



ZTA-18-002

Outdoor Lighting Regulations
Ordinance Amendment
City-Wide



OUTDOOR LIGHTING

City Council

September 4, 2019

ZTA-18-002

Overview

Light Pollution: Light where it isn't wanted.

- In our eyes.
 - In our homes.
 - While driving.
 - While relaxing.
- It can keep our eyes from seeing what we want to see.
- This can result in wasted energy (having been expended on something that is unhelpful)

Overview

Desired Outcomes

- Consolidate various existing outdoor lighting provisions into one comprehensive ordinance;
 - Simple, straightforward ordinance / consolidation
- Conserve energy and natural resources;
- Improve the enjoyment of private property;
 - Outside and Inside
- Increase the health and safety of residents and others;
 - Reduce Automobile Collisions (Vehicles and Pedestrians)
 - Improve sleep conditions
 - Less crime and increased personal safety
- Improve the nighttime ambiance and aesthetics;
- Lessen impacts on natural wildlife and ecosystems;

Summary Matrix

		Issues				
		Trespass	Glare	Health/ Safety	Energy	Skyglow
Tactics	Full Cut-off Fixtures	X	X		X	X
	Height Limitations	X	X	X		
	Illumination Caps	X	X		X	X
	Spectrum Control		X	X		
	Automatic Timers				X	X
	Photometric Plans	X	X	X	X	X

Applicability

All Land Uses Except Single-Family Zoning

- New construction;
- Additions increasing a land use or building by 25% or more;
- Interior remodels affecting 50% or more of the structure.

Single-Family Residential

- Asked by Planning Commission to Develop
- Ultimately, PC recommended that single-family residential standards be optional

Amendments Since Work Session – June 18

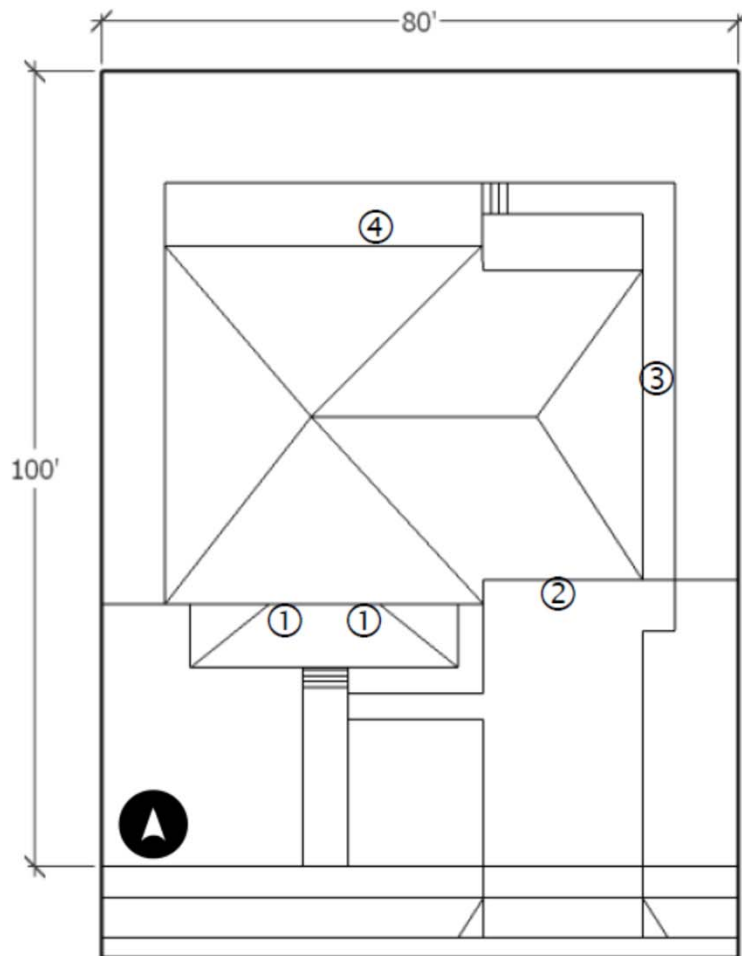
- Net Acre Definition (19.77.020)
- Clarification on Applicability (19.77.030.B) (was an unfinished thought)
- Based on Police Dept Recommendations, Automatic Switching Controls are recommended, not required. (19.77.050.F)
- Seasonal Lighting clarified. (19.77.060.H)

Updates

- Met with Mr. Ken Garner. We have researched his suggestions and incorporated several of his suggestions into the proposed ordinance (gold colored additions).
- Red-colored additions have been added from staff since the June work session.

Policy Question

Should the proposed residential standards be advisory or required for new single-family homes and homes with substantial remodels?



P1

Project ID: ZTA-18-002

Drawn By: MJT

Date: 2019_09_11

Notes

- Not to Scale
- Concept only. Compliance with all City standards has not been drawn or verified, i.e. parking, landscaping, etc.

Total Lumen Output Worksheet

Lot Size	Lumen/acre	Total Site Lumen Allowed
8,000 sq. ft.	43,560	8,000

Fixture Type

	Product	Qty	Fixture Height	Ttl Lamp Lumens	Lamp Kelvins
①	Residence Collection 1-Light 9.2 in. Outdoor Textured Black LED Wall Lantern	2	10 feet	500 (35 W)	2901
②	Kichler 15494AZT 3" Downlight with Long Cowl for MR16 Lamps	2	12 feet	825 (GE 50W 12V MR16 Halogen Wide Flood Bulb)	3000
③	Lavardin Dualux® Outdoor Barn Light with Motion Sensor	1	8 feet	1500 (120 W)	2700
④	Lavardin Dualux® Outdoor Barn Light with Motion Sensor	1	10 feet	1500 (120 W)	2700
				Total: 5650	

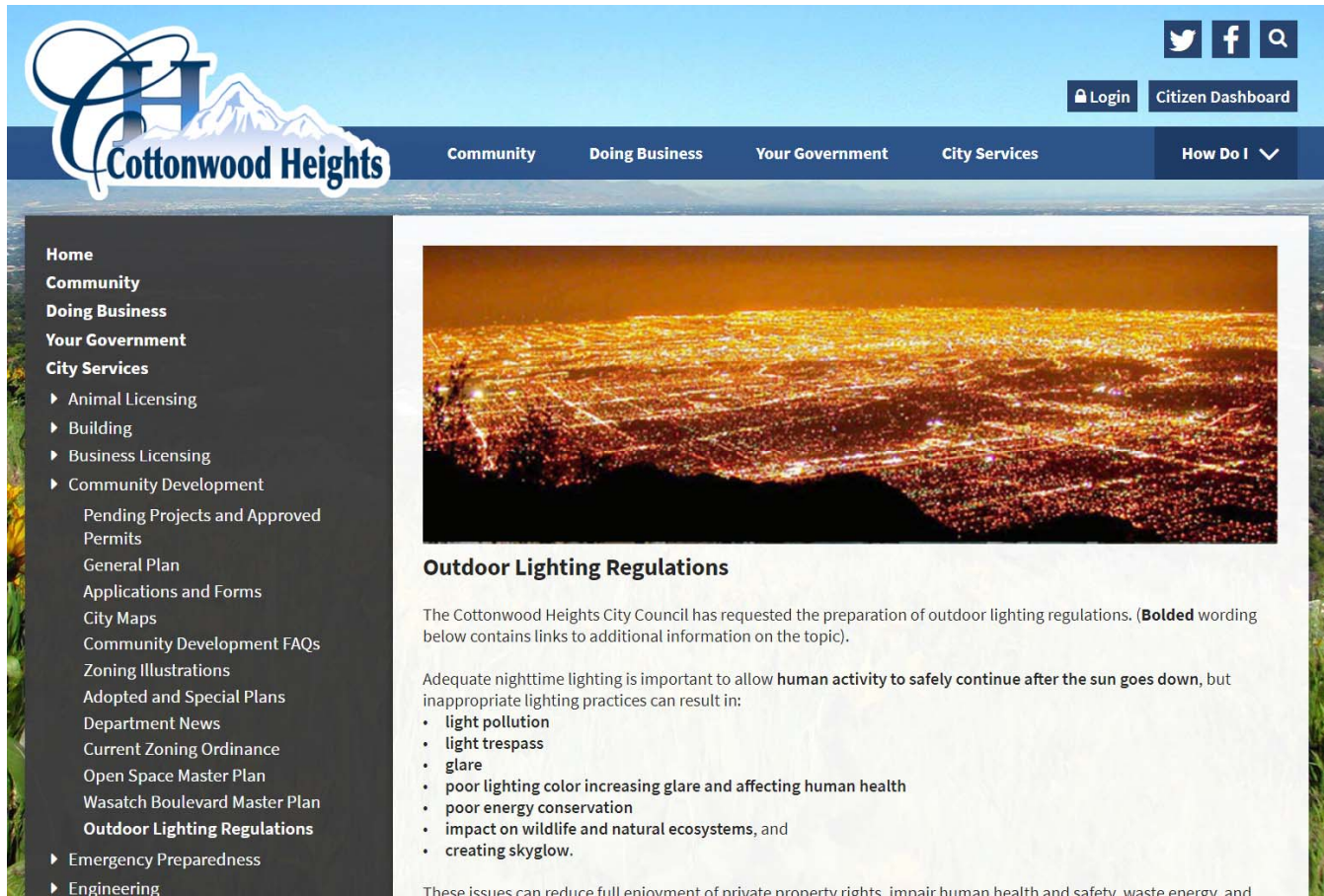
COTTONWOOD HEIGHTS CITY COMMUNITY DEVELOPMENT DEPARTMENT

R1-8 ZONE LIGHTING PLAN EXAMPLE

SITE ADDRESS
Cottonwood Heights, Utah



Additional Resources



The screenshot shows the Cottonwood Heights website. The header features the city logo, navigation links (Community, Doing Business, Your Government, City Services, How Do I), and social media icons. A left sidebar lists various services, with 'Outdoor Lighting Regulations' highlighted. The main content area includes a night cityscape image, the title 'Outdoor Lighting Regulations', and text about the city council's request for regulations. A bulleted list of issues is provided, and the bottom of the page begins with a sentence about the impacts of these issues.

Cottonwood Heights

Community Doing Business Your Government City Services How Do I ▾

Home
Community
Doing Business
Your Government
City Services

- ▶ Animal Licensing
- ▶ Building
- ▶ Business Licensing
- ▶ Community Development
 - Pending Projects and Approved Permits
 - General Plan
 - Applications and Forms
 - City Maps
 - Community Development FAQs
 - Zoning Illustrations
 - Adopted and Special Plans
 - Department News
 - Current Zoning Ordinance
 - Open Space Master Plan
 - Wasatch Boulevard Master Plan
 - Outdoor Lighting Regulations**
- ▶ Emergency Preparedness
- ▶ Engineering



Outdoor Lighting Regulations

The Cottonwood Heights City Council has requested the preparation of outdoor lighting regulations. (**Bolded** wording below contains links to additional information on the topic).

