

McDonald Observatory
Fort Davis, Texas





Hobby•Eberly Telescope (*HET*)



82" Otto Struve Telescope

Dark Sky Destination

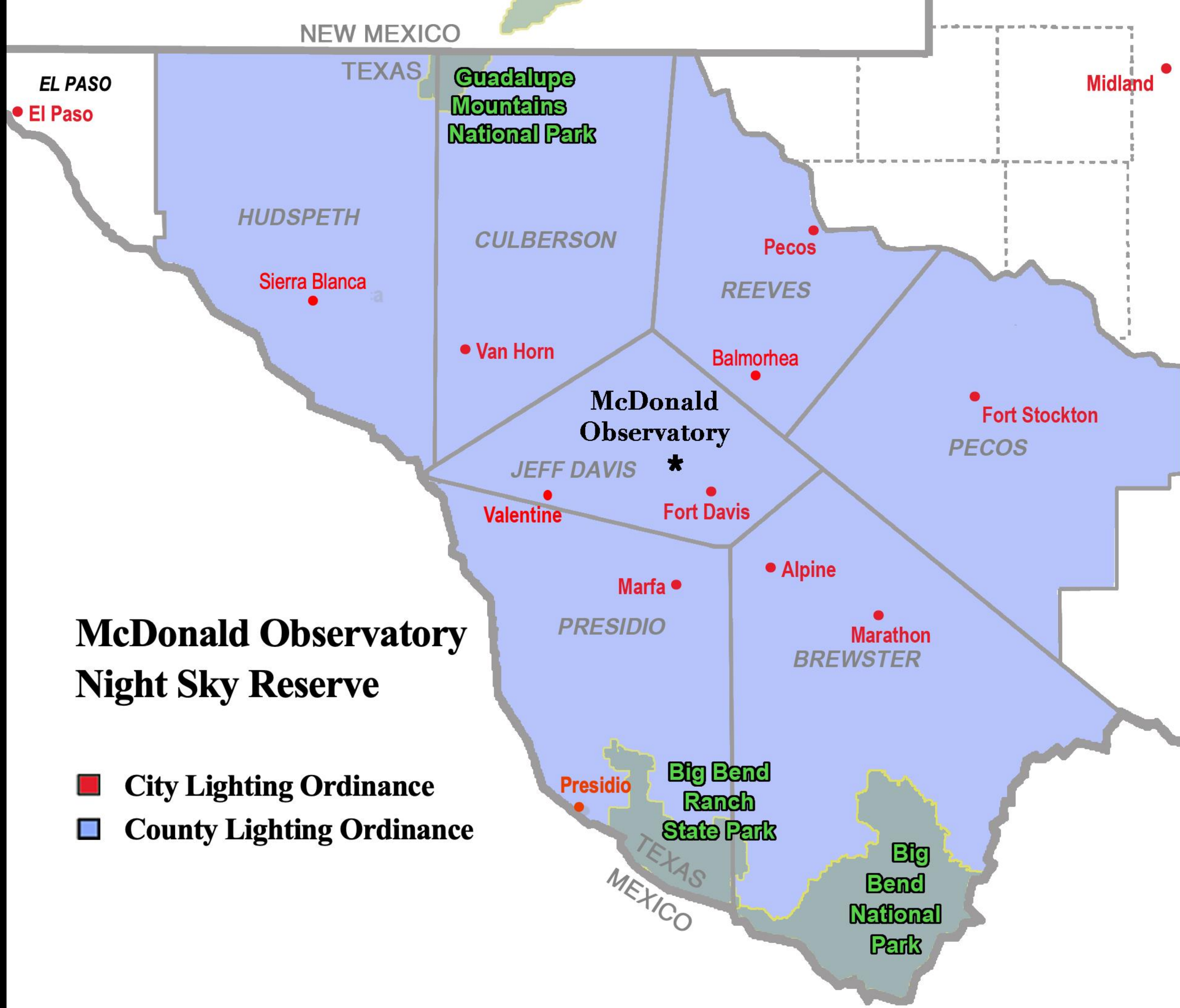


Informal Science Education
~86,000 Visitors per year

**ARIZONA STATE UNIVERSITY
ASTRONOMY AUSTRALIA LTD.
AUSTRALIAN NATIONAL UNIVERSITY
CARNEGIE INSTITUTION FOR SCIENCE
FAPESP - THE SÃO PAULO RESEARCH FOUNDATION
HARVARD UNIVERSITY
KOREA ASTRONOMY AND SPACE SCIENCE INSTITUTE
SMITHSONIAN INSTITUTION
TEXAS A&M UNIVERSITY
THE UNIVERSITY OF TEXAS AT AUSTIN
UNIVERSITY OF ARIZONA
UNIVERSITY OF CHICAGO**

