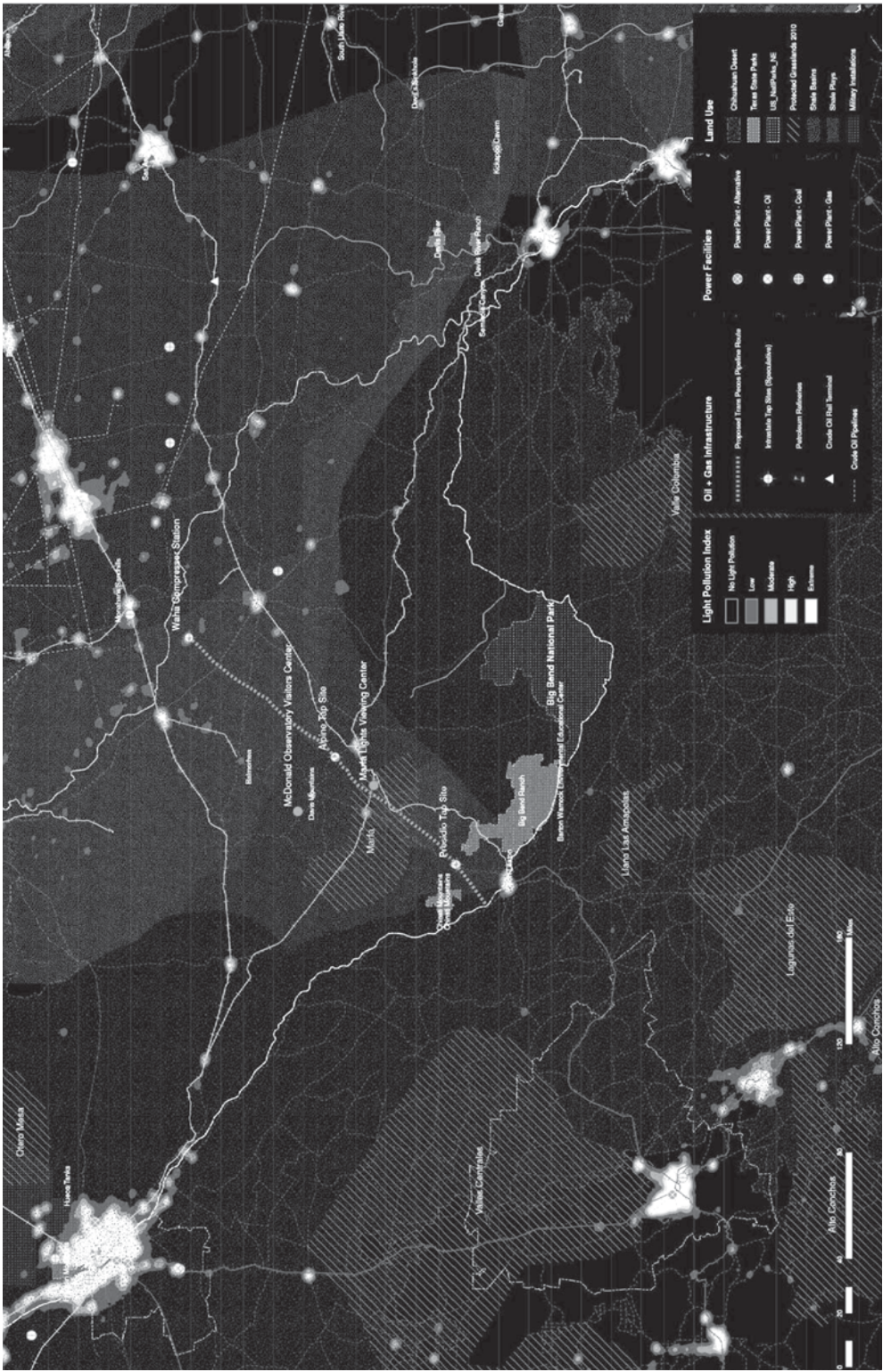


Big Bend Oil Infrastructure and Regional Light Pollution



The Cover of Daylight: Negotiating Transnational Infrastructures on the U.S.-Mexico Border

Ersela Kripa and Stephen Mueller, AGENCY

TRANSNATIONAL ENERGY FRONTIER

Energy security policy is remapping transnational infrastructure on the U.S.-Mexico border, and may very soon alter one of the largest untouched “cultures of darkness” through cross-border negotiations. Companies on either side of the border are frenzied in the wake of a deregulated Mexican energy economy, developing partnerships to enable the free flow of U.S. energy into the emerging Mexican market. This frenzy is manifest in a slew of transnational natural gas pipeline projects coming online in the borderland this year, creating a continuous binational,

cross-border energy infrastructure. In the rush to control the neighbouring energy economy, some of the last vestiges of land untouched by the energy industry are now being exploited.