Adequate nighttime lighting is important to allow **human activity to safely continue after the sun goes down**, but inappropriate lighting practices can result in:

- **light pollution**
- **light trespass**
- **glare**
- **poor lighting color increasing glare and affecting human health**
- **poor energy conservation**
- **impact on wildlife and natural ecosystems, and**
- **creating skyglow.**

These issues can reduce full enjoyment of private property rights, impair human health and safety, waste energy, and

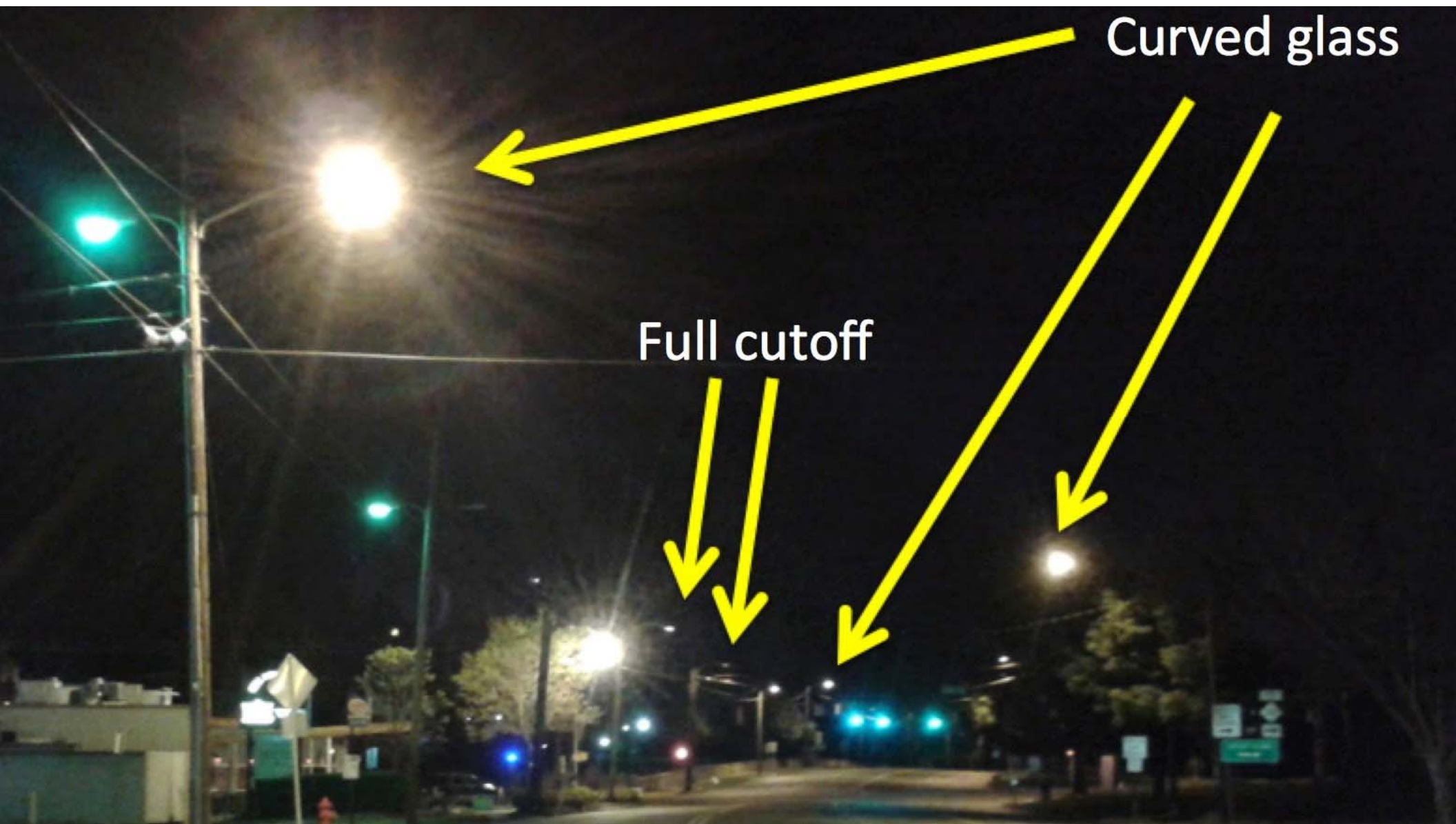


Issue:
Light Trespass

Light Trespassing

Directed away from neighbors





Curved glass

Full cutoff

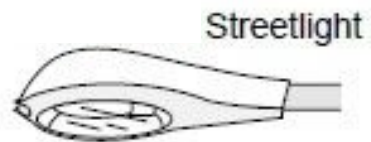


NONCUTOFF

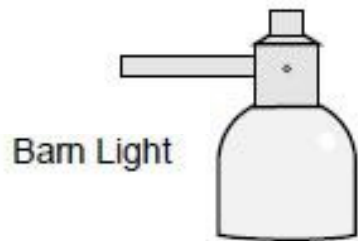
SEMICUTOFF

CUTOFF

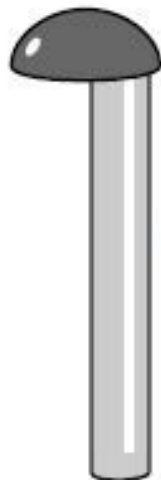
FULL CUTOFF



Streetlight



Barn Light



Walkway
Bollards



Decorative
Fixtures

bulb shielded
in opaque top



'Period' Style
Fixtures

bulb shielded
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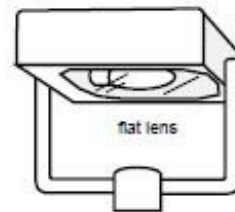
Flush Mounted or Side
Shielded Under Canopy
Fixtures



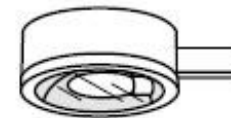
Properly-aimed
PAR Floodlights



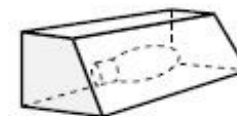
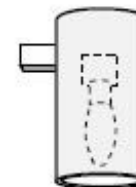
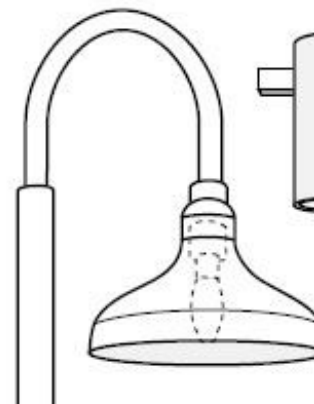
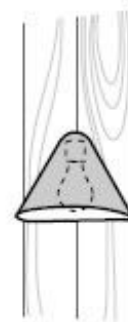
Designed / illustrated by Bob Crelin ©2/05



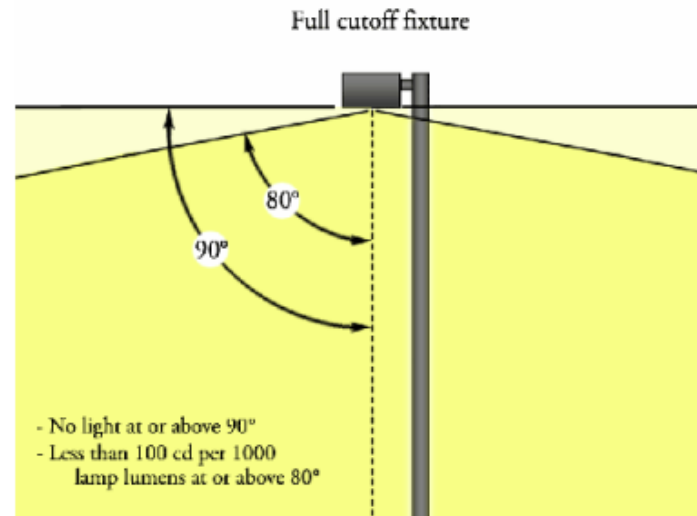
flat lens



Wallpack & Wall
Mount Fixtures

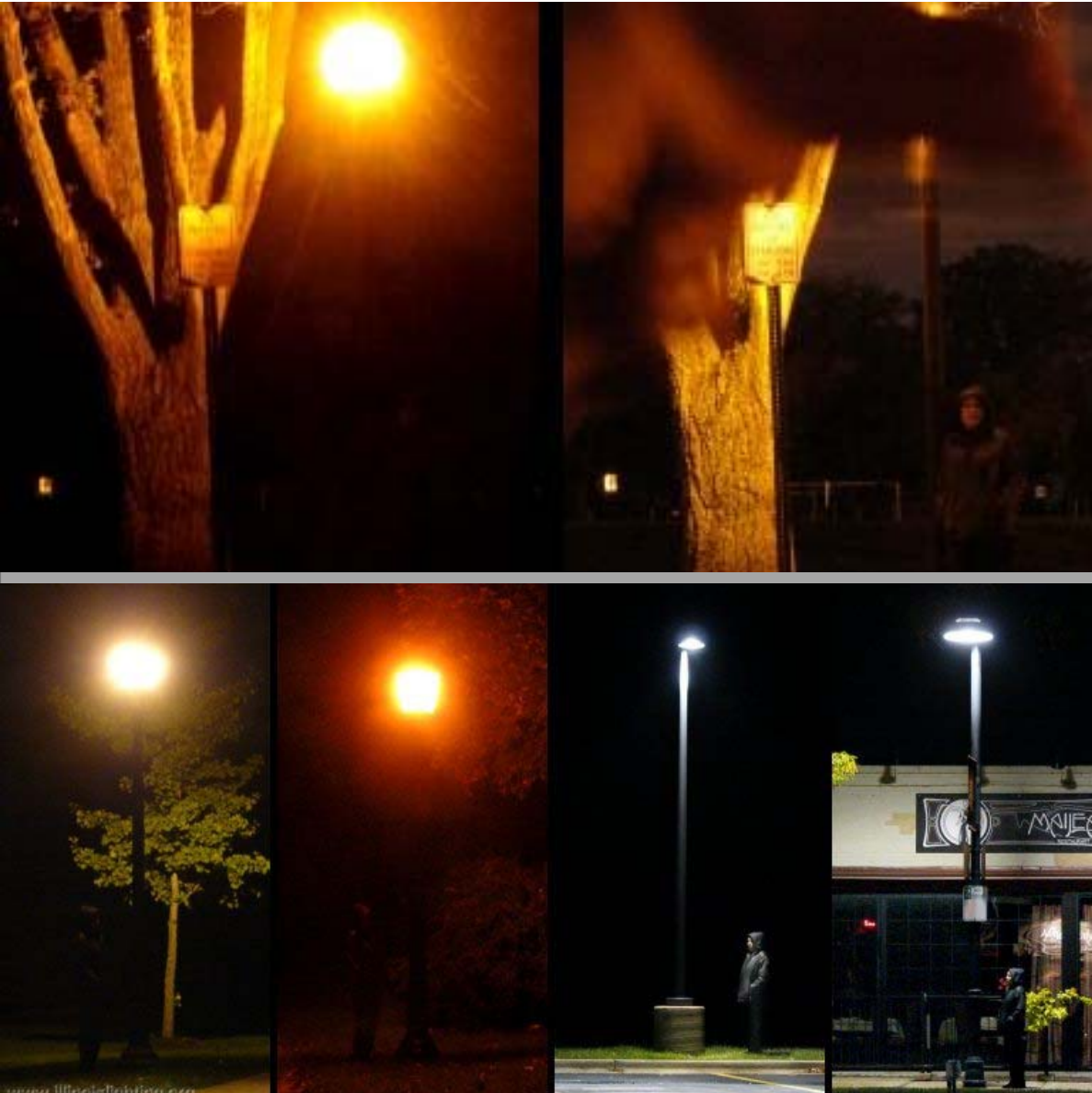


**Definition of Acceptable Fixtures:
"Full Cut Off", "Fully Shielded", and RLM shield.**



- "Full Cut Off" fixtures are independently certified by the manufacturers, and do not allow light to be emitted above the fixture and the fixture reduces glare by limiting the light output to less than 10% at and below 10 degrees below the horizontal.
- If the manufacturer is unable to provide the "cut off" characteristics for a fixture (also called a "luminaire"), the following definition needs to be met, which can usually be determined by a visual inspection:

"Fully Shielded": a fixture constructed and installed in such a manner that all light emitted by it, either directly from the lamp (bulb) or a diffusing element, or indirectly by reflection or refraction from any part of the fixture, is projected below the horizontal. This can be determined by a "field test" or a visual assessment of an operating sample.



