



# WPI

Worcester Polytechnic Institute

## Dark Skies

Final Presentation

October 13<sup>th</sup>, 2020

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# Goal

*The goal of this project was to assist Glacier National Park in achieving **full International Dark Sky Park status** by evaluating the park's **night sky quality, lighting compliance, and educational programs** to identify ways to ensure achievement of full IDSP status in the timeframe given by the International Dark Sky Association.*



# International Dark Sky Association (IDA)



“The International Dark Sky Association (IDA) is the recognized authority on light pollution and is the leading organization combating light pollution worldwide.”





# International Dark Sky Parks

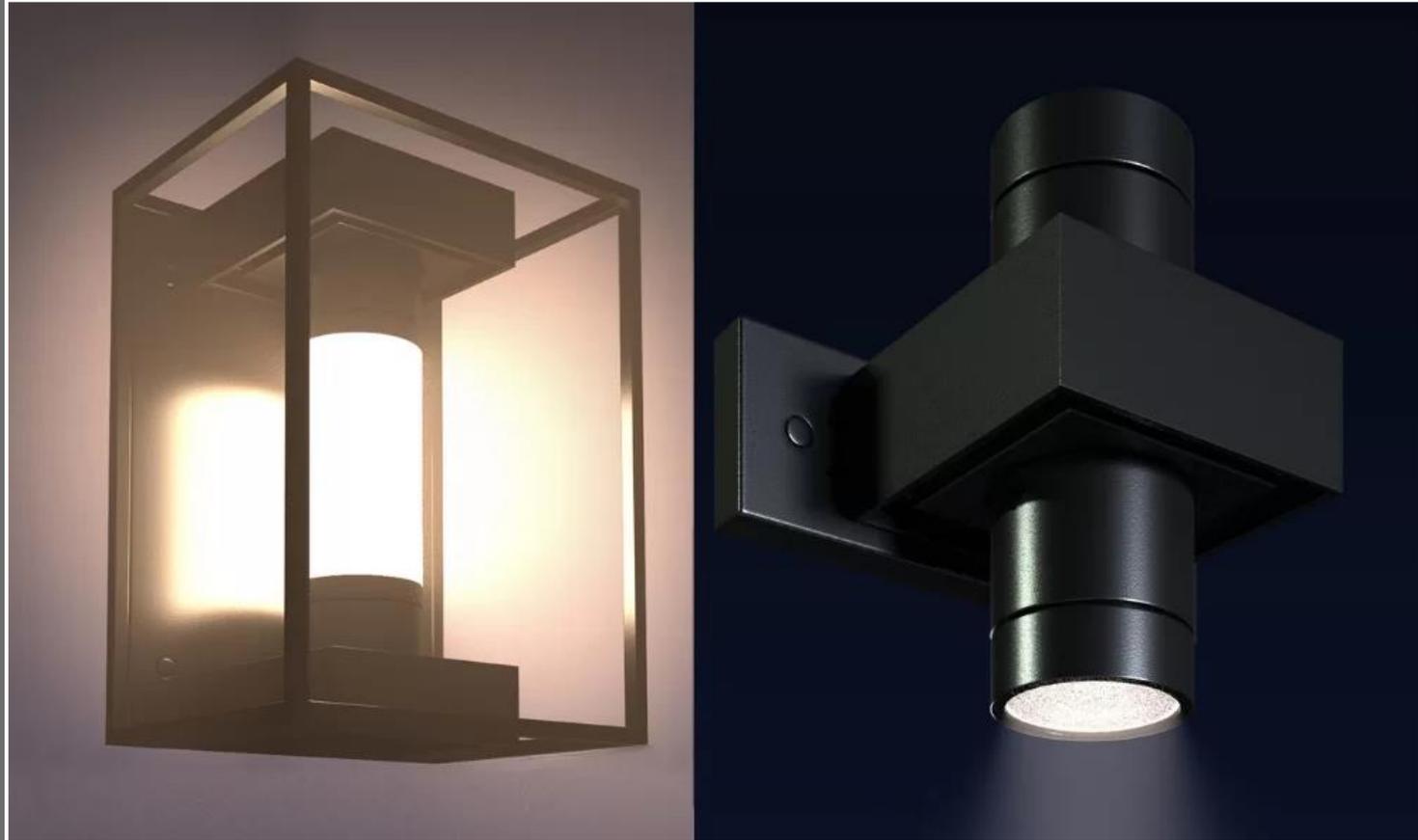


[darksky.org](http://darksky.org)



# Lighting Compliance

**Not Compliant**



**Compliant**

Wayfair.com



# Lighting Compliance (cont.)



# Results





# IDA Annual Report



[Flickr.com/glaciernps](https://www.flickr.com/photos/glaciernps/)



