

A LIGHTING INVENTORY MANUAL FOR THE OREGON OUTBACK



Not dark sky friendly



Dark sky friendly light

November 2021

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OREGON OUTBACK LIGHTING INVENTORY



Introduction

Members of the Oregon Outback Dark Sky Network (ODSN) are embarking on a nomination for what would be by far the world's largest International Dark Sky Place (IDSP) per a global program managed by the International Dark-Sky Association (IDA), a non-profit organization. IDA does not choose places to nominate, rather members of the public nominate places to IDA via a rigorous application process that usually takes one to three years to complete. An important element of the nomination application is a lighting inventory. This toolkit has been prepared to help volunteers conduct the required lighting inventory within the proposed International Dark Sky "Sanctuary."

Artificial Light at Night

Artificial light at night (ALAN) has several intended purposes. In the past, these purposes were mainly wayfinding and aiding community activities to extend into the night. More recently, we are seeing an abundance of outdoor lights that are for marketing, decoration, and what some term "vanity lighting." Architectural lighting (that is, illumination for building design and function) was once limited to museums, public buildings, and monuments. This type of lighting has now become popular at even the most modest residences. As lighting gets less expensive to purchase and operate, instead of conserving, people are simply using more lights. We are losing our natural night skies not just from too much, often unnecessary outdoor lighting, but from poor lighting design that incidentally lights the sky instead of the ground or intended building. We've all seen the photographs of ALAN from space satellites. That's wasted light, or "light pollution."

There has been a recent surge in scientific studies regarding the impacts of ALAN on human health and safety, plants and wildlife, and astronomy. The findings are not favorable, particularly with outdoor lighting that yields light from the short-wave spectrum (i.e., blue light). The bottom line is that ALAN is not compatible with the natural circadian rhythms of living organisms. As the Earth revolves each day, we have daylight as we face the sun and night as we turn our backs to the sun. All life has evolved under these conditions. ALAN is important to our modern way of life, so no one is looking to eliminate it. However, we are wise to look at ways to improve how we light the night to reduce or avoid light pollution.

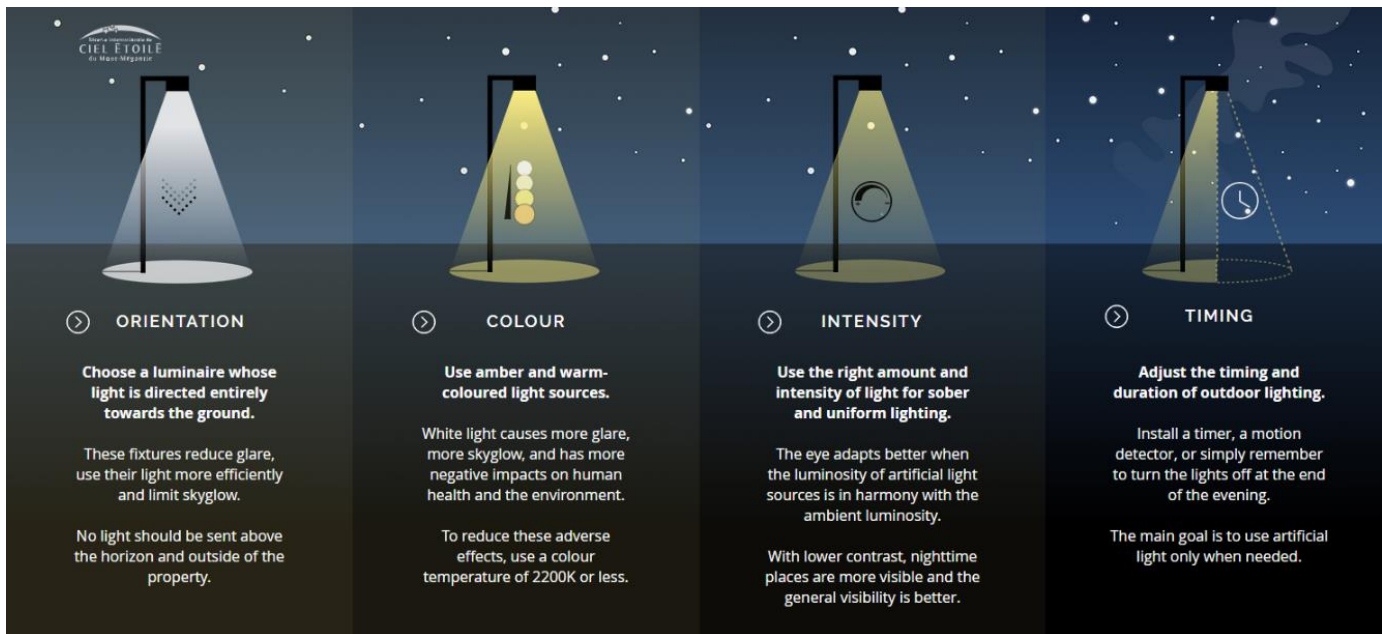


Figure 1. Outdoor Lighting Guidance

Dark Sky Friendly Lighting Goals

What does dark sky friendly lighting (DSFL) mean? Quite simply, the term refers to lights that minimize light pollution, light trespass, glare, and offensive light sources. An easy rule of thumb is to *light only where needed, when needed, no brighter than necessary, avoid or minimize blue light emissions, and be fully shielded*. This guidance is well illustrated in Figure 1, a graphic prepared by the organization that manages the Mont Megantic International Dark Sky Reserve in Quebec Province, Canada. It's the largest reserve in the world and is a poster child for excellent lighting management.

Outback Light Source Clusters and Inventory Sheets

The Oregon Outback covers an area the approximate size of New England. Satellite data was used to determine where to focus the lighting inventory over such a large area. Imaging from NASA's VIIRS Satellite is so sensitive that it can

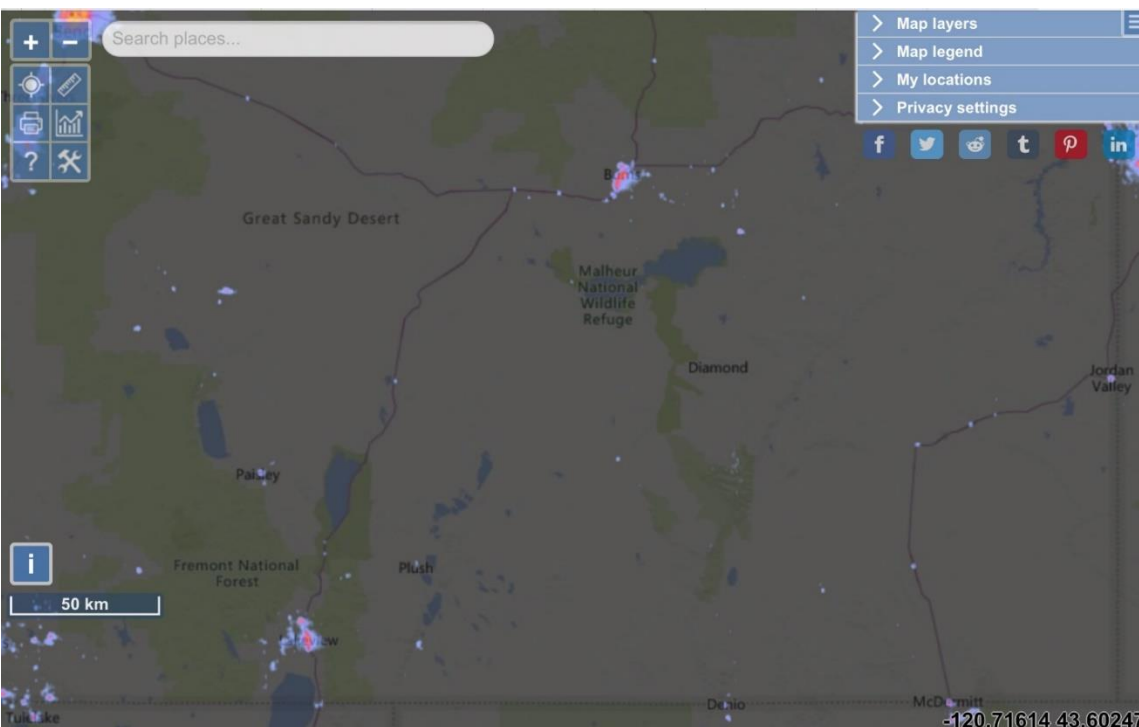


Figure 2. Light sources as detected by NASA's VIIRS Satellite.

usually detect a single street light. As shown in Figure 2, there are only a few light sources in the Outback that are readily seen from space. Two of these sources (or light clusters) are from temporary, controlled brush pile burns in the Fremont-Winema National Forest. Most are from incorporated cities, small towns, state waysides, and agricultural complexes. Light radiance measures 0.11-0.88 at sites within the proposed sanctuary boundaries. For comparison, the VIIRS Satellite radiance measurement for a neighborhood in Portland 4 miles from downtown is over 18.0! So, though light is detected from sites within the sanctuary boundaries, it's negligible to minimal.

Several larger scale maps were created (Appendix A) to locate light clusters for each of the three counties (i.e., Lake, Harney, and Malheur). Maps were numbered by using the first letter of each county (e.g., Map L1, H2, and H3). Clusters within each large scale map and approximate to the sanctuary boundary were also numbered. A master spreadsheet was developed to track the clusters and to add additional source data (for Lake County Phase 1A only) based on additional remote sensing data (e.g., aerial photography). Some of the clusters were found to be sky glow from nearby sites. This inventory approach labels clusters by map and number on map. For example, a spreadsheet labeling of L2/3 would indicate cluster site 3 found on map 2 of Lake County.

Volunteers are asked to use the inventory forms in Appendix B to conduct an on-the-ground lighting inventory at or near each cluster site closest to them. Information for each cluster site will then be entered into a spreadsheet similar to that shown in Figure 3. **Instructions for completing the forms and spreadsheets are provided below.**

LIGHTING INVENTORY TEMPLATE











Fixture ID	Location	Function	No. of Fixtures	Lamps per Fixture	Fixture Type	Lamp Type	Color Temp (K)	Lumens	Hazards	Shielding State	Operable?	Adaptive Controls?	LMP Compliant?	Closeup Photo	Context Photo	Notes
1	Restroom Building at parking lot of Visitor Center	Building egress	8	1	Can	Par16 Amber lamp, 3W	1800	120	None	Fully	Yes	None	Yes			Some additional shielding provided by the building eaves
2	Path near Visitor Center	Wayfinding	22	1	Post	8 5W Amber A-lamp; 4 yellow LED or CFL "bug ilites"	<2700	200	Uneven surface	Partially	Yes	None	8 Yes / 14 No			To be replaced with fully-shielded bollards in 2018
3	Administration Building	Building approach	1	2	Spot	8W Par30 Amber LED	1800	320	Steps	Eave	Yes; only one socket in use	Motion sensor	Yes			
4	Laboratory Building	Building egress	1	1	Jelly jar	3W Par16 Amber LED	1800	320	None	Unshielded	No	None	No			Rarely used; will be disconnected from utility power
5	Staff housing	Building egress	1	1	Wallpack	7W Amber LED	1800	280	Step	Fully	Yes	None	Yes			

Figure 3. Lighting Inventory Template Example

Master Location: Include the cluster site code (e.g., L2/3, H2/11, M3/15) based on map number and cluster number.