Issue:
Glare

Contrast



Normal



High



Low

Contrast and Night Lighting



Unshielded – Glare



Shielded – Less Glare

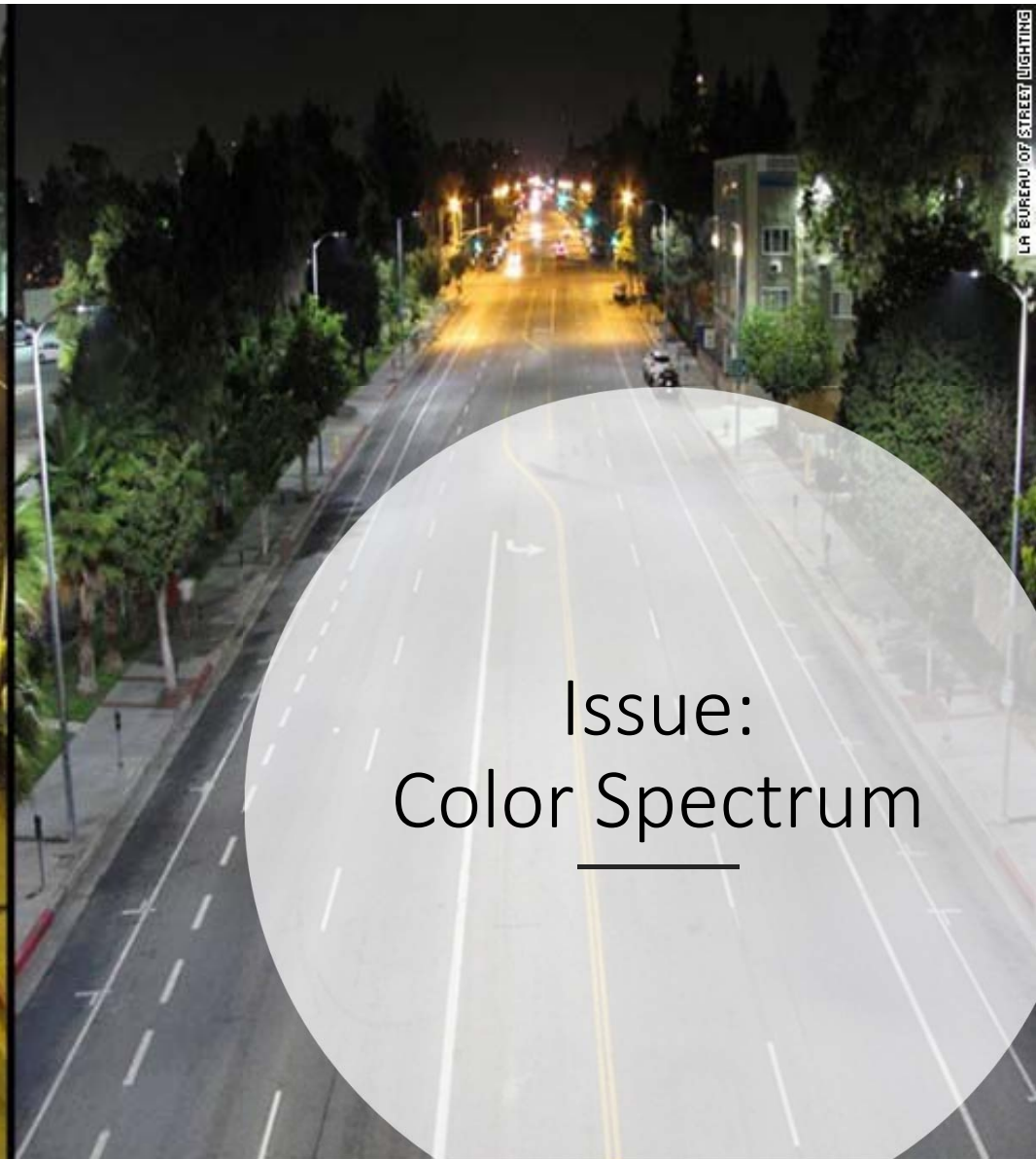


Light Glare Summary

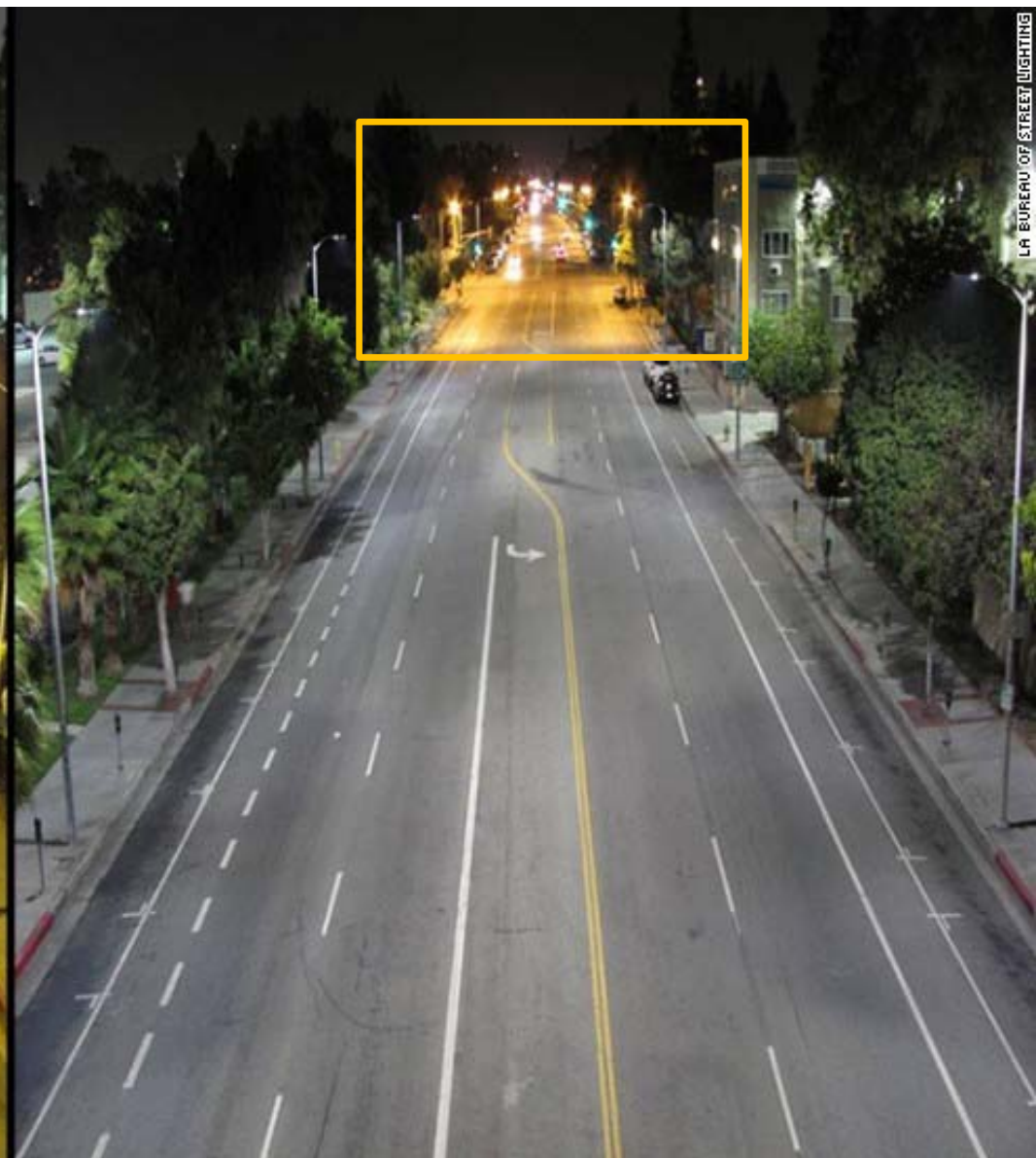
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Problem	Your eye loses sensitivity to fainter light.
Results	• Shadows are deeper: • Harder to surveil surroundings • Easier for the bad guys to hide. • Difficulty seeing what needs to be seen. • May result in “disability glare” and “blinding glare”. • May impair night driving and cause accidents.
City Objectives	• Increase Safety – Driving, walking • Reduce Crime – I
Means to Achieve Objectives	1) Shielded light fixtures. 2) Appropriate total light output based on needs. 3) Reduce lighting color to warm hues that reduce contrast. 1) Est. Max CCT / Kelvin Levels.



Issue:
Over Illumination

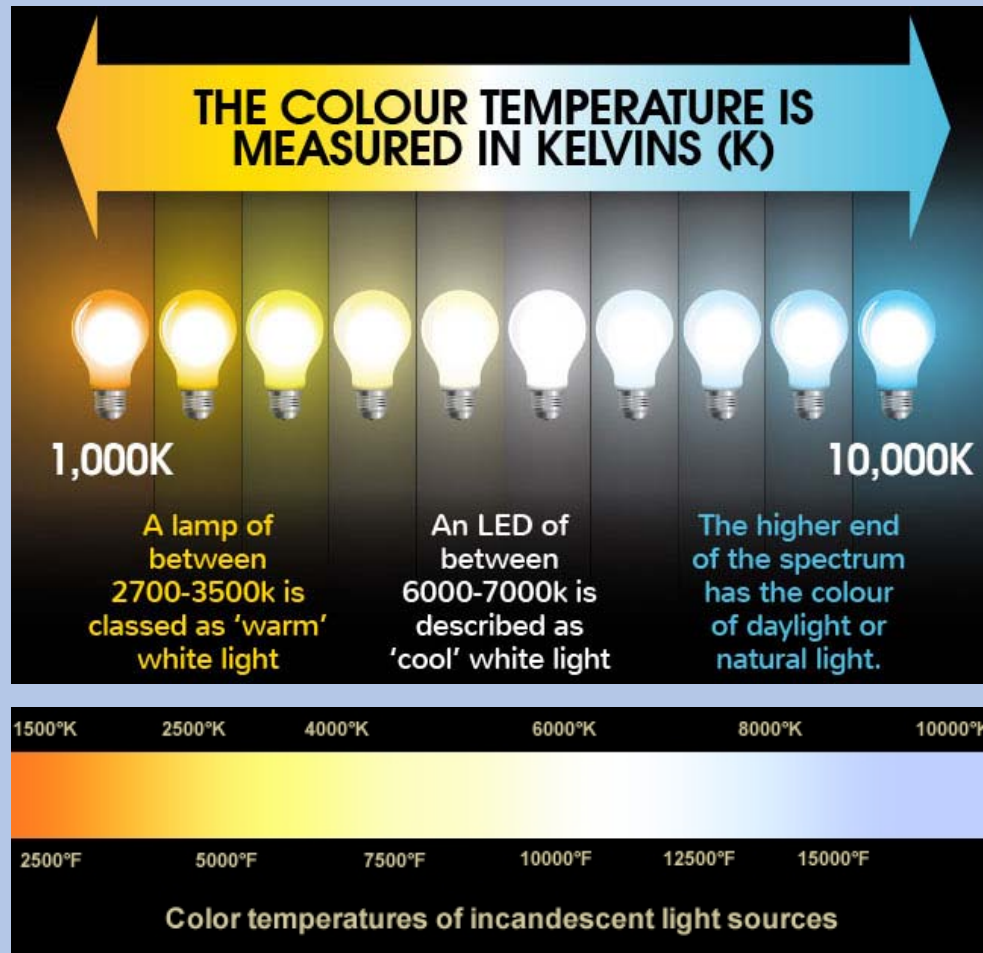


Issue:
Color Spectrum





Understanding CCT (kelvins)



Warm Light

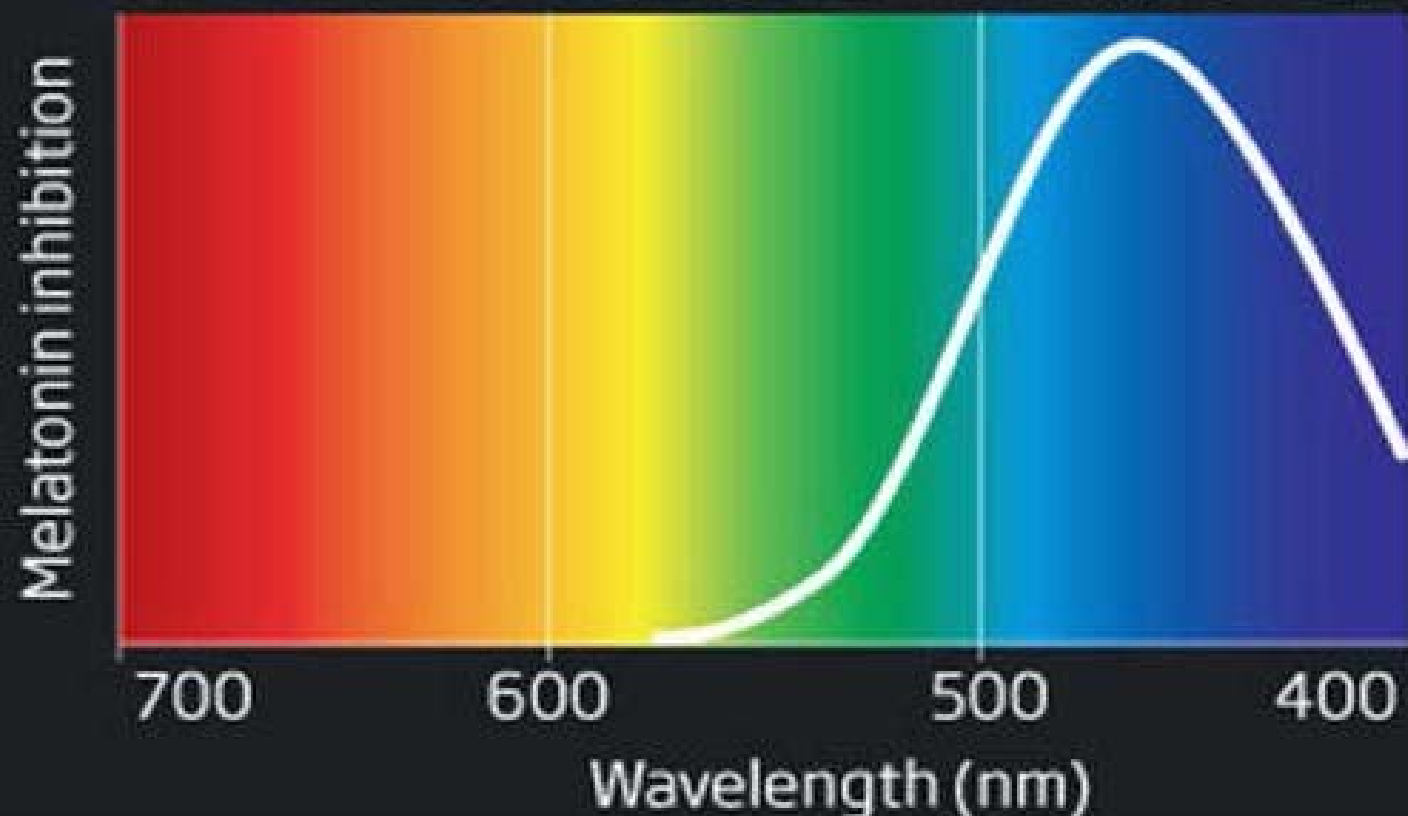
Blue Light





EFFECT ON MELATONIN

Blue light has the greatest power to switch off the production of melatonin, the hormone that makes us sleepy at night



Blue Light

Melatonin Suppression



80%



80%



40%



<2%



Issue:
Energy Waste

ENERGY WASTE

What is light pollution costing us?



