fluted poles. This higher level of lighting creates a visual destination, aiding wayfinding. It is easy to see one’s way in these areas and there is a sense of safety. The globe light fixtures on the northwest side of the Auditorium were added in the 1940s, and the acorn pedestrian lighting in 1998. Some of the acorn poles have dedication placards as people have made donations for them.

- Near the Auditorium and Dining Hall ambient lighting is created with these acorns and globes. Additional lighting around the Dining Hall is spill light from porch ceiling mounted and scone luminaires.

- These public buildings also have various egress luminaires at exits.

- The auditorium has some architectural accent lighting.

- The light sources are warm compact fluorescent or LED retrofit bulbs, with good color rendering (>75 CRI)
The ambient lighting luminaires are not Dark-Sky Friendly and operate dusk to dawn every day. The Dining Hall porch lights are controlled by the porch ceiling minimizing spill into the sky. The bulbs are medium wattage gauged by their brightness and do not cause glare.

**Residential**

- Minimal lighting from high pressure sodium cobrahead streetlights at intersections supplemented by porchlights on cabins. The streetlights are owned and maintained by Xcel and are mounted on wood utility poles. The east-west streets typically become darker at mid-block making seeing difficult for pedestrians walking in the street. The porch lights add some visual brightness, but no illuminance in the street.

- The light sources are warm, high pressure sodium in the streetlights and incandescent, compact fluorescent or LED bulbs at the cottages. While the streetlights can be mildly glary due to their high wattage, the eclectic mix of porch lights are visually interesting.

- The streetlights are Dark-Sky Friendly, with one or two exceptions, if installed correctly. Porch lights are typically not Dark-Sky Friendly with translucent diffusers.

- Cottage occupants typically control the porchlights.

**Parking / Vehicular**

- There are four off-street parking areas, none of which are illuminated consistently:
  - The Academic Hall lot is lit by spill from two nearby streetlights. It is possible to find one’s car, but the lighting is minimal.
  - The Half-Moon lot is not lit. Light from a nearby streetlight on 12th street is shadowed by a large tree.
  - The Overflow/Tennis lot has residential grade LED floodlights controlled by integral motion sensors with unreliable operation. This area is surrounded and isolated by vegetation and accessed by a winding path or steep stairway. Safety and security are both minimal here.
  - The Ranger Cottage parking area is lit from a single cobrahead streetlight located at the trailhead.

- Streets are lit by cobrahead luminaires at intersections and parking pull-outs on Sumac Drive which does allow wayfinding for pedestrians around the green.
Existing Conditions Assessment

- The streetlights are warm high pressure sodium, the floodlights are cool color LED sources and can be very glary due to the low mounting height necessitating a low aiming angle.
- The streetlights are Dark-Sky Friendly. The floodlights are not.
- The streetlights are operated dusk to dawn. The floodlights are intermittent and unreliable.

Primary Pedestrian

- Primary Paths: There is no dedicated pedestrian path lighting. Near the Auditorium and Dining Hall the acorn and globe style luminaires provide adequate illumination to navigate between buildings but minimal to no lighting between the Dining Hall to the Arbor, and onto the Trolley Station/Kings Gate.
- Secondary Paths: In residential areas there are no paths and pedestrians use the streets to travel. The streetlights provide way-finding lighting supplemented by the porchlights.

Park

- Chautauqua Green, Waterwise Garden, and Centennial Garden are lit by spill from adjacent lighting, and Centennial Garden additionally has four compact fluorescent landscape uplights. They are all dark spaces and yet are comfortable due to light from outside the park areas.
- The at-grade uplights at the Centennial Garden negatively impacts pedestrian visibility and experience at night. They are not Dark Sky Friendly and are a source of glare.

Open Space

These spaces are not currently illuminated and provide a dark nighttime experience. There is little light trespass or glare, dependent on orientation (one can see the city lights) and depth into the Open Space. Stars are readily visible.

Baseline

There are currently cobrahead style streetlights at each crosswalk. The lighting levels are adequate for pedestrian/vehicular safety at a minimal level, the single light at each crosswalk does not provide preferable three-dimensional lighting.
Needs Assessment
Lighting Needs

The cultural and educational mission of the Chautauqua continues today through concerts, lectures, and social events. Use tends to peak during the summer, however, the Dining Hall and special events draw people to Chautauqua year-round and at various times during the day. In 2016, forty community events were held at the Community House in the evening, hosting 4,675 attendees. Numerous private events, including wedding receptions and award programs were also held.