GPS Coordinates: Include GPS coordinates (longitude/latitude) confirming the one provided in the master spreadsheet, or if not provided or confirmed, based on the use of free applications (apps) of your choice that can automatically provide GPS coordinates of your location once activated. Free apps include, but are not limited to *Google Earth* and *Coordinates – GPS Formatter*.

Specific Location: Provide a short description of where the lighting is located (e.g., “State Parks wayside,” “maintenance complex,” “ranch yard”).

Function: Identify the basic purpose or intended task of the lighting. If the function is not evident, select “Unknown.”

Examples include:

- Area (illuminates a large area of ground),
- Decorative (serves no safety or task performance purpose, but is installed for aesthetic reasons),
- Egress (as from a structure),
- Pathway (to prevent tripping or to point out a drop-off),
- Parking,
- Roadway,
- Safety (to point out specific safety hazards),
- Security (intended to discourage or prevent the incidence of property or violent crime; *note that IDA does NOT considered this a valid reason for lighting in an International Dark Sky Park/Reserve/Sanctuary*),
- Sign (as in a form of advertising), and
- Wayfinding (safe transit between points, marking, e.g., the edges of a trail).

Number of Fixtures: If more than one identical fixture is present at a discrete location, group these together. For example, a restroom building might have several identical fixtures on its various sides or under an eave.

Fixture Type: The variety of fixture, usually relating to its function. Examples are shown in Figures 4 and 5.



Barn



Bollard



Can



Ceiling



Emergency



Flood



Phone Booth



Pole



Spot



String



Vending Machine



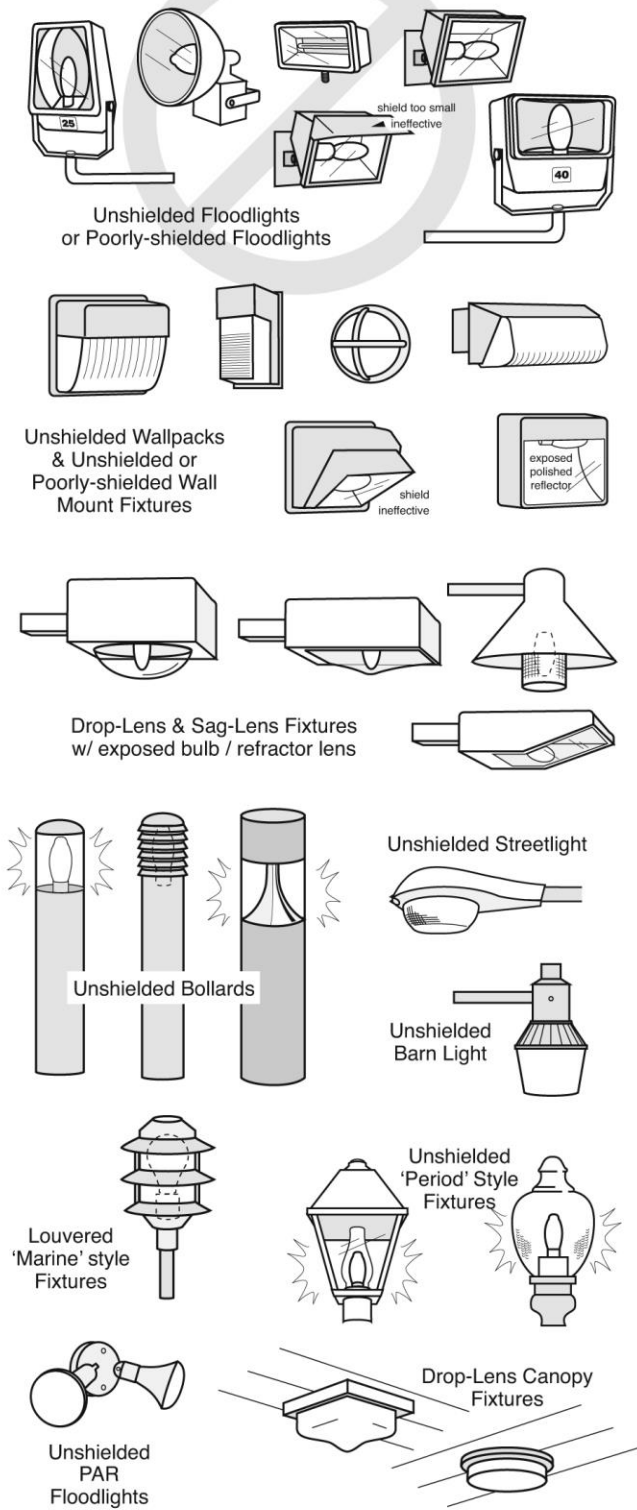
Wallpack

Figure 4. Varieties of Fixture Types

Examples of Acceptable & Unacceptable Lighting Fixtures

Unacceptable/Not Compliant

Fixtures that produce glare and light trespass



Acceptable/Compliant

Fixtures that shield the light source to minimize glare and light trespass and to facilitate better vision at night

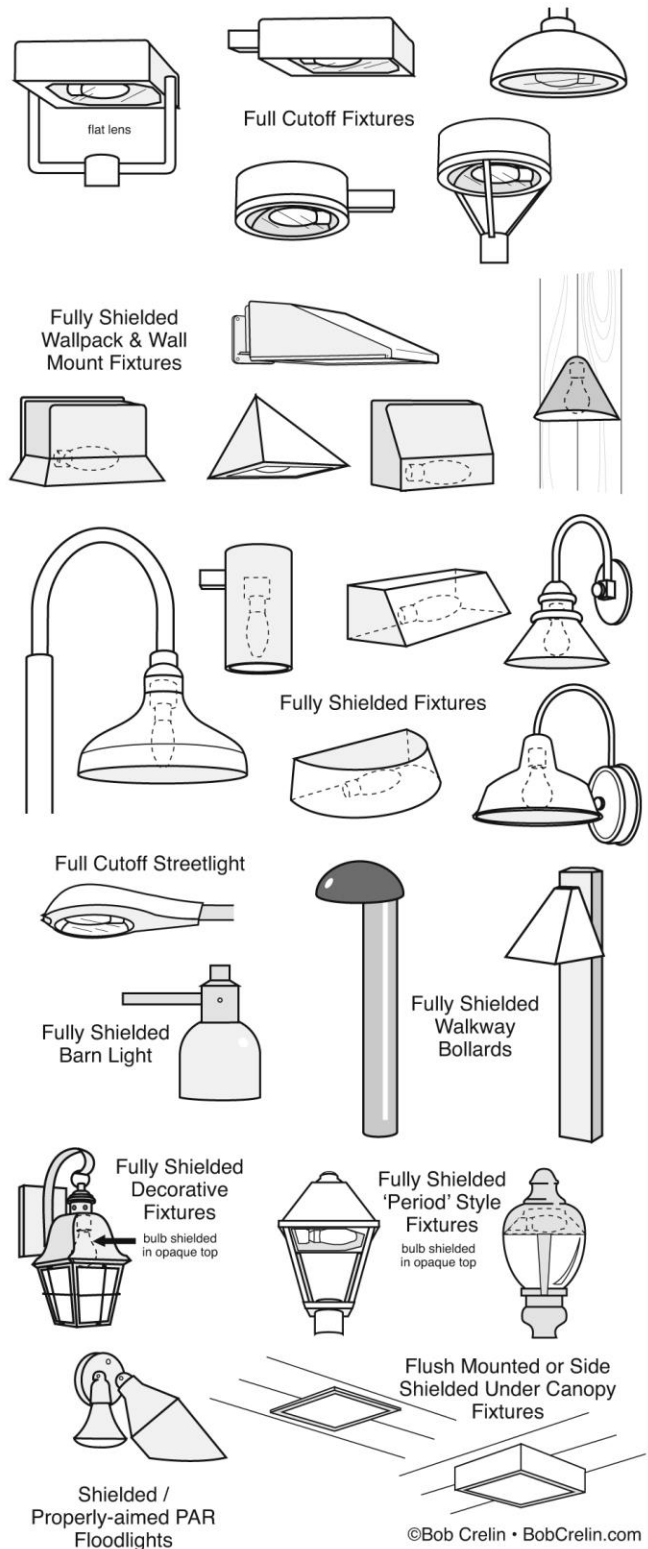


Figure 5. Examples of Acceptable and Unacceptable Lighting Fixtures

NOTE: If a fixture is identified as one of the “unacceptable” fixtures in Figure 5 and if it is unlikely that the fixture could be easily and safely modified to produce shielding, reduce brightness, or change color temperature, **then skip other fixture and lamp questions.** Such information would be moot if it’s clear the fixture would be more practically replaced than modified. For example, given the poor energy efficiency and color spectrum of a fluorescent tube light, such lights warrant replacement. There is no practical modification. However, it is possible to use parshields™ on PAR floodlights to shield them and make them dark sky friendly, and it is possible to change the bulbs to fewer lumens and a warmer color temperature. If equipped with a motion detector that is not activated, this feature could simply be used.

Lamps per Fixture: The number of discrete lamps per individual fixture, regardless of the number of fixtures at a site. The total number of lamps at a site = number of fixtures × lamps per fixture. For example, floodlights often come two lamps per fixture.

Lamp Type: The source of light. Examples include:








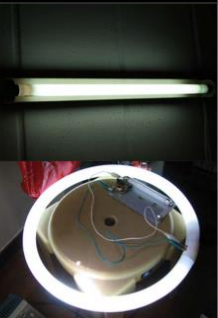









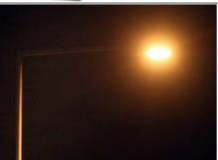



Type	Appearance	Spectrum			
			Incandescent		
CFL			LED (left: ‘cool white’; right ‘warm white;)	 	
Fluorescent Tube			LPS		
			Mercury Vapor		
Halogen			Metal Halide		
HPS			Neon		

Figure 6. Variety of Lamp Types

Color Temp (K): The Correlated Color Temperature (CCT) of the lamp, expressed in Kelvins. This information is obtained from the product packaging of new lighting or from manufacturer data sheets. It can also be determined in the field using a spectrometer. Absent a spectrometer, simply observe the lamp on at night and select the closest color match to the chart shown in Figure 7. Enter the approximate Kelvin temperature to the nearest thousands place. If the CCT cannot be determined, enter “Unknown.”