# Lighting Compliance Timeline

**2017**

**29%  
Compliance**

**Initial  
Application**

**2020**

**61%  
Compliance**

**Current**

**2021**

**67%  
Compliance**

**On Track  
For 74%**

**2022**

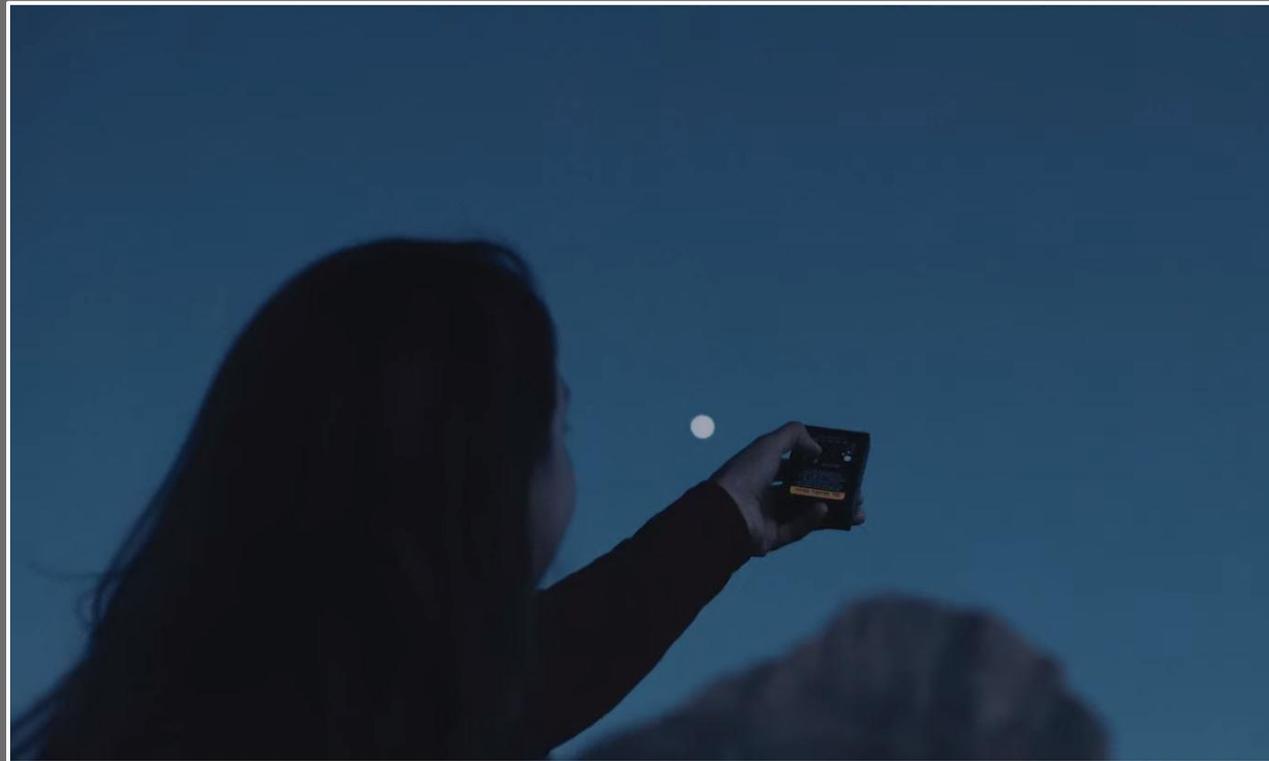
**90%  
Compliance**

**2027**

**100%  
Compliance**



# Sky Quality Measurements



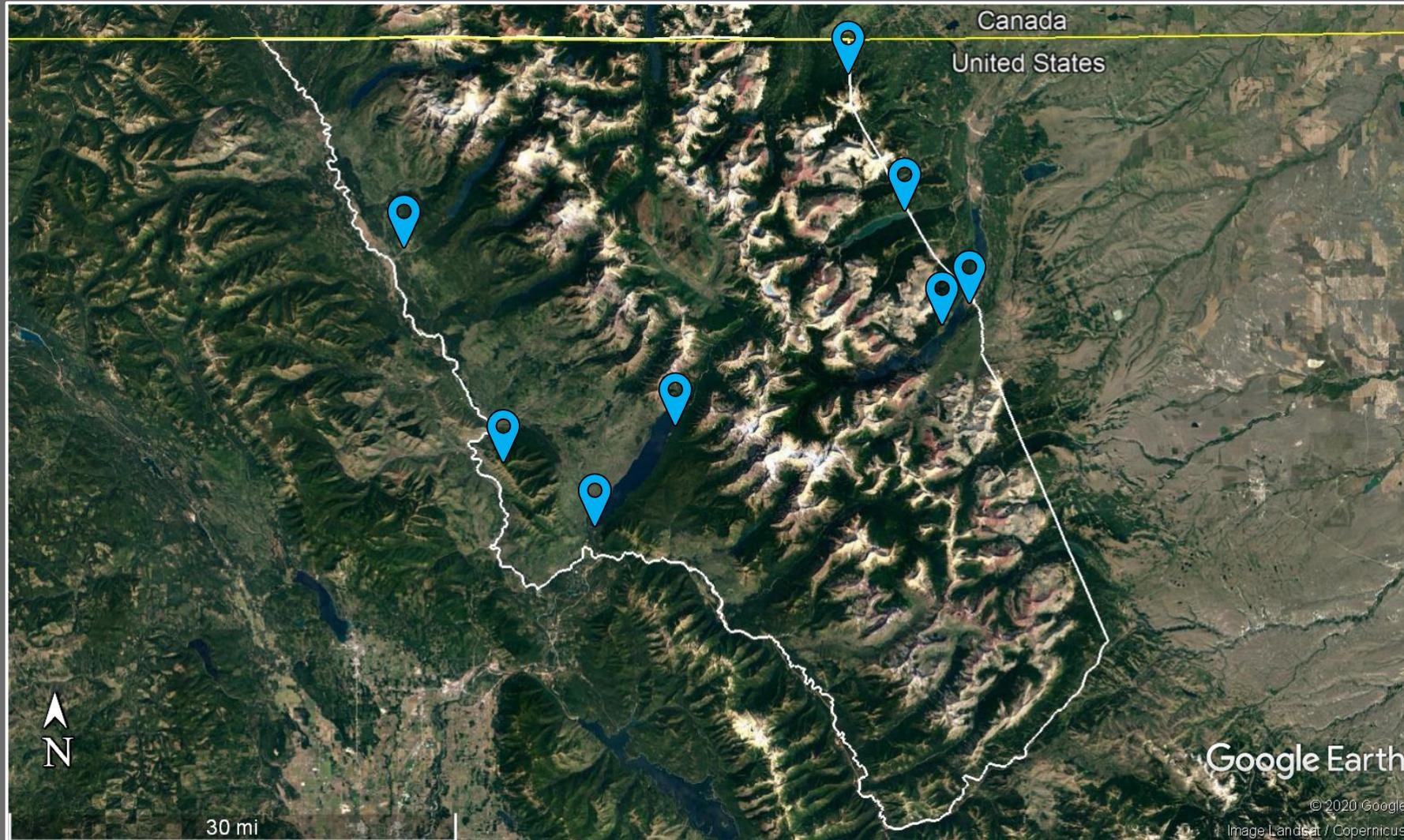
[youtube.com/glaciernps](https://www.youtube.com/glaciernps)