Visitors and newcomers alike enjoy the different amenities Chautauqua has to offer. Over 40,000 people attended performances at the Auditorium in 2016 and the Dining Hall averages 3,500 customers per week. Staff and volunteers support various activities and events, often arriving earlier and staying later than the scheduled event times. Cottagers, lodging guests and hikers navigate through the historic district on a regular basis.

In their joint stewardship, the City of Boulder and the CCA are tasked with carefully considering changes to this special historic place. Acknowledging the increased number of evening events and the diverse set of users, including people of all ages and abilities, the design of exterior lighting should have the least amount of impact while meeting the safety, security and wayfinding needs that have been expressed through this process.

Needs Assessment

Input was gathered over the course of the development of the Lighting Design Guidelines through meetings, study sessions, open houses, a feedback booth, an online survey, and an evening walking tour. Participants included representatives of five city departments and CCA staff, five community groups, the Landmarks Board and CCA Board of Directors, community members, concert-goers and Dining Hall employees.

While there was a wide variety of opinions, there was general agreement in a number of areas. Namely, that a conservative approach to lighting is appropriate, that different areas of Chautauqua require specialized approaches to lighting, that the need for lighting should be clearly documented.

In terms of lighting qualities, the majority of participants considered that lighting approaches should minimize light pollution and light trespass, and provide lighting only when and where it is necessary. To that end, there were many suggestions that lights be programmed to be turned down or off when they are not needed.
Needs Assessment

Most participants indicated that lighting is needed for safety, to reduce tripping hazards, and wayfinding. While there were many people who considered lighting is not needed for security purposes, the majority of Dining Hall employees expressed a desire for increased lighting between the Dining Hall and the Tennis Court Parking Lot, which they typically access late at night and early in the morning. Residents and staff reported interactions with bears and other animals across the campus after dark.

Public Spaces

Public spaces, including the Auditorium, Dining Hall and Community House, are regularly programmed for evening public use and are destinations for community members and visitors of many ages and abilities. As such, there exists a greater need for lighting than other areas. Many participants indicated that the quality of lighting (glare, spill, color temperature) could be improved at the Auditorium and Dining Hall.

Lighting at Public Spaces should facilitate wayfinding, and address safety concerns by illuminating tripping hazards such as stairs and curbs. In some public spaces, additional safety and wayfinding lighting may be necessary, where in other areas existing lighting may be too bright and unpleasant and may be reduced.

Residential

Residential areas have a need for lighting to provide safe walking areas and pedestrian navigation at night, but residents have expressed concern that they would not like this area to be brightly illuminated. Currently, portions of the campus are difficult to navigate by pedestrians due to inconsistent lighting – glare from inappropriately sited and angled lights, in contrast to dark areas that obscure stone swales, rocks, and uneven walking surfaces that are characteristic of the historic district.

While residents may be encouraged to leave porch lights on, lighting from individual cottages is not consistent, and cannot be relied upon to adequately provide light in the residential areas.

Appropriate lighting levels are needed to facilitate safe movement for drivers and pedestrians. Pedestrian safety includes the ability to navigate in the dark with a minimization of tripping hazards. Safety issues include the need for adequate lighting at pedestrian intersections, to minimize accidents with vehicular traffic.
Parking/Vehicular Circulation

In general, participants indicated that streetlights, located at key intersections, provided adequate lighting, but that the fixtures could be improved by reducing the level of spill onto lawns and into houses and by trimming vegetation that currently obscures the light source.

Improved lighting is needed along the path to the Tennis Court parking lot and at the parking lot to provide a consistent level of light to see one’s car and to address security concerns of employees and volunteers that use this lot. Stairs and other tripping hazards should be adequately lit.

Primary Pedestrian

The network of sidewalks are used on a daily basis by concert-goers, Dining Hall and Colorado Music Festival employees and volunteers, residents and visitors of all ages and abilities. Lighting is needed for wayfinding and to reduce tripping hazards (safety). Some participants indicated that lighting was needed at the Arbor and between the King’s Gate entrance at Baseline Road and the Auditorium, to address security and wayfinding concerns.

