

Waterton-Glacier International Dark Sky Park 2020 Annual Report Addendum

General

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This addendum details the results of a research project that was conducted in partnership with Glacier National Park but was not included in the 2020 annual report submission. A team of five students from Worcester Polytechnic Institute (WPI), Massachusetts, USA, worked with the park over a 7-week period from the end of August to mid-October. The purpose of their project was to assist Glacier National Park with advancing from provisional IDSP status to full IDSP status. To accomplish this, the team analyzed Glacier's lighting inventory, dark sky educational programs, and night sky quality. They determined that sky quality has improved to gold tier status as of the 2020 measurements. They also created resources to facilitate and expand the park's dark sky outreach programs. The team's analysis determined that Glacier is on track to achieve its IDSP goals. A set of recommendations was compiled and presented to the park.

WPI Project Website: wp.wpi.edu/darksky2020

WPI Research Paper (found at bottom of webpage): <https://wp.wpi.edu/darksky2020/about/>

Lighting

The WPI team analyzed Glacier's lighting inventory and determined that the park currently has a 61% lighting compliance. However, the park has the fixtures on hand to achieve 74% compliance, which would surpass the 67% lighting compliance needed by March 2021 (three years after initial IDSP application) to achieve full IDSP designation. The park plans to install these fixtures in the Many Glacier, St. Mary, and East Glacier areas before the March deadline. A list is currently being developed to detail the purchase of the same light fixtures for the remaining areas of the park.

Sky Quality

As mentioned in the main report, in September of 2020, Glacier National Park staff took sky quality measurements at 7 of the 8 locations included in the 2017 IDSP application. Due to accessibility issues, measurements were not taken at site 7, Huckleberry Mountain, but will be included in future years. The test site locations are as follows:

1. Park Boundary, Chief Mountain International Peace Park Highway
(48°58'54" N, -113°36'60" W)
2. Many Glacier Valley at Sherburne Lake Dam / Park Boundary
(48°49'75" N, -113°31'47" W)
3. Going to the sun Road at one-mile gate, near St. Mary
(48°44'23" N, -113°27'48" W)
4. Lake McDonald Lodge
(48.629 -113.869 W)
5. Apgar Village, on dock
(48.528 N, -113.985 W)
6. Polebridge Entrance Station
(48.783 N, -114.28 W)
7. Huckleberry Mountain [Not tested in 2020]
(48.6N, -114.14W)
8. St. Mary Visitor Center
(48.74N, -113.44W)

The WPI team compared the sky quality measurements from the 2017 IDSP application to the 2020 measurements. As shown in the table on the next page, the average of the sky quality measurements (excluding Huckleberry Mountain) rose 0.16 mpsas, to 21.82 mpsas. Several measurement locations also changed tiers; three advanced from silver to gold tier, and one site lowered from gold to silver tier. These changes now raise Glacier's sky quality average above 21.75 mpsas, the minimum requirement for gold-tier status.

Table 6: The highlight on the 2016 and 2020 Avg columns denotes what status the average measurement achieves, yellow denotes gold tier status and grey denotes silver tier status.

Site Number	Description	2016 Measurements	2016 Avg	2020 Measurements	2020 Avg	Status	Δ (mpsas)
1	Park Boundry, Chief Mountain International Peace Park Highway (48°58'54" N, -113°36'60" W)	No Reading	21.792	21.60	21.77	Lighter	-0.02
		21.73		21.84			
		21.77		21.73			
		21.82		21.67			
		21.82		21.84			
		21.82		21.79			
2	Many Glacier Valley at Sherburne Lake Dam / Park Boundry (48°49'75" N, -113°31'47" W)	No Reading	21.81	21.55	21.73	Lighter	-0.08
		21.80		21.74			
		21.80		21.93			
		21.80		21.66			
		21.83		21.67			
		21.83		21.67			
3	Going to the Sun Road at one mile gate, near St. Mary (48°44'23" N, -113°27'48" W)	No Reading	21.81	21.70	21.77	Lighter	-0.04
		21.82		21.69			
		21.80		21.78			
		21.81		21.89			
		21.81		21.81			
		21.83		21.70			
4	Lake McDonald Lodge On the beach near the river inlet (48.629 N, -113.869 W)	No Reading	21.59	21.92	21.90	Darker	0.31
		21.60		21.94			
		21.41		21.88			
		21.68		21.90			
		21.68		21.90			
		21.58		21.88			
5	Apgar Village, on dock (48.528 N, -113.985 W)	No Reading	21.51	21.88	21.86	Darker	0.35
		21.44		21.88			
		21.57		21.90			
		21.57		21.85			
		21.49		21.83			
		21.50		21.86			
6	Polebridge Entrance Station (48.783 N, -114.28 W)	No Reading	21.54	22.12	22.13	Darker	0.60
		21.52		22.18			
		21.49		22.11			
		21.52		22.09			
		21.57		22.13			
		21.58		22.15			
7	Huckleberry Mountain (48.6 N, -114.14 W)	No Reading	21.65	0.00	21.65	No Change	NA
		21.65		0.00			
		21.65		0.00			
		21.65		0.00			
		21.65		0.00			
		21.65		0.00			
8	St. Mary Visitor Center (48.74 N, -113.44 W)	No Reading	21.56	21.59	21.58	Darker	0.02
		21.56		21.56			
		21.56		21.59			
		21.56		21.56			
		21.56		21.53			
		21.56		21.68			
		Avg	21.66		21.82		0.16

Outreach

Websites

To enhance Glacier’s outreach and online presence, the WPI team developed a Dark Sky website called “Glacier’s Night Skies”. The educational website, located at <http://wp.wpi.edu/darksky2020>, is designed to facilitate all information regarding Glacier’s Night Skies. A flowchart of the website can be found in Figure 4.