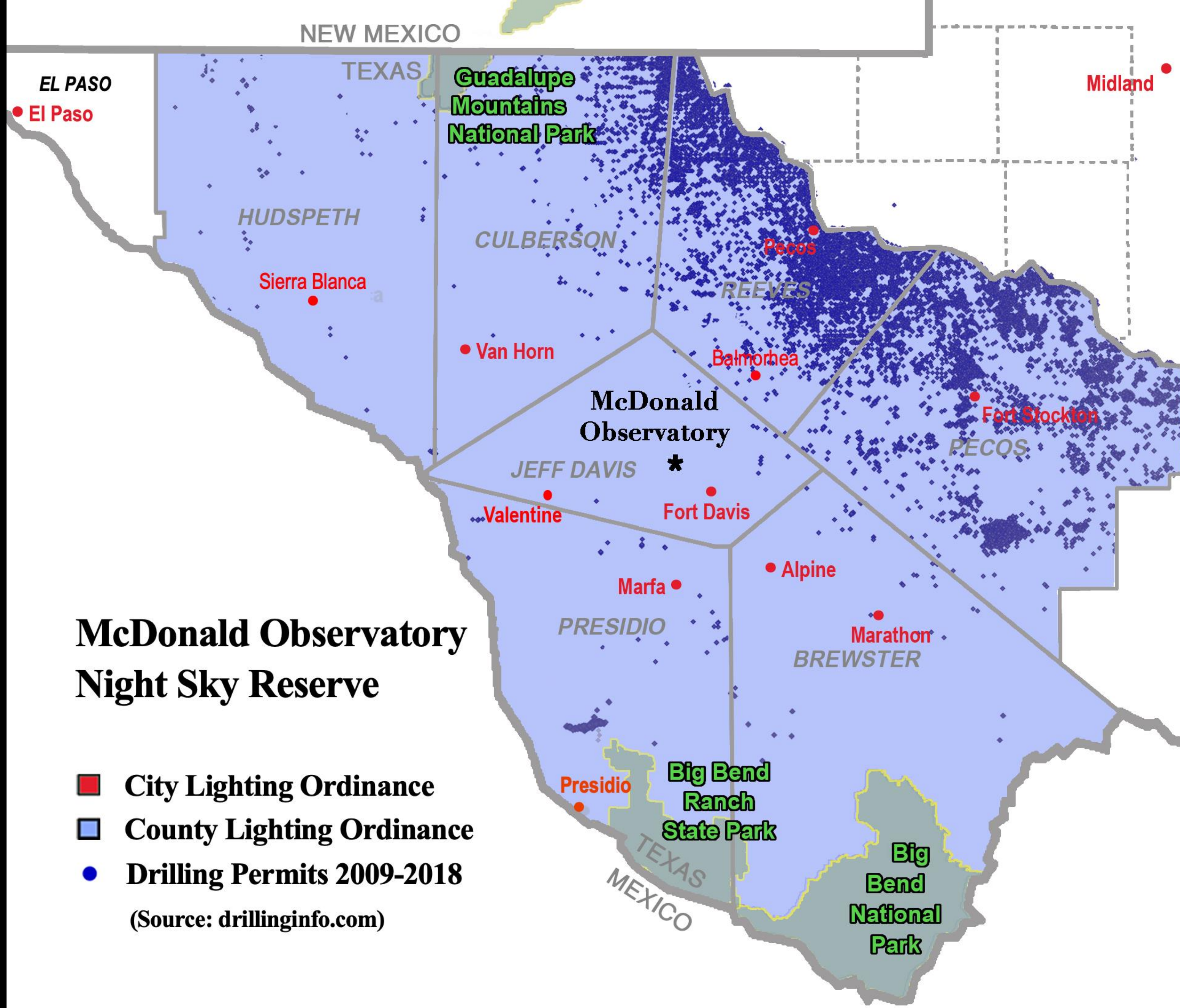


The Giant Magellan Telescope



McDonald Observatory Night Sky Reserve

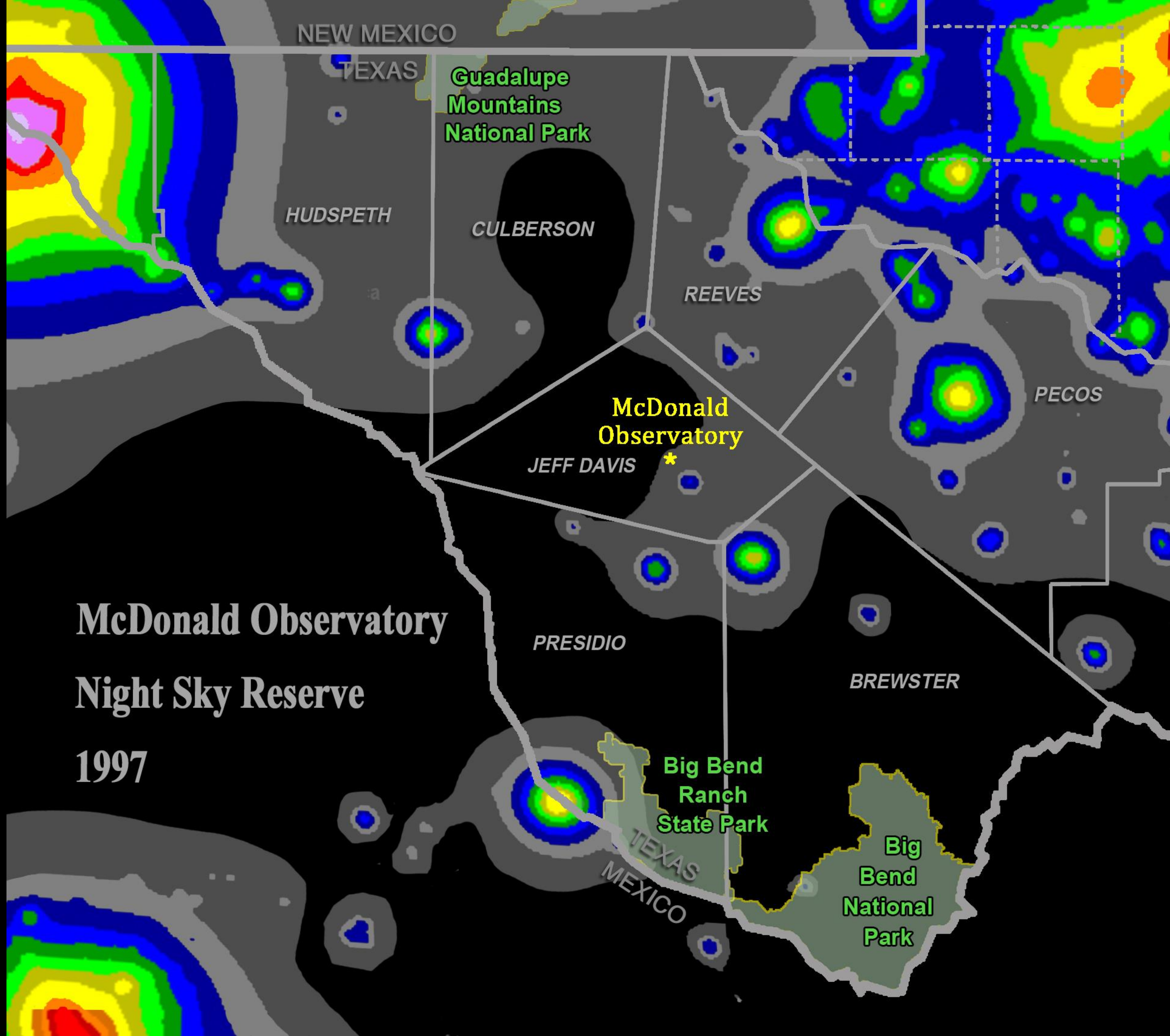
- City Lighting Ordinance
- County Lighting Ordinance



McDonald Observatory Night Sky Reserve

- City Lighting Ordinance
- County Lighting Ordinance
- Drilling Permits 2009-2018

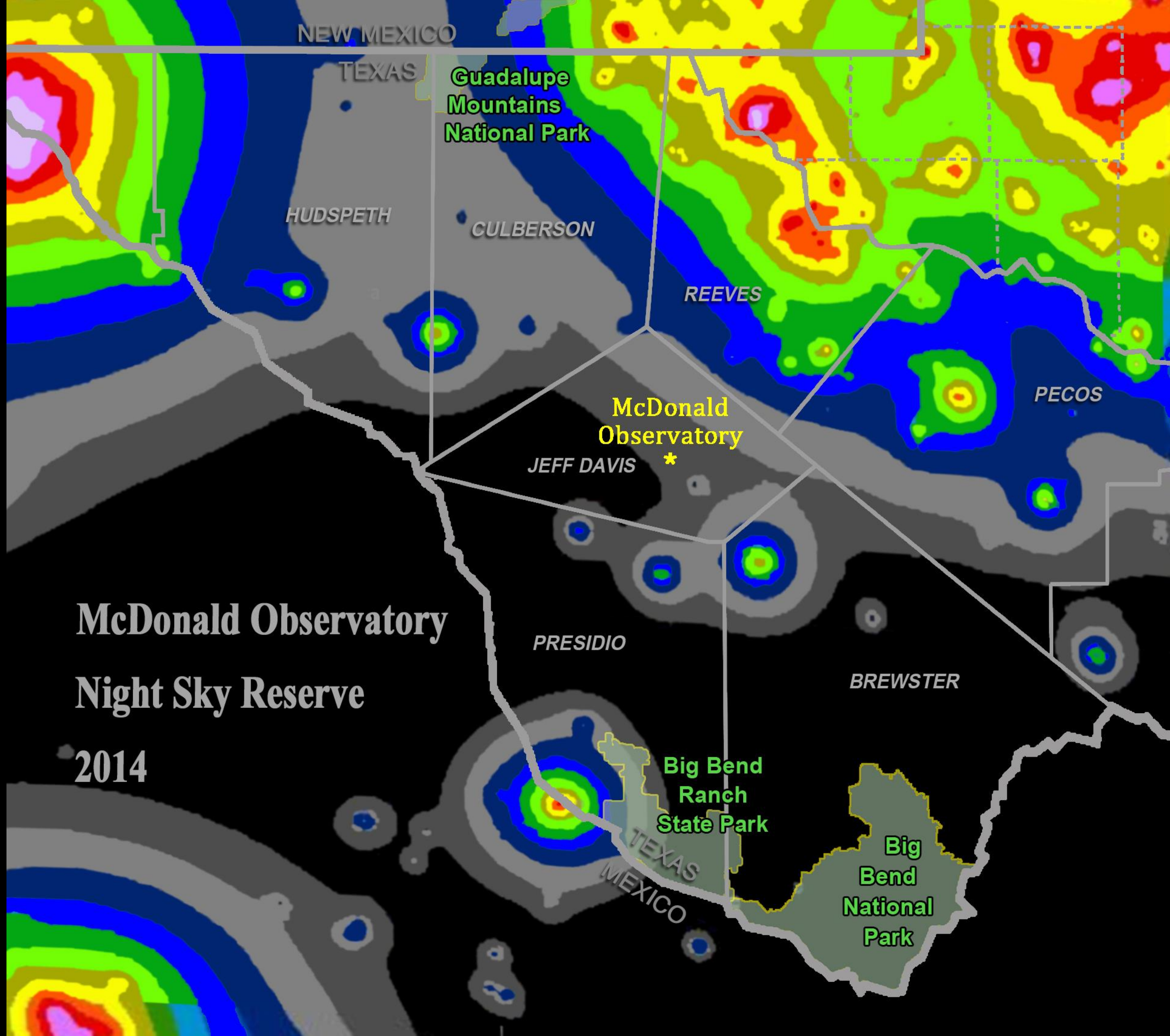
(Source: drillinginfo.com)



McDonald Observatory

Night Sky Reserve

1997



**McDonald Observatory
Night Sky Reserve**

2014



CREDIT: JOE HANSON/IT'S OKAY TO BE SMART

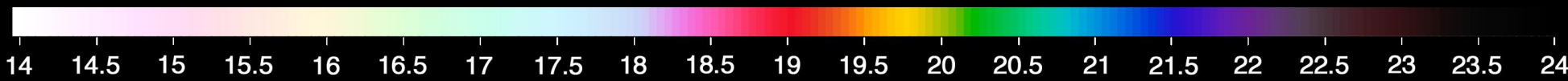


McDonald Observatory, Mt. Fowlkes

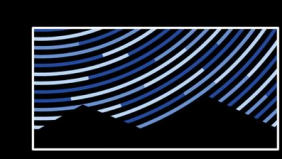
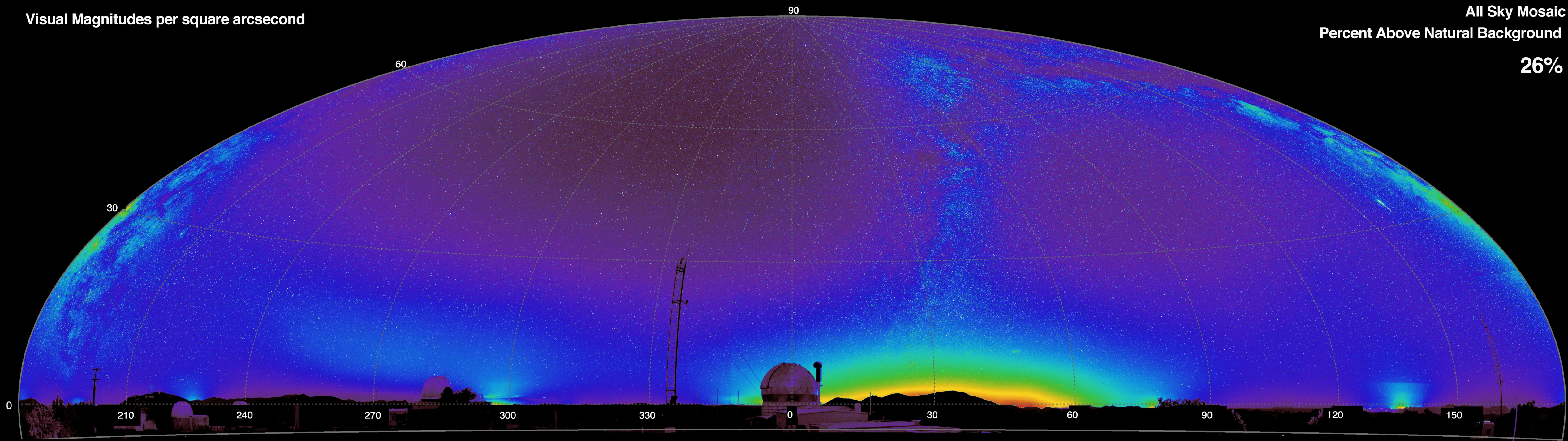
August 14, 2020, 20.4 LMT