Park

The center of Chautauqua Green has historically not been lit, and there is not a need to introduce lighting there. The area should remain unlit to maintain the historic and architectural integrity of the district. Minimal light exists in the Centennial and Waterwise Gardens, which provides appropriate wayfinding.

Open Space

All participants agreed that the Open Space surrounding the historic district should remain dark, to protect wildlife, open spaces and park areas, and scenic viewsheds.

Baseline

Additional lighting would facilitate safer pedestrian crossings at Baseline. Some participants considered lighting to be needed at the bus stops and at the bus shelter/trolley stop.

The feedback gathered over the course of the project shaped the recommended approaches to lighting and the lighting design guidelines.
Recommended Approaches to Lighting
Chautauqua Lighting Design Guidelines

LEGEND
- PUBLIC SPACE
- RESIDENTIAL AREA
- PARKING / VEHICULAR CIRCULATION
- PRIMARY PEDESTRIAN ROUTES
- PARK AREAS
- OPEN SPACE
- BASELINE ROAD

Lighting Areas at Chautauqua, overlaid on the Existing Lighting Conditions Map.
LIGHTING AREAS

Seven Lighting Areas have been identified to acknowledge the variety of spaces and uses within the Chautauqua Historic District. Each have distinct approaches to exterior lighting. The lighting areas are intended to be broad, illustrative and not to represent firm boundaries; some locations may fall into two lighting areas. The lighting areas include the following.

1. **Public Spaces** - most used areas, frequently visited by non-residents, including areas surrounding public buildings: Auditorium, Dining Hall, Academic Hall, Community House and the Picnic Shelter.

2. **Residential** - Cottage areas at the southern portion of campus including roads within this area

3. **Parking/Vehicular** - Parking areas; major intersections; tennis court; Academic Hall parking; 12th St. between Picnic Shelter and Tennis Court parking.

4. **Primary Pedestrian** - Key pedestrian crossings; select pedestrian circulation routes and sidewalks; Auditorium to Kings Gate; Dining Hall to Tennis Courts; South side of Clematis

5. **Park** - Chautauqua Green; Waterwise Garden; Centennial Garden.


7. **Baseline** - Perimeter and exterior of historic district boundary.

The existing condition evaluation of the lighting areas identifies inadequacies, specifically where lighting does and does not meet needs. Through stakeholder and community consultation, examples of these existing conditions illustrate considered desirable and undesirable lighting conditions.
Chautauqua Lighting Design Guidelines
Lighting Design Guidelines
INTRODUCTION

The Chautauqua Lighting Design Guidelines are intended to assist applicants as they plan changes to exterior lighting within the Chautauqua Park Historic District. The guidelines provide the City of Boulder Landmarks Board and the Colorado Chautauqua Association’s Building and Grounds Committee with a framework for making consistent decisions in its review of lighting proposals.

These Lighting Design Guidelines have been developed to recognize the unique character of Chautauqua Historic District and are intended to supplement the General Design Guidelines for Boulder’s Historic Districts and Individual Landmarks, which apply unless otherwise stated. Where the guidelines conflict these Lighting Design Guidelines shall prevail.

Lighting Design Guidelines are intended to be used as an aid to appropriate design and not as a checklist of items for compliance. In some cases, unusual circumstances may allow projects to deviate.

Lighting Design Guidelines are broken into General Guidelines followed by more detailed guidance for seven identified lighting areas. The seven lighting areas recognize that different parts of the campus require different treatment.

Regulations

There are two regulations that apply to exterior lighting at Chautauqua.

City of Boulder Land Use Code 9-9-16 Outdoor Lighting ordinance controls light trespass, light pollution and glare. There are maximum light level restrictions, pole height restrictions, and control recommendations. Uniformity ratios are restricted to 15:1 which is appropriate for wayfinding lighting along a path. Otherwise, there are not minimum requirements.

City of Boulder Energy Conservation Code regulates energy use and control strategies.

Lighting proposals must meet all applicable regulations.
1.0 GENERAL LIGHTING DESIGN GUIDELINES

1.1 Improve existing lighting by modifying or removing inappropriate luminaires.

.1 Ensure existing and new luminaires are properly installed so light is directed downwards and does not spill onto adjacent areas.

.2 Where vegetation obscures existing light, either sensitively trim vegetation or reposition luminaires so output is not obscured.