Lumens: The number of lumens of light emitted by a given lamp. This information is obtainable from the product packaging of new lighting, or from manufacturer data sheets. It cannot be exactly determined in the field. However, if a light is too bright, it will produce glare. If you observe glare, state “glare” in the lumens box.

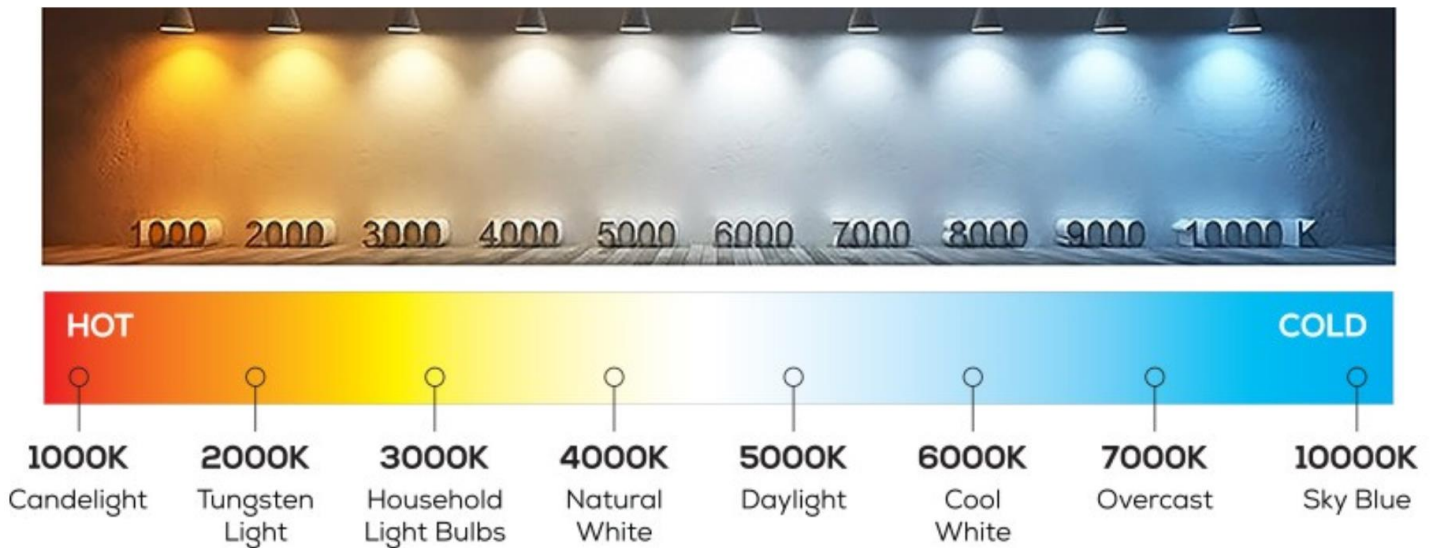


Figure 7. Correlated Color Temperature Comparison Chart

Hazards: What safety hazard is the lighting intended to mitigate? If no hazards are evident, enter “None.” If hazards cannot be determined, enter “Unknown.”

Hazard examples include:

- Curb
- Pathway
- Stairs (indicating multiple steps)
- Uneven surface
- Water

Shielding State: To what extent is the fixture shielded? Choose one of the following as illustrated in Figure 8:

- Fully Shielded (shielded in such a way that no light can be seen above a horizontal plane passing through the lowest light-emitting part of the fixture with respect to the illuminated surface)
- Partially Shielded (some shielding, usually of the fixture top, but not meeting the definition of ‘fully shielded’)
- Unshielded (shielding is not a part of the design, with light emitted or diffused from all surfaces other than the mounting point)
- Other (some other arrangement not captured by ‘fully shielded,’ ‘partially shielded,’ or ‘unshielded’)
- Unknown (unable to determine in the field)

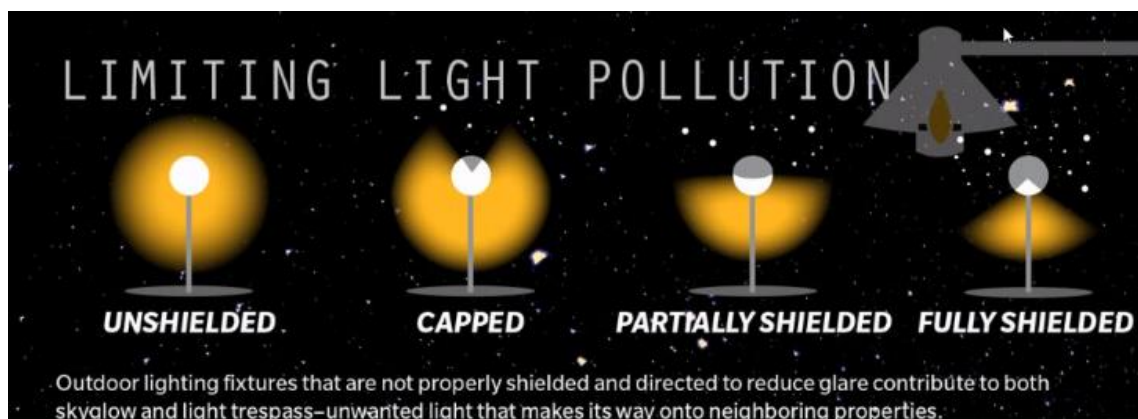


Figure 8. Examples of Light Shielding

Operable?: [Can the fixture be operated according to the manufacturer’s instructions?](#) Response options are “Operable,” “Inoperable,” or “Unknown.” Lights are typically inoperable because they are fully disconnected from a power supply, and are thus considered LMP-compliant by nature. Note that a light with a broken switch or missing lamp is not considered “inoperable.”

Adaptive Controls: Any electronic or mechanical device attached to a light intended to dynamically control the duration, intensity, or area illuminated by the lighting.

Examples:

- Automatic switch
- Motion sensor
- Timer

LMP Compliant?: [Does the light meet all of the requirements of the sanctuary’s lighting management plan?](#) Answer yes, no, or uncertain. (Note: this will be finalized at a later date once the Lighting Management Plan is completed). The following types of lighting will automatically be considered compliant:

Lighting controlled with motion-activated switches limiting the duration of illumination to less than five (5) minutes after activation is exempt

Close-up Photo: [Take a photo of the light in place](#) (by day and by night, if possible). Include enough of the image in the frame to reveal some details about it. (Note: When shooting photos of more than one fixture, it’s best to take a blank shot in-between fixtures to keep track of what light goes with what exact fixture). Photos (with the jpg labeled according to fixture label and location) may be sent to fibonacci@comcast.net for inclusion into the spreadsheet. Photo nomenclature example: [L2.3_maintenance shed.jpg](#). (Slashes aren’t allowed in file names. Use a “dot” instead of slash).

Context Photo: [Take an image of the light in place](#), taken from further away to illustrate its function or other contextual information. (See above instructions for tracking and naming photographs).

Notes: [Any additional details not captured by the other columns in the table.](#)

How to Address “Questionable” Lights

No lighting inventory is cut and dry. Volunteers often encounter “head-scratchers” such as those shown in Figure 9. The



Figure 9. Examples of Questionable Lights

photo on the left shows lights under a canopy that is either sloped or quite deep. Light can’t extend “above the horizontal plane.” While not full cut-off fixtures, the placement has the same effect. The lamp cover is obvious, but is the lamp or bulb? Per Figure 5, these lights are considered unacceptable (without consideration of their setting). These lights don’t produce glare and are fairly innocuous. When encountering lights like this, use your best judgement by looking at the fixture and lamp with respect to the guidance shown in Figure 1.

Post Inventory Instructions

Once an inventory form(s) is completed for all light sources within a light cluster, enter the field data onto an online datasheet (easy drop-down menus are provided) per the appropriate light cluster sheet. Contact Dawn Nilson for the link at fibonaccie@comcast.net. If there is any problem with online data entry, scan the form(s) and send it in an email attachment to fibonaccie@comcast.net. Resize photos to fit into the spreadsheet while online, or submit photos for resizing to fibonaccie@comcast.net.

If you have any questions on how to conduct the inventory, contact Dawn J. Nilson at 503.709.2205 or fibonaccie@comcast.net.

Appendix A

Light Cluster Maps by County

Lake County Light Sources

Light clusters falling within the proposed sanctuary boundaries and not stray skyglow are numbered 4, 5, 9 to 13, 15 to 17, 22 to 24. Christmas Valley is no longer considered for inclusion in the sanctuary. Please notify Dawn Nilson at fibonacci@comcast.net to volunteer to inventory one or more cluster.