13% of residential electricity use in the U.S. is for outdoor lighting



About
15 million
tons of CO₂ are
emitted each year
in order to power
residential outdoor
lighting in the U.S.

About
35%
of light is wasted
by unshielded and/or
poorly-aimed
outdoor lighting

SKYGLOW

is the artificial brightness of the night sky
that's caused by light pollution.

This is about
**\$3
BILLION**
per year worth of
energy lost to
skyglow

About
3 million
passenger cars have
the same CO₂ emission
rate, which is 40,000
tons per day.



Which is about
\$10.00
spent for every man, woman, and
child in the U.S. every year

About
600 million
trees would need to
be planted to offset
that amount of
carbon emission



Average House

Bad outdoor
lighting wastes

0.5 kilowatt-hours (kWh)
of energy
per house, per night

0.5 kWh
of electricity

=
enough energy to
power a 50-inch
plasma TV for 1 hour



50% WASTE

10% GLARE

40% PRODUCTIVE



Issue:
Skyglow

A night photograph of a city skyline, likely London, viewed from a distance. The city lights are a dense, glowing mass of yellow and orange, contrasting with the dark night sky. A large, semi-transparent white circle is overlaid on the right side of the image, containing the text 'Issue: Skyglow'.

Issue:
Skyglow



Effectiveness

From The Ground Up I: Light Pollution Sources in Flagstaff, Arizona

Christian B. Luginbuhl, G. Wesley Lockwood, Donald R. Davis, Kevin Pick and Jennifer Selders



*Publications of the
Astronomical Society of
the Pacific*
Vol. 121, No. 876 (2009
February), pp. 185-203
(19 pages)

Published by:
[Astronomical Society of
the Pacific](http://www.astronomicalsociety.org)

We show that the adoption of the 1989 lighting code has reduced the growth of Flagstaff's sky glow from an expected 43% without the code to just 17%, while the population has increased by about 25%. If all lighting in Flagstaff could be brought within the standards of the 1989 code, Flagstaff sky glow could be reduced to 64% of the 2003 value; if all lighting were fully shielded total output would be reduced to 47%. By far the majority of the improvement in reducing sky glow has resulted from the lumens per acre caps of the 1989 code; the shielding

V magnitudes per square arc second



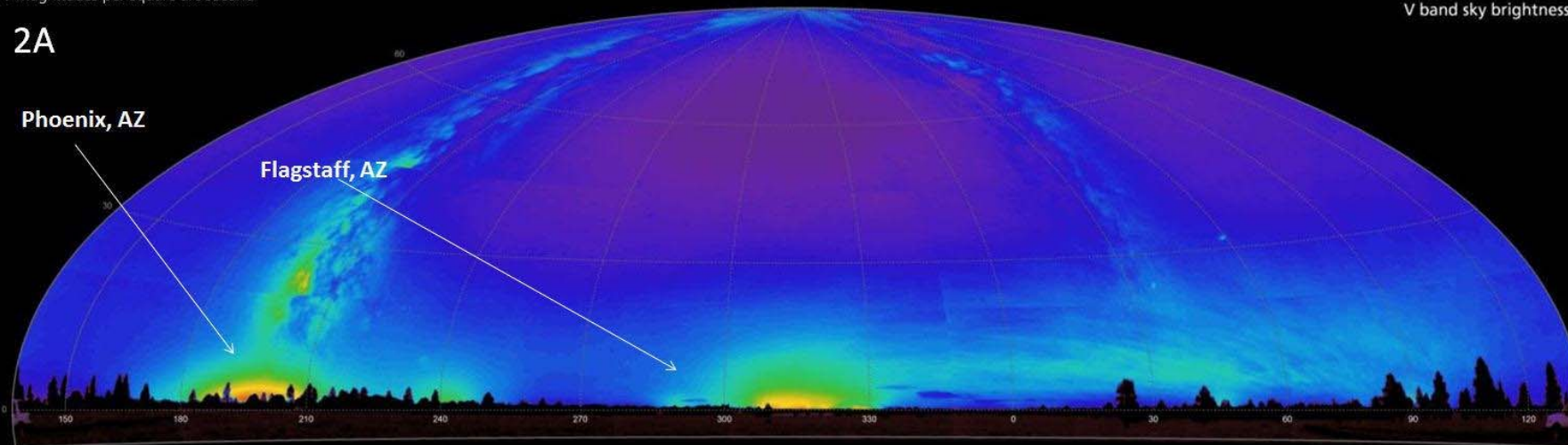
Flagstaff Population: 72,000 Ashurst Lake July 8 2016

V band sky brightness

2A

Phoenix, AZ

Flagstaff, AZ



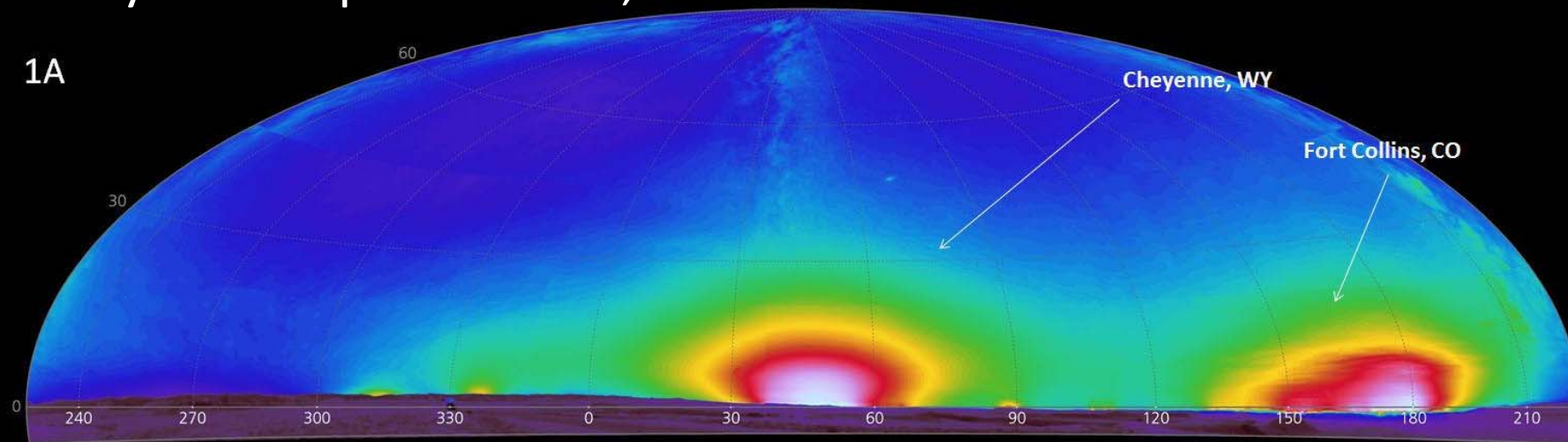
Cheyenne Population: 64,000

Soapstone Prairie Natural Area, Colorado August 2, 2016 23.9 hours LMT

1A

Cheyenne, WY

Fort Collins, CO



Applicability

Option A

- New development (excluding SFR)
- Uses/structures increased in size by 25% or more (excluding SFR)

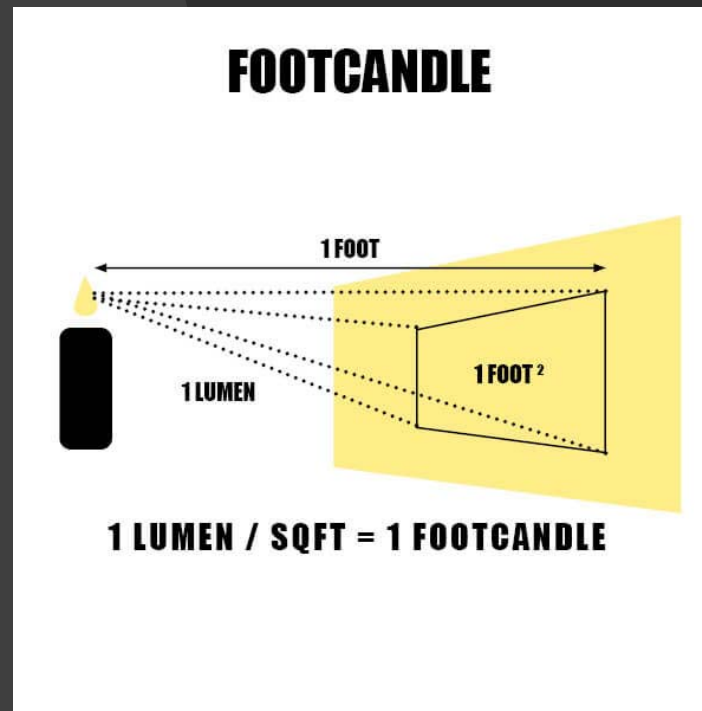
Option A

- New development (including SFR)
- Uses/structures increased in size by 25% or more, SFR increased by 50%

Request

- Provide Preliminary Feedback on Scope/Direction

Visual Glossary – Foot Candle



Sources Consulted



Dark Sky Association



Illuminating Engineering Society of America



American Planning Association



Illinois Coalition of Responsible Lighting



Intermountain West Municipalities



Scores of Other Sources



SUB-18-002

Outdoor Lighting Regulations

Ordinance Amendment

City-Wide



OUTDOOR LIGHTING

Planning Commission

February 6, 2018

ZTA-18-002

Sources Consulted



Dark Sky Association



Illuminating Engineering Society of America



American Planning Association



Illinois Coalition of Responsible Lighting



Intermountain West Municipalities



Scores of Other Sources

Problem Overview

- Light Pollution: Light where it isn't wanted.
 - It can keep our eyes from seeing what we want to see.
 - It can invade our life where we don't want it to.
- Improper use of light may create:
 - Light Trespass
 - Glare
 - Over Illumination
 - Color
 - Wasted Energy
 - Skyglow

Desired Outcomes

- Improve Enjoyment of Personal Property
 - Outside and Inside
- Increase Health and Safety of Residents and Visitors
 - Reduce Automobile Collisions (Vehicles and Pedestrians)
 - Improve sleep conditions
 - Less crime and increased personal safety
- Improve Nighttime Ambience
- Conserve Natural Resources
- Administratively straightforward and enforceable

Issues

[illegible]