All Sky Mosaic
Percent Above Natural Background

26%



Visual Magnitudes per square arcsecond



Data collected by: B. Wren, J. Moss-Wren
Data processed by: B. Meadows

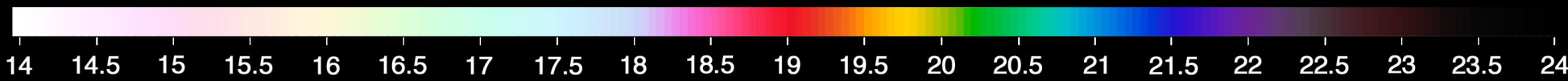
Hammer-Aitoff Equal Area Projection

McDonald Observatory, Mt. Fowler

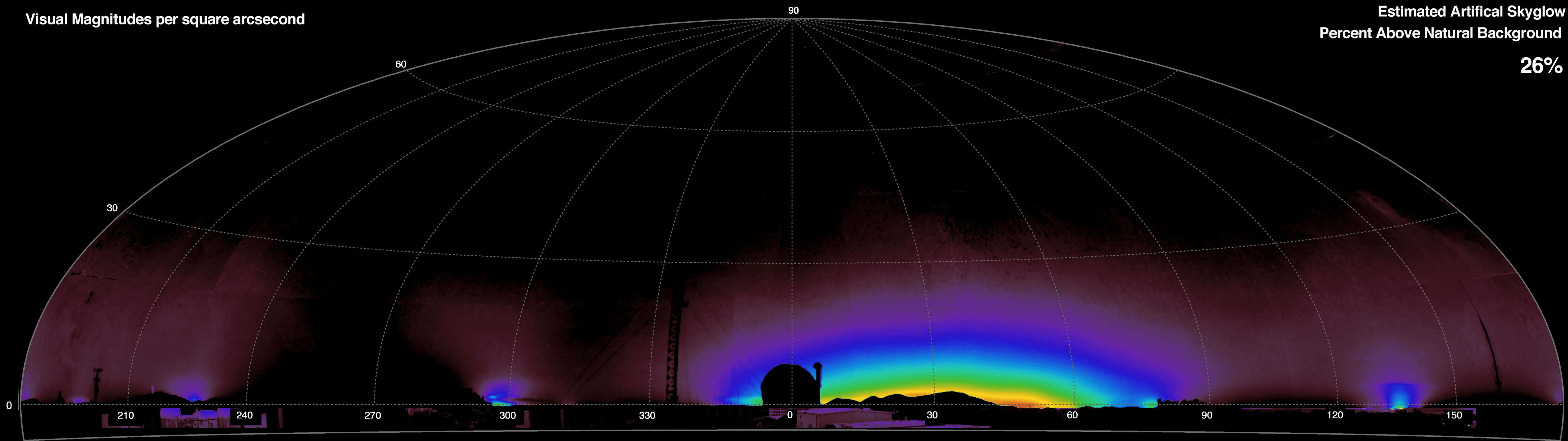
August 14, 2020, 20.4 LMT

Estimated Artificial Skyglow
Percent Above Natural Background

26%

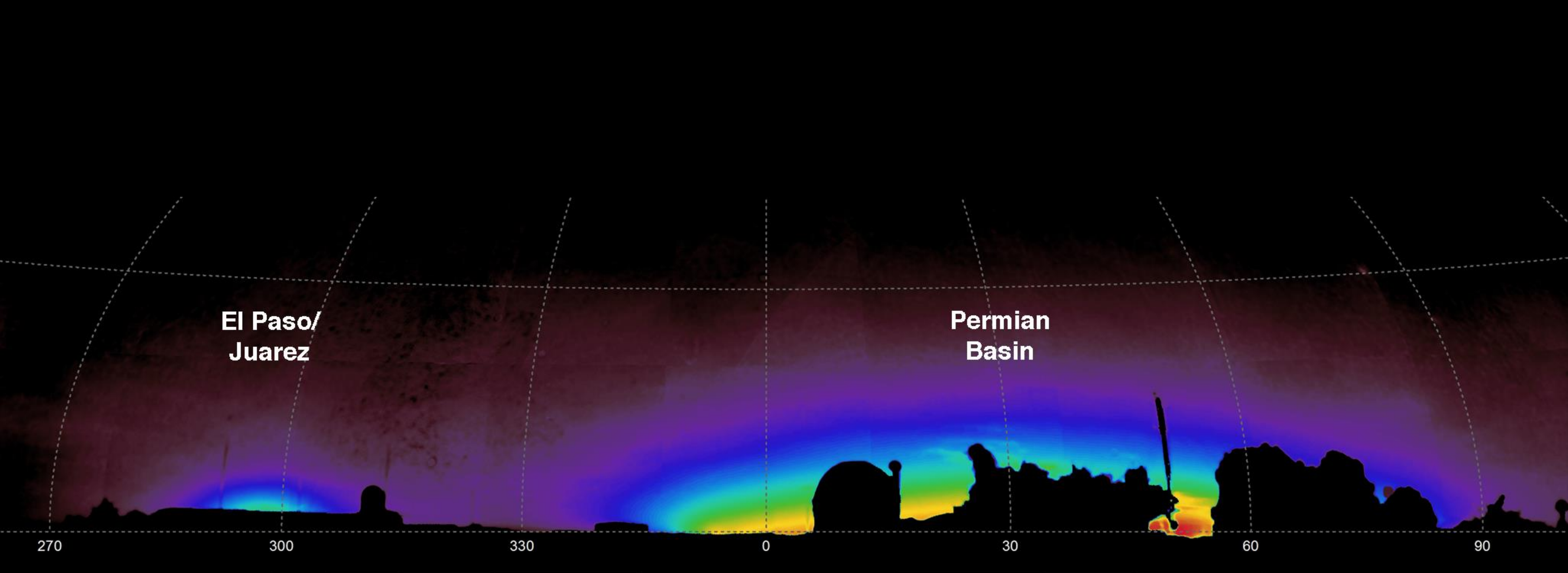


Visual Magnitudes per square arcsecond



Data collected by: B. Wren, J. Moss-Wren
Data processed by: B. Meadows

Hammer-Aitoff Equal Area Projection



University of Texas at Austin
McDonald Observatory

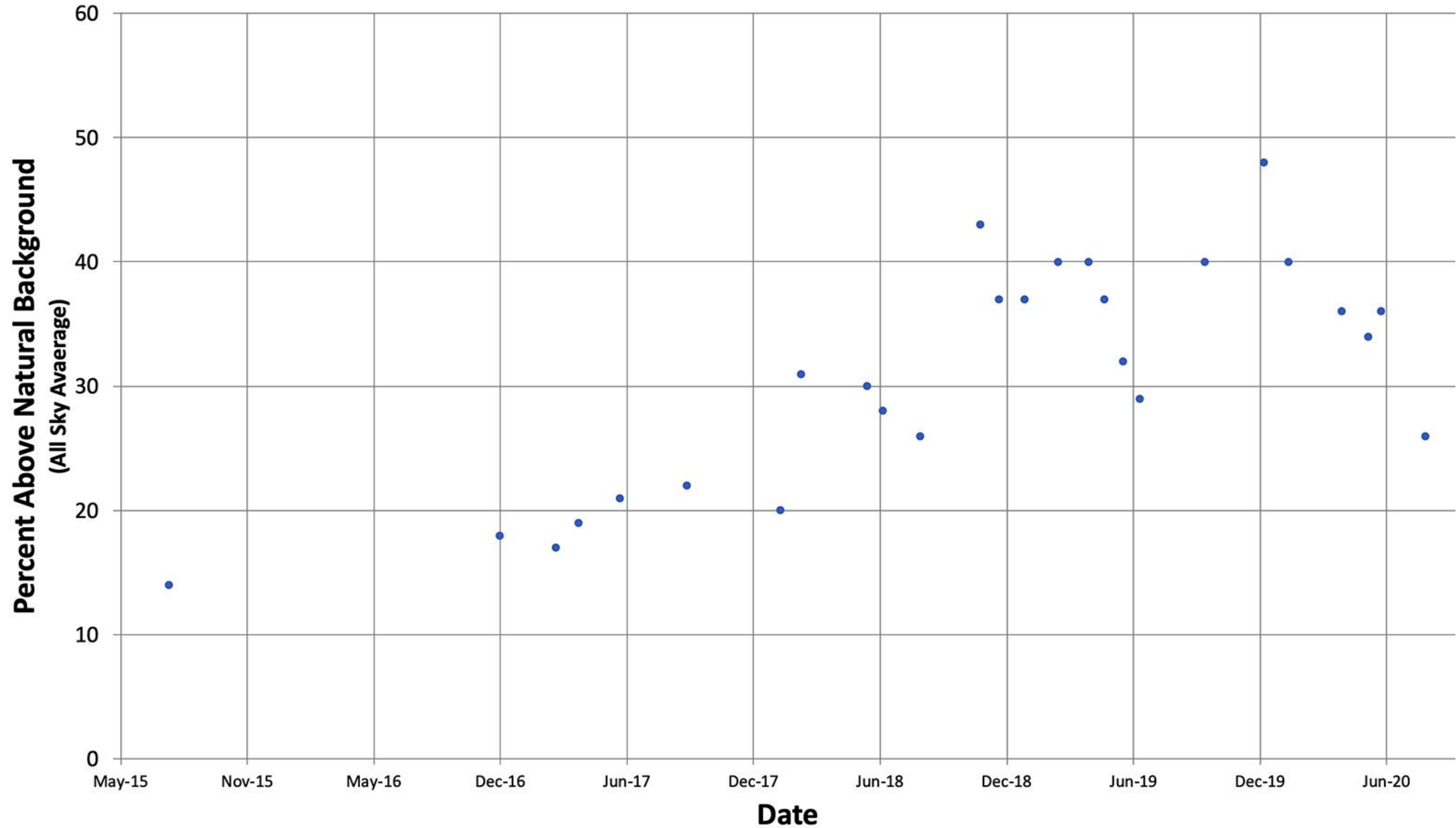


U.S. National Park Service
Night Skies Program

January 13, 2018

Data collected by: B Wren, J Moss-Wren
Data processed by: B Meadows

McDonald Observatory All Sky Photometry



NOTE: Percent above background is an all sky average. Most all of the brightening is occurring below 30-degrees above the horizon to the north in the direction of the Permian Basin.



Mud tank lighting old and new



Locke/Wren



Pioneer Energy Services/McDonald Observatory

Before



After



WPX Lindsay Compressor Station

"The employees love it! One commented that he could actually see the equipment and where he was walking now! ...plans to implement field wide."

– Olivia McNamara, Manager, HSE, WPX Energy



**RAILROAD COMMISSION OF TEXAS
Oil and Gas Division**

NOTICE TO OPERATORS

**MINIMIZING LIGHTING IMPACTS FROM
OIL AND GAS ACTIVITIES**

The Railroad Commission of Texas (RRC) has been contacted about concerns related to light originating from oil and gas rigs in the Permian Basin, specifically in the vicinity of the University of Texas McDonald Observatory in the Davis Mountains of West Texas. Since 2010, the development associated with the exponential growth of oil and gas drilling and production in the Permian Basin has generated light reflecting off the sky.

The McDonald Observatory is a state-of-the-art facility on the cutting edge of scientific research in the field of astronomy. Astronomers there focus on measuring objects at the very edge of the observable universe. Without mitigation, the gleam of light from oil and gas operations could compromise the research for which the McDonald Observatory is famous.

The McDonald Observatory will also soon complete a major upgrade to its historic Hobby-Eberle telescope. If a solution to bright skies is found, the upgrade will allow three-dimensional glimpses deep into the universe.