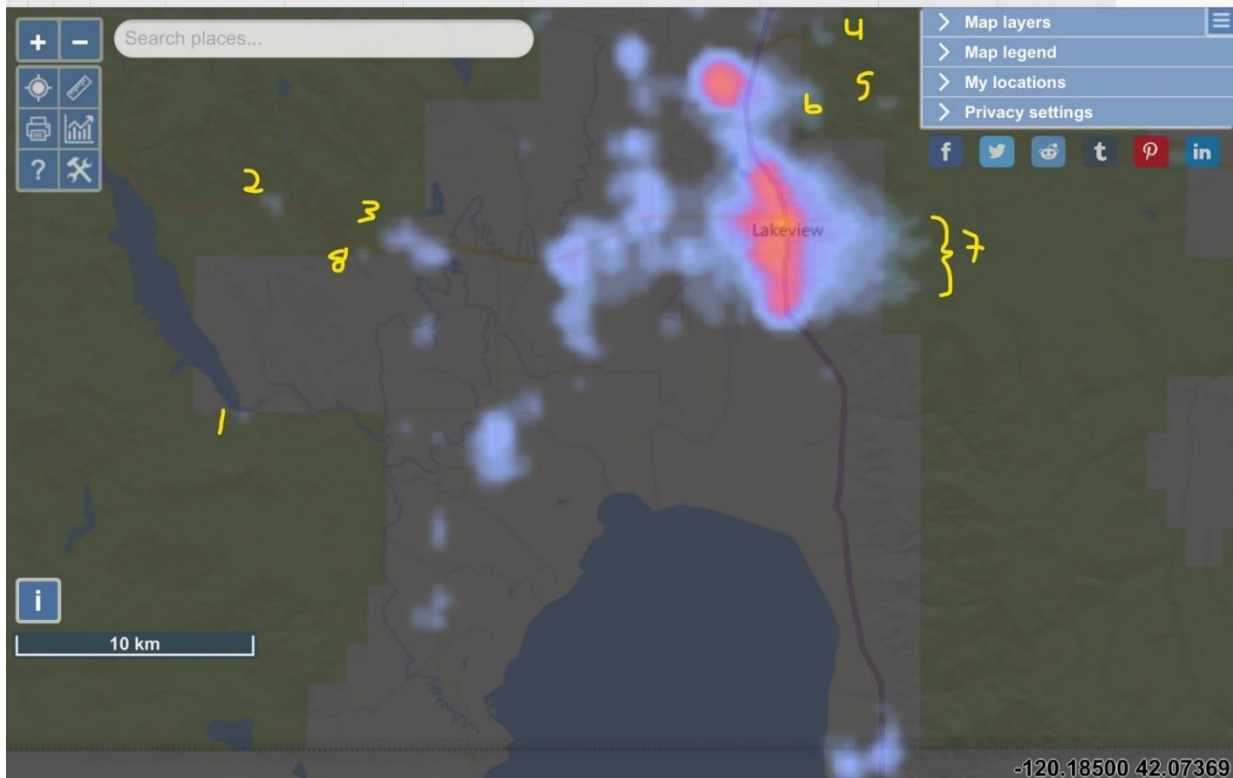


Figure A1. Cluster Map L1: Clusters 1 through 7

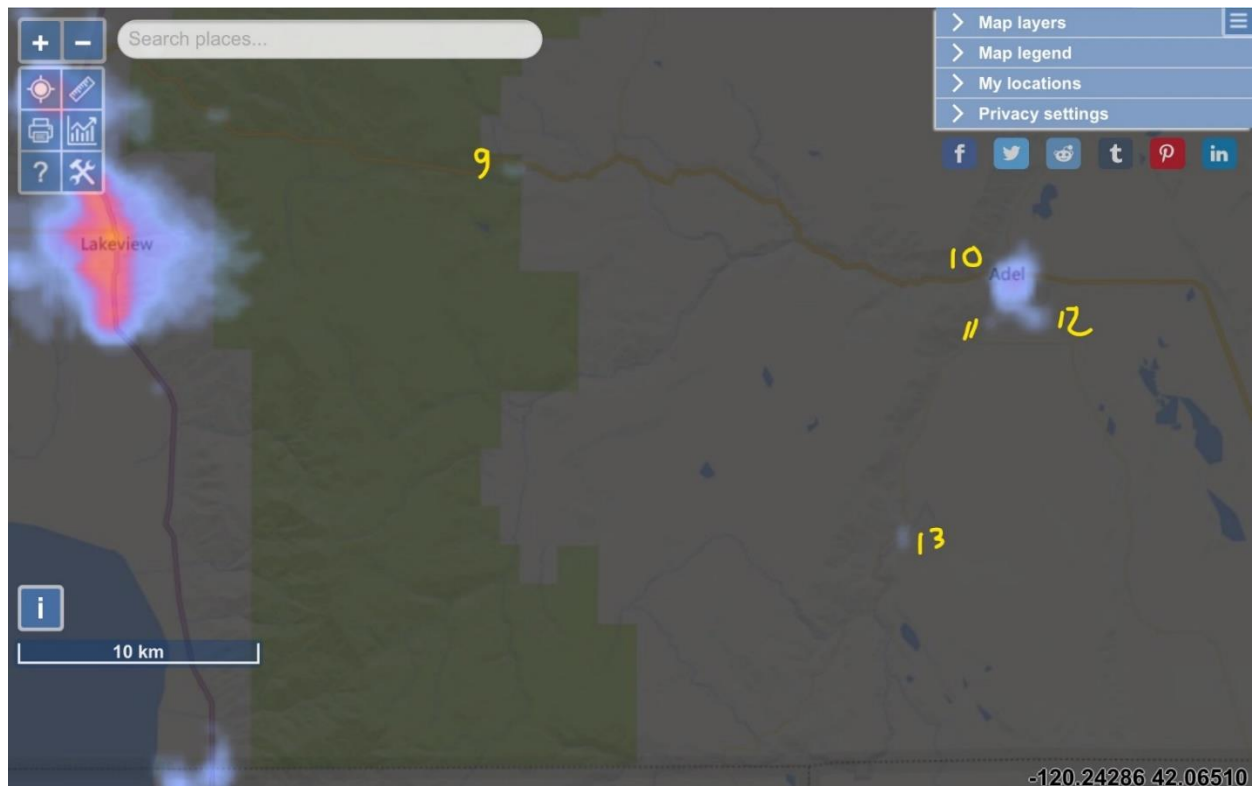
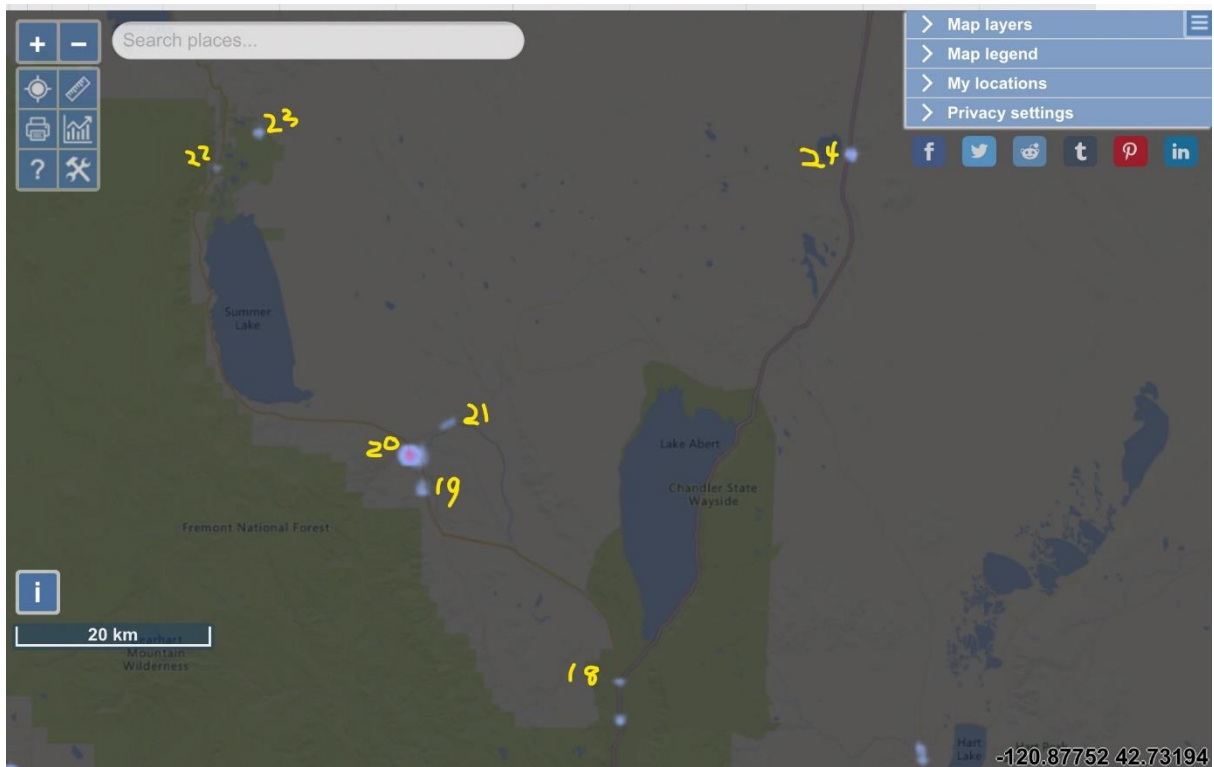
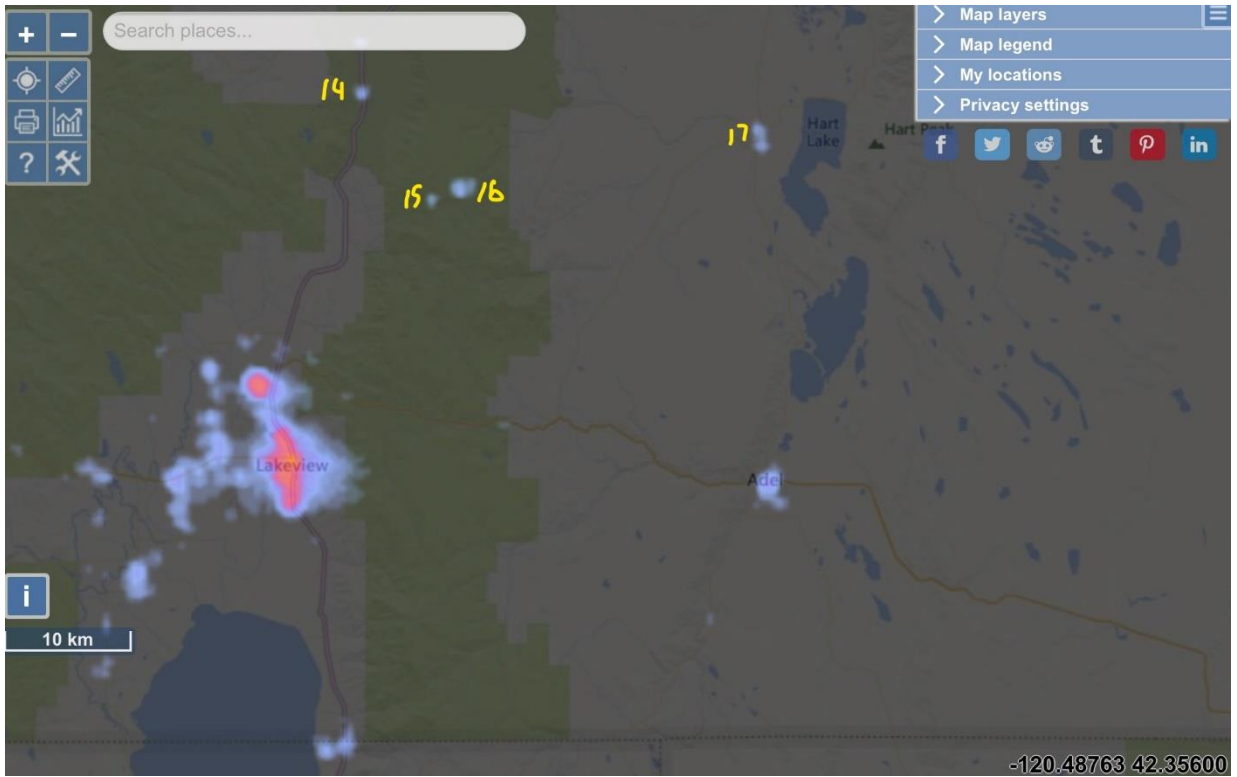