[optcorp.com](http://optcorp.com)



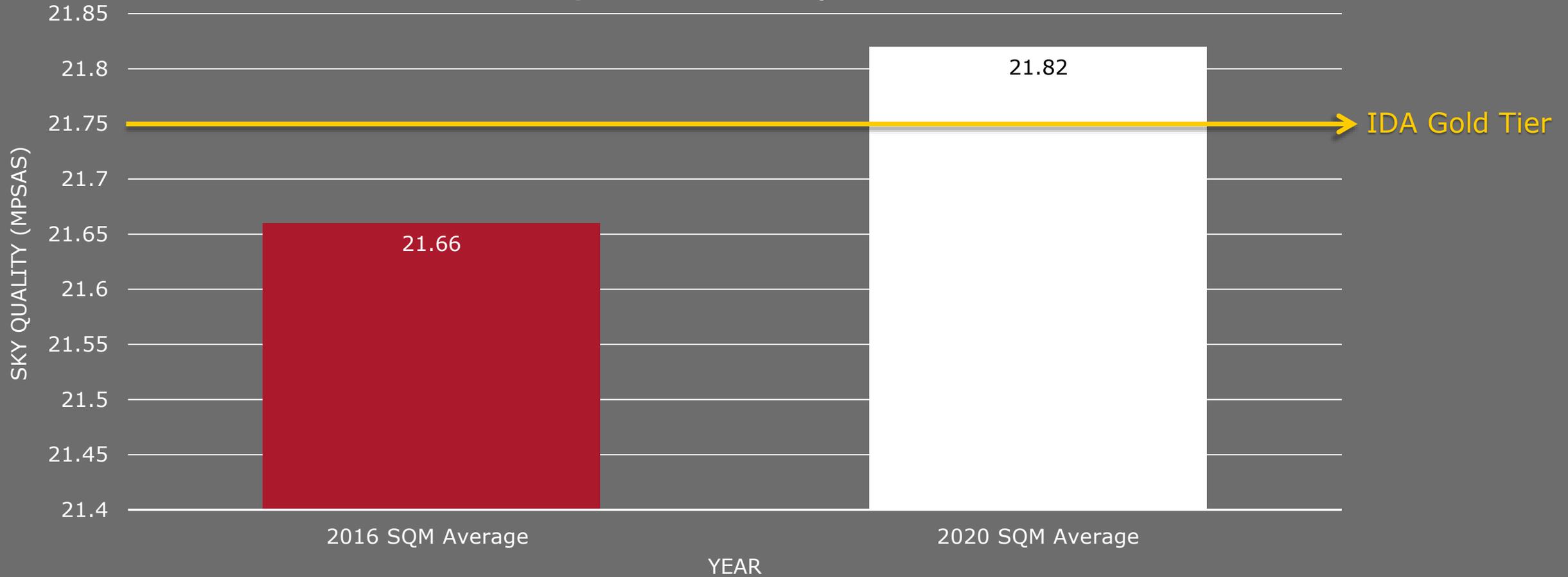
# Sky Quality Measurements (cont.)





# Sky Quality Data Analysis

## SQM Data Analysis





# Glacier's Night Skies Website



- ❖ Hard to locate
- ❖ Little about IDA designation
- ❖ No activity descriptions
- ❖ No observatory

Glacier National Park Montana

Plan Your Visit Learn About the Park Get Involved

INFO ALERTS MAPS CALENDAR RESERVE

NPS.gov / Park Home / Learn About the Park / Nature / Environmental Factors / Lightscape / Night Sky

## Night Sky

Milky Way over Logan Pass  
NPS/Jacob W. Frank

Dark night skies are environments undisturbed by light and air pollution. Dark night skies have natural, cultural, and scenic importance. Wildlife is impacted by light pollution because animals often depend on darkness in order to hunt, conceal their location, navigate, or reproduce. For nocturnal animals, light pollution also means habitat disruption. Additionally, many species have far more sensitive vision than humans. Plants are affected by artificial light because it disrupts their natural cycles.



# Glacier's Night Skies Website

Home   Activities   Dusty Star Observatory ▾   Education and Awareness   Consortium   About Us ▾

Telescope View  
Requests  
Telescope Media  
How a Telescope Works

Contact

wp.wpi.edu/darksky2020/



Link To Website

Glacier's Night Skies

Home   Activities   Dusty Star Observatory ▾   Education and Awareness   Consortium   About Us ▾

**Glacier's Night Skies**  
Help us preserve the night sky in Glacier National Park

LEARN MORE



# Activities Webpage

Glacier's Night Skies

Home [Activities](#) [Dusty Star Observatory](#) [Education and Awareness](#) [Consortium](#) [About Us](#)

## Dark Sky Activities

Come experience the skies of Glacier in person.