U.S. domestic energy policy has turned to transnational infrastructures in the name of domestic security. At the federal level, this supports an agenda of energy independence and domestic security based on a self-sufficient and exportable energy market. Federal policies have enabled recent booms in hydraulic fracturing (“fracking” more popularly) throughout the domestic interior, with companies investing in new and more elaborate transnational pathways to ensure a steady supply. Among a growing list of examples are the controversial Keystone

... on the U.S.–Mexico Border
XL (KXL) pipeline, which seeks to connect Canadian crude with gulf refineries and foreign markets, and a number of proposals for east–west corridors connecting interior supply with coastal shipping routes.

Energy on the border is becoming more transnational. The Mexican government has transitioned its energy outlook in recent years, from a state–owned monopoly through Petróleos Mexicanos (PEMEX), to attracting private investment and transnational companies into the mix. This has resulted in a significant increase in Mexican pipeline infrastructure in just the last few years. The U.S., for its part, is looking to do business with this emerging market, and hoping to find a new buyer for the growing surplus of natural gas from the major domestic shale plays close to the border, the Permian Basin and Eagle Ford.

This transnational energy frontier is manifest most explicitly in a series of borderland pipeline projects coming online in the next several months. These projects are lines of least resistance, where multiple interests align, connecting domestic natural gas supply with a growing Mexican demand. The activity of the natural gas industry in Texas alone will sponsor no fewer than four significant pipeline projects in 2016, charting hundreds of miles of new transmission lines on both sides of the border.¹ Connecting extraction landscapes with remote border towns and points south, these projects facilitate the rapid export of natural gas to the Mexican market in unprecedented volume. Two lines will run mostly in parallel from the Waha distribution hub near Cayanosa, leaving the Permian Basin and traveling almost 200 miles west to cross into Mexico near San Elizario. The first of these, which came online in March 2016, is the Roadrunner Gas Transmission Pipeline. Developed by ONEOK Partners, the project is relatively small compared to other, more ambitious infrastructures soon to cross the region. The 30–inch line will progressively increase its throughput from a current 170 million cubic feet per day to a maximum capacity of 640 million cubic feet per day by 2019.

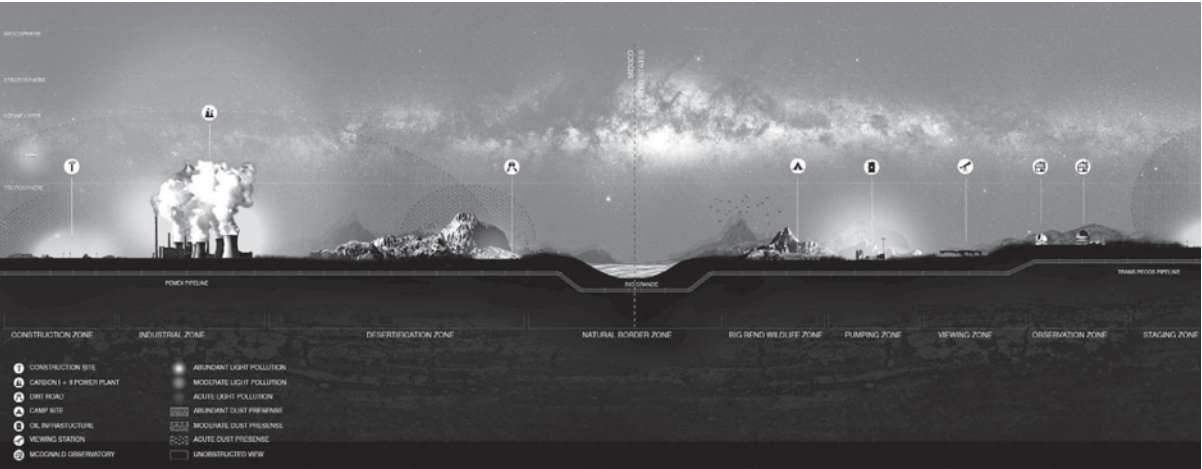
Traversing the same territory, the Comanche Trail Pipeline, developed by Energy Transfer Partners (ETP) will be capable of delivering 1.1 billion cubic feet of natural gas per day through its 42–inch diameter line. The pipeline is scheduled to begin operations in early 2017.²

South of the border, the Los Ramones project will enter its second phase this year, with a new 42–inch gas transmission line. The project will extend an existing transnational network, which in its current configuration moves natural gas from Eagle Ford near Agua Dulce, Texas, to the Mexican town of Los Ramones, crossing the border at Tamaulipas. Two new legs will be capable of delivering more than 1.4 billion cubic feet of natural gas per day a further 460 miles into the Mexican interior to the city of San Luis Potosi, over half the distance from the border to Mexico City. Towns on the U.S.–Mexico border within reach of the emerging Mexican energy economy will become newly important geostrategic hubs, transitional waypoints between U.S. and Mexican natural gas. The territories connecting these points are thus being remapped, newly subject to cross–border energy economies.