Figure A2. Cluster Map L2: Clusters 9 through 13



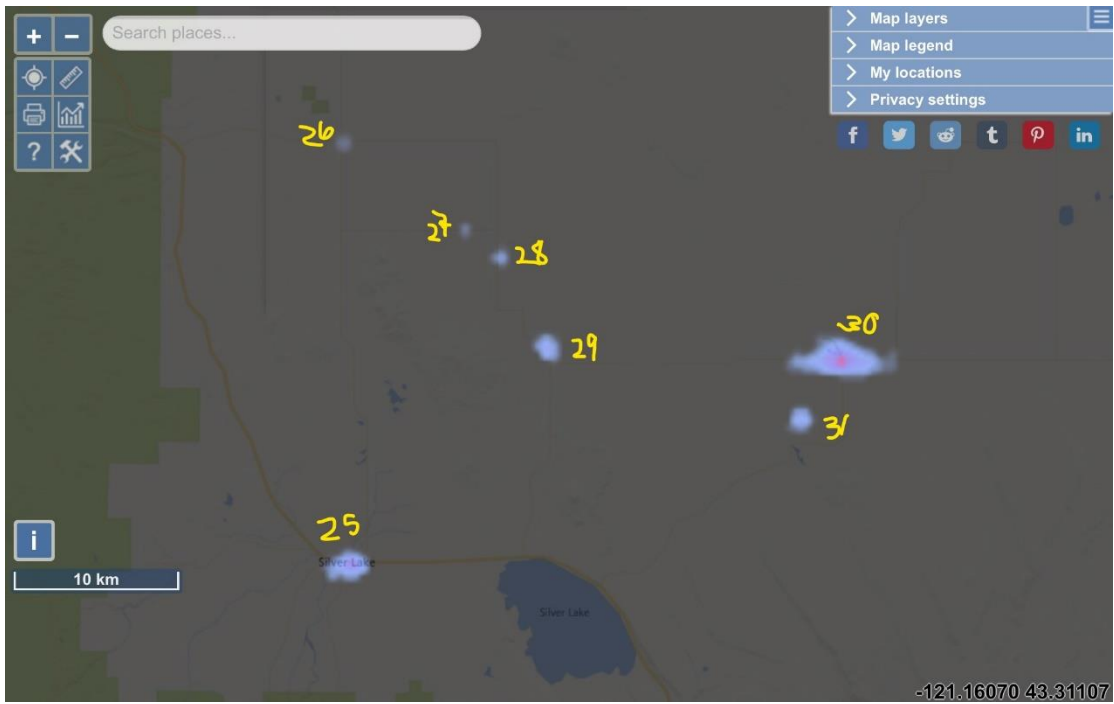


Figure A5. Cluster Map L5: Clusters 25 through 31

Harney County Light Sources

Light clusters falling within the proposed sanctuary boundaries are numbered 1 through 9, 11 to 13, 36, 37, 40, 41, 43 to 45, and 59. (Light sources at Steens Mountain are likely reflective snow caps; some lights show no obvious source). Perhaps there is burning near canals, etc. Please notify Dawn Nilson at fibonacci@comcast.net to volunteer to inventory one or more cluster.