In 2011, the Texas Legislature revised Section 240.032 of the Local Government Code to require the commissioners court of a county, any part of which is located within 57 miles of the McDonald Observatory, to adopt orders regulating the installation and use of outdoor lighting in any unincorporated territory of the county. The counties where this requirement applies are Brewster, Culberson, Hudspeth, Jeff Davis, Pecos, Presidio, and Reeves. You are advised to check with any of these counties in which you operate regarding applicable outdoor lighting requirements.

In addition, the McDonald Observatory is working with its local neighbors to promote simple solutions to minimize lighting impacts. Stacy Locke with Pioneer Energy Services and Bill Wren with the University of Texas McDonald Observatory have developed a report titled "*Oilfield Lighting Can Coexist with Dark Skies*," which is available on the observatory's website

at: http://mcdonaldobservatory.org/sites/default/files/oilfield_lighting_can_coexist.pdf.

More general information about the McDonald Observatory's Dark Skies Initiative is available at: : <http://mcdonaldobservatory.org/darkskies>.

You are encouraged to consult these resources and consider ways to reduce stray light. The solutions can be simple and cost effective and can actually improve nighttime visibility and increase worker safety.

**PLEASE FORWARD TO THE APPROPRIATE SECTION OF YOUR
COMPANY**



RAILROAD COMMISSION OF TEXAS
Oil and Gas Division

NOTICE TO OPERATORS

“The solutions can be simple and cost effective and can actually improve nighttime visibility and increase worker safety.”

observatory's website

at: http://mcdonaldobservatory.org/sites/default/files/oilfield_lighting_can_coexist.pdf.

More general information about the McDonald Observatory's Dark Skies Initiative is available at : <http://mcdonaldobservatory.org/darkskies>.

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PLEASE FORWARD TO THE APPROPRIATE SECTION OF YOUR COMPANY

Austin, Texas
February, 2016

Recommended Lighting Practices

A Collaborative Effort To Preserve
West Texas' Dark Night Skies



McDonald Observatory
Fort Davis, Texas

Introduction

Located atop Mount Locke and Mount Fowlkes in Fort Davis, Texas and under some of the darkest night skies in the continental United States, sits the 500-acre world-renowned University of Texas at Austin's McDonald Observatory. The Observatory's mission is to inform, educate, and inspire through their public programs, and support the teaching of the science and hobby of astronomy.

Through a campaign of education and awareness, the McDonald Observatory's **Dark Skies Initiative** seeks to protect the beautiful, Milky Way-filled night skies of West Texas for ongoing astronomical research and education.

The following **Recommended Lighting Practices** are a result of collaboration between several partner organizations. These organizations strongly support the McDonald Observatory's mission.

The recommendations in this document are designed for oil and gas operations in the following Texas counties that have lighting ordinances: Brewster, Culberson, Hudspeth, Jeff Davis, Pecos, Presidio, and Reeves. While these counties surround the McDonald Observatory, the recommendations are equally beneficial across the industry.

The McDonald Observatory and all of our partners thank you for following the Recommended Lighting Practices and for helping to keep the night skies of West Texas dark.

Partners



Mike Sommers
American Petroleum
Institute
President and CEO

Bill Wren
McDonald Observatory
Special Assistant to the
Superintendent

Ben Shepperd
Permian Basin Petroleum
Association
President

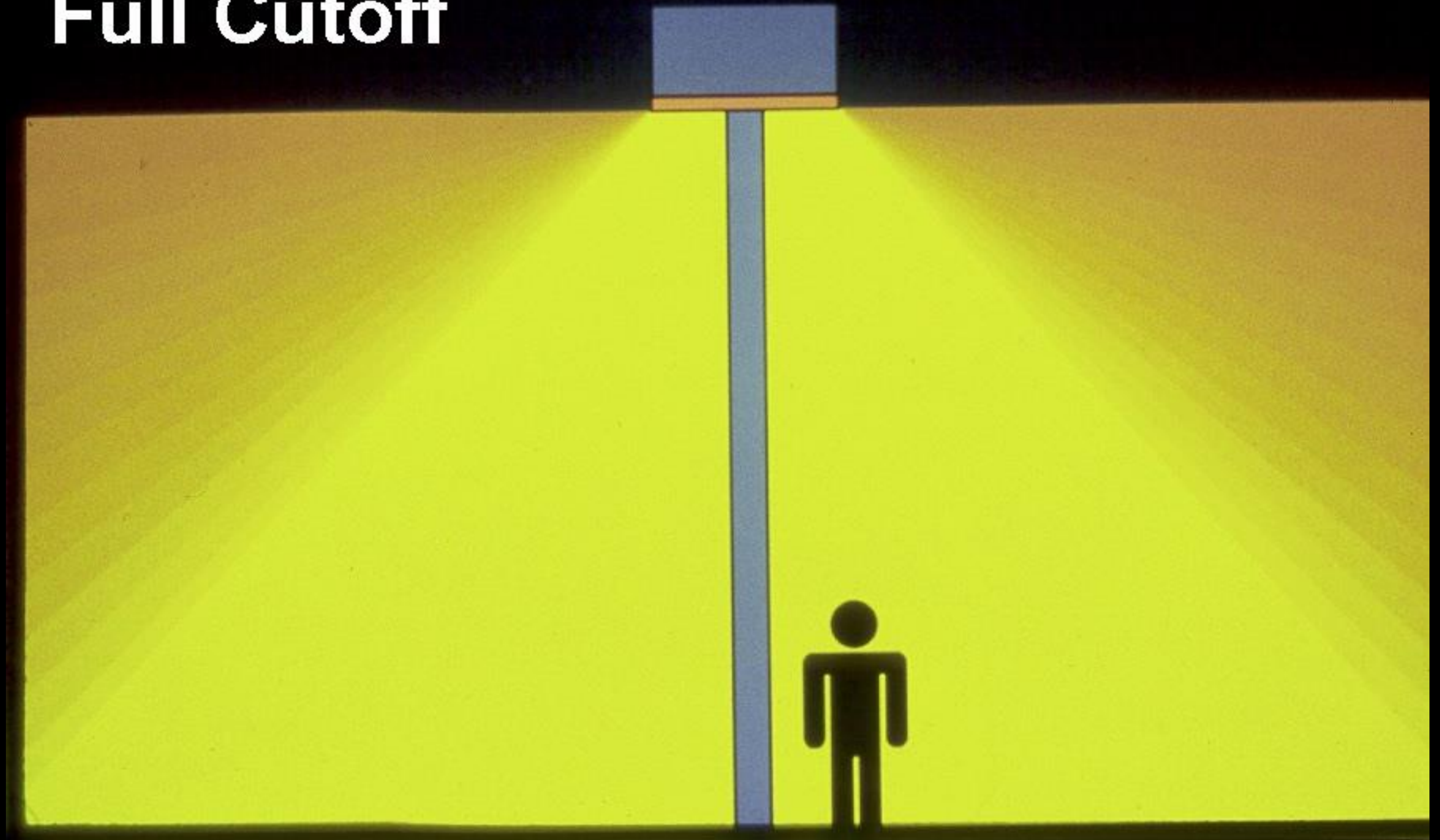
Joni Carswell
Texan by Nature
CEO and President

Ed Longanecker
Texas Independent
Producers and Royalty
Owners Association
President

Todd Staples
Texas Oil & Gas
Association
President

Mark Houser
University Lands
CEO

Full Cutoff









Precision Drilling
RIG 601



Precision rig 601

Warm White

Daylight White

Cool White

1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 K



Dark Sky Friendly Oilfield Lighting



Apache Corporation Compressor Station

Dark Sky Friendly Oilfield Lighting



Apache Corporation Tank Battery

Dark Sky Friendly Oilfield Lighting



Apache Corporation Cryo Complex





Cimarex Energy



September 4, 2020

The Honorable Wayne Christian
The Honorable Christi Craddick
The Honorable Ryan Sitton
Railroad Commission of Texas

Re: Proposed amendment to Statewide Rule 32 Exception Data Sheet

Dear Chairman Christian and Commissioners Craddick and Sitton,

We, the undersigned, write to express our dismay with the gross waste of natural gas that is occurring in Texas oilfields. While your proposed changes to the Rule 32 Exception Data Sheet may help to better understand the practice of flaring, these changes do not confront the gravity of the issue.

As many of us stated in a letter just four weeks ago, "In the last seven years, the Commission has granted operators more than 27,000 permits to flare,¹ resulting in the burning of nearly one trillion cubic feet of natural gas."² Routine flaring comprises a significant portion of this waste and is not adequately addressed by the proposal.

This profligacy wastes the state's fossil fuel resources, results in lost tax revenue, harms our environment and public health, and is a "black eye" for the state of Texas. We once again urge you to adopt a formal policy goal to end routine flaring by 2025.

¹ "Pipeline giant sues Railroad Commission, alleging lax oversight of natural gas flaring," Texas Tribune, Dec. 3, 2019,

<https://www.texastribune.org/2019/12/03/railroad-commission-sued-lax-oversight-natural-gas-flaring/>

² "A zero flaring policy is long overdue, and investors can help make it reality," Environmental Defense Fund, May 27, 2020,

<http://blogs.edf.org/energyexchange/2020/05/27/a-zero-flaring-policy-is-long-overdue-and-investors-can-help-make-it-reality/>



Investment giants urge Texas to end most natural gas flaring

By **KEVIN CROWLEY** on 9/7/2020



HOUSTON (Bloomberg) --Investors managing more than \$2 trillion are calling on Texas regulators to ban the routine burning of natural gas from shale fields, arguing that the energy industry hasn't moved quickly enough to curb the controversial practice.

AllianceBernstein, California State Teachers' Retirement System and Legal & General Investment Management said they support eliminating gas flaring by 2025, according to a letter to the Texas Railroad Commission, which oversees oil and gas in the state. All three investors have been vocal on environmental issues before, but it's the first time large institutional investors have taken such a public stance to the Texas regulator.

"Actions of leading operators demonstrate the financial and technical viability of ending routine flaring," the fund managers said in the letter, which was seen by Bloomberg. "It is clear, however, that voluntary actions alone have been insufficient to eliminate routine flaring industry-wide."

Investors and environmentalists are increasingly drawing attention to flaring because of its wastefulness and contribution to climate change. Flaring is utilized around the world as a way to deal with gas that producers can't -- or don't want to --

September 4, 2020

The Honorable Wayne Christian
The Honorable Christi Craddick
The Honorable Ryan Sitton
Railroad Commission of Texas

Re: Proposed amendment to Statewide Rule 32 Exception

Dear Chairman Christian and Commissioners Craddick and Sitton:

We, the undersigned, write to express our dismay with the amount of natural gas flaring occurring in Texas oilfields. While your proposed changes may help to better understand the practice of flaring, these changes do not address the issue.