.3 Remove existing luminaires within the historic district that distract from the historic setting, obscure viewsheds, or provide a false sense of history.

.4 Eliminate up-lighting or directional lighting that is not Dark Sky Friendly.

1.2 Approach lighting holistically to avoid incremental change that may lead to a higher overall illumination of the historic district.

.1 In new lighting proposals, consider lighting either by building or area, taking into consideration the overall impact of existing and proposed illumination. Consider ambient light from adjacent buildings and fixtures.

.2 Provide a consistency of luminaire design and aesthetic within the historic district. Lighting qualities, including color temperature, should have a consistent warmth and appearance across the landscape.

.3 Consideration should be given to users with visual impairments, and the variety of users in age and ability.

1.3 Preserve the night sky, architectural character, views, and historic integrity of the historic district by only lighting areas and features when and where need has been demonstrated.

.1 Avoid lighting where and when it is not required, and illuminate only where need has been clearly established.

.2 Lighting building facades, front yards, or park spaces is not appropriate.

.3 Light spill onto adjacent properties outside of the historic district should be avoided.

.4 Design lighting utilizing Dark Sky Friendly qualities, including the following.
   • Lights should be no brighter than necessary.
   • Fixtures should have no spill or limited spill, be Full Cut-off or have a B-U-G Rating with Uplight=0.
1.4 Design lighting to facilitate navigation and address safety concerns for pedestrians to find their way.

.1 New fixtures may be appropriate at destination points with points of light at the beginning and end of paths so a pedestrian may find their way.
  - Additional points of light may be appropriate where conflicts are identified.
  - The greatest uniformity should not exceed 15:1.

.2 Consider ambient light from adjacent buildings and fixtures when designing new lighting.

1.5 Utilize a programmable control system to turn off lights when they are not needed and to dim the output for the time of night and occasion.

.1 Recognize the varied use of the campus throughout the week and year and modify lighting times and locations as needed.
.2 Luminaire should have addressable wireless control modules that communicate with the programmable control system.

1.6 Select new fixtures that are simple in design and respect the utilitarian character of the historic district’s original lighting.

.1 New lighting in the historic district should generally be unobtrusive and compatible with the overall historic character of the buildings, sites, and streetscapes of the historic district.
.2 Select poles and luminaires that are neutral in design, and do not create a new aesthetic or ahistorical character.
.3 Select materials, colors, and finishes that are simple and blend with the existing materials in the historic district.
.4 Reconstruction of missing fixtures or restoration of existing features from the historic district’s period of significance (1898-1930) is appropriate only if the materials and design are clearly documented.
.5 It is not appropriate to introduce replica luminaires that mimic a time or place other than what is documented at Chautauqua, as these create a false sense of history.

1.7 Scale and size of luminaires should not overwhelm the historic setting and should be compatible with the scale of historic buildings and landscape.

.1 Where possible, integrate lighting into the historic setting through low mounting-level light fixtures such as bollards, directional lights mounted in unobtrusive locations, pedestrian scale pole mounted luminaires, and carefully located streetlights.
.2 Provide a consistency of scale and size for luminaires throughout each lighting area, appropriate to the scale of the individual building or landscape.
1.8 Lighting qualities should respect the historic character of the district.

.1 Light color should be warm and evoke the camp-like character of the historic district.
  • In all areas except the residential area, light sources should have a CCT of 3000K CRI; light sources in residential areas should have a CCT of 2700K CRI.
  • Across lit areas, create a balance of lighting that eliminates glare.
  • Luminaires under 900 lumen output should have a maximum B-U-G rating of G=0
  • Luminaires over 900 lumen output should have a maximum B-U-G rating of G=1.

1.9 Luminaires should be easy to maintain and energy efficient.

.1 When existing lighting is replaced, select fixtures that are energy efficient, with appropriate light output per these guidelines.
  .2 Luminaires should have modular lighting components for replacement if failure occurs.