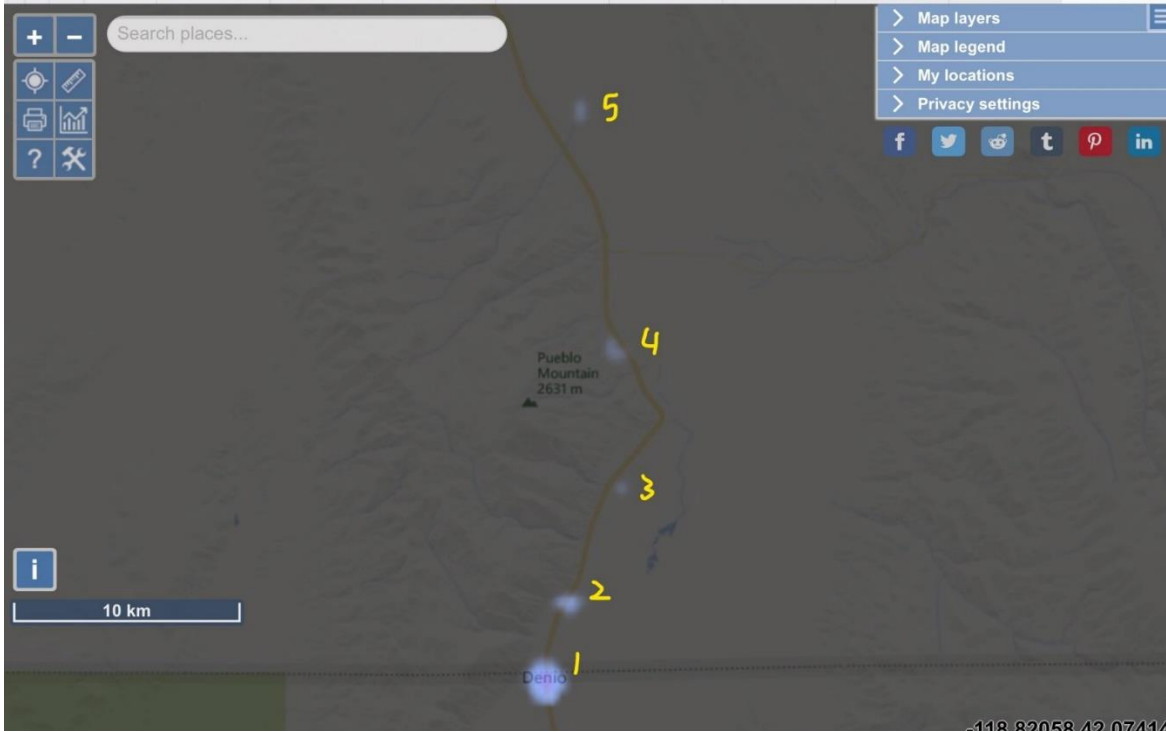


Figure A6. Cluster Map H1: Clusters 1 through 5

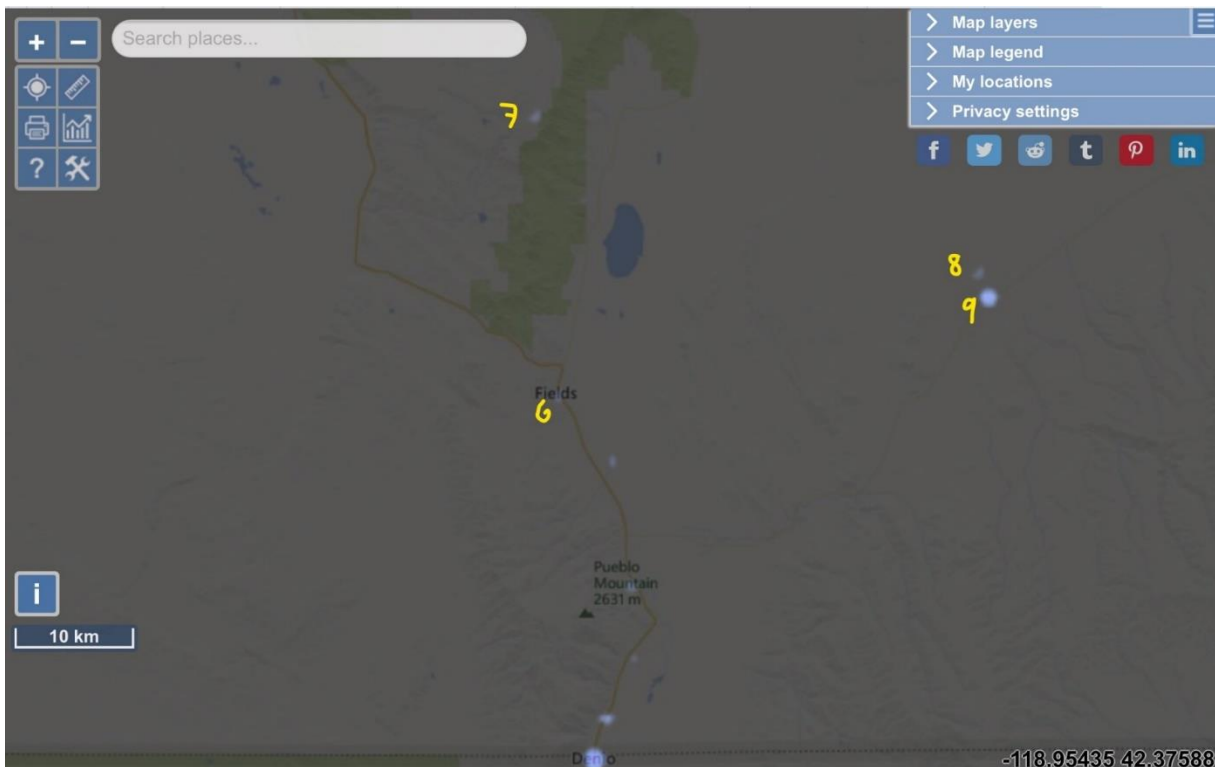


Figure A7. Cluster Map H2: Clusters 6 through 9

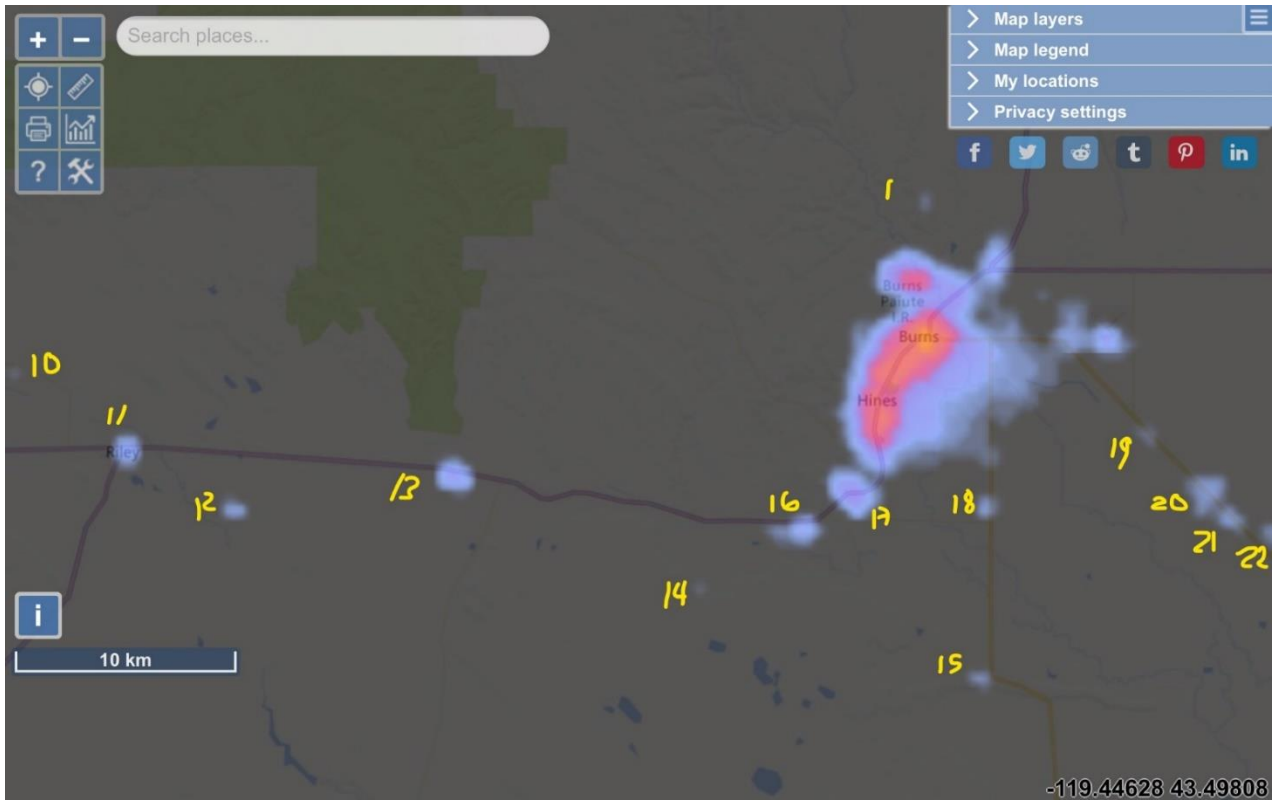


Figure A8. Cluster Map H3: Clusters 10 through 22

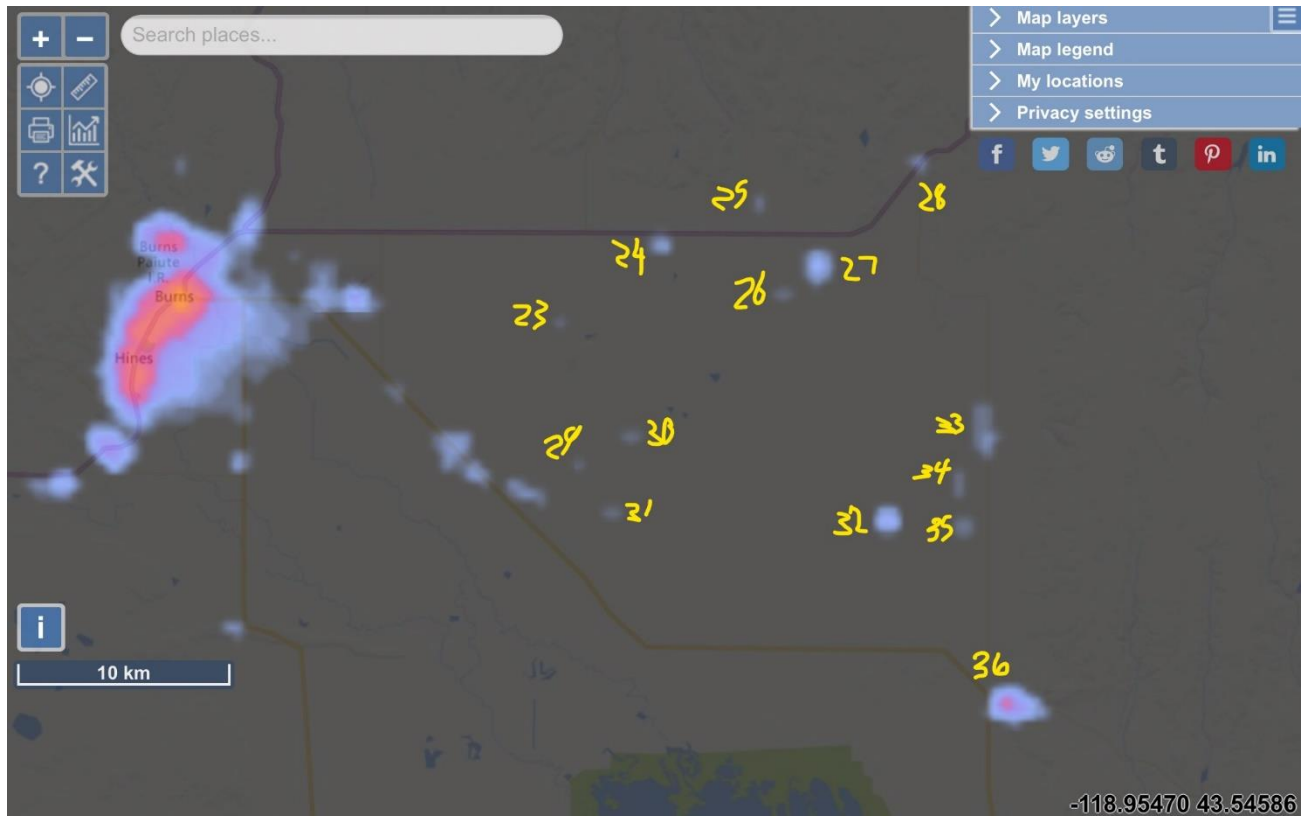


Figure A9. Cluster Map H4: Clusters 23 through 36

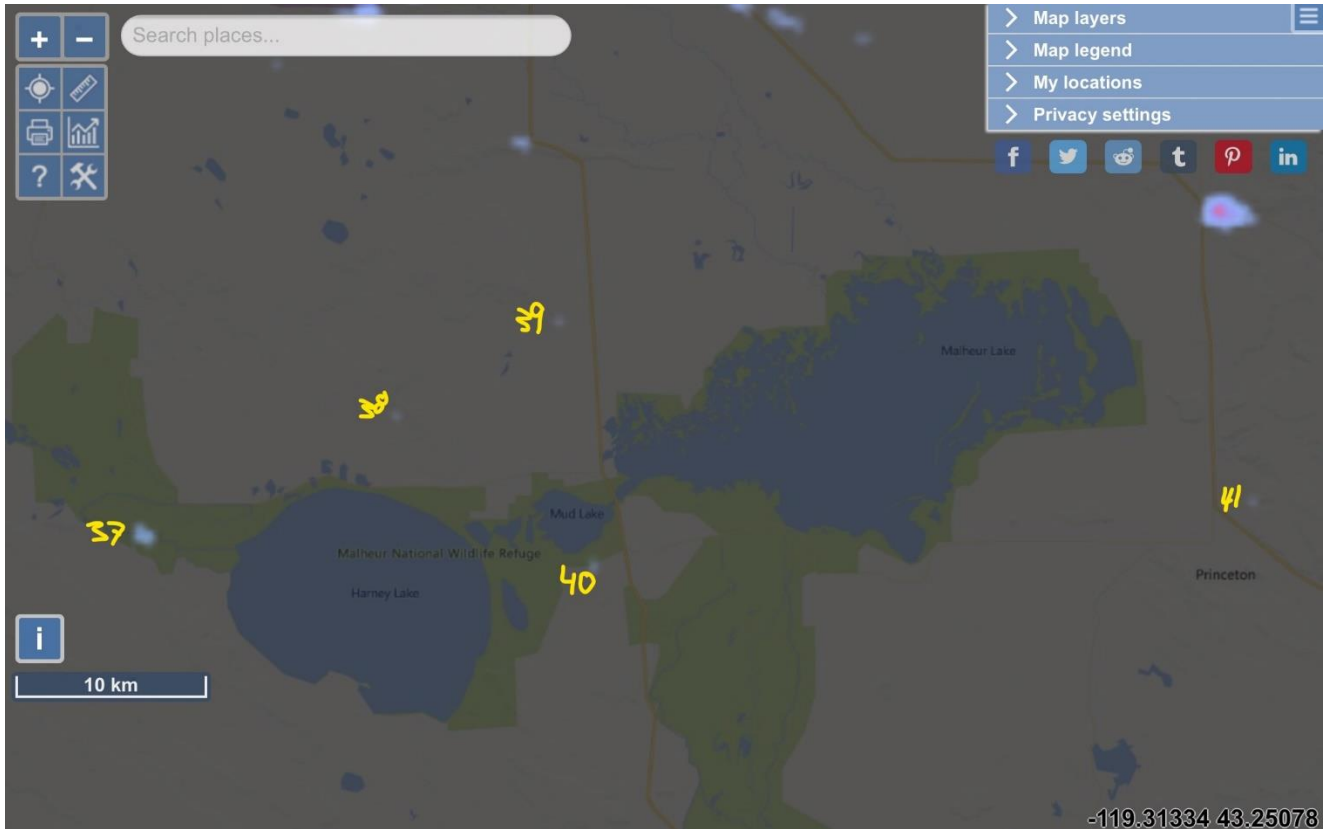


Figure A10. Cluster Map H5: Clusters 37 through 41

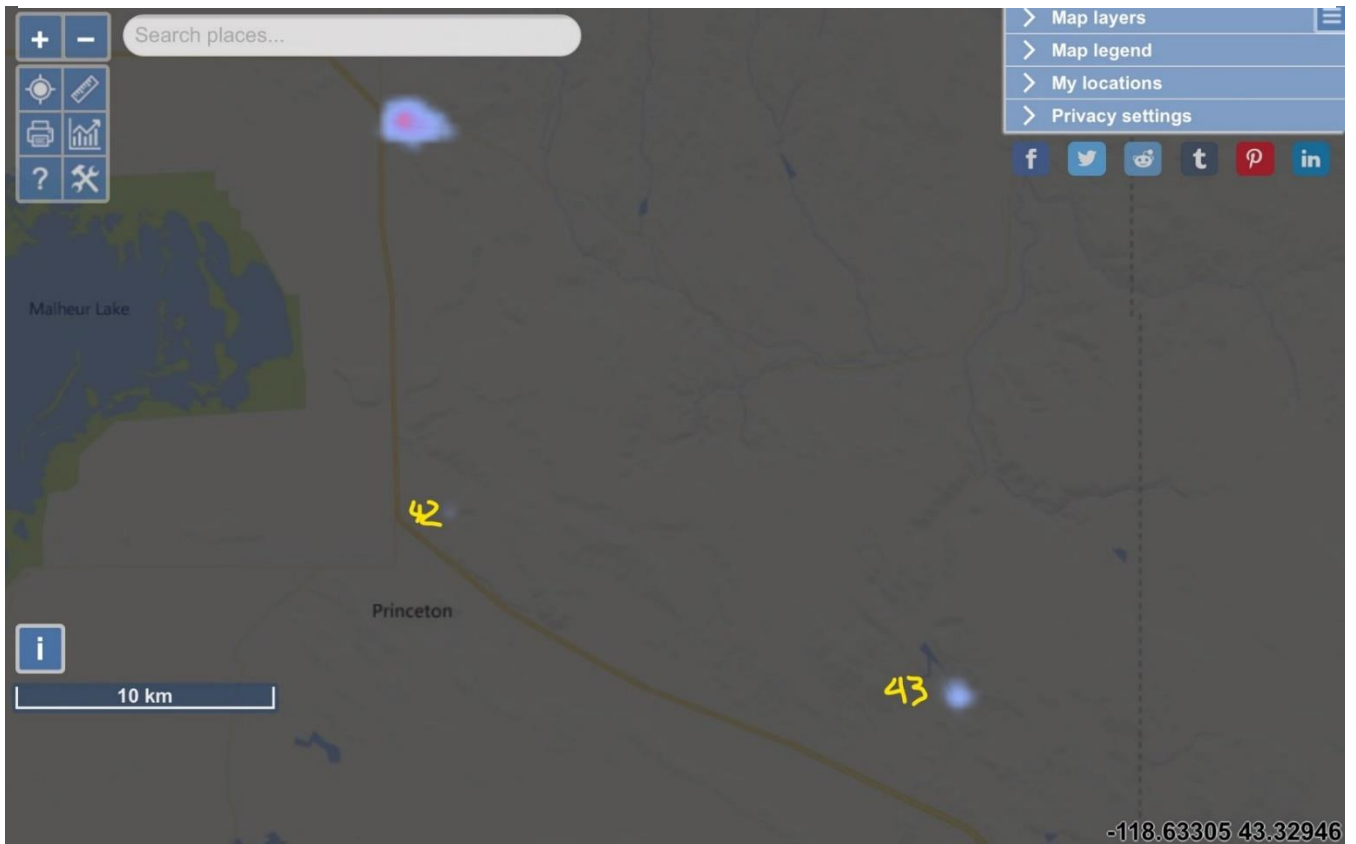