As many of us stated in a letter just four weeks ago, "In the past, the Railroad Commission has granted operators more than 27,000 permits to flare, 1.5 trillion cubic feet of natural gas."² Routine flaring comprises 10% of total gas production and is not adequately addressed by the proposal.

This profligacy wastes the state's fossil fuel resources, resourc... environment and public health, and is a "black eye" for the state. We urge you to adopt a formal policy goal to end routine flaring by...

¹ "Pipeline giant sues Railroad Commission, alleging lax oversight," *Texas Tribune*, Dec. 3, 2019, <https://www.texastribune.org/2019/12/03/railroad-commission-sues-pipeline-giant/>

² "A zero flaring policy is long overdue, and investors can help make it a reality," *Energy Exchange*, May 27, 2020, <http://blogs.edf.org/energyexchange/2020/05/27/a-zero-flaring-policy-is-long-overdue-and-investors-can-help-make-it-reality/>

Sep 11, 2020

COMMODITIES News Wire Investing

BP, Shell Urge Texas Regulator to End Routine Gas Flaring

Kevin Crowley, Bloomberg News



(Bloomberg) -- Two of Europe's biggest oil companies urged Texas regulators to end the routine flaring of natural gas, joining with large investors who want greater oversight of the harmful environmental practice.

BP Plc and Royal Dutch Shell Plc are calling for tougher rules than those proposed by the Railroad Commission of Texas, which regulates oil and gas in the state. The commission is considering requiring operators to disclose more data when they apply for flaring permits and issuing them for shorter periods.

"We believe there is a real opportunity for the state to set the bar for others to follow," BP and Shell said in a joint letter to the regulator dated Sept. 4 and published late Wednesday. "We encourage the Railroad Commission of Texas to support an ambition of zero routine flaring in Texas."

Last week, investors managing more than \$2 trillion asked the commission to end routine gas flaring by 2025. AllianceBernstein, California State Teachers' Retirement System and Legal & General Investment Management said the actions of leading operators "demonstrate the financial and technical viability" of their proposal.

READ: Investment Giants Urge Texas to End Most Natural Gas Flaring (1)

September 4, 2020

The Honorable Wayne Christian
The Honorable Christi Craddick
The Honorable Ryan Sitton
Railroad Commission of Texas

Re: Proposed amendment to

Dear Chairman Christian and

We, the undersigned, write to you regarding the routine flaring of natural gas occurring in Texas oilfields. We hope this letter may help to better understand the issue.

As many of us stated in a letter to the Railroad Commission of Texas, the state has granted operators more than 1 trillion cubic feet of natural gas flaring permits and is not adequately addressing the issue.

This profligacy wastes the state's natural gas environment and public health. We urge you to adopt a formal policy to

Investment most nat

By KEVIN CROWLEY on 9/7/20



HOUSTON (Bloomberg) -- Investors are urging the Railroad Commission of Texas to end the routine flaring of natural gas from shale gas production.

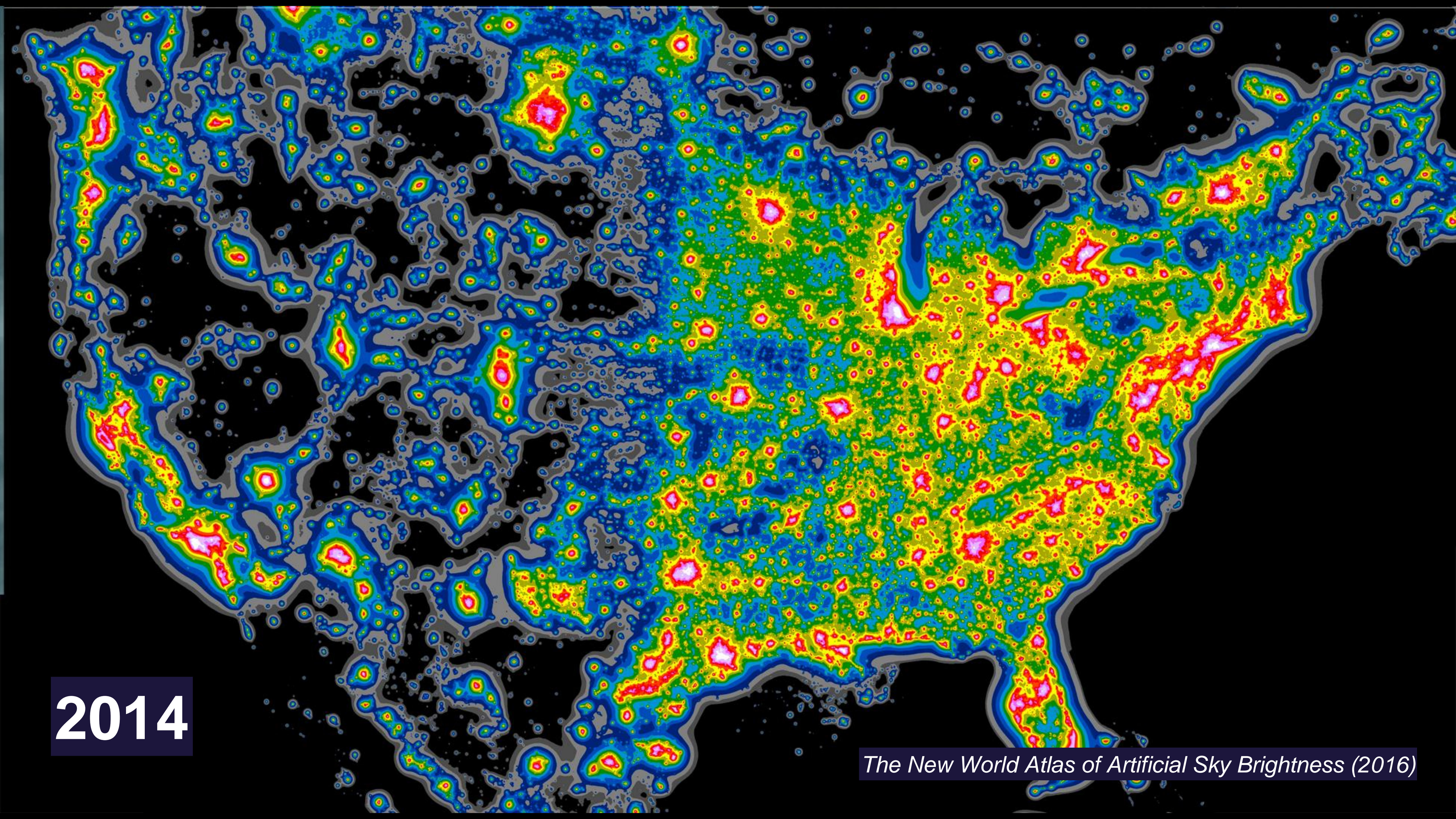
AllianceBernstein, California State Teachers' Retirement System and Legal & General Investment Management support eliminating gas flaring in the state. All three investors have taken such actions in the past.

"Actions of leading operators in the state, as outlined in the letter, which was published last week, will help to eliminate routine flaring in Texas."

Investors and environmental groups are urging the Railroad Commission to end routine flaring of natural gas. Flaring is a

¹ "Pipeline giant sues Railroad Commission of Texas," Dec. 3, 2019, <https://www.texastribune.org/2019/12/03/pipeline-giant-sues-railroad-commission-of-texas/>

² "A zero flaring policy is long overdue," EDF, May 27, 2020, <http://blogs.edf.org/energyexchange/help-make-it-reality/>



2014

The New World Atlas of Artificial Sky Brightness (2016)

The background of the image is a reproduction of the painting 'The Starry Night' by Vincent van Gogh. It depicts a night scene with a dark, turbulent sky filled with swirling, luminous stars and a bright, glowing moon. In the foreground, a dark, silhouetted cypress tree stands on the left, and a small village with a church spire is visible in the distance under the swirling sky.