The particular constellation of energy demand, lack of regulatory infrastructures in West Texas, and the remoteness of small towns near the Permian Basin, makes for a particularly volatile set of conditions, with increased energy production and speculation on future gas exports poised to dramatically affect the region. Texas recently banned fracking bans,³ enabling the wholesale transformation of towns atop shale plays. While much of the activity is localized around historic oil and gas centres like Midland/Odessa, and more recently established natural gas exploits near Pecos, there are signs that gas exploration may migrate further into as–yet–unexplored territory. New finds of productive wells near the border, in towns like Ojinaga,⁴ suggest that virgin territories and natural reserves nearby may soon be compromised by the machinations of energy and security interests.

In the Big Bend region of West Texas, this impact is already underway. The Trans–Pecos Pipeline (TPP) will cross 143 miles

NIGHT: PASSAGES



Trans Pecos Pipeline | Transnational Infrastructure, Atmospheres, and Agents

of West Texas, carrying natural gas from productive fields in the Permian Basin to the Rio Grande River—the U.S.–Mexico border—just outside Presidio.⁵ Another 42–inch pipeline, the TPP will have a capacity of 1.4 billion cubic feet of natural gas per day. Along its route, the pipeline bisects the virtually untouched Big Bend region, an area of the country famed for its dark skies and unspoiled, pre–anthropocenic desert ecosystem.

FLARES IN THE DARK — A DARK SKY AND PETROCHEMICAL RESERVE

Since the proposal of the TPP, the Big Bend region has emerged as a unique paradox, a combustible mix of binational energy interests and nighttime tourism. The area’s low density and remoteness make it a destination for scientists, casual observers, and adventurers to reconnect with the night sky, far from the sources of light pollution and atmospheric haze that cover more populated centres. Big Bend National Park, uniquely exploiting the region’s potential for darkness, was the largest Gold–tier Dark Sky Park in the world in 2012—“one of the largest, most remote, and least–visited national parks in the lower 48 United States.” The nearby McDonald Observatory and Marfa Lights further benefit from the dark Texan sky.

The region’s “culture of darkness” is 43

enacted through festivals and gatherings, which celebrate and contribute to its unique nighttime identity. The Marfa Lights Festival draws thousands to the area each Labor Day weekend to take in the mysterious nighttime spectacle in the flats east of town. Since the festival began in 1986, national awareness of the region’s dark sky culture has increased, with “busloads of tourists [...] stopping by the side of U.S. 90 and scanning the horizon” for their chance to glimpse the elusive Marfa Lights.⁶ The Big Bend Conservancy offers a “Dark Sky Weekend” with nighttime demonstrations in astrophotography.⁷ The Texas Dark Skies Festival in Presidio offers presentations ranging from astronomy to



Light Pollution As Seen From Marfa Lights Viewing Station

The Cover of Daylight: Negotiating Transnational Infrastructures ... science fiction.⁸ This culture is forged daily by a range of official and unofficial actors. Scientists and hobbyists routinely comele with casual stargazers, activists, and conspiracy theorists in the West Texas landscape.