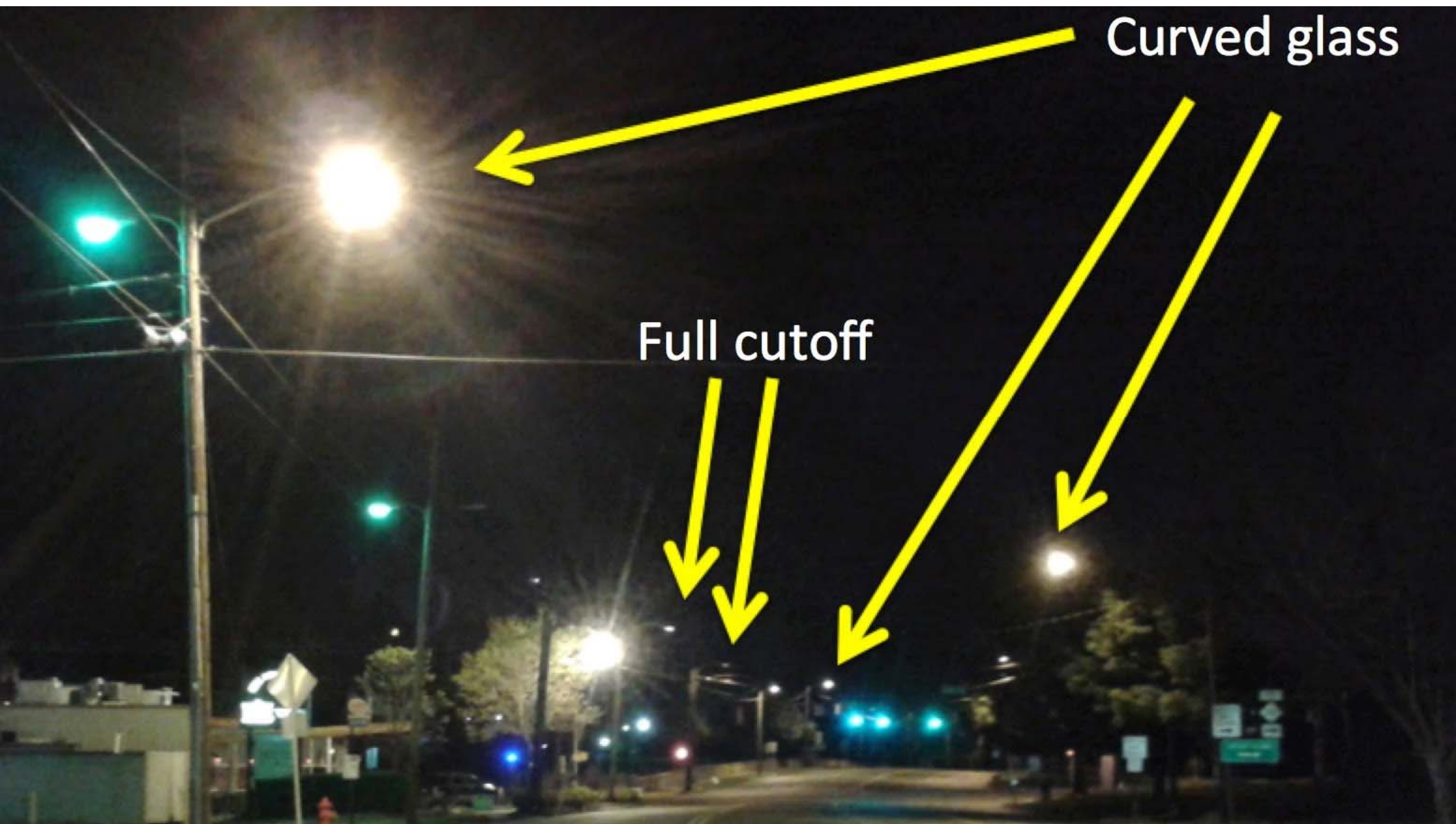


Issue:
Light Trespass

Light Trespassing

Directed away from neighbors





Curved glass

Full cutoff

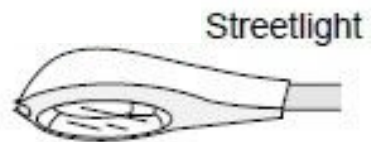


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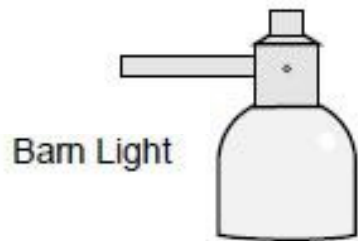
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CUTOFF

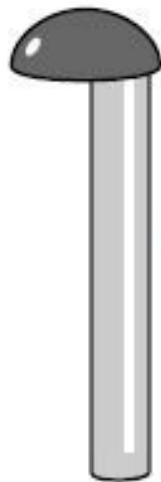
FULL CUTOFF



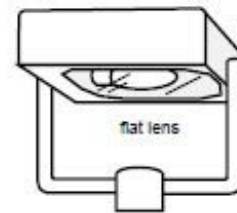
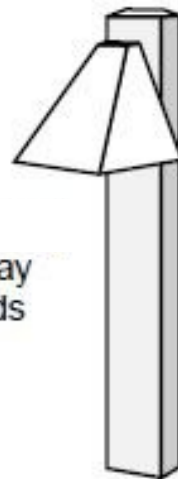
Streetlight



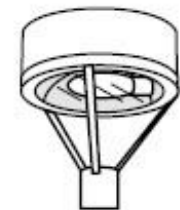
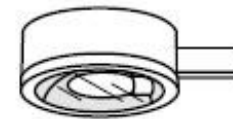
Barn Light



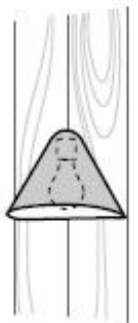
Walkway
Bollards



flat lens



Wallpack & Wall
Mount Fixtures



Decorative
Fixtures

bulb shielded
in opaque top



'Period' Style
Fixtures

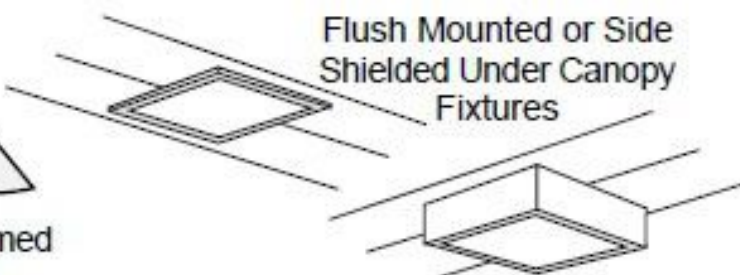
bulb shielded
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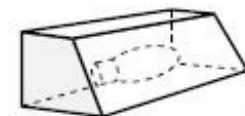
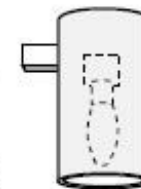
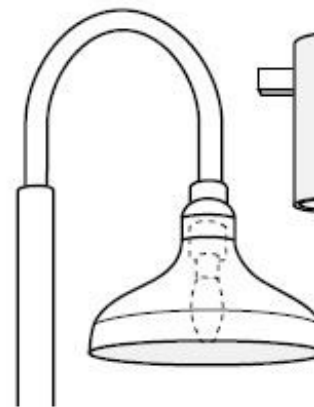
Flush Mounted or Side
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Fixtures