**For my part I know nothing with
any certainty, but the sight of
the stars makes me dream.**

- *Vincent Van Gogh*

1889

January/February 2015



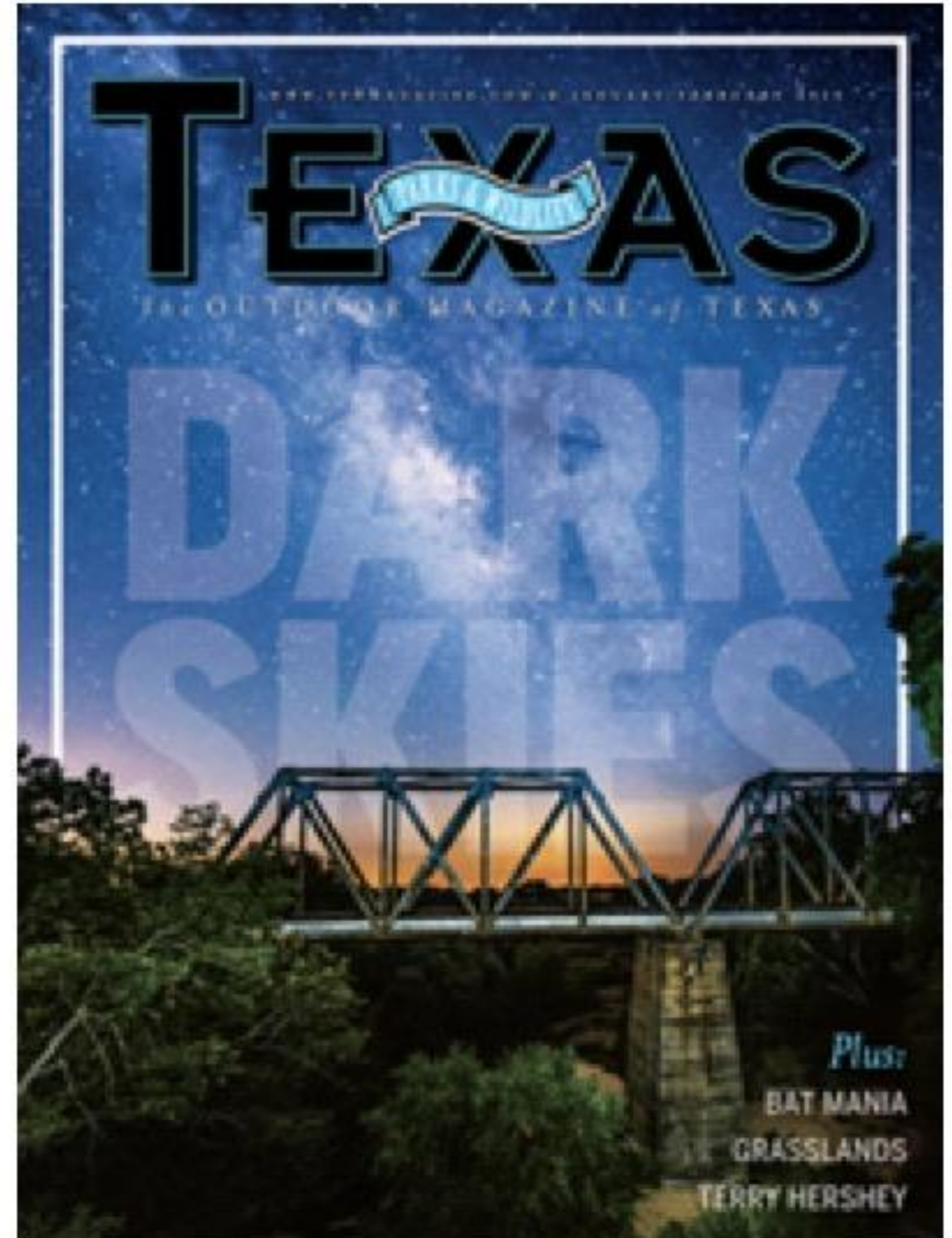
SEEING STARS

State parks embrace measures to protect dark skies at night

By Rob McCorkle

*"The stars at night are big and bright ...
Deep in the heart of Texas"* — June Hershey
and Don Swander

The 1942 Hit Parade song paying tribute to the Lone Star State's starry skies strikes a sour note today in large cities nestled deep in the heart of Texas, where artificial light pollution has





YOUTH

MOOOVING EXPERIENCE

Livestock show teaches youngsters about animals/1C

LOCAL

PARKS PROJECT

Officials to present plan to City C

ODESSA AMERICAN

January 23, 1996

Stargazers strive to keep city in dark

By Cathy Frye
Odessa American

FORT DAVIS — A shimmering skyline would show up well against the hulking Fort Davis Mountains that hover protectively over this small West Texas town.

But residents and astronomers are wary of even the most innocuous porch lights, which collectively are capable of casting a glow that interferes with the stargazing that takes place here.

"If we lose our dark skies to the extent that big cities lose theirs, we've lost part of the advantage of living in this part of the country," says Jim Walker, president of the

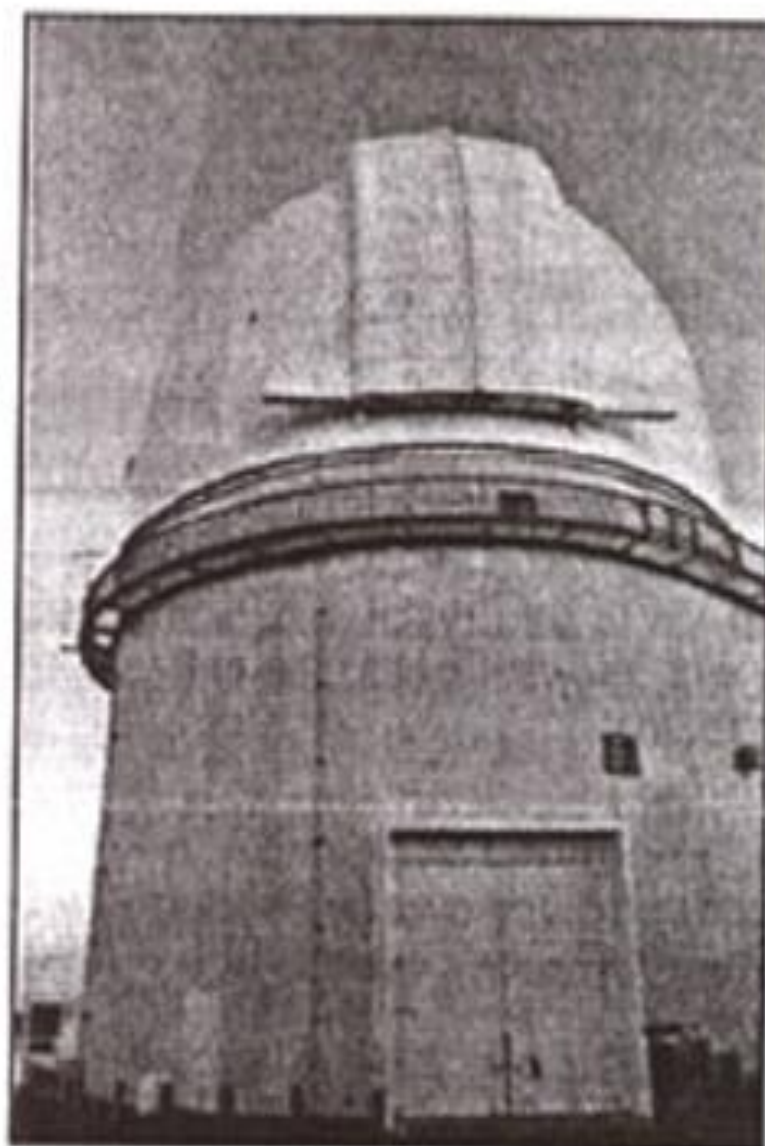
Big Bend Astronomical Society.

Fort Davis is home to the University of Texas' McDonald Observatory, the country's third-largest observatory. And it is in these mountains that the darkest pocket on the North American continent can be found.

For that reason, researchers and amateur astronomers alike gather in Fort Davis to use the observatory's 107-inch telescope. And the star parties at McDonald have made it one of West Texas' most successful tourist attractions.

But with the tourists come new businesses that are hoping to capi-

See STARS on Page 2A



Odessa American: Darwin Weigel

The University of Texas' McDonald Observatory, located in Fort Davis, is the world's third largest observatory.









PRODUCTS /

- › [Santa Maria](#)
- › [Aspen](#)
- › [Bellagio](#)
- › [New Orleans](#)
- › [Santa Rosa](#)
- › [Colonade](#)
- › [Carmel](#)

CONTACT US /

Find out how Visionaire Lighting can customize your lighting solutions.



ORNAMENTAL LIGHTING



Santa Maria



Aspen



Bellagio



New Orleans



Santa Rosa

Be a Good Neighbor

Check for the Good Neighbor Lighting & IDA logo seal of approval



The seal guarantees that you'll—

- Reduce light pollution & enhance dark sky
- Lessen impact of artificial light on ecosystems
- Reduce glare & intruding light in neighbor's home
- Minimize energy use & operating cost
- Improve visibility, safety & security

Sea un buen vecino

Busque la iluminación Good Neighbor y el sello de aprobación con el logotipo IDA



El sello garantiza que usted va a:

- Reducir la contaminación luminosa y mejorar el cielo oscuro
- Disminuir el impacto de la luz artificial en los ecosistemas
- Reducir el resplandor y la luz que se introduce en la casa de los vecinos
- Minimizar el consumo de energía y los costos operativos
- Mejorar la visibilidad, la seguridad y la protección



0338844

PORTFOLIO outdoor

DARK SKY

Wall Lantern
Lanterna murale
Faro de pared

dark sky

del oscuro cielo oscuro

7 in x 4.5 in x 7 in / 17,28 cm x 11,43 cm x 17,28 cm

\$19⁹⁸ Everyday Low Price

Dark Sky Cylinder Black

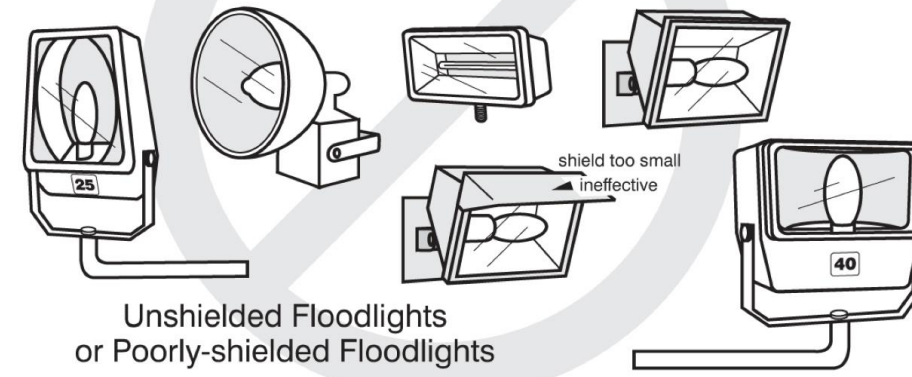
12 P 17



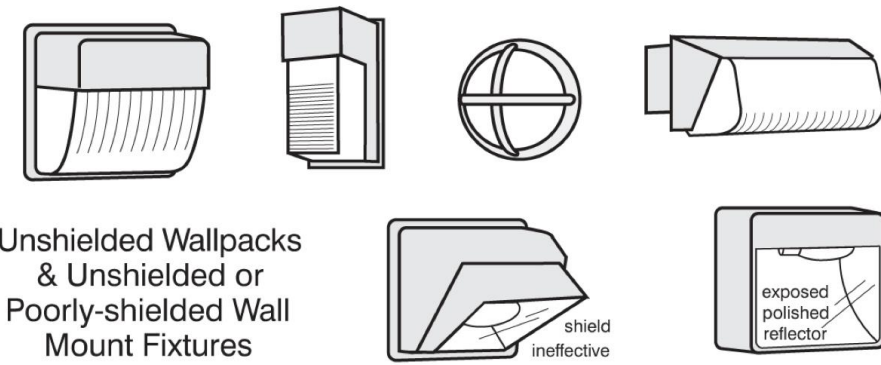
Examples of Acceptable / Unacceptable Lighting Fixtures

Unacceptable / Discouraged

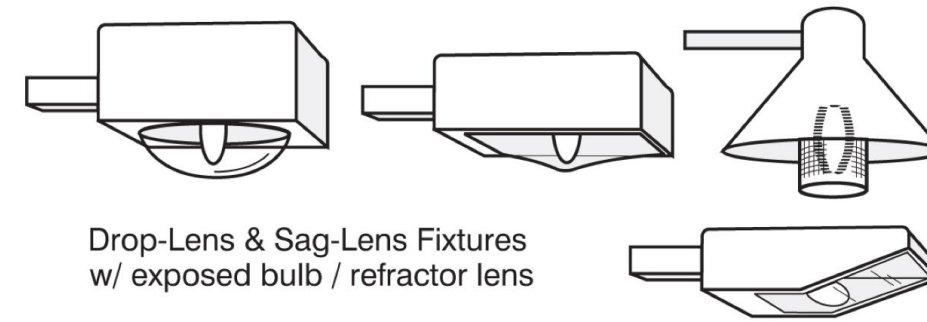
Fixtures that produce glare and light trespass