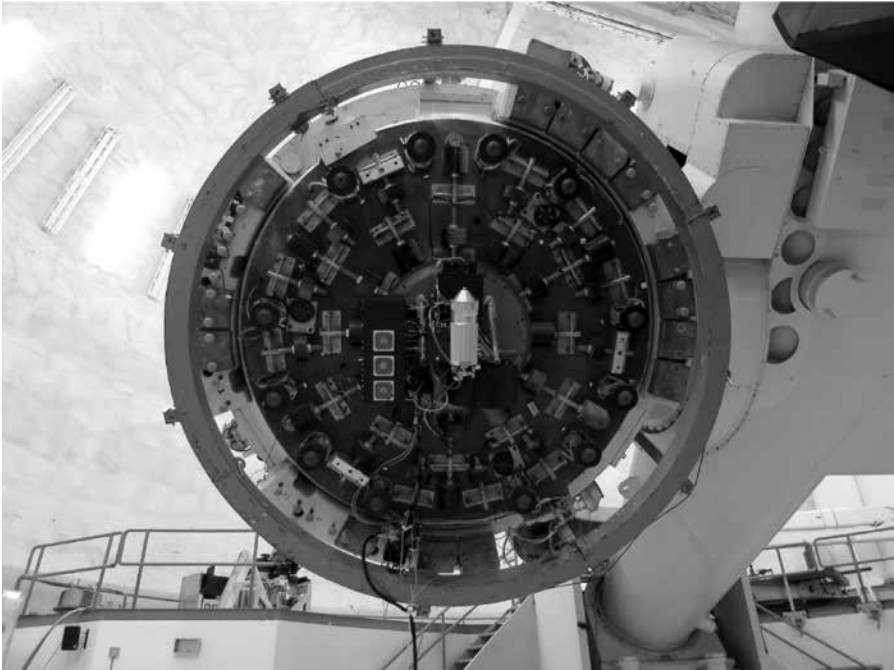
Big Bend’s geostrategic location and natural geology, however, suggest that the seemingly infinite darkness of its depopulated nighttime landscape will not last much longer. Energy companies on both sides of the Rio Grande now view the region as an expedient and underdeveloped resource, a shortcut for moving natural gas from Permian Basin shale plays to the Mexican border. The area is also potentially a source for untapped supply, with successful natural gas exploration in the area having been developed over the last several years. The local Sierra Club reports that over 135,000 acres in the Big Bend region had been leased to energy companies, starting in 2006.⁹ Concerned about the expansion of such activity, its encroachment on the unspoiled landscape, and potential impact on the region’s famed darkness, in 2014 the residents of Alpine, Texas called for a fracking ban.¹⁰



Light Sensitive Area Signage | Mcdonald Observatory | Fort Davis Tx

NEGOTIATING DARKNESS —
INFRASTRUCTURE OF A DARK SKY
TERRITORY

The uneasy coexistence of pristine nature and its profitable exploitation has made strange bedfellows in the Big Bend, with a series of negotiations playing out between private citizens, regulatory infrastructures, and energy interests throughout the territory. The



Mitchell Spectrograph | Harlan J. Smith Telescope | Mcdonald Observatory | Fort Davis Tx

NIGHT: PASSAGES



Star Party | Mcdonald Observatory | Fort Davis Tx

McDonald Observatory in Fort Davis requires absolute darkness for the observation of celestial bodies. On site, visitors are restricted from driving with headlights through areas after certain hours, in order to not compromise sensitive equipment. World-class telescopes utilize “spectrography,” dividing starlight into its component wavelengths in order to analyze the distance, velocity, temperature, and chemical composition of distant stars. Sophisticated optical technologies like the Mitchell spectrograph routinely contribute to astronomic discoveries.¹¹ These super-scaled observational instruments reflect distant starlight through building-sized optical devices, with chambers for mirrors and lenses snaking their way through the floors, walls, and laboratory spaces of the observatory. Visitors and researchers are sequentially sensitized to

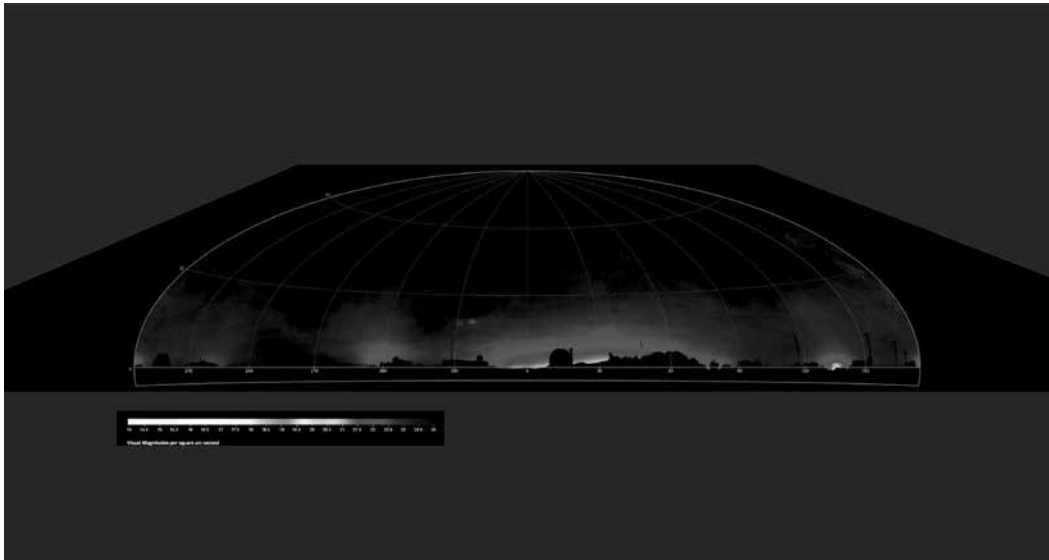
the low light levels required for observation, with elevator lighting suddenly changing from a typical white fluorescent glow to near darkness as it reaches the telescope floor. The magnification capabilities bring starlight to a human scale, recording miles worth of high-resolution digitized imagery at once. The Mitchell spectrograph serves only as a prototype for a much larger project nearby. The Hobby-Eberly Telescope, will host no fewer than 145 spectrometers. The high-powered array, exponentially multiplying the capacity of the single instruments composing it, will be capable of measuring “dark energy” in the farthest reaches of the galaxy.