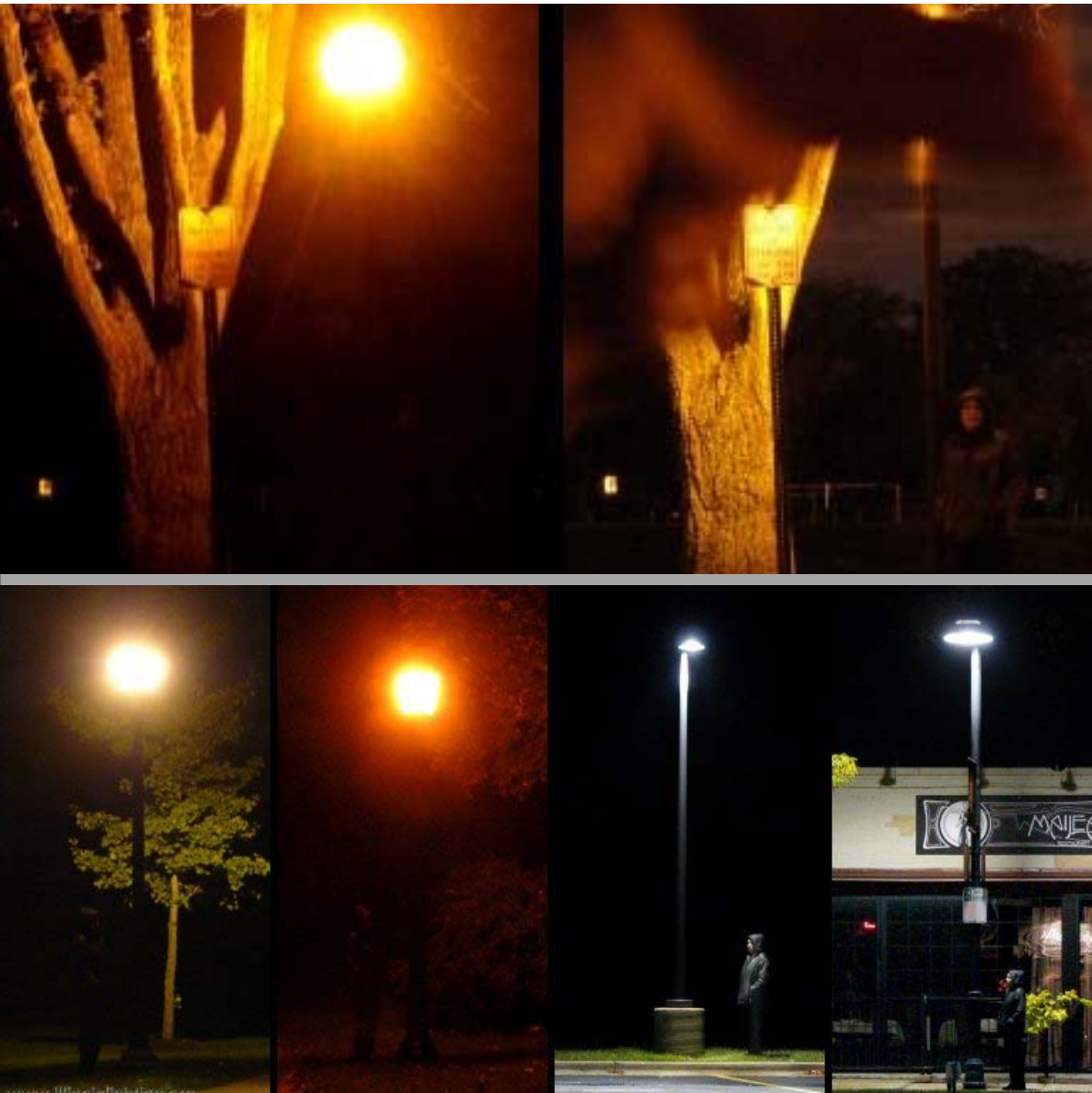


Properly-aimed
PAR Floodlights



Designed / illustrated by Bob Crelin ©2/05





Issue:
Glare

Contrast



Normal



High



Low

Contrast and Night Lighting



Unshielded – Glare



Shielded – Less Glare



Light Glare Summary

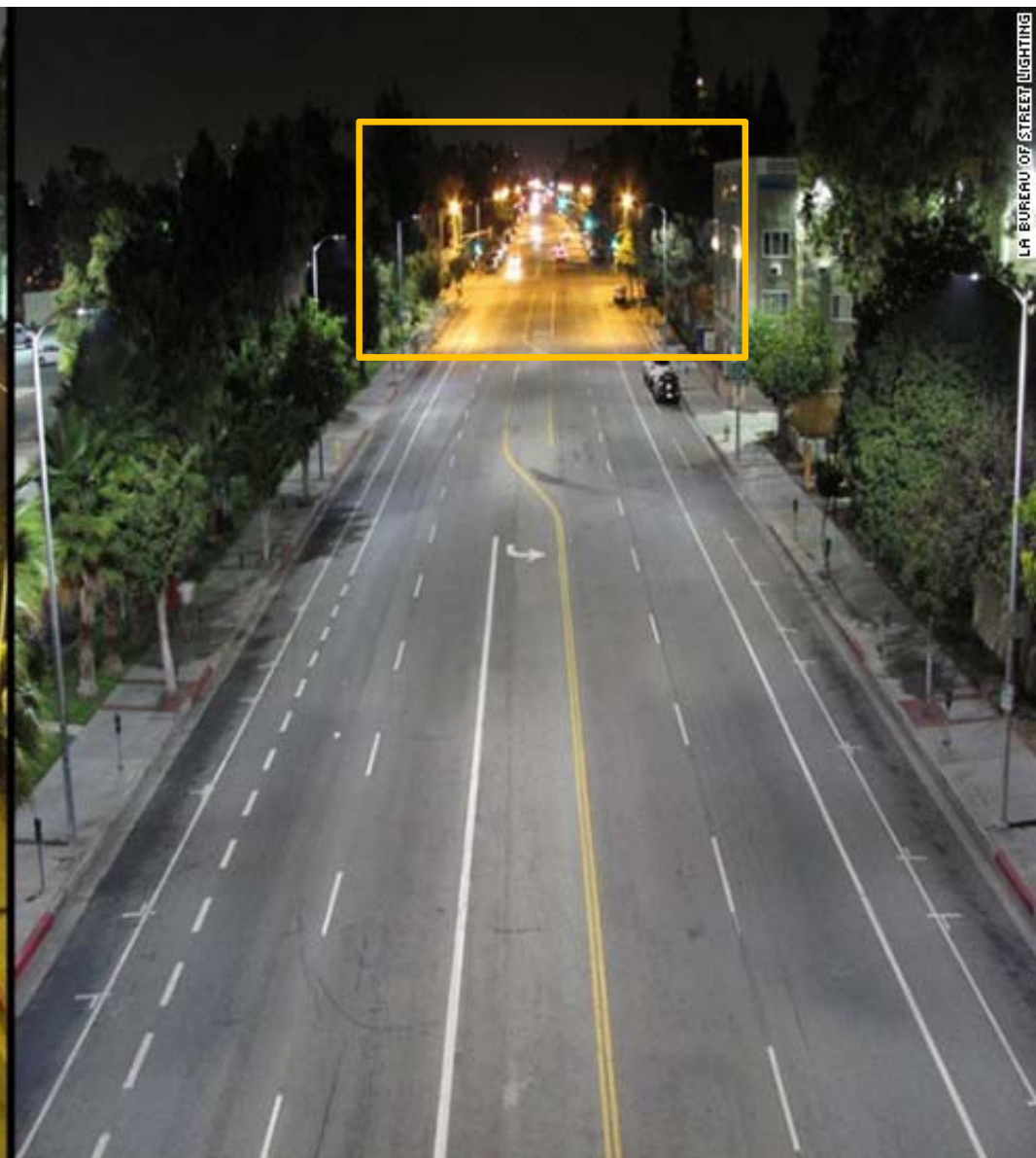
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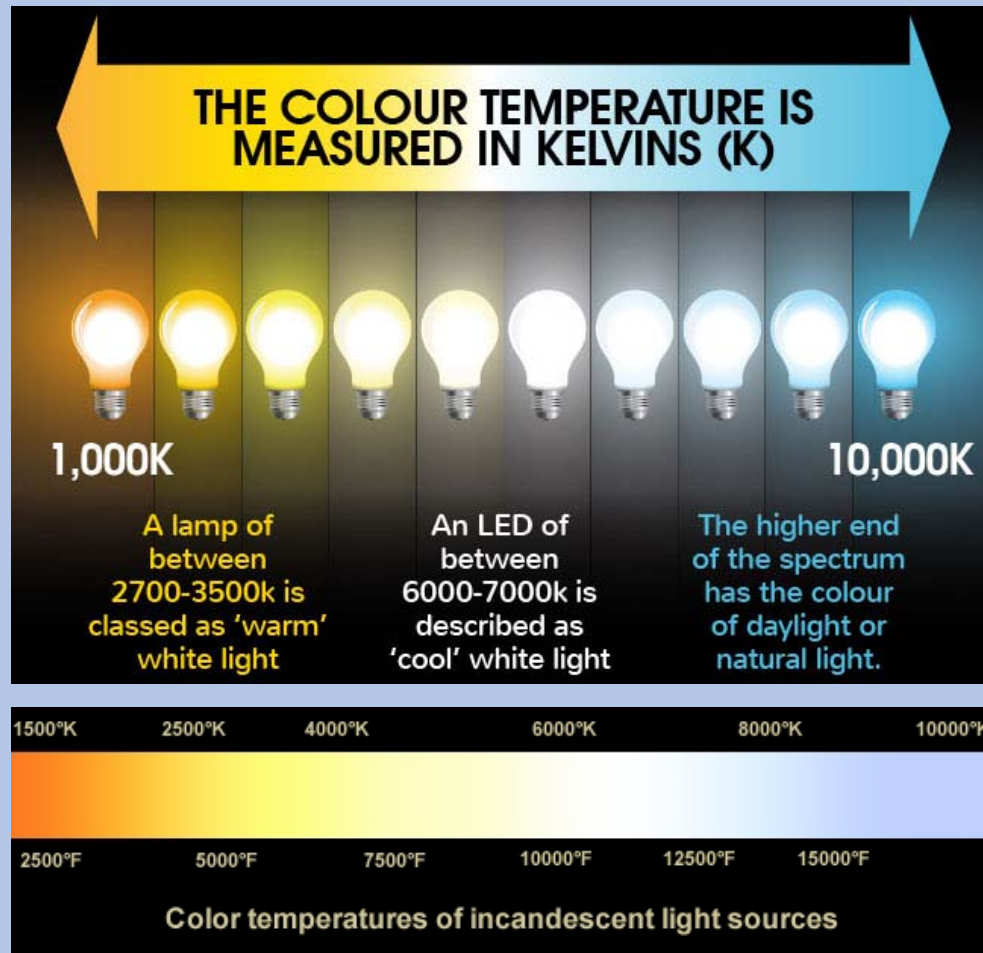


Issue:
Color Spectrum





Understanding CCT (kelvins)



Warm Light

Blue Light

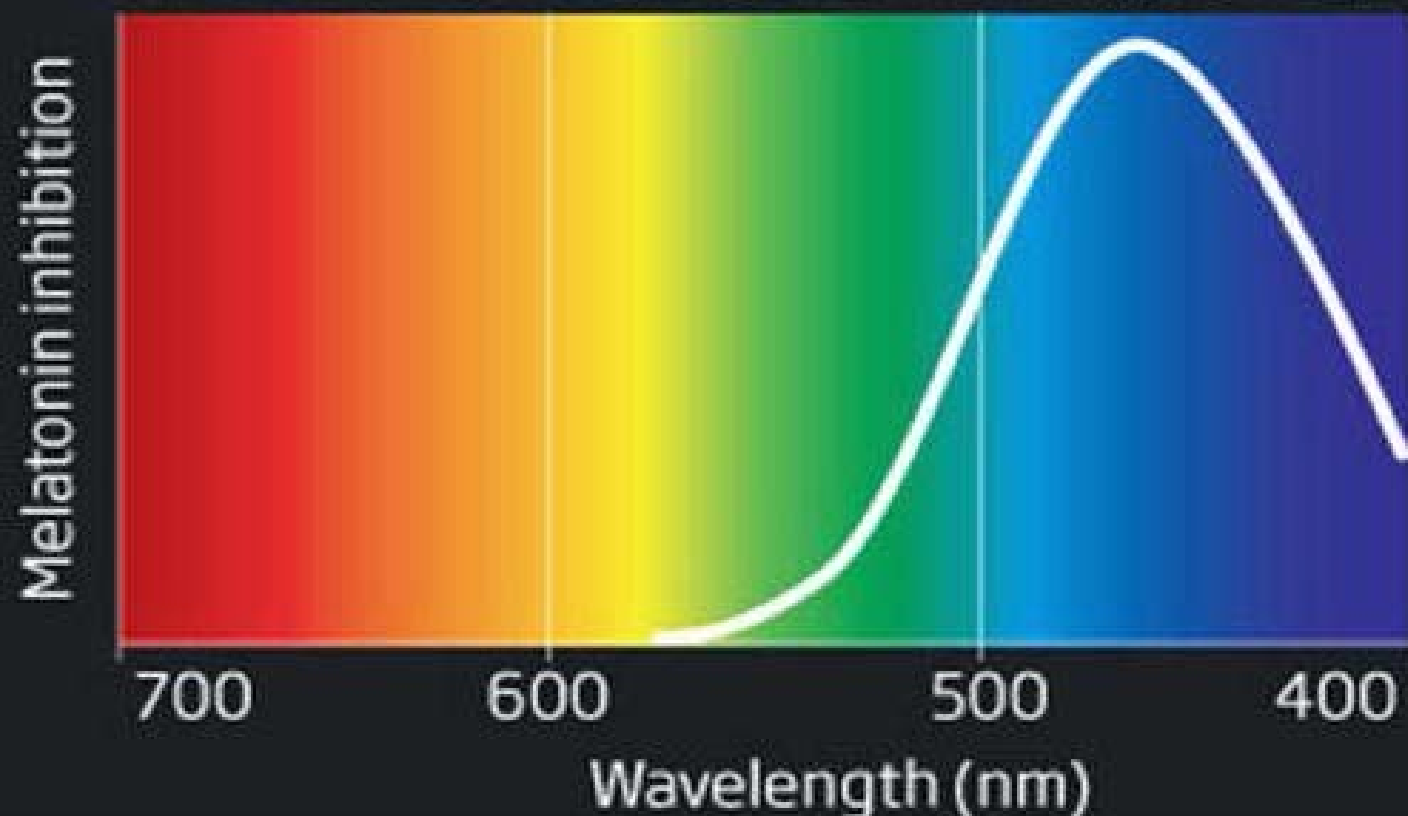






EFFECT ON MELATONIN

Blue light has the greatest power to switch off the production of melatonin, the hormone that makes us sleepy at night



Blue Light

Melatonin Suppression



80%



80%



40%



<2%



Issue:
Energy Waste

ENERGY WASTE

What is light pollution costing us?



13% of residential electricity use in the U.S. is for outdoor lighting



Average House

Bad outdoor lighting wastes

0.5 kilowatt-hours (kWh) of energy per house, per night

0.5 kWh of electricity

= enough energy to power a 50-inch plasma TV for 1 hour



SKYGLOW

is the artificial brightness of the night sky that's caused by light pollution.

About **35%** of light is wasted by unshielded and/or poorly-aimed outdoor lighting



About **15 million** tons of CO₂ are emitted each year in order to power residential outdoor lighting in the U.S.

About **3 million** passenger cars have the same CO₂ emission rate, which is 40,000 tons per day.



This is about **\$3 BILLION** per year worth of energy lost to skyglow



Which is about **\$10.00** spent for every man, woman, and child in the U.S. every year

About **600 million** trees would need to be planted to offset that amount of carbon emission



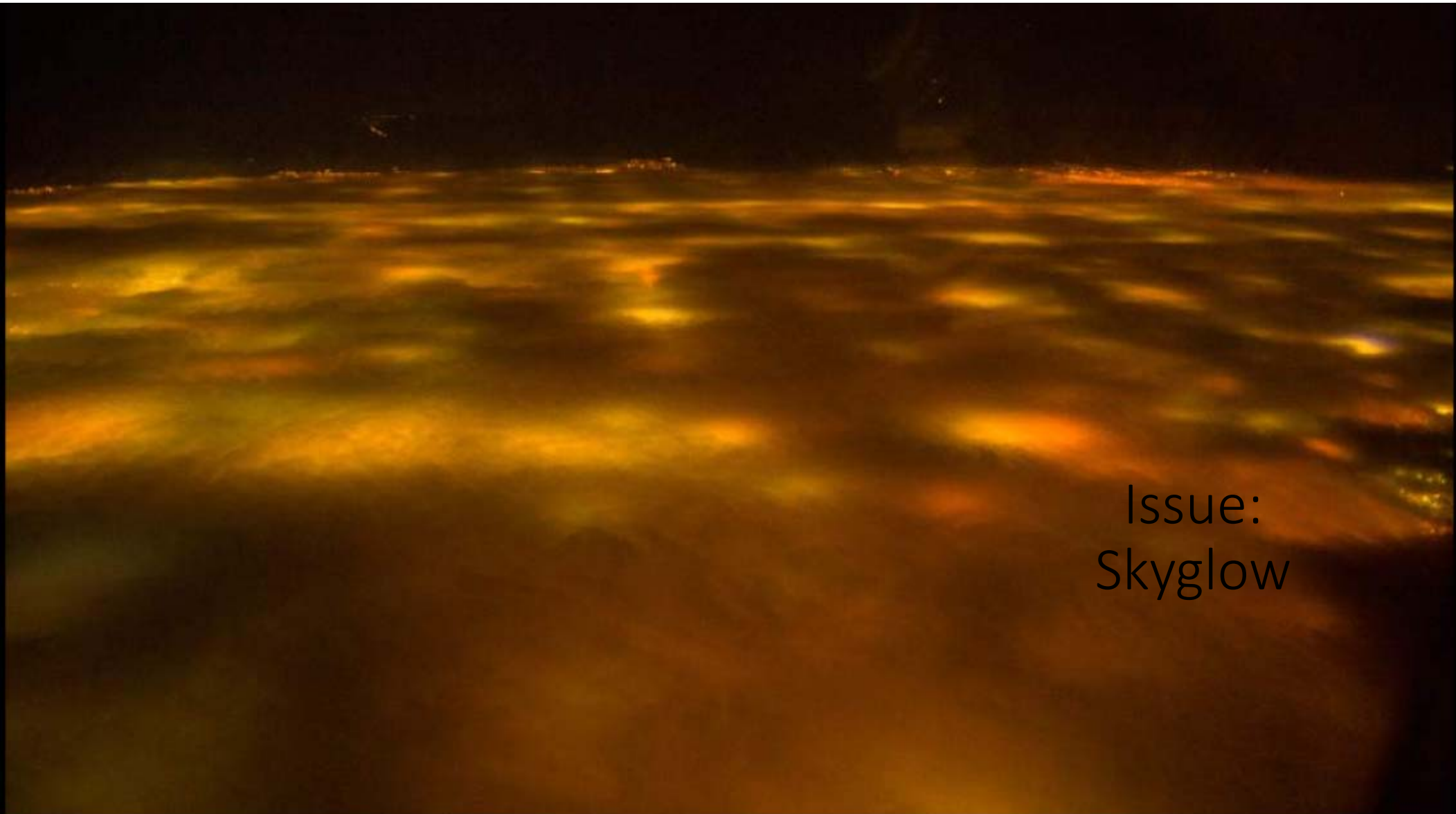
Sourced from U.S. Department of Energy 2011 data.