1.10 Sign Lighting

.1 Entrance signs at King’s Gate and Kinnikinic and select navigation signs may be illuminated to be legible. Design of sign luminaires should be simple and unornamented, with minimal visibility by day.
  .2 Number of illuminated signs and illuminance levels should be kept at a minimum, to provide only enough for signage visibility.
    • Ensure that all lighting is Dark Sky Friendly with either a Full Cutoff classification or a B-U-G rating of U=0.
    • *Illuminance on the face of the sign should be between 1.0 and 3.0 vertical footcandles with ≤4:1 uniformity.*
    • Operation should be on from dusk to close of business, or utilize an automatic on/off schedule to meet daily, weekly, and seasonal needs.
    • The lighting should not cause glare at normal viewing angles, obstruct the sign, or create daytime shadows.
    • *Light sources should have a CCT of 3000K CRI and a CRI of ≥80.*
    • *The light should be directed at the sign with minimal spill.*
    • *The light source shall be fully shielded.*
2.0 PUBLIC SPACE

Public spaces include areas of most pedestrian traffic and are most frequently visited. They are usually adjacent to, or near public buildings including the Auditorium, Dining Hall, Academic Hall, and Community House. Lighting in public spaces should recognize the essential “camp-like” character of the historic district. Lighting in Public Spaces should be subdued while providing adequate navigation and illumination of potential tripping hazards, including steps and curbs.

2.1 In public spaces it is appropriate to light public entries to facilitate navigation.
   1. Provide lighting at building entrances to facilitate wayfinding and meet code requirements for emergency egress.
   2. Lighting should be programmed to reflect evening activities.

2.2 Lighting for aesthetic purposes only, including accent, façade, graze lighting and wall-washing, is generally not appropriate.
   1. If aesthetic lighting is combined with providing function or navigation, it may be acceptable.
   2. In rare cases, subdued lighting of the Auditorium towers may be appropriate for very special events. The number of events should be determined on an annual basis, and used very selectively. The lights should be programmed to be on only immediately before, during and after the event.

2.3 Where lighting of public spaces is appropriate, it should be subdued, warm, with minimal spill, glare, and light trespass.
   1. Illuminance levels should be kept at a minimum, and should be only the minimum to provide safe navigation in areas of circulation.
      • Ensure that all lighting is Dark Sky Friendly either with a Full Cutoff classification or a B-U-G rating of U=0.
      • Ambient lighting in public areas should not exceed an average of 3.0 foot candles in a contiguous area and maintain 10:1 uniformity.
      • Operation should be on from dusk to close of business, or utilize an automatic on/off schedule to meet daily, weekly, and seasonal needs.
   2. Lighting should have a warm color.
      • Remove existing lighting that produces harsh or bluish light.
      • Light sources should have a CCT of 3000K CRI and a CRI of ≥80.

2.3 Consider replacing non-historic lighting over time, including acorn lights and globe lights, with elements more in keeping with the historic utilitarian aesthetic.
   1. In the interim, consider updating the acorn lights to have a consistent color temperature throughout and upgrade the fixture to be Dark Sky Friendly.
3.0 RESIDENTIAL

The residential area includes cottages owned and leased by the CCA, those that are privately owned, and other buildings south of Clematis extending to the southern edge of the historic district. A conservative approach to lighting is recommended for the residential area, and the overall sense of brightness should remain lower than nearby residential areas. Lighting should be subdued and unobtrusive while providing navigation and illumination of potential tripping hazards, including swales and curbs. Lighting should be visually comfortable, with consistency in color temperature. Street lights should be designed to only illuminate the street, with minimal light trespass onto lawns and into buildings. The goal of residential lighting is to provide pools of light that serve as wayfinding lights, rather than a uniform, consistent background.

3.1 Maintain a camp-like neighborhood character through a combination of porch/entry light and street lighting.

1. Lighting should provide a sense of safety and provide navigation to minimize tripping hazards.
2. Permanent landscape lighting in front yards and lighting that is visible from the public right of way is discouraged. Landscape lighting includes illumination of trees, shrubs, and other garden and landscape features. Minimal path lighting may be appropriate to illuminate tripping hazards.
3. Selective landscape lighting in the backyard that is not visible from the public right of way may be appropriate, if it is Dark Sky Friendly.
4. Landscape luminaires over 500 lumen output should be Full Cutoff classification or a B-U-G rating of U=0.
5. Light sources should be 2700 - 3000K CRI and shielded so that the source is not visible.