The observatory hosts weekly “star parties,” in which scientists demonstrate to the public the benefits of the dark-sky observation area, using a variety of observation methods, ranging from the naked eye to more sensitive and far-reaching telescopes. Attendees are asked to slowly grow accustomed to the darkness, limiting flash photography, the use of flashlights, and ambient illumination from mobile phones in order to adjust to the visual experience of starlight. At the observatory, on a clear night, even faint stars, distant planets, and the glow of galaxies lightyears away are visible. The effect is disorienting, with even seasoned stargazers reportedly being unable to recognize familiar constellations given the additional layers of depth recognizable in the night sky.

The de facto “jurisdiction” of light conditions necessary for the success of experiments, observations, and events at the observatory reach far beyond the site boundaries, hundreds of miles in every direction. With the work of the observatory so useful to national and international communities of researchers, local boundaries and daily practices acquiesce to its will toward darkness. Darkness at the observatory is supported by a state law mandating that residents in neighbouring counties turn off their lights at prescribed times.¹² The impact on nighttime viewing goes beyond light pollution to pollution itself. Coal-burning power plants throughout the region impact



Permian Basin Light Pollution As Seen From Mcdonald Observatory



Estimated Artificial Skyglow From Artificial Sources| Mcdonald Observatory, 5 Aug 2015

visibility.¹³ “Regional haze rules,” enacted by the EPA, regulate allowable amounts of airborne particulate to remedy “anthropogenic visibility impairment,” maintaining clear views and skies in Federal Class I areas like the nearby Big Bend National Park.¹⁴ These rules target sources of airborne pollutants even further afield than the light pollution regulations, including power plants in Northern Chihuahua across the U.S./Mexico border.

The largest coal plants in Mexico, Carbon I and Carbon II, are thought to be the most significant contributors to the growing haze problems in the park, contributing 20 percent of the airborne particulate in a recent study.¹⁵ On the ground, in the counties surrounding the observatory, the institution helps to shape the territory of darkness in its own image. Bill Wren, an observatory assistant who manages the effects of light pollution within the viewing



Triple Crown Gas Plant | Permian Basin | Before And After Lighting Adjustments
Top photo courtesy of Robert Flaherty. Bottom photo courtesy of William Wren

area of the telescopes at McDonald, says “the observatory provides free light shields to the public and the utility will install them at a customer’s request, also for free.”¹⁶ Forced to share the night sky in support of new discoveries, geologists and astronomers are now routinely negotiating for control of ground-level lighting. Lights from gas flares and oil rigs hundreds of miles away, in the oil and gas fields of the Permian Basin, have spoiled the darkness and compromised the institution’s research.¹⁷ The encroachment of light pollution from the energy industry has a visible impact, a soft red halo to the northeast. Using proprietary technology developed for use in mitigating light pollution throughout the National Parks system, Wren and his associates have conducted photometric analyses of artificial skyglow affecting the viewshed of the observatory. Advocates for the observatory have approached the oil and gas industry directly, and issued a report encouraging drillers to reign in light pollution by more effectively shielding and directing light on work sites.¹⁸ As part of the evaluation procedures, observatory consultants routinely visit working rigs to better shield and direct floodlights, to simultaneously improve visibility on-site and attenuate light pollution miles away. Oil well operators in the Permian Basin now shield their lights to avoid light pollution disrupting

scientific discoveries at the observatory. But the light from oil rigs appears to be a moving target, conditional on the discovery of natural gas and the mercurial whims of the global market. As operators intensify operations and discover new shale plays, new bright spots emerge throughout the observation area. As supplies become exhausted, and as the boom slowly goes bust, the rigs may move on or go dark. The mobile nature of the natural gas infrastructure and its conditional relationship to an ever-shifting supply, makes the control of its lighting a difficult task. As a rig is moved, lighting is adjusted or reinstalled, and the shields that once protected its lights may then become reoriented, or forgotten. As new companies and operators enter the territory, they must be trained in the impacts their decisions may have, far from their work site. The observatory and its technicians must constantly keep tabs on new sites, and advocate to new operators the importance of light management. While this delicate dance plays out on the somewhat temporary sites related to energy extraction, perhaps the greatest impact to the darkness of the territory lies in the more permanent sites of energy transmission—the networks of pipelines and attendant infrastructures which will enable more lasting impacts.