50% WASTE

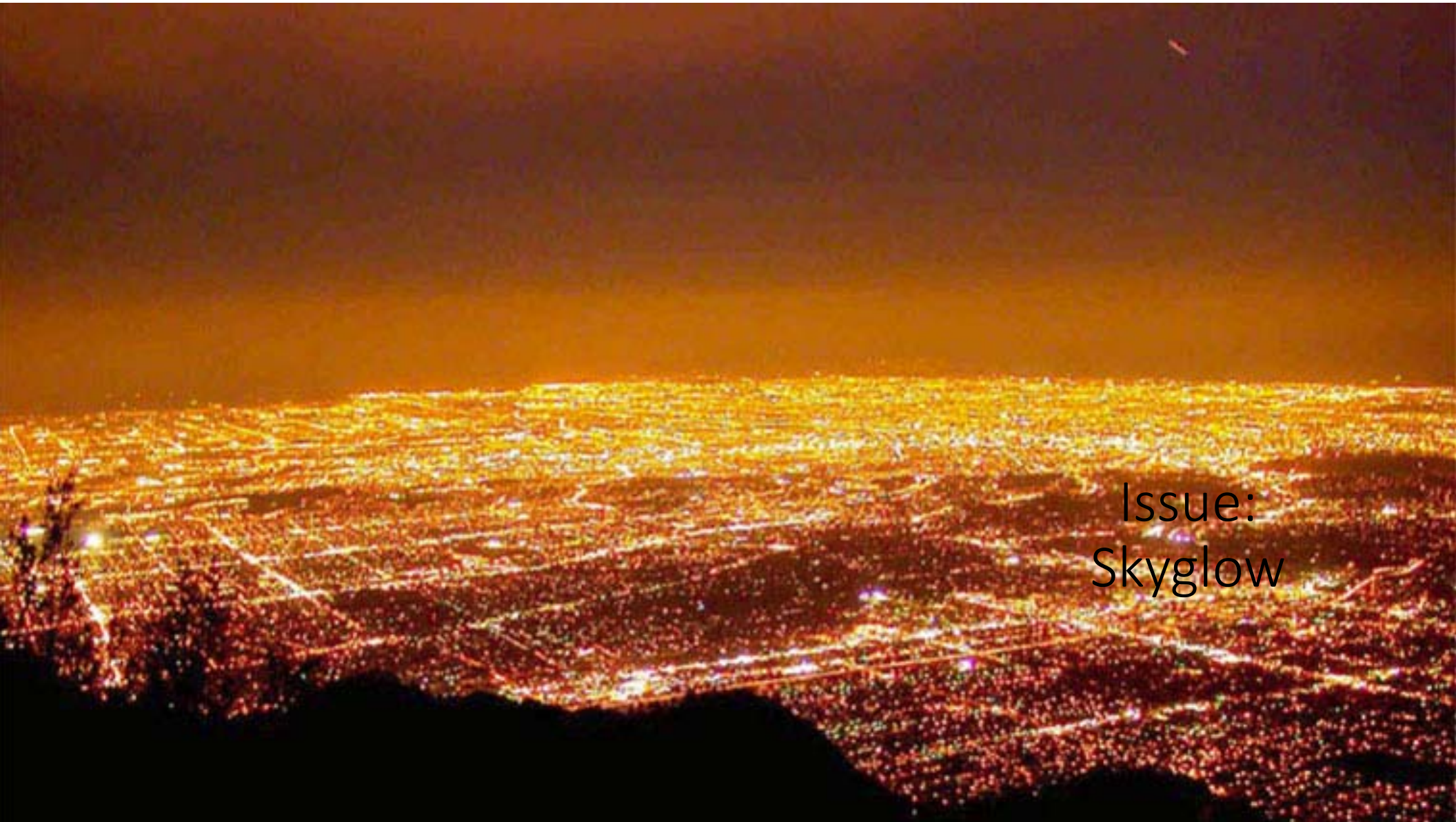
10% GLARE

40% PRODUCTIVE

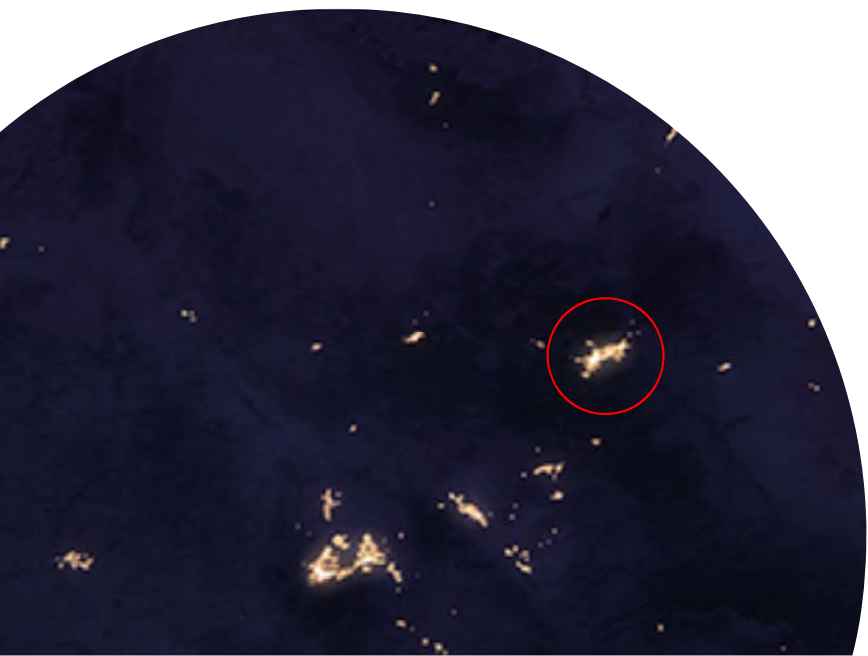




Issue:
Skyglow



Issue:
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From The Ground Up I: Light Pollution Sources in Flagstaff, Arizona

Christian B. Luginbuhl, G. Wesley Lockwood, Donald R. Davis, Kevin Pick and Jennifer Selders



*Publications of the
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V magnitudes per square arc second



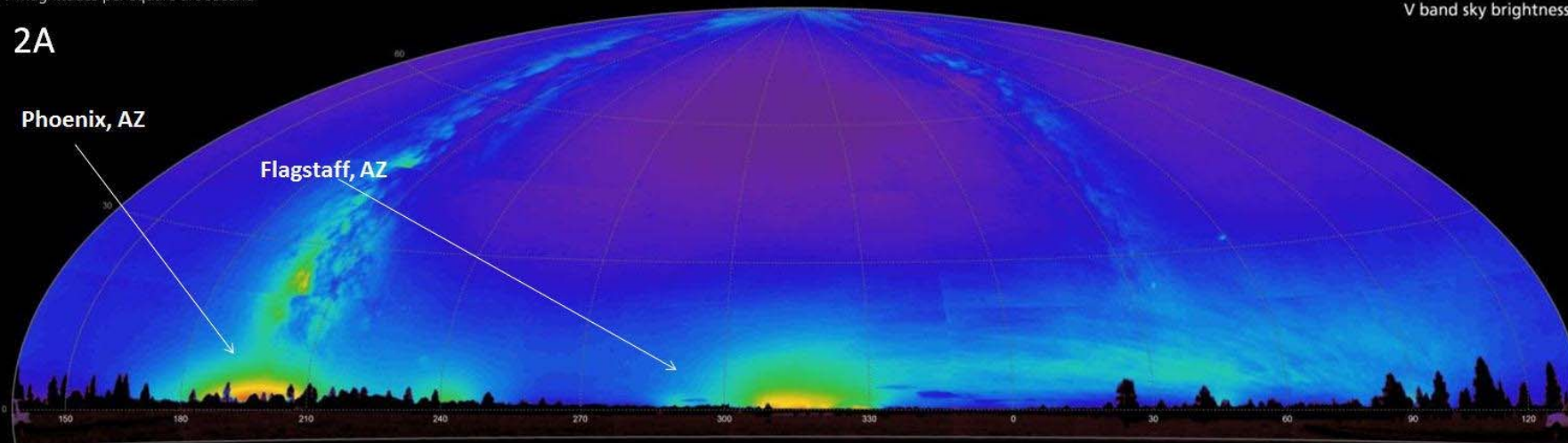
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V band sky brightness

2A

Phoenix, AZ

Flagstaff, AZ



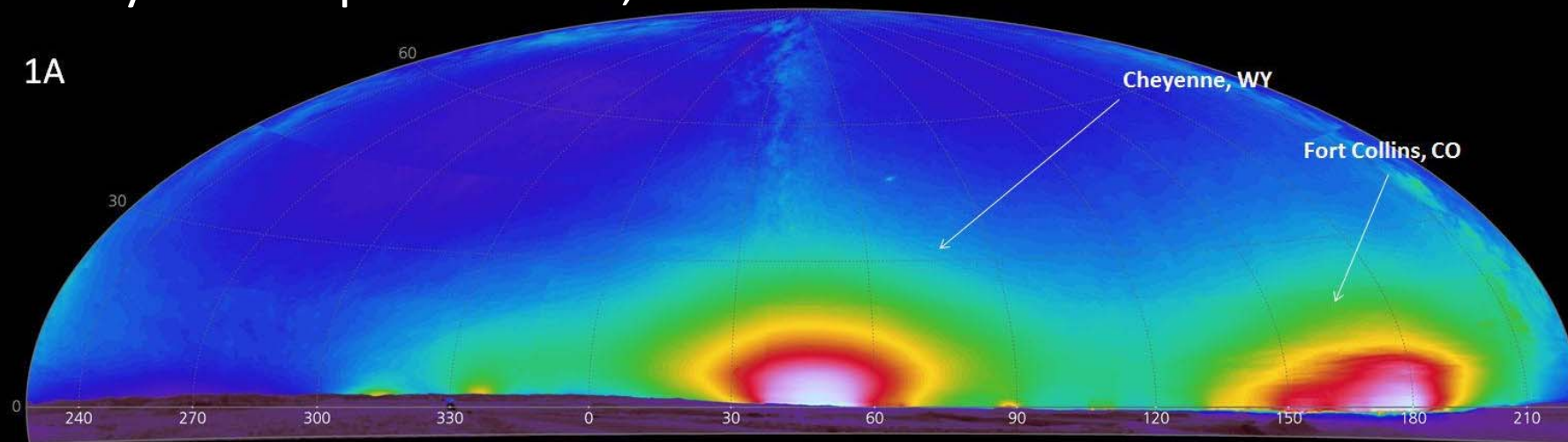
Cheyenne Population: 64,000

Soapstone Prairie Natural Area, Colorado August 2, 2016 23.9 hours LMT

1A

Cheyenne, WY

Fort Collins, CO



Methods to Achieve Desired Outcomes

Tactics	Full Cut-off	X	X		X	X
	Height Limitations	X				X
	Illumination Max.	X	X		X	X
	Spectrum Control		X	X		
	Automatic Timers				X	X
	Photometric Plan	X	X	X	X	X

Tactic Details

- Full cut-off light fixtures are required for any light illuminating the equivalent of a standard 60w bulb.
- A maximum height of 18 feet for all light fixtures.
- All light fixtures are to be pointed downward.
- Maximum lighting output is regulated by establishing a maximum average illumination of the ground.
- Limits on the amount of light that may spill over a property line, measured at eye-level.
- Limiting lights to warm (red/orange/yellow) hues in the color spectrum.
- Requires walkway lighting.
- Requires automatic shut-off one-hour after sun down or the close of business (except for security lighting – max 25% of fixtures).
- Establishes a maximum amount of illumination per net acre.
- Establishes exceptions for a limited list of land uses.
- Amend city street light standards for consistency and adopts by ordinance.
- If this ordinance is adopted, all existing lighting provisions in the City code will be consolidated into this chapter.