Figure A11. Cluster Map H6: Clusters 42 and 43

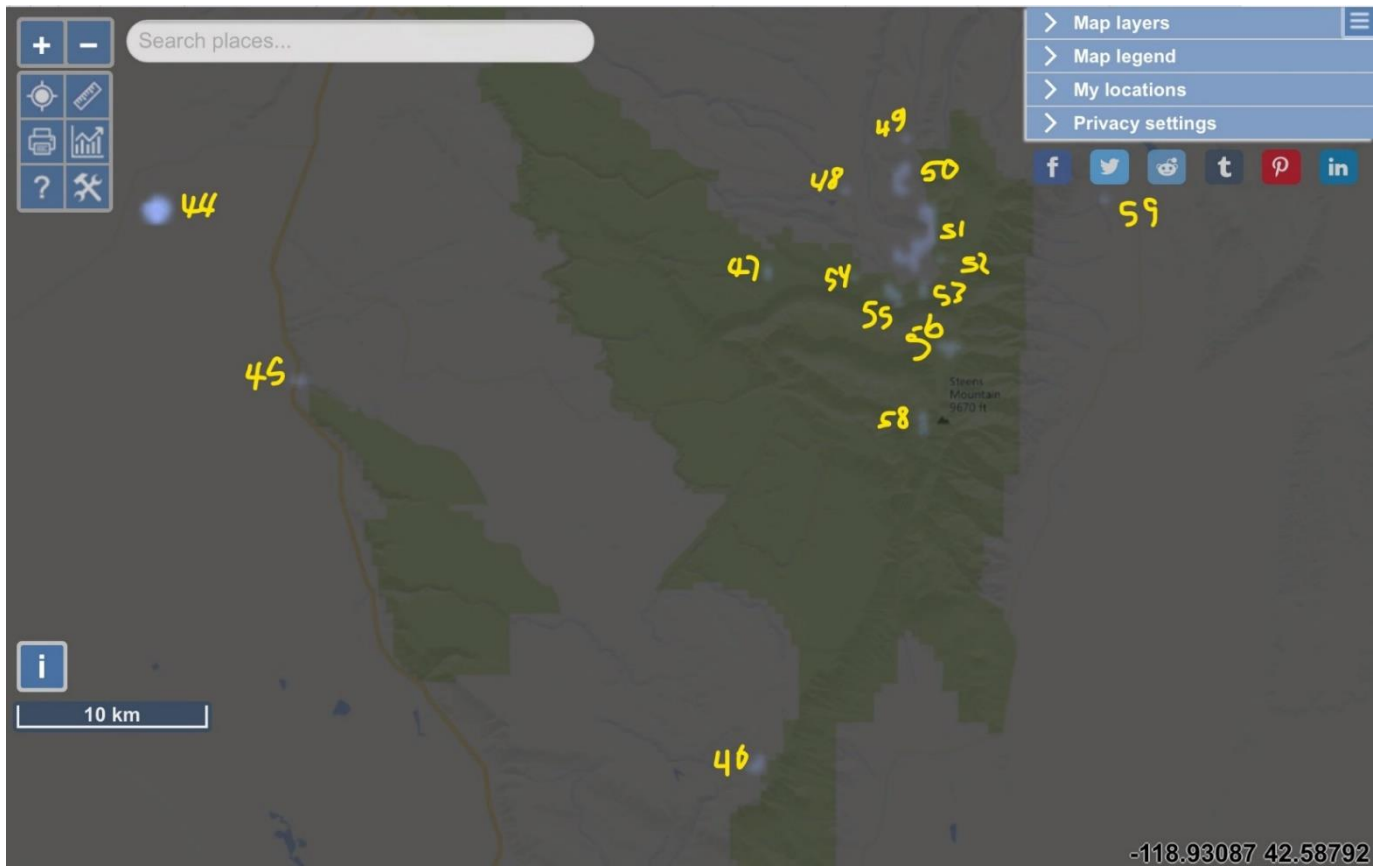


Figure A12. Cluster Map H7: Clusters 44 through 59

Malheur County Lighting Sources

Light clusters falling within the proposed sanctuary boundaries are numbered 3 through 10 and 13. (Sites 1 and 2 are accidental duplications of H8 and 9. Sites 11, 12, 14 to 24 are not included). Please notify Dawn Nilson at fibonacci@comcast.net to volunteer to inventory one or more cluster.