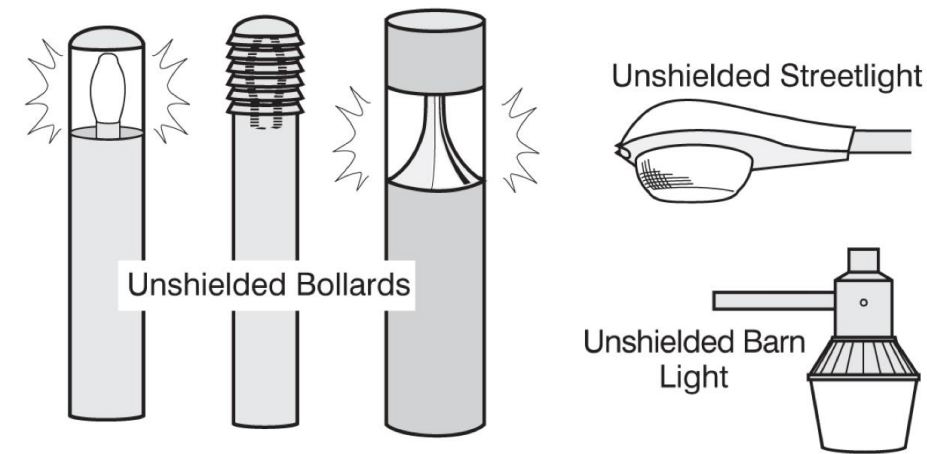
Unshielded Floodlights or Poorly-shielded Floodlights



Unshielded Wallpacks & Unshielded or Poorly-shielded Wall Mount Fixtures



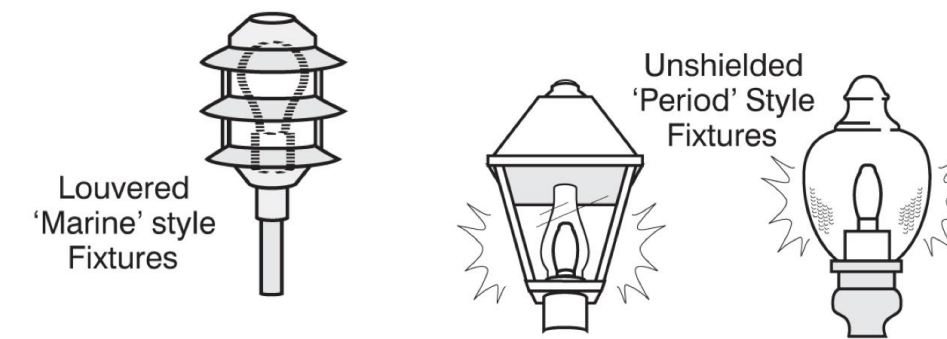
Drop-Lens & Sag-Lens Fixtures w/ exposed bulb / refractor lens



Unshielded Streetlight

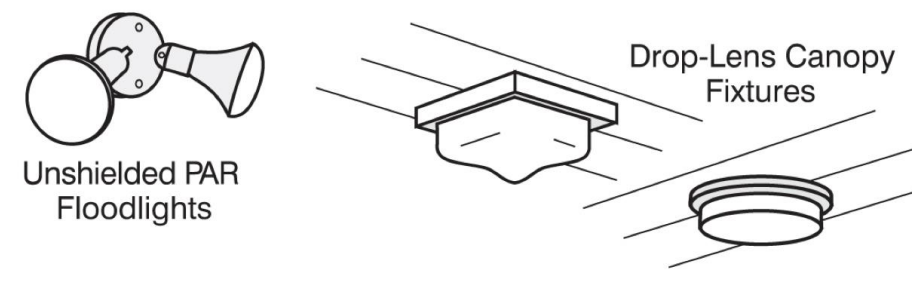
Unshielded Bollards

Unshielded Barn Light



Louvered 'Marine' style Fixtures

Unshielded 'Period' Style Fixtures

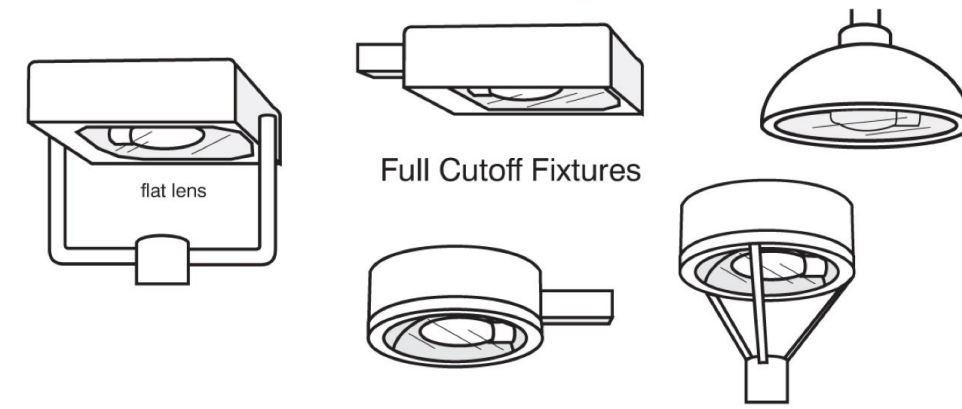


Unshielded PAR Floodlights

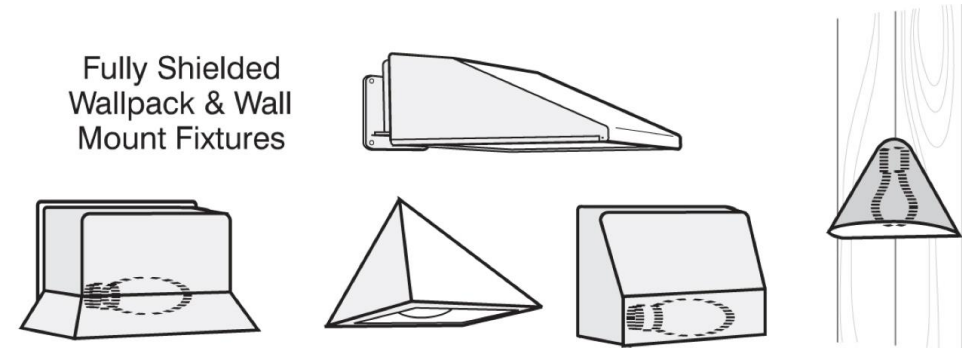
Drop-Lens Canopy Fixtures

Acceptable

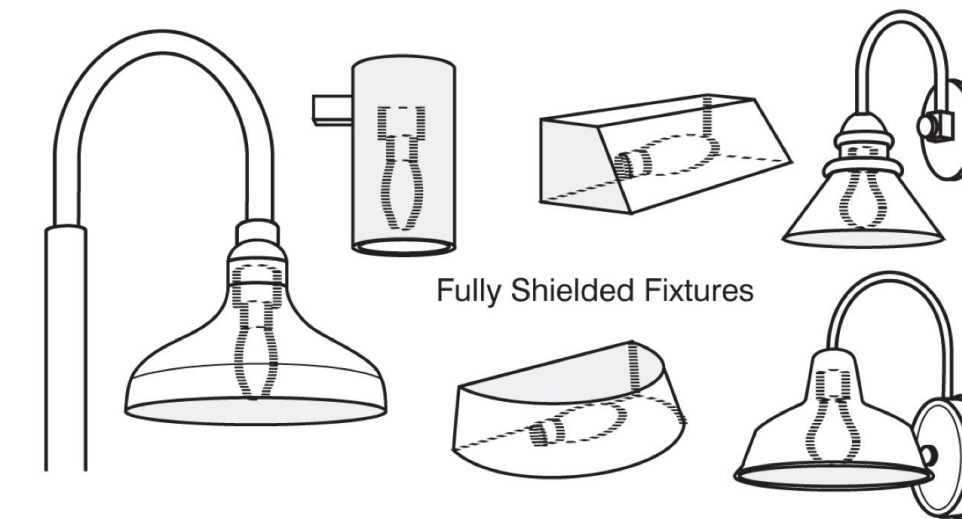
Fixtures that shield the light source to minimize glare and light trespass and to facilitate better vision at night