Applicability

Option A

- New development (excluding SFR)
- Uses/structures increased in size by 25% or more (excluding SFR)

Option A

- New development (including SFR)
- Uses/structures increased in size by 25% or more, SFR increased by 50%

Request

- Provide Preliminary Feedback on Scope/Direction

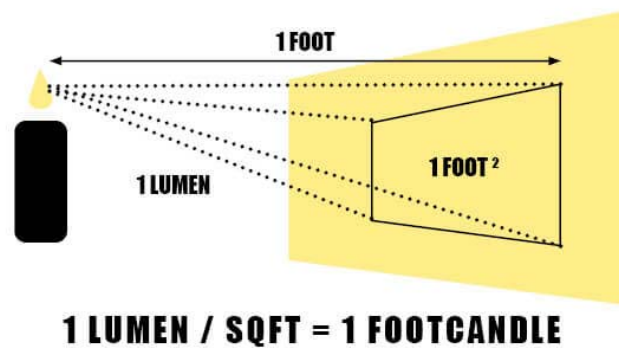
Next Steps

- Finalize Proposal for Consideration by the Planning Commission
- Planning Commission to Make Recommendations to the City Council

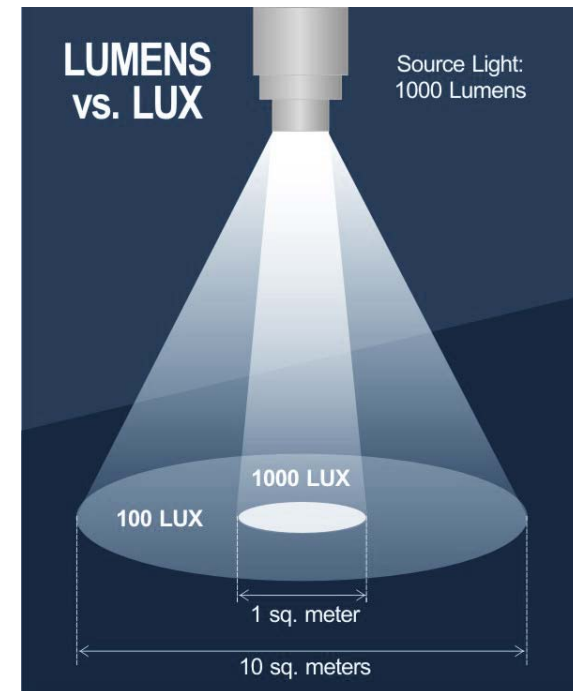
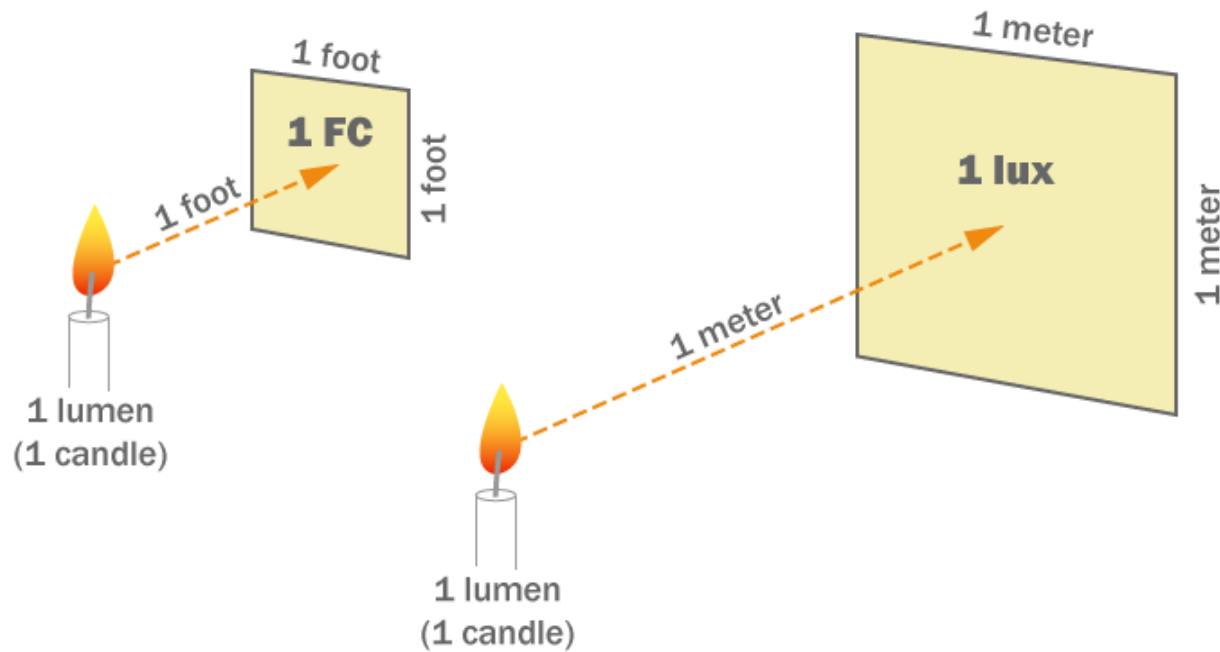
Visual Glossary – Foot Candle



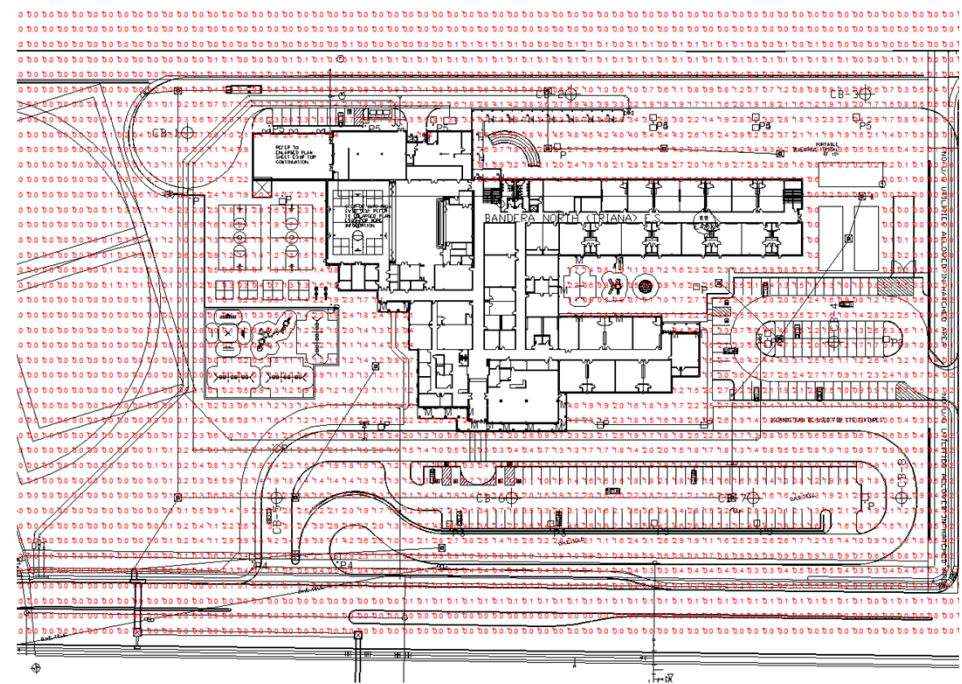
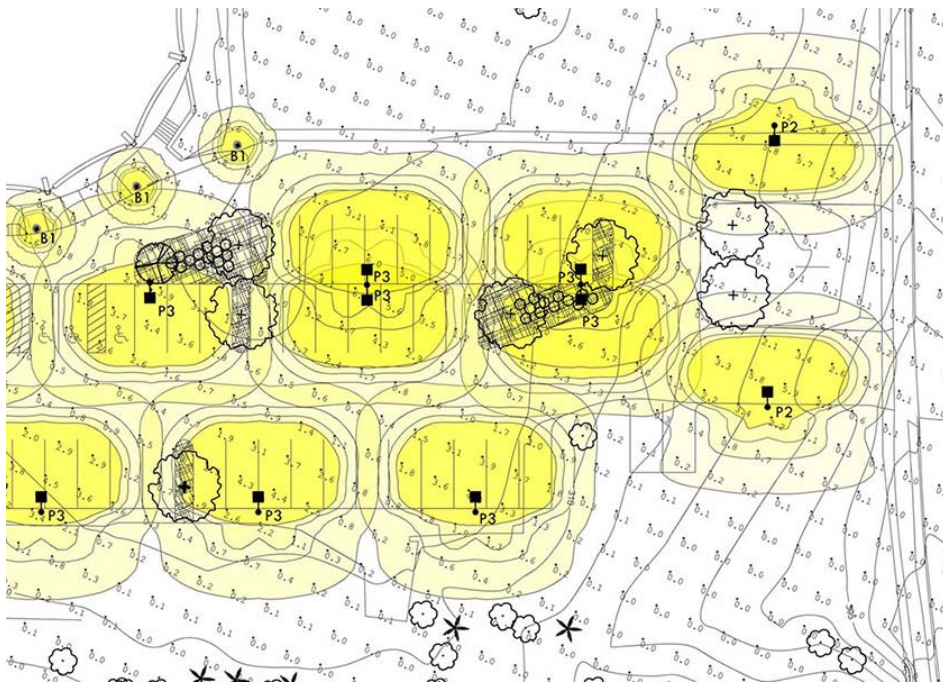
FOOTCANDLE



Visual Glossary – Lumen



Visual Glossary – Photometric Plan



Current Zoning Lighting Standards

Zone	RO – Residential Office	NC – Neighborhood Commercial	MU – Mixed Use	CR – Regional Commercial	O-R-D – Office, Research, and Development	PDD – Planned Development District
Objective	19.35.110 Lighting. A. Uniformity of lighting is desirable to achieve an overall design objective of continuity, and to avoid objectionable glare to adjacent residential areas .	19.37.110 Lighting. A. Uniformity of lighting is desirable to achieve an overall objective of continuity, and to avoid objectionable glare.	19.36.120 Lighting. A. Uniformity of lighting is desirable to achieve an overall objective of continuity and to avoid objectionable glare.	19.40.140 Lighting. A. Uniformity of lighting is desirable to achieve an overall objective of continuity, and to avoid objectionable glare.	19.46.110 Lighting. A. Uniformity of lighting is desirable to achieve an overall objective of continuity, and to avoid objectionable glare.	19.51.060.13. Lighting Standards. (c) Uniformity of lighting is desirable to achieve an overall objective of continuity, and to avoid objectionable glare.
Height of Luminaries	B. The maximum height of luminaries shall be 18 feet unless the planning commission requires a lower height as part of its approvals.	B. The maximum height of luminaries shall be 18 feet unless the planning commission requires a lower height as part of its approvals.	B. The maximum height of luminaries shall be 18 feet unless the planning commission requires a lower height as part of conditional use approval .	B. The maximum height of luminaries shall be 18 feet unless the planning commission requires a lower height as part of its approval .	B. The maximum height of luminaries shall be 18 feet unless the planning commission requires a lower height as part of its approvals.	(a) The maximum height of luminaries shall be based on the lighting plan approved by the PDZ ordinance .
Brightness	The light shall be low intensity, full cut-off , shielded from uses on adjoining lots, and directed away from adjacent property in a residential zone or an adjacent residential use.	The light shall be low intensity, shielded from uses on adjoining lots, and directed away from adjacent property in a residential zone or an adjacent residential use.	The light shall be low intensity, shielded from uses on adjoining lots, and directed away from adjacent property in a residential or agricultural zone or an adjacent residential or agricultural use .	The light shall be low intensity, shielded from uses on adjoining lots, and directed away from adjacent property in a residential zone or an adjacent residential use.	The light shall be low intensity, shielded from uses on adjoining lots, and directed away from adjacent property in a residential zone or an adjacent residential use.	The light shall be low intensity, shielded from uses on adjoining lots, and directed away from adjacent property in a residential zone or an adjacent residential use.
Walkways	C. Pedestrian walkways shall be lighted with bollards or lights at a maximum height of ten feet .	C. Pedestrian walkways shall be lighted.	C. Pedestrian walkways shall be lighted.	C. Pedestrian walkways shall be lighted.	D. Pedestrian walkways to mass transit facilities shall be lighted.	(d) Pedestrian walkways shall be lighted.
Fixture Type		D. All lighting next to residential uses, or where the planning commission requires, shall be full-cut-off lighting to reduce light pollution	D. All lighting next to residential zones, or where the planning commission requires, shall be directional; shall contain hoods or other measures to hide the light source; shall be no more than 15 feet in height to reduce light pollution and light spillage to the adjacent residential zone . The city may require a photometric study to be provided by the applicant demonstrating that such unacceptable light spillage to adjacent residential zones will not result, as determined by city staff.	D. All lighting next to residential uses, or where the planning commission requires, shall be full-cut-off lighting to reduce light pollution.	E. All lighting next to residential uses, or where the planning commission requires, shall be full-cut-off lighting to reduce light pollution.	
Photometric Study						
Curfew					C. All parking luminaries, except those required for security, shall be extinguished one hour after the end of business hours. The exception for security lighting applies to a maximum of 25% of the total luminaries used, unless the planning commission approves a higher percentage.	(b) All parking luminaries, except those required for security, shall be extinguished one hour after the end of business hours. An exception for security lighting will apply to a maximum of 25% of the total luminaries used, unless the PDZ ordinance specifies a higher percentage .