### Logan Pass Star Parties

Come experience Glacier's unusually dark skies by joining rangers, astronomers, and members of the [Big Sky Astronomy Club](#) to look through telescopes into the depths of the universe. This event is held at the Logan Pass Visitor Center, which provides views of Glacier's darkest skies. Only offered several times per year, Logan Pass Star Parties are among the most popular events Glacier has to offer. Viewing times go from 10 PM to after midnight.

*Admission ticket only. Tickets (\$5 per vehicle) can be purchased at the Apgar or St. Mary visitor centers starting the day before the star party. In case of inclement weather, the star party will be held the following night. Check at the visitor centers or on Glacier National Park's social media accounts for [more information](#).*

*Image source: [GlacierNPS](#), [NPS.gov](#)*





# Activities Webpage

Today ◀ ▶ July 2019 Week Month Agenda

Sun	Mon	Tue	Wed	Thu	Fri	Sat
30	Jul 1	2	3	4	5	6
	10pm Glacier's Night Sky	10pm Glacier's Night Sky	9:30pm Half the Park Hike 10pm Glacier's Night Sky	9:30pm Half the Park Hike	9:30pm Half the Park Hike	9:30pm Half the Park Hike
7	8	9	10	11	12	
10pm Glacier's Night Sky	10pm Glacier's Night Sky	10pm Glacier's Night Sky	9:30pm Half the Park Hike 10pm Glacier's Night Sky	9:30pm Half the Park Hike	9:30pm Half the Park Hike	9:30pm Half the Park Hike
14	15	16	17	18	19	
10pm Glacier's Night Sky	10pm Glacier's Night Sky	10pm Glacier's Night Sky	9:30pm Half the Park Hike 10pm Glacier's Night Sky	9:30pm Half the Park Hike	9:30pm Half the Park Hike	9:30pm Half the Park Hike
21	22	23	24	25	26	
10pm Glacier's Night Sky	10pm Glacier's Night Sky	10pm Glacier's Night Sky	9:30pm Half the Park Hike 10pm Glacier's Night Sky	9:30pm Half the Park Hike 10pm Logan Pass Star Party	9:30pm Half the Park Hike	9:30pm Half the Park Hike
28	29	30	31	Aug 1	2	
10pm Glacier's Night Sky	10pm Glacier's Night Sky	10pm Glacier's Night Sky	9:30pm Half the Park Hike	9:30pm Half the Park Hike	10pm Logan Pass Star Party	

+ Google Calendar

**Logan Pass Star Party**

**When** Fri, July 26, 2019, 10pm – Sat, July 27, 2019, 12am

**Where** Logan Pass Visitor Center, Browning, MT 59417, USA ([map](#))

**Description** Take advantage of Glacier's unusually dark skies and join rangers and members of the Big Sky Astronomy Club to gaze through telescopes into the depths of the universe. The second star party is scheduled for July 26 at the Logan Pass Visitor Center parking lot, from 10 pm to 12 am. Admission by ticket only. Tickets (\$5 per vehicle) are available at the Apgar or St. Mary Visitor Center bookstores beginning the day before the star party.

*In case of inclement weather, program will be rescheduled for the following night. Check at*

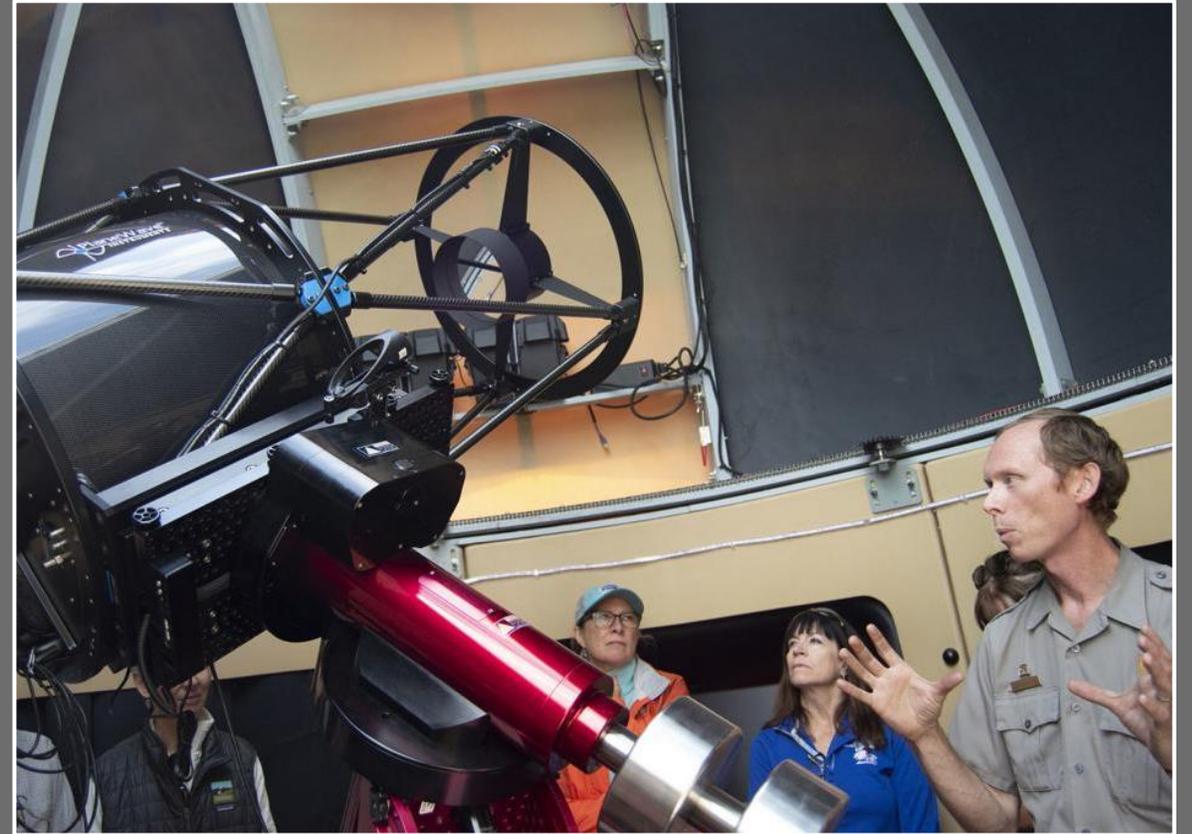
[more details»](#) [copy to my calendar»](#)