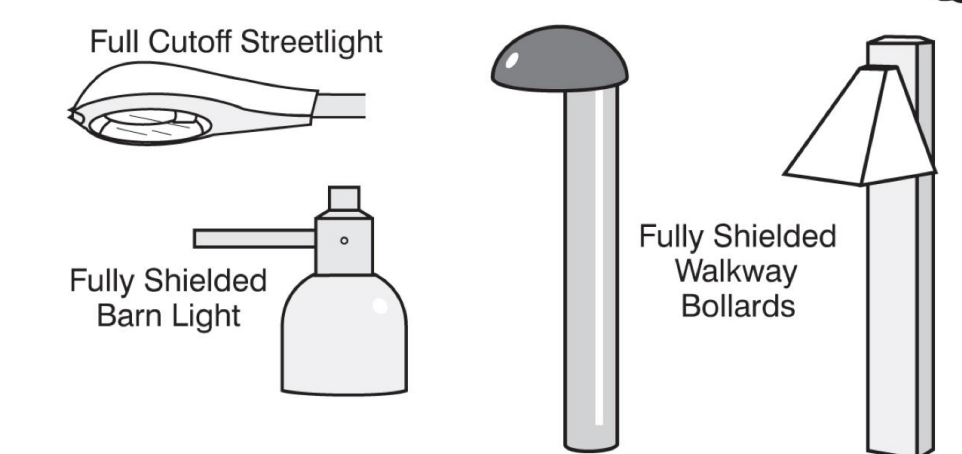
Full Cutoff Fixtures



Fully Shielded Wallpack & Wall Mount Fixtures



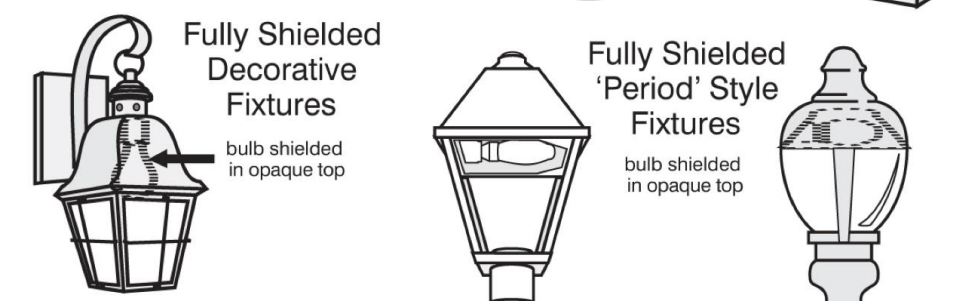
Fully Shielded Fixtures



Full Cutoff Streetlight

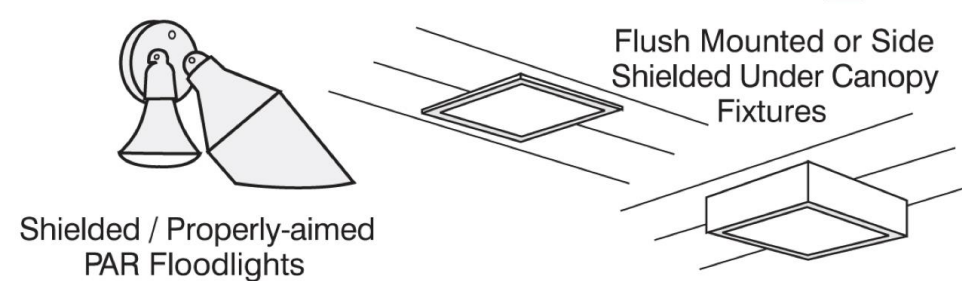
Fully Shielded Barn Light

Fully Shielded Walkway Bollards



Fully Shielded Decorative 'Period' Style Fixtures

Fully Shielded 'Period' Style Fixtures



Shielded / Properly-aimed PAR Floodlights

Flush Mounted or Side Shielded Under Canopy Fixtures

OUTDOOR LIGHTING GUIDELINES:

OUTDOOR LIGHTING GUIDELINES:

- 1. Shield and aim fixture as necessary to prevent light source (bulb) from being visible from off site or off property.**

OUTDOOR LIGHTING GUIDELINES:

- 1. Shield and aim fixture as necessary to prevent light source (bulb) from being visible from off site or off property.**
- 2. Maximum color temperature of 2,700-degrees Kelvin.**

OUTDOOR LIGHTING GUIDELINES:

- 1. Shield and aim fixture as necessary to prevent light source (bulb) from being visible from off site or off property.**
- 2. Maximum color temperature of 2,700-degrees Kelvin.**
- 3. No more than 100,000 lumens per acre for non-residential developments.**

Esta bombilla tiene una garantía de 5 años. En caso de falla o si no está satisfecho con su rendimiento, llame al 1866-994-4148 para recibir instrucciones para el remplazo de la bombilla. El reemplazo es el único recurso provisto por esta garantía y la responsabilidad por daño incidental o resultante queda expresamente excluida. No devuelva la bombilla a la tienda.

CAUTION

Use only on 120 volt, 60Hz circuits. This LED is suitable for damp locations. This device shall not be used in recessed/sealed fixtures. It is not intended for use with emergency exit fixtures or emergency exit lights. This lamp may not be compatible with all dimmers. When installing, turn power off before connecting or disconnecting to fixture. Added weight of the device may cause instability of a freestanding portable luminaire. Use only with a portable table lamps that have a shade. Use in portable lamps in which the distance from the bottom of the base to the top of the lamp holder does not exceed 3 times the minimum base diameter.

PRECAUCIÓN

Use sólo con circuitos de 120 voltios y 60 hz. Esta bombilla LED es adecuada para utilizarse en lugares húmedos. Este dispositivo no se debe usar en lámparas selladas/completamente empotradas. No está diseñada para usarse con lámparas o luces de salidas de emergencia. Es posible que ésta bombilla no sea compatible con todos los reguladores. Al momento de instalar, corte la alimentación antes de conectar o desconectar la lámpara. El aumento de peso en el dispositivo puede causar inestabilidad de una luminaria portátil independiente. Use sólo con lámparas de mesa portátiles que tengan pantalla. Use en lámparas portátiles en donde la distancia desde la parte inferior de la base hasta la parte superior del portalámpara no mida más de tres 3 veces el diámetro mínimo de la base.

Lighting Facts Per Bulb

Brightness 800 lumens

Estimated Yearly Energy Cost \$1.45
Based on 3 hrs/day, 11¢/kWh
Cost depends on rates and use

Life
Based on 3 hrs/day 22.8 years

Light Appearance
Warm Cool
3000 K

Energy Used 12 watts

These lamps comply with federal energy efficiency labeling requirements

Estas bombillas cumplen con las exigencias en etiquetaje de ahorro de energía federales



60w
Replacement*
Reemplazo de
60w*

565
Lumens/Lúmenes

Uses only
43w
Utiliza sólo 43w

0.9
Year Life**
0,9 años de vida**

Lighting Facts Per Bulb

Brightness 565 lumens

Estimated Yearly Energy Cost \$5.18
Based on 3 hrs/day, 11¢/kWh
Cost depends on rates and use

Life
Based on 3 hrs/day 0.9 years

Light Appearance
Warm Cool
2900 K

Energy Used 43 watts

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Visit us on the internet...
www.GELighting.com
800-GE-Light

Manufactured for GE Lighting
Fabricado para GE Lighting
General Electric Company
Nela Park
Cleveland, OH 44112 USA

Made in China
Fabricado en China

1 bombilla

PC: 85960
Desc: 43A/CLRVL/H-LTP1
Res. #1141754



0 43168 85960 8
CTNHALA191RV43GE85960ASCH-00



The book cover features a blue-tinted night scene. A large, leafless tree is the central focus, its intricate branches silhouetted against a deep blue sky filled with numerous small white stars. The overall mood is serene and nocturnal.

Ecological Consequences
of
Artificial Night Lighting

Edited by

Catherine Rich • Travis Longcore



Harvard Health Publishing
HARVARD MEDICAL SCHOOL

Blue light has a dark side

What is blue light? The effect blue light has on your sleep and more.

Updated: August 13, 2018



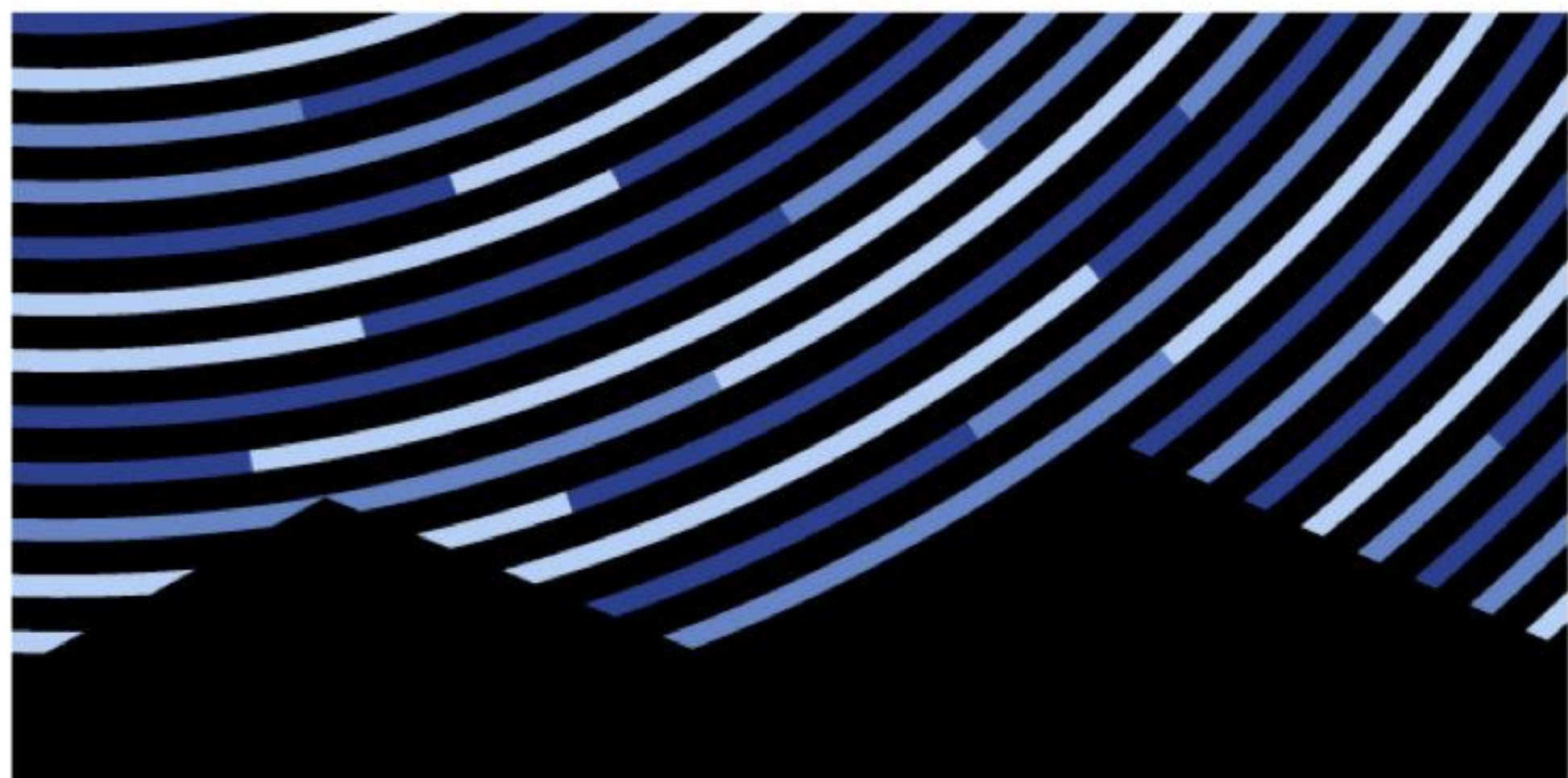
**Goodwood, Ontario
August 14th, 2003**

**Goodwood, Ontario
August 15th, 2003**



RESOURCES:

- **McDonald Observatory Dark Skies Initiative**
 - <http://mcdonaldobservatory.org/darkskies>
- **International Dark-sky Association (IDA):**
 - <http://darksky.org>



McDonald Observatory
Fort Davis, Texas