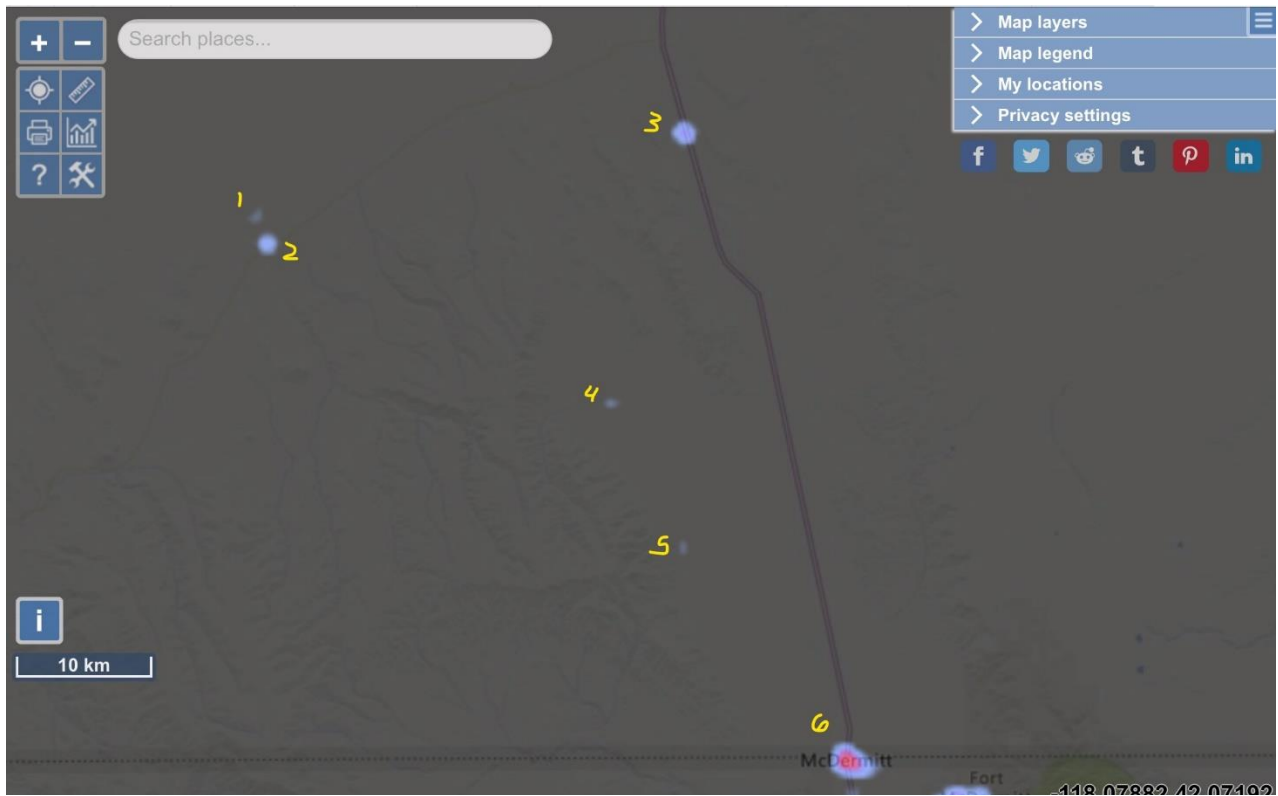


Figure A13. Cluster Map M1: Clusters 1 through 6

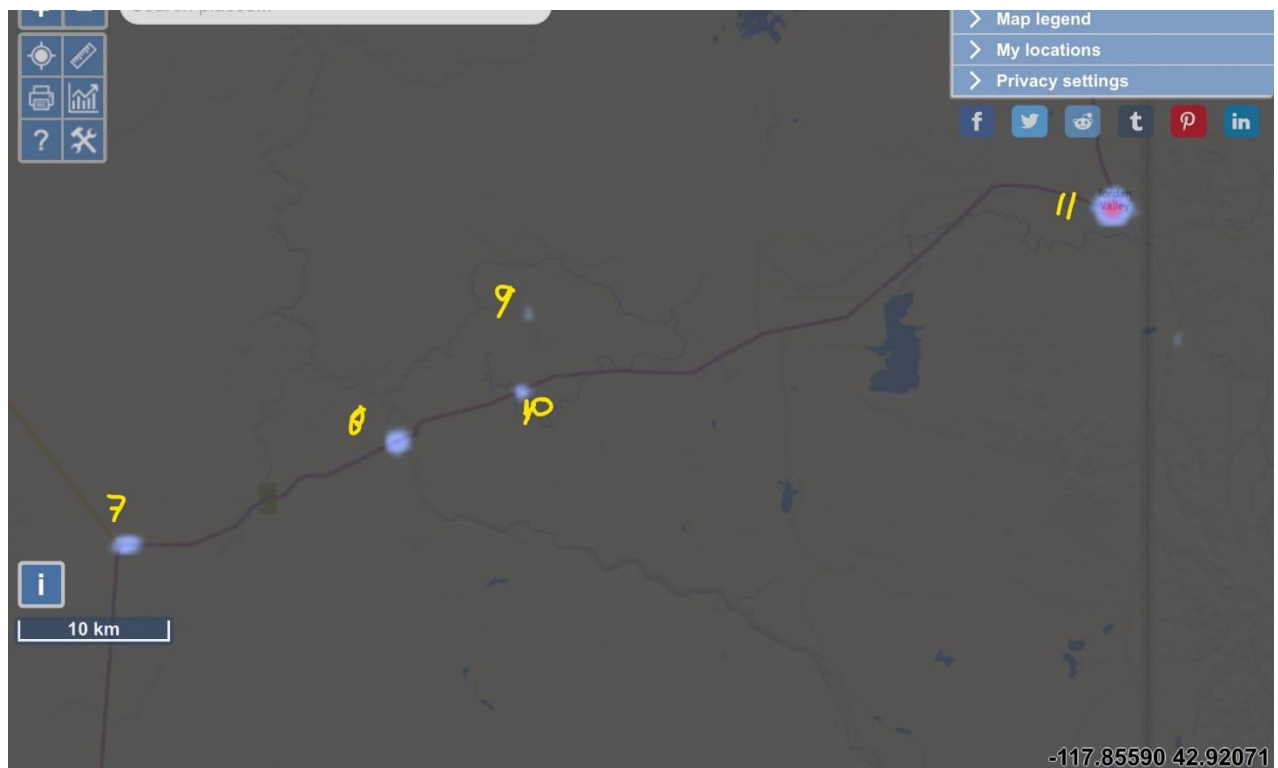


Figure A14. Cluster Map M2: Clusters 7 through 11

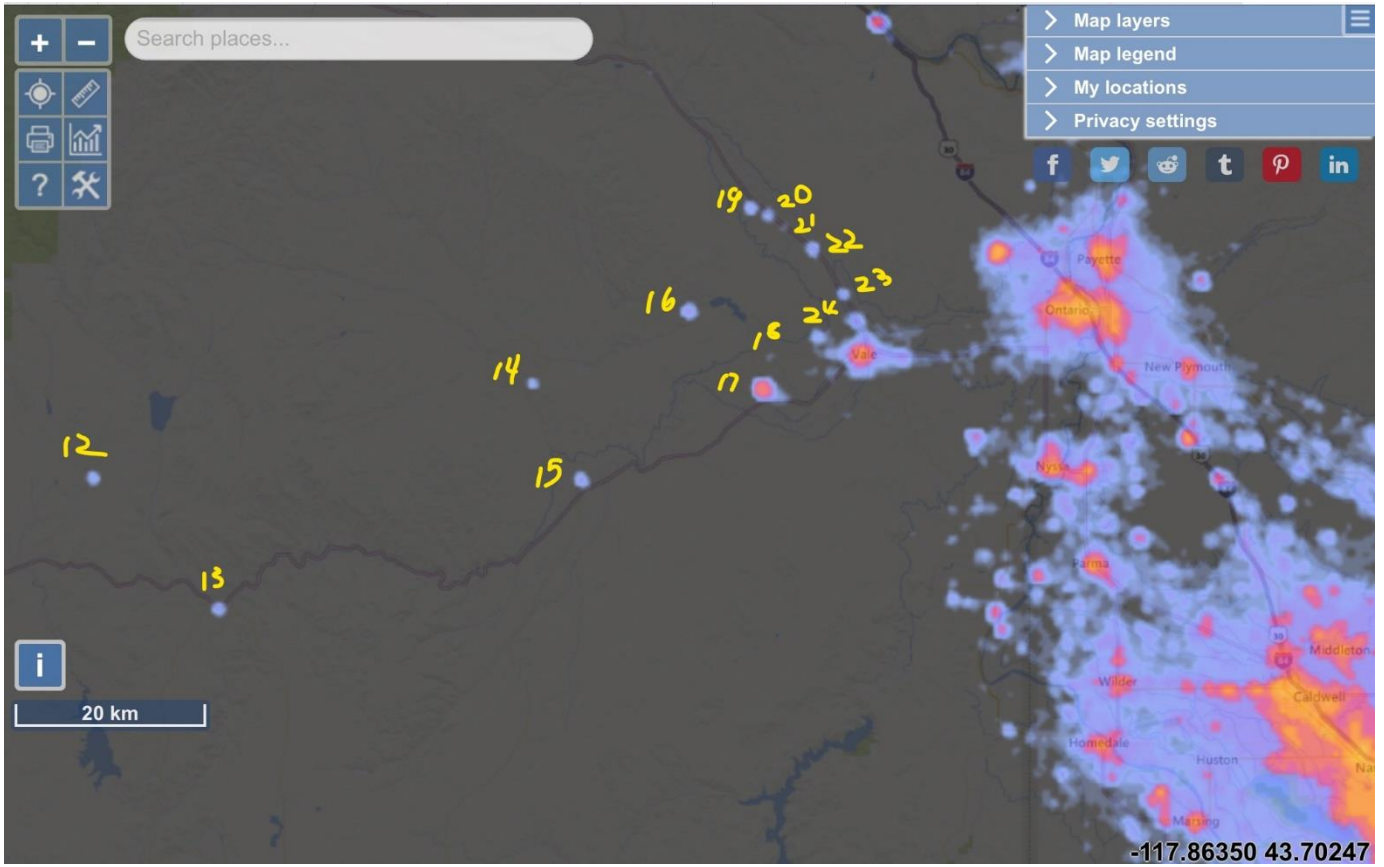


Figure A15. Cluster Map M3: Clusters 12 through 24

Master Inventory Map

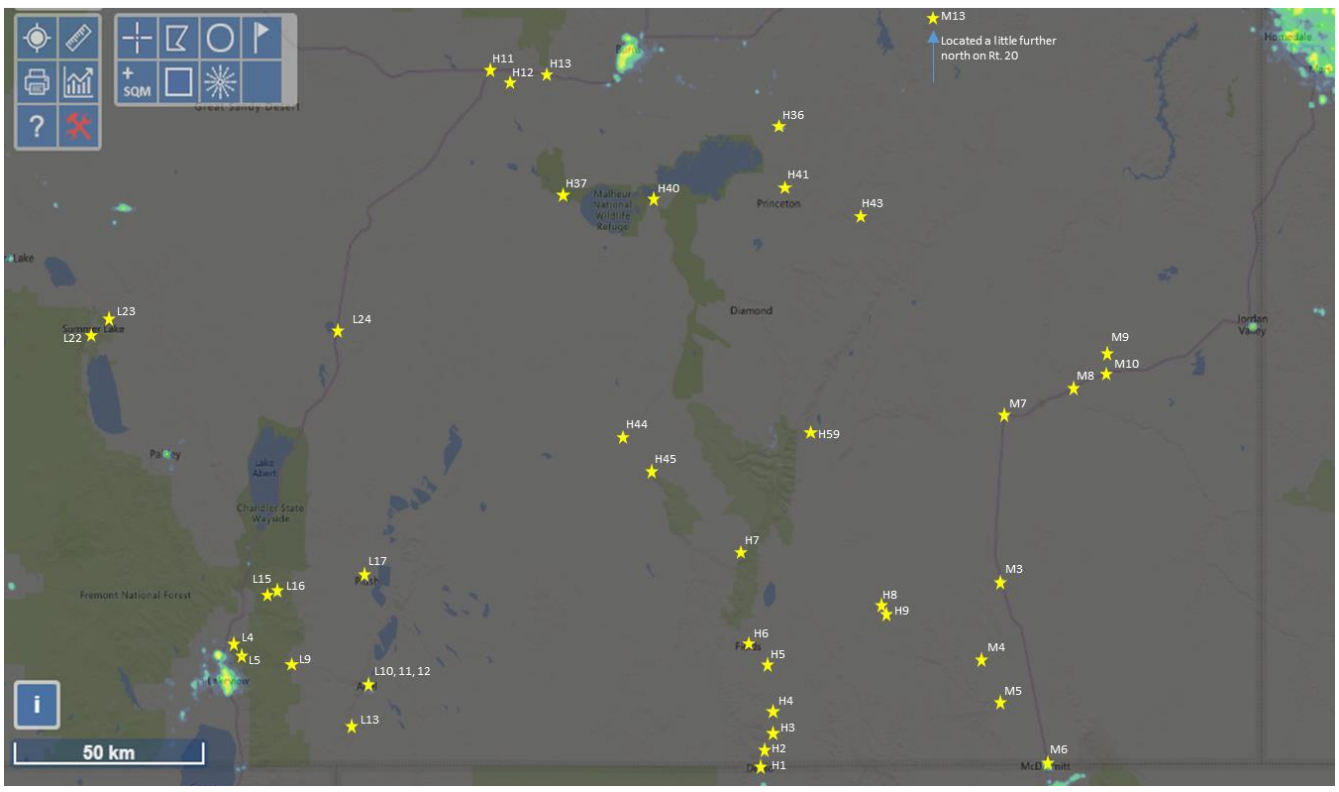


Figure A16. Master Inventory Map

Appendix B

Blank Inventory Form