# Dusty Star Observatory



Ben Allan Smith (2019)



GNP Conservancy



# Telescope Requests Webpage

Glacier's Night Skies

Home Activities **Dusty Star Observatory** Education and Awareness Consortium About Us

## Telescope Viewing Requests

### Is there something you want to see in the night sky?

Do you have a favorite planet, galaxy, or nebulae? Submit a request for celestial objects to be captured by the Dusty Star Observatory telescope. If it is visible, we may be able to capture an image of the object and upload it to the "Telescope Media" page!

Below are some interactive star charts and a calendar of celestial events.

### Interactive Sky Chart

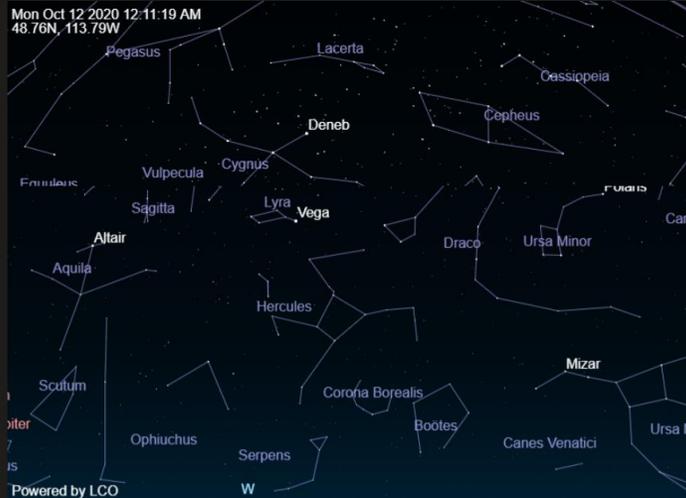


Chart provided by VirtualSky, Las Cumbres Observatory

### Calendar of Celestial Events

Today	October 2020							Week	Month	Agenda
Sun	Mon	Tue	Wed	Thu	Fri	Sat				
27	28	29	30	Oct 1	2	3				
			10:46am Asteroid 68	4:32am Mercury at c	9:26pm Conjunction					
			3:05pm Full Moon	10pm Close approach						
			5:56pm M110 is well	10pm Lunar occultat						
			5:59pm M32 is well							
			5:59pm M31 is well							
4	5	6	7	8	9	10				
10:19am October Ca	10:32am Mercury at		6:27am Draconid me	6:40pm Moon at Las	9:36pm δ-Aurigid m					
					9:19pm Southern Ta					
11	12	13	14	15	16	17				
6am C/2020 P1 (NE	6:19pm Mars at opp	5:59pm M33 is well		10:47pm 136199 Eri	11:05pm ε-Geminiid i					
18	19	20	21	22	23	24				
	6am C/2020 P1 (NE		11:12am Conjunction	7:23am Moon at Firs						
	11:31pm Orionid me		11:26am Close appr	10:46am Asteroid 11						
			9:42pm Conjunction	11:51pm Leonis Minc						
			10:13pm Close appr							
25	26	27	28	29	30	31				
6am C/2020 M3 (AT	1:10pm Asteroid 471		10:16am Conjunction		8:49am Full Moon					
5:56pm NGC 859 is	5:56pm NGC 884 is		12:43pm Close appr		9:38am Uranus at o					

Calendar provided by InTheSky



# Telescope Requests Webpage

**Calendar of Celestial Events**

Today ◀ ▶ **October 2020** ▼ Week Month Agenda

Sun	Mon	Tue	Wed	Thu	Fri	Sat
27	28	29	30	Oct 1	2	3
			10:46am Asteroid 68	4:32am Mercury at g 3:05pm Full Moon 5:56pm M110 is well 5:59pm M32 is well 5:59pm M31 is well	9:25pm Conjunction 10pm Close approach 10pm Lunar occultat	
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25	26	27	28	29	30	31
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[+ Google Calendar](#)

Calendar provided by [InTheSky](#)

❖ Celestial Events Calendar



# Telescope Requests Webpage

The screenshot shows the Stellarium Web Interactive Night Sky Simulator interface. The main view displays the Andromeda Galaxy (M31) in a dark sky. A sidebar on the left provides detailed information about the galaxy:

**Andromeda Nebula**  
Spiral Galaxy

Also known as: M 31, Andromeda Galaxy, Great Nebula in Andromeda, NGC 224, UGC 454, PGC 2557, MCG+07-02-016

Magnitude: 3.44  
Size: 177.83' x 69.66'  
Ra/Dec: 00h 43m 53.2s +41° 22' 58.3"  
Az/Alt: 073° 57' 44.6" +45° 07' 34.0"  
Visibility: Always visible tonight

The Andromeda Galaxy (IPA:  $\text{M}31$ ), also known as Messier 31, M31, or NGC 224 and originally the Andromeda Nebula (see below), is a barred spiral galaxy approximately 2.5 million light-years (770 kiloparsecs) from Earth and the... [more on wikipedia](#)

At the bottom of the simulator, there is a navigation bar with icons for home, search, and other functions. A timestamp in the bottom right corner reads "22:32:28 2020-10-12".