COVER OF DAYLIGHT

The proposed Trans Pecos Pipeline will impact the darkness of the region in yet-undefined ways. The language of the pipeline proposal, and the methods by which it will be realized, cloak the project in a kind of transparency, while obfuscating its potential impact and enabling potentially destructive actions. We propose that the wholesale transformation of this region will soon be predicated on these and other disingenuous tactics steeped in the language of corporate responsibility, transparency, and pseudo-environmentalism, which manifest themselves in novel physical and regulatory infrastructures. We call this strategy, deployed by a new brand of savvy binational agents, “the cover of daylight.”

While outside the geographic limits of the national park and its “Dark-Sky Reserve,” the pipeline falls within its impact area, making its effect on light pollution a top priority for the region. The unique superimposition of this pipeline and the dark-sky territory has dramatically shaped the conditions of protest. Previous actions against pipeline projects like the KXL have focused largely on the negative environmental effects of increased extraction, and the potential destruction from the subterranean network itself, which as it deteriorates over time can pollute underground aquifers and spoil land.¹⁹ With the announcement of the TPP, activists are similarly mobilized against the pipeline, but this time choose to emphasize the forecast detrimental impact on regional light pollution instead. The Big Bend Conservation Alliance (BBCA), which has organized efforts against the project, cites light pollution as a primary concern.²⁰ In documents filed by the Sierra Club against the project, it is claimed that “the tranquility of the area [...] will be disturbed by the noise, particulate emissions and, potentially, light pollution associated with pipeline construction.”²¹

This, in turn, has shaped the official response. Energy Transfer Partners (ETP), developers of the TPP, insists that the project will respect Dark-Sky mandates, preserving

the darkness of the corridor despite the intrusion of the energy infrastructure. Language from the ETP website concerning the impact of the project almost exclusively concerns its impact on light pollution. In the construction phase, activity around pipeline corridors is often expected to increase the amount of light pollution in the regions they traverse. Easements for the pipelines and the requisite energy transmission infrastructure have been documented as severely impacting biological and ecological corridors, with some species capable of sensing or viewing the energy transmission in the line.²² Vehicles and work-area lighting passing through the corridor after dusk could disturb otherwise dark and vacant areas of land. Some corridors, in order to provide visibility for maintenance or repairs, provide intermittent lighting along the entire easement length. The official language from ETP is steeped in pragmatism, positioning lighting along the route, while undesirable, as a potentially unintended consequence—an inevitable necessity. The company insists that no nighttime construction lighting will be necessary, stating “Dark Skies will be further protected by only conducting construction during daylight hours.” The company ensures “no lighting along the mainline [TPP] route corridor,” while providing a conditional provision for “safety lighting [complying] with all outdoor lighting ordinances” along the route.²³ Where necessary, lighting will include “specially engineered light covers [to] mitigate any possible light pollution.”²⁴ While these claims, if enacted, would go far to alleviate the potential light pollution, they do not restrict light completely.

Another common source of light pollution in pipeline construction—flood lighting at pumping stations along the route—are cause for additional concern. While early outreach insisted that the route would not require any pumping stations along its length to achieve adequate pressure,²⁵ and the website insists that “no surface lights are planned near the Marfa viewing area,”²⁶ later reports indicate that company representatives have suggested Marfa as an appropriate location

RECEIVED
RRC OF TEXAS
FEB 02 2015
APPLICATION FOR PERMIT TO OPERATE A PIPELINE IN TEXAS
(See 16 TAC 2.70)

FORM
(1/28)

RAILROAD COMMISSION OF TEXAS
Pipeline Safety Division, Permits Section

PIPELINE SAFETY DIVISION
AUSTIN, TEXAS

Permit No. 093

ORGANIZATION INFORMATION

1. Operator (Applicant) (See Instruction 1)
Energy Transfer Company

Address
1300 Main Street, Suite 100
Houston, TX 77002

2. Does the above named operator own pipeline?
Trans-Pecos Pipeline, LLC

Yes
PS# 252817

No
If "No", give name and address of owner.
3738 Oak Lawn Avenue
Dallas, TX 75219

3. Does the above named operator conduct or control the economic operations on the pipeline?
If "No", give name, address and P.O. of economic operator. (See Instruction 2)

Yes
Trans-Pecos Pipeline, LLC

No
If "No", give name and address of owner.
3738 Oak Lawn Avenue
Dallas, TX 75219