3.2 Porch lighting should have low light levels, with a consistent warm color, and limited light trespass and glare.

1. To facilitate navigation and reduce the number of necessary fixtures in the district, porch lights should be located to illuminate the entry and address number, with minimal spill and light trespass.
2. Porch lights should have 2700 - 3000K CRI light sources which should be shielded so that the source is not visible and with maximum lumen output ≤900 lumens.
3. Automatic timers for porch lights on cottages are encouraged.
4. Select residential fixtures that are simple and do not create a false sense of history.
5. The style of fixtures on a residential cottage should reflect the individual character of the building.

3.3 Street lights should provide pools of light to aid navigation, with limited glare and light trespass.

1. When replaced, manage streetlights so they can be dimmed significantly late at night, while still providing navigation and energy efficiency.
2. Street lights in residential areas should provide light for the streets and swales, not for the cottages and lawns.
3. Streetlights should have consistent levels across the lighting area, 3000K CRI or warmer, Type II or III distribution and employ a House Side Shield (HSS) when in front of a cottage to minimize light trespass. Maximum lumen output ≤4000, maximum bug rating of B1-U0-G1 (without HSS). The luminaire should be installed plumb for Dark Sky Friendly operation with the distribution aligned with the street.
4.0 PARKING/VEHICULAR CIRCULATION

Parking/Vehicular Circulation includes areas along major roadways and parking areas utilized primarily by visitors and staff during evening hours. These include the parking areas at the tennis court and Academic Hall, major intersections, and 12th Street between the picnic shelter and tennis court parking. This does not include parking for cottages or on-street parking. Where appropriate, lighting in parking areas should be adequate for navigation and to address safety and security concerns.

4.1 Lighting in parking/vehicular areas may be appropriate to provide a sense of security and navigation.

.1 Lighting of vehicular circulation should be limited to major intersections, and should be designed to have limited spill light outside the intersection.

4.2 If appropriate, parking areas should only be lit with low intensity lighting and have no spill light outside of the parking area.

.1 Maximum average approximately 0.2 footcandles with 20:1 uniformity. Use house side shields to minimize spill light.

4.3 Lighting in parking areas should be managed according to the varied activities occurring within the historic district.

.1 Parking area luminaires should be 3000K CRI, Type III distribution and employ a House Side Shield (HSS) to minimize spill light. Maximum BUG rating of B1-U0-G1 (without HSS). The luminaire should be installed plumb for Dark Sky Friendly operation with the distribution aligned with the parking area, and no higher than 20’.

.2 Parking lot lighting controls should be programmed to meet needs for different night uses.

4.4 Provide light for vehicular circulation at major vehicular and pedestrian conflict points.

.1 Lighting may be appropriate in the following areas:

- Street intersections to reduce potential conflicts.
- Pick-up/drop-off locations.
- Vehicular entrances at Kinnikinic and 12th Street.
- Parking areas at the Academic Hall; Ranger Cottage; 12th Street; and Tennis Court.
5.0 PRIMARY PEDESTRIAN

Primary pedestrian routes are major pedestrian circulation routes, sidewalks, and pedestrian crossings. These include the route between the Auditorium and King’s Gate; the route from the Dining Hall to the Tennis Court parking; King’s Gate; the Arbor; the south side of Clematis Drive; and along Kinnikinic from Clematis to the Baseline entrance. Lighting along primary pedestrian routes should be visually comfortable, without glare, and should provide lighting for navigation and to illuminate tripping hazards. The use of wayfinding lighting may be appropriate to direct pedestrians to their destination with intermittent pools of light and beginning and ending points along paths.

5.1 Where appropriate, provide pedestrian lighting for navigation, to guide users to destinations.

.1 Lighting should be visually comfortable without glare.

.2 Lighting should only occur at intervals sufficient enough to provide adequate navigation, to see from one light location to another, whether a bollard, pole, lit building, or combination.

.3 Where appropriate, paths may be illuminated with pedestrian scale luminaires. Pole mounted luminaires should be Type II Distribution, Dark Sky Friendly, either with a Full Cutoff classification or a B-U-G rating of U=0, and 3000K CRI.

5.2 Operation of pedestrian lighting should be programmed to meet operational needs, based upon business and event hours.