GOING-TO-THE-SUN ROAD

Use the simulator to see what the observatory can see right now, in a week, or in a year! Just make sure to set the location to Glacier National Park. Simulator created by [Stellarium](#)

- ❖ Celestial Events Calendar
- ❖ 2 Astronomy Simulators



# Telescope Requests Webpage

## Submit a telescope view request.

If visible, we will try to capture an image of your request through our telescope. Personal information will not be collected.

\* Required

What would you like the telescope to view? \*

Your answer

---

- ❖ Celestial Events Calendar
- ❖ 2 Astronomy Simulators
- ❖ [Request Form](#)



# Telescope Media Gallery

Glacier's Night Skies

[Home](#) [Activities](#) [Dusty Star Observatory](#) [Education and Awareness](#) [Consortium](#) [About Us](#)

## Telescope Media Gallery

Peer into the universe with images taken by the observatory. Even though the gallery is small and currently growing, it provides the foundation for an extensive media gallery in the future, consisting of images of planets, stars, galaxies, and nebulae.

### Highlighted Images and Media



**Dumbbell Nebula**

Date Taken: 9/10/2020

Distance: 1,200 light years

[More Info](#)



**Whirlpool Galaxy  
and Satellite**

Date Taken: 9/9/2020

Messier Catalog Number: M51

Distance: 31 Million Light Years

[More Info](#)



**Whirlpool Galaxy**

Date Taken: 8/22/2019

Distance: 37 million light years

[More Info](#)



Date Taken: 7/30/2020

Distance: 239,000 miles

[More Info](#)



# How Telescopes Work

## Finderscope



The finderscope is a smaller telescope or sight that is mounted to the side of a telescope. They often have lower magnification but provide a wider field of view of the night sky. Finderscopes align with the telescope's line of sight. They are used for quickly aiming the telescope at objects in the sky then fine-tuning the aim with the full-size telescope. The Observatory's telescope uses a red laser sight to help with aiming.





# Education and Awareness Webpage



Glacier's Night Skies

Home Activities Dusty Star Observatory ▾ Education and Awareness Consortium About Us ▾

## Dark Sky Awareness

What is dark sky?

### What are dark skies?

Dark Skies are night skies as they are meant to be: without any light pollution.

In the United States, 80% of the population can't see the Milky Way from their backyard. This is because light pollution from buildings and streets block our view of the stars.



# Education and Awareness Webpage



UnderLuckyStars.com (2020)

- ❖ What are dark skies?
- ❖ Light Pollution
  - ❖ Interactive Slider
- ❖ Types of Light Pollution
- ❖ Why is it harmful?
- ❖ What you can do
- ❖ At-home activities



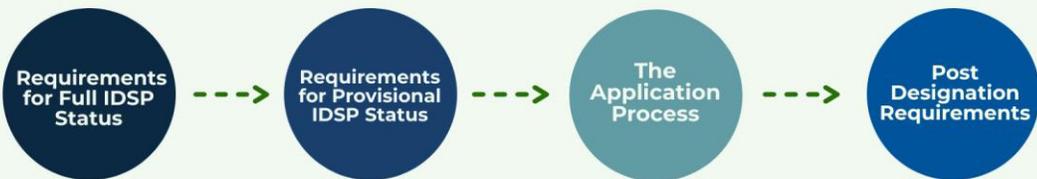
# "How to Become an IDSP" Infographic



# "How to Become an IDSP" Infographic

## What is an International Dark Sky Park?

An IDSP is an area of public or private land that is recognized for and dedicated to preserving its exceptional views of the night sky. Becoming an IDSP promotes the sky without light pollution and educates the public on why it is harmful. IDSPs also protect the nocturnal environment. Many species rely on dark skies to maintain sleep and migration patterns. As for the park itself, benefits of the IDSP designation include an increase of visitation due to astrotourism and a decrease in energy costs.



## Requirements for Full IDSP Status

Refer to the IDA 2018 Guidelines for more detailed requirements.