PIPELINE INFORMATION

1. Mark appropriate block for each of the following questions:
a) Are the pipelines covered under this permit.
b) Fluid transported:
c) Does fluid contain H₂S?
Pipeline classification:
If answer to (b) is other than natural gas, will the pipeline be operated as a _____ a private line?
If answer to (b) is natural gas, will the pipeline be operated as a _____ gas utility or as a _____ private line?
NOTE: A natural gas pipeline permit will not specify whether the pipeline is a gas utility or a private line. The Gas Services Division Gas Utility Audit Section will make that determination and notify the operator of its status.
d) Does pipeline use any public highway or road, railroad, public utility, or other common carrier right-of-way?
e) Will the pipeline carry only the gas and/or liquids produced by pipeline owner or operator?
If answer to (f) is "No", is the gas and/or liquids:
_____ Purchased from others.
_____ Owned by others, but transported for a fee.
_____ Both purchased and transported for others.

2. a) New installation?
b) Renewal for same operator?
c) Extension or modification?

Yes
X Yes
X Yes
Yes

No
No
No

New Construction Record Number
Approximately 143 miles of Natural Gas in Pecos,
Presidio and Brewster county.

TBD
(See 16 TAC 8.115 for applicability)

3. Check desired purpose(s) for which described pipeline will be used:
_____ Transmission
_____ Gathering
_____ Gas Injection
_____ Industrial Distribution
_____ Gas Lift
_____ Gas Plant
_____ Manufacturing Feed Stock (Own Consumption)
_____ Other (explain):

1. U.S.G.S. 7.5 Minute Quad attached? (Scale 1" = 2,000 feet)
Overview map (24" x 24" / 1" = 20 miles or less) attached and digital data sent?

Yes
X Yes

No
X No
No

Trans Pecos Pipeline operation permit application | Excerpt showing 'intrastate' status

for such a station if needed.²⁷ It is possible, given the initial, unidirectional, southbound transmission that the line will not require the added pressure the pumping station would provide. But with the likely development of a more robust gas trade between U.S. and Mexico, transmission may need to reverse course, or increase capacity. Both scenarios would make a future Marfa pumping station likely. Like others of its kind, such a station would presumably come equipped with nighttime lighting. The cloaking of the pumping station and its safety lighting in the language of necessity makes it appear that the company is “planning” and acting in the public interest, all while enabling potential transgressions of public statements and presumed agreements.

ETP also argues that the project will actually improve the atmospheric conditions of the region by modernizing northern Mexico’s energy plants, providing “cleaner burning” natural gas to replace the prevalent coal, oil, and wood plants responsible for the region’s growing haze problem. In addition, ETP has worked through a peculiar regulatory loophole

to expedite construction of the pipeline, without the typical federal oversight and environmental analysis afforded to other, similar projects. While a truly transnational pipeline like KXL requires Department of Energy oversight and presidential approval, a local, intrastate project in Texas only requires permits from local and state authorities. The Railroad Commission of Texas has “primary jurisdiction over all agents owning or operating pipelines in Texas” and would be instrumental in certifying such a construction, as they did in early April 2015.²⁸ By insisting on the “intrastate” nature of construction for all but the border crossing, ETP thus savvily navigates the jurisdictional gap.

Moreover, in their permit applications, ETP designated the length of line physically crossing the international border as a separate project. Rebranded “the Presidio Border Crossing Project” in official documents,²⁹ the project would include only the 1,093 feet of line necessary to cross the international boundary. The Federal Energy Regulatory Commission (FERC), responsible for federal approval of transnational projects, would thus review the Presidio Border Crossing Project as only indirectly related to the 143-mile pipeline which ultimately necessitates it, naming the rest of the length of the pipeline as “non-jurisdictional facilities” under the purview of the Railroad Commission only.³⁰ Commenters during the public federal evaluation period specifically requested that FERC “assume federal jurisdiction” for the intrastate components in order to safeguard the project’s full scope. This request was denied.³¹ Following the logic of the independent permit submittal for such a small crossing, FERC decided under initial review that the Border Crossing Project did not constitute a “major federal action significantly affecting the quality of the human environment,” and that a full Environmental Impact Statement (EIS) including the effects of the intrastate Trans Pecos Pipeline was not mandated. The presidential permit for the project was issued on 5 May 2016.³² A nearly identical permit



Trans Pecos Pipeline Staging Area Construction | Marfa Tx



Trans Pecos Pipeline Staging Area | Fort Stockton Tx

was issued for Energy Transfer Partners’ Comanche Trail project just two weeks later.³³ By positioning the pipeline as serving local Texas communities, ETP has thus been able to argue that the project is for the “public interest,” as well as bring lawsuits against property owners in order to claim easements, citing eminent domain.³⁴ The obligatory local connections to the line may serve only as “decoy” sites, unnecessary but expedient additions to the project, considering the pipeline’s main objective is to rush natural gas across the border.