5.3 Sensitively designed lighting may be appropriate in these areas:

- Interior of the Arbor and King’s Gate bus shelter, taking care to protect historic fabric and integrate fixtures to be minimally visible.
- The pedestrian path between the Dining Hall, Auditorium and Tennis Court Parking area, and the stairs near the Tennis Court Parking area.
- The pedestrian path from the Auditorium to King’s Gate.
- Clematis Drive.
PARK AREAS

Park lighting areas include Chautauqua Green, Waterwise Garden and the Centennial Garden. The desire for lighting in the park areas is for these areas to remain dark, particularly within Chautauqua Green. In other park areas, it may be desirable for low level wayfinding light with minimal spill light.

6.1 Park areas should remain dark within the interior of the space.

.1 Remove existing up-lighting or directional lighting that is not Dark Sky Friendly or produces glare.

.2 It is not appropriate to introduce new fixtures into the Waterwise Garden or the Chautauqua Green.

.3 It may be appropriate to provide lighting within the Centennial Garden for pedestrian navigation through the interior of the space. Existing lighting may remain but should be upgraded to meet these design guidelines.

6.2 Preserve the character of a dark night sky within the interior space of the Chautauqua Green.

6.3 In some cases, it may be appropriate to provide adequate lighting for vehicular safety and navigation at the perimeter of park areas to facilitate navigation.

6.4 American flags should be taken down at night. If flown at night, American flags should be illuminated to meet the Flag Code.

.1 If a direct light is desired, use only a single well shielded adjustable spotlight, located as close to the base of the flagpole as possible; Maximum output of the spotlight should not exceed 3500 lumens and be 3000K CCT and ≥80 CRI.
7.0 OPEN SPACE

Open Space includes the perimeter of the historic district boundary which borders the City of Boulder Open Space and Mountain Parks (OSMP) land. This includes the west, south, and southeast edges and perimeter of the historic district. These areas should remain dark in order to protect wildlife and scenic viewsheds. Lighting at trails is not appropriate, and the transition areas should remain unlit with minimal light trespass from other areas.

7.1 The interface with the Open Space and Mountain Parks should remain unlit with minimal light trespass from other areas in the historic district.

7.2 Efforts to minimize or eliminate spill light and light trespass should be employed when lighting adjacent areas.

.1 Pole mounted luminaires should be oriented into the adjacent area and away from open space.

.2 House side shields should be used with the Open Space on the house side.

7.3 Allow minimal lighting at the Ranger Cottage and parking for OSMP evening events.

.1 Porch lighting at the Ranger Cottage and parking area lighting meeting 4.0 above, may be appropriate immediately before, during and after an event. Design these lights to be subdued and only illuminate the immediate area, with no spill light into the adjacent Open Space.
8.0 **8.0 BASELINE ROAD**

Baseline Road includes the interface between the historic district and Baseline Road. Pedestrian crossings, intersections, and street parking at Baseline Road are included. Currently cobrahead-style streetlights are at each Baseline crosswalk. Within the historic district boundary, lighting may be appropriate at bus stops and at the vehicular entrance into the historic district from Baseline. While outside of the historic district boundary, these guidelines acknowledge that sufficient lighting may be necessary to facilitate safe pedestrian crossings at Baseline crosswalks and King’s Gate.

8.1 Baseline Road should have sufficient lighting to provide safe pedestrian crossing and vehicular access.

1. When upgraded, the streetlights should maintain the current nominal height, 3000K CRI, Type III distribution and employ a House Side Shield (HSS) when in front of a residence to minimize light trespass.

   • Maximum lumen output ≤4000, maximum bug rating of B1-U0-G1 (without HSS).
   • The luminaire should be installed plumb for Dark Sky Friendly operation with the distribution aligned with the street.

8.2 It may be appropriate to locate streetlights at vehicular and pedestrian conflict points.

1. Adequate lighting may be necessary at intersections along primary streets, at King’s Gate, and the Baseline / Kinnikinic entrance to the historic district.

2. A single streetlight before or at a crosswalk that meets minimum lighting requirements may be appropriate. Using two streetlights, each one a half-mounting height before the crosswalk in the direction of oncoming traffic, provides maximum pedestrian visibility.
Glossary
Arc Lamp: A lamp that produces light by an electric arc between carbon electrodes in air. It was widely used starting in the 1870s for street lighting, this image is a typical 19th-century arc light. See Figure G.1.

Ambient Lighting: Light that serves as general illumination for a space for basic visual recognition and travel through that space.