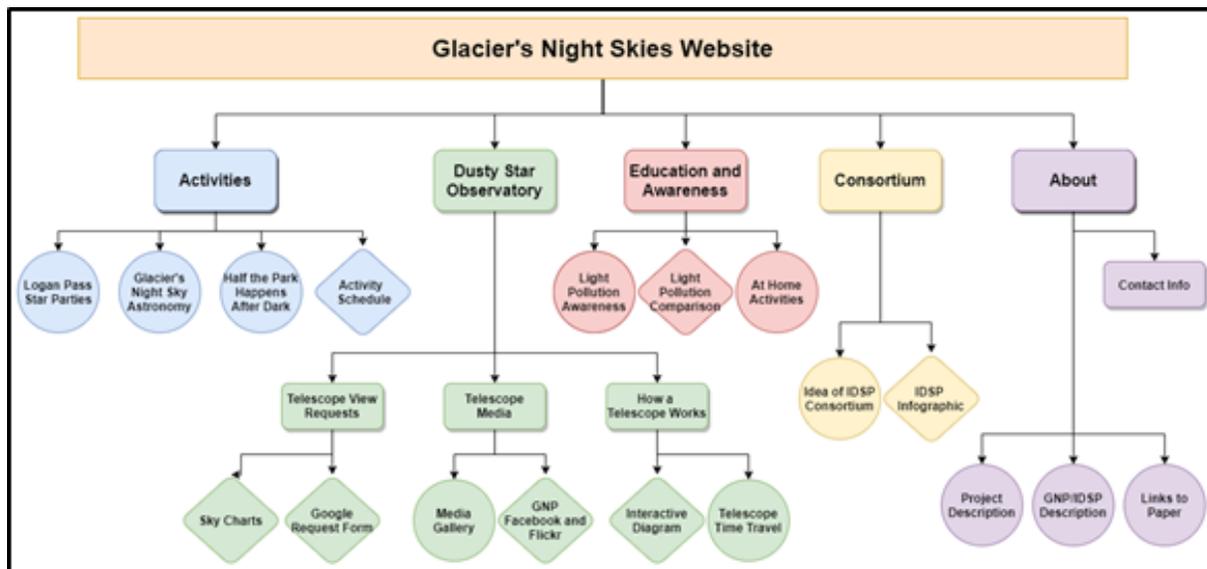


Figure 4: The flowchart for the Glacier’s Night Skies website.

The website expands upon Glacier’s education and outreach by containing information about its three current outreach programs: *Logan Pass Star Parties*, *Half the Park Happens After Dark*, and *Glacier’s Night Skies*. The website also contains a calendar that documents when each program occurs to simplify trip planning for visitors.

The website enhances the outreach of the Dusty Star Observatory, which opened in 2019 at St. Mary. The WPI team created a system where users can request an image taken through the observatory’s telescope. Users can determine visible celestial objects by using the website’s embedded calendars and interactive sky simulators. Images taken by the observatory can be uploaded to the website’s media gallery. Lastly, the website contains information about how telescopes work, including an interactive feature that highlights each component of the Dusty Star Observatory Telescope.

A page of the website is dedicated to dark sky awareness, which explains the causes and classifications of light pollution, as well as how light pollution affects the environment, humans, and wildlife. At-home educational activities for children are also found on this page.

Infographic

The WPI team also created an infographic about becoming an IDSP. This infographic is meant to encourage and help qualified locations take the first step towards becoming an IDSP. Figure 5 shows a condensed version of this infographic. The full-sized infographic can be found on the [Dark Sky website](#).