AFTERGLOW

The effects of pipeline construction are already being noticed outside of Marfa. The Marfa Lights Viewing Station marks one of

the most popular vantage points for viewing the “Marfa Mystery Lights,” a fleeting and understudied atmospheric effect of coloured lights above an uninhabited—and unlit—expanse of ranchland east of Marfa. A staging area for the TPP has been cleared on a private road to the immediate southwest, with some reports claiming that stacks of pipe are now visible from the viewing platform. Many are concerned that the inexplicable phenomenon may be lost forever with even the slightest change to the delicate landscape. Miles from the northernmost terminus of the line, hundreds of pipe segments designated for the project stack neatly on acres of cleared land. As pipe trucks routinely enter empty and leave with their payload, the stacks slowly diminish, and the pipeline grows.

NIGHT: PASSAGES

NOTES

1 For a complete index of current pipeline projects in the Texas border region, see the Railroad Commission of Texas’s Public GIS Viewer (Map): <http://www.gisp.rrc.texas.gov/GISViewer2>.

2 Energy Transfer Partners, “Comanche Trail Pipeline Overview,” <http://www.comanchetrailpipelinefacts.com>.

3 Elliot Hannon, “Texas Bans Fracking Bans in the State,” [Slate](http://www.slate.com/blogs/the_slatest/2015/05/19/new_texas_state_law_outlaws_local_fracking_bans.html), 19 May 2015, http://www.slate.com/blogs/the_slatest/2015/05/19/new_texas_state_law_outlaws_local_fracking_bans.html.

4 “Oil and Gas Play Under Way Near Ojinaga,” [Big Bend Now](http://bigbendnow.com/2014/02/oil-and-gas-play-under-way-near-ojinaga), 27 February 2014, <http://bigbendnow.com/2014/02/oil-and-gas-play-under-way-near-ojinaga>.

5 Alicia Neaves, “Two Natural Gas Pipelines Heading to West Texas,” [NewsWest9](http://www.newswest9.com/story/28203495/two-natural-gas-pipelines-headed-to-west-texas), 25 February 2015, <http://www.newswest9.com/story/28203495/two-natural-gas-pipelines-headed-to-west-texas>.

6 Michael Hall, “The Truth is Out There,” [Texas Monthly](http://www.texasmonthly.com/articles/the-truth-is-out-there), June 2006, <http://www.texasmonthly.com/articles/the-truth-is-out-there>.

7 Big Bend Conservancy, “Big Bend Conservancy Hosts Dark Sky Weekend,” 17 December 2015, <http://www.bigbendfriends.org/sites/default/files/press-releases/DSW%20press%20release%2012-15.pdf>.

8 Texas Dark Skies Festival, <http://presidiotx.us/zone>.

9 Kay Plavidal, “The Big Bend of Texas: The Last Frontier for Shale Gas in Texas,” Sierra Club, 30 July 2014, <http://www.sierraclub.org/texas/blog/2014/07/plavidal-big-bend-texas-last-frontier-shale-gas-texas>.

10 Travis Bubenik, “Big Bend Area Residents Call for Local Fracking Ban,” [StateImpact NPR](http://stateimpact.npr.org/texas/2014/07/02/big-bend-area-residents-call-for-local-fracking-ban), 2 July 2014, [https://stateimpact.npr.org/texas/2014/07/02/big-bend-area-residents-call-for-local-fracking-ban](http://stateimpact.npr.org/texas/2014/07/02/big-bend-area-residents-call-for-local-fracking-ban).

11 “Mitchell Spectrograph,” McDonald Observatory, <https://mcdonaldobservatory.org/research/instruments/mitchell-spectrograph>.

12 Benjamin Wermund, “New Law Aims to Keep Lights

Low in Far West Texas,” [Big Bend Now](http://bigbendnow.com/2011/07/new-law-aims-to-keep-lights-low-in-far-west-texas), 7 July 2011, <http://bigbendnow.com/2011/07/new-law-aims-to-keep-lights-low-in-far-west-texas>.

13 Amy Sinatra Ayres, “Coal-Fired Haze Mars the Dark Skies of Big Bend,” [National Geographic](http://energyblog.nationalgeographic.com/2012/02/16/coal-fired-haze-mars-the-dark-skies-of-big-bend), 16 February 2012, <http://energyblog.nationalgeographic.com/2012/02/16/coal-fired-haze-mars-the-dark-skies-of-big-bend>.

14 Environmental Protection Agency, “Approval and Promulgation of Implementation Plans; Texas and Oklahoma; Regional Haze