Architectural Lighting: Lighting techniques using the structure of a form to create visible luminance. Fixtures maybe designed into the construction of the building or structure itself or light may be cast upon it. Techniques may include:

Accent Lighting: Precise lighting used to highlight a specific object or building detail.

Facade Lighting: The illumination of the exterior of a building.

Graze Lighting: Casting light in a parallel plane to a surface to reveal the texture of that surface.

Wall Washing: Uniformly illuminating a vertical planer surface with an even wash of light creating a luminous background.

Wall washing and grazing are two techniques for adding perceived brightness to an area without glare. Lighting walls can make spaces appear brighter and more inviting.

Brightness: The extent to which an object is judged to emit more or less light. The perceived brightness of an object can change depending on whether it is seen against a light or dark background due to contrast.

Bug Rating: A rating based on the lighting output in Backlight, Uplight and Glare zones. (Supersedes cutoff classifications). See Figure G.2.

Color Rendering Index (CRI): A measurement, on a scale of 1 to 100, used to describe the ability of a light source to render all colors accurately.

Color Temperature (CCT): A measure in degrees Kelvin (°K) of light’s warmness or coolness. Lamps with a CCT of less than 3,200 °K are yellowish-white and considered warm. Lamps with a CCT greater than 4,000 °K are bluish-white and considered cool. Often referred to as CCT (correlated color temperature). Describes the overall color appearance of a light source. See Figure G.5.

Cutoff Classification: Classification for controlling stray light. See Figure G.6.
Dark-Sky Friendly: Lighting efforts to minimize the harmful effects of light pollution.

- Only be on when needed
- Only light the area that needs it
- Be no brighter than necessary
- Minimize blue light emissions
- Be fully shielded (pointing downward), FullCutoff or BUG Rating = B_\text{--}U0-G_

Footcandle, FC: The unit of illuminance when the foot is taken as the unit of length. The illuminance on a surface one square foot in area on which there is a uniformly distributed flux of one lumen, or the illuminance produced on a surface, all points of which are at a distance of one foot from a directionally uniform point source of one candela.

Fully Shielded Fixture:

1. A fixture that allows no emission above a horizontal plane through the fixture (for Dark-Sky).
2. An opaque shield restriction the view of a light source.
3. A translucent diffuser obscuring the view of a light source.

Glare: An interference with visual perception caused by an uncomfortably bright light source or reflection within a person’s field of view; a form of visual noise. A light within the field of vision that is brighter than the brightness to which the eyes are adapted. Very high contrast. As we age our eyes are more susceptible to glare.

Disability Glare: Glare resulting in reduced visual performance and visibility. It is often accompanied by discomfort.

Discomfort Glare: Glare that produces discomfort, but does not necessarily diminish visual performance. See Figure G.4.

Illuminance: Light on a surface or object. Sometimes called “illumination.” Unit is footcandle or lux.

Light Pollution: Any adverse effect of generated light. Examples include light into the night sky creating sky-glow and obscuring the view of stars.

Light Trespass: Light falling where it is not wanted or needed. Examples include streetlighting into a residential window or residential lighting spilling into a natural area with nocturnal biotic.

Luminaire: A complete light fixture with source, mounting, shielding and housing.
Figure G.5. Color Temperature Spectrum (K = Kelvin Temperature Rating)

Figure G.6. Cutoff Classifications
Luminance: The light given off a surface or object, whether produced or reflected. See Figure G.7.

Pathway Lighting: The illumination of a pedestrian route. There are two basic approaches to lighting a pathway:

Continuous: Even lighting having good uniformity from beginning to end creating an uninterrupted corridor of illumination. Uniformity ratios should not exceed 10:1.

Wayfinding: Points of light at the beginning and end of a Pathway with low light levels in-between so that a pedestrian may find their way even through the darker areas. Additional points of light may be supplemented at possible points of conflict or around curves limiting visibility, etc. Wide uniformity in the light levels. The greatest uniformity should be 15:1 (conforms to Boulder Lighting Ordinance).

Three-Dimensional Lighting: Illuminating an object or person from more than one location to reveal the full form through height, width, and depth.

Two-Dimensional Lighting: Illuminating an object or person from a single location to create a silhouette or halo effect.

Uniformity: The ratio between the darkest point and brightest point. The lower the ratio the more uniform the lighting.