**Must be protected public or private with regular nighttime public access**

**Must create a Lighting Management Plan**



**Milky Way is Visible to the naked eye**

**Minimal light glare is present and any light domes are close to the horizon**



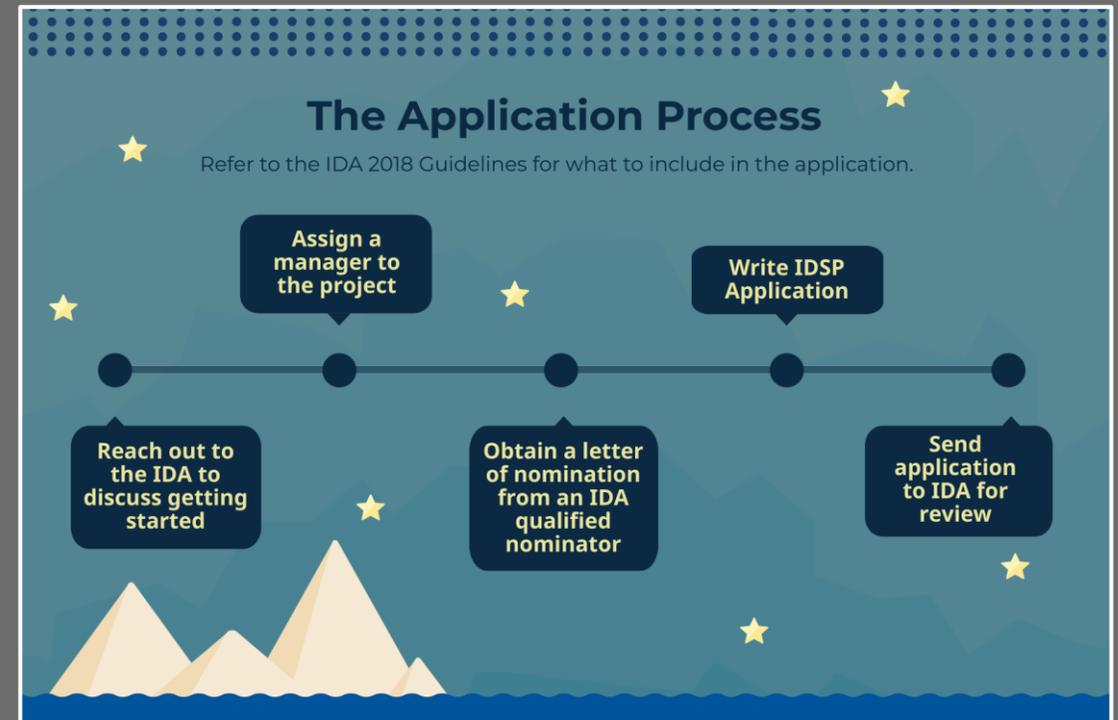
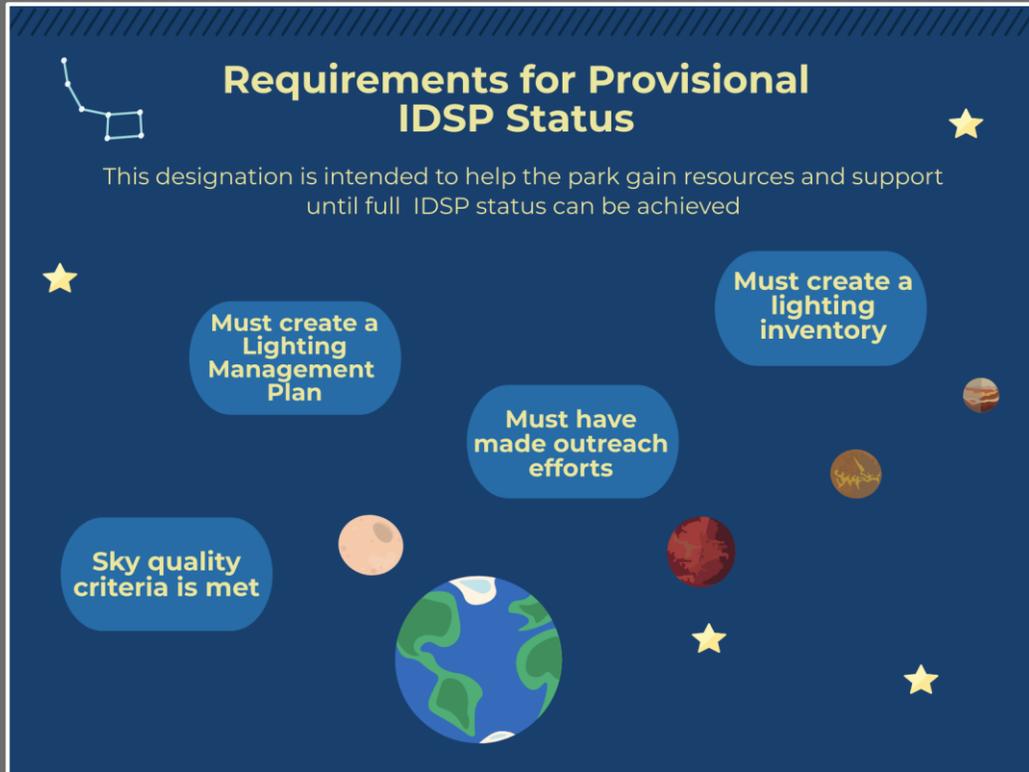
**Commitment to preserving Dark Skies**

**Must be able to set a leadership example in the conservation community**





# "How to Become an IDSP" Infographic





# "How to Become an IDSP" Infographic

## Post Designation Requirements

Write a concise annual report to show progress towards meeting the goals of the Lighting Management Plan



**Thank you for celebrating  
the night sky and protecting  
our planet's resources!**

### References:

International Dark Sky Association. (2018). International Dark Sky Association Dark Sky Park Program Guidelines. Retrieved Apr. 9, 2020, from <https://www.darksky.org/wp-content/uploads/2018/12/IDSP-Guidelines-2018.pdf>