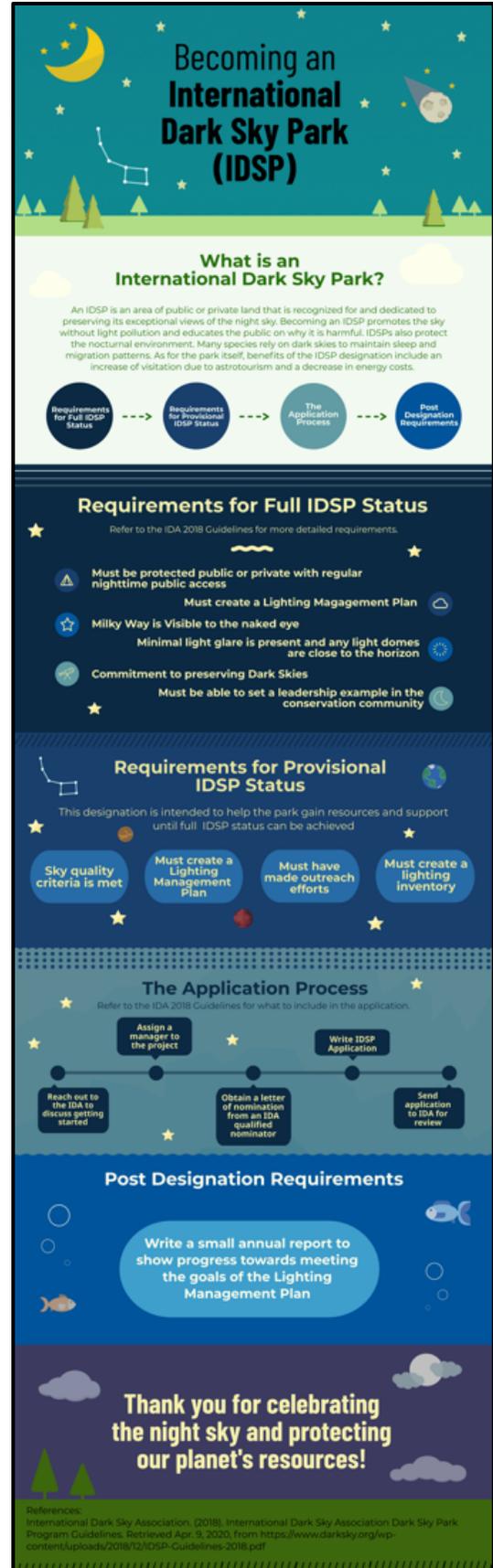


Figure 5: A condensed version of the IDSP infographic.

Social Media

For International Dark Sky Week 2020, Glacier National Park created a video titled “Glacier’s Dark Skies”. Statistics about the video are shown below for YouTube, Instagram, and Facebook. Note: The WPI team did not create the video but felt that it should be mentioned in the annual report.

Table 7: Summary of Glacier National Park Dark Sky Material on YouTube.

Date	Messaging	Likes	Dislikes	Views
April 23, 2020	<p>Glacier’s Dark Skies</p> <p>This video highlights the dark skies of Glacier National Park and describes the efforts taken to designate the park as an official International Dark Sky Park</p> 	114	0	5,195

Table 8: Summary of Glacier National Park Dark Sky Material on Instagram.

Date	Messaging	Likes	Comments
April 20, 2020	Same as First Facebook Post	11,575	33
April 24, 2020	<p>International Dark Sky Week continues! And to celebrate, we want to share our new video, “Glacier’s Dark Skies.” This beautiful film highlights Glacier’s epic night skies and the efforts currently being made to establish Waterton-Glacier as an official International Dark Sky Park. We hope you enjoy the video, and don’t forget to look up at the sky tonight! What is it you see?</p> <p>https://www.youtube.com/watch?v=suXpf_tmkps</p> <p>An audio described video is also available at https://youtu.be/4KJrTxt3uNk [image description: A bright, yellow-blue arches across the mountains, its reflection shines in the lake below.]</p> 	13,538	50

Table 9: Summary of Glacier National Park Dark Sky Material on Facebook.

Date	Messaging	Likes	Reactions	Shares	Comments
<p>April 20, 2020</p>	<p>It's International Dark Sky Week! This is a time to celebrate the shared heritage and stories of the stars, the science and discoveries of astronomy, the critters and creatures of the night, and a perfect opportunity for you to turn down/off an outdoor light, step outside, and look up.</p> <p>Glacier National Park is an International Dark Sky Park (provisional status) in conjunction with Waterton Lakes National Park across the border in Canada. In Glacier's nearly light pollution free skies we see more stars than we can count! Not to mention being able to view the distinct glow of our Milky Way Galaxy. With the aid of binoculars or a telescope, you can even see deep space objects like star clusters, galaxies, and colorful nebulae. So, tonight, take a moment to gaze at the sky above your home and know that the same beauty above Waterton-Glacier International Dark Sky Park is there, the only difference may be your porch light...maybe turn it off and see?</p> <p>And stay tuned! Later this week, we will promote our new Dark Sky video that highlights Glacier National Park's epic night skies and the efforts made to protect them!</p> 	<p>1,600</p>	<p>428</p>	<p>316</p>	<p>40</p>

Date	Messaging	Likes	Reactions	Shares	Comments
April 24, 2020	<p>International Dark Sky Week continues! And to celebrate, we want to share our new video, “Glacier’s Dark Skies.”</p> <p>This beautiful film highlights Glacier’s epic night skies and the efforts currently being made to establish Waterton-Glacier as an official International Dark Sky Park. We hope you enjoy the video, and don’t forget to look up at the sky tonight! What is it that you see?</p> <p>https://youtu.be/suXpf_tm_kps</p> <p>An audio described video is also available at https://youtu.be/4KJrTxt3uNk</p> 	857	228	294	33