# Recommendations





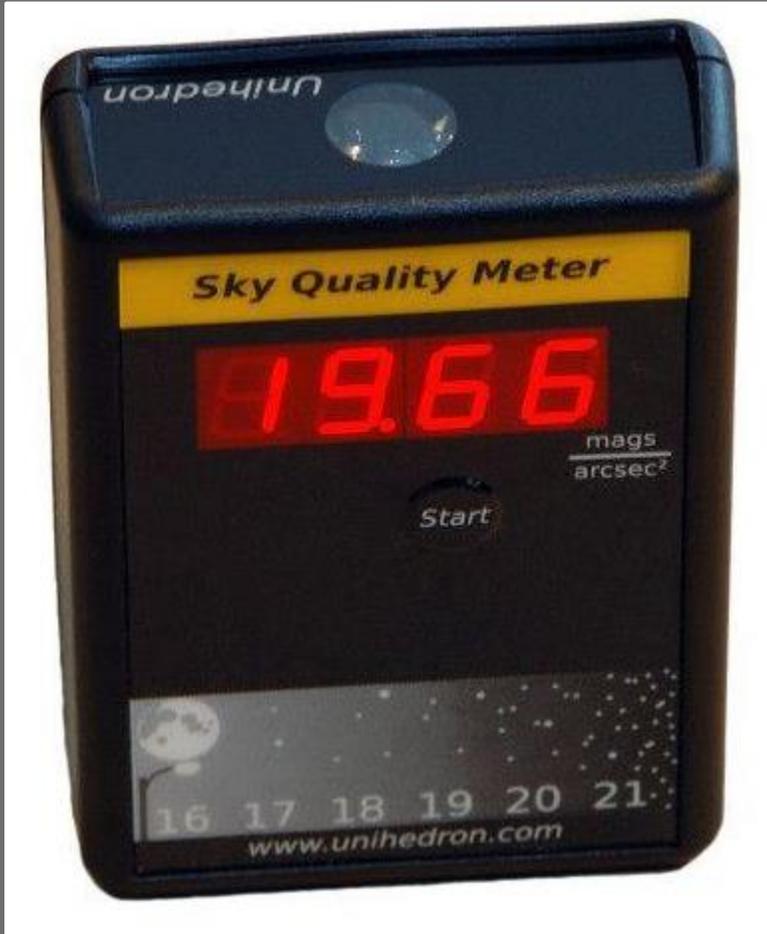
# Create a Dark Sky Consortium



- ❖ Subgroup of IDA Annual Conference
- ❖ Facilitated by our webpage, infographic



# Increase SQM measurement frequency



optcorp.com



lettherebenight.com

# Increase SQM measurement frequency



[unihedron.com](http://unihedron.com)



[ikarusimaging.com](http://ikarusimaging.com)



# Livestream Dark Sky Activities



## Virtual Grand Canyon Star Party 2020



**Grand Canyon  
National Park**

**600,000 Followers**



# Livestream Dark Sky Activities



## Virtual Logan Pass Star Party 2021



**Glacier  
National Park**

**800,000 Followers**

# ***Acknowledgements***

*Tara Carolin*

*Mark Biel*

*Lee Rademaker*

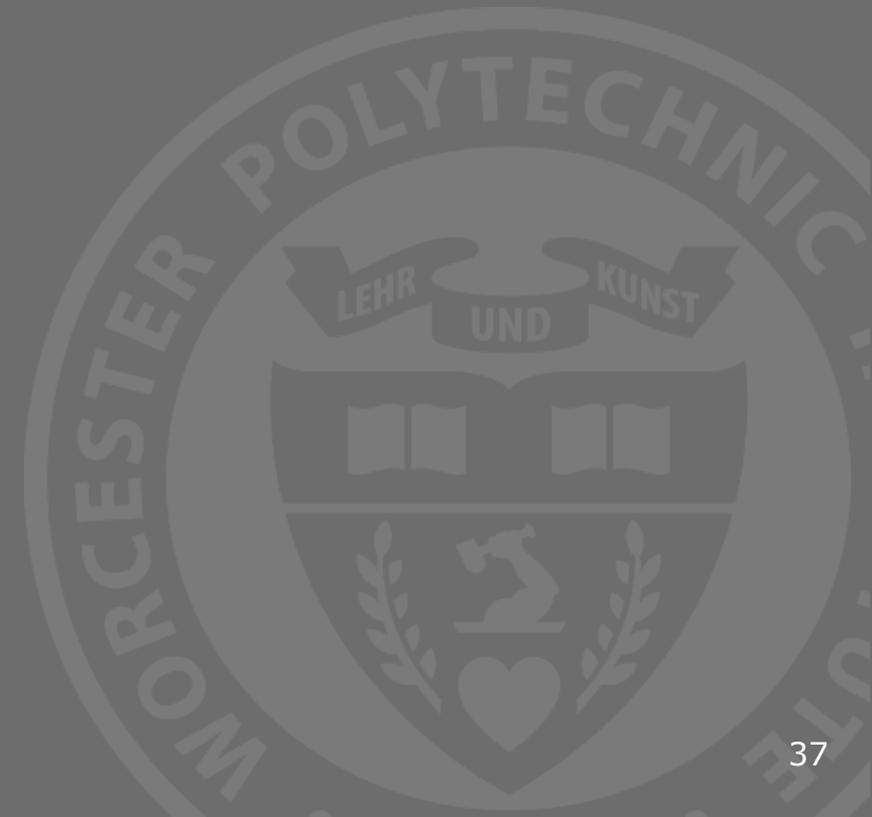
*Iree Wheeler*

*Ed Eberhardy*

*Bettymaya Foott*

*Adam Dalton*

*Bark Ranger Gracie*



# Thank You

*Questions or Comments?*

[wp.wpi.edu/darksky2020/](http://wp.wpi.edu/darksky2020/)



Link To Website







# SQM Data Analysis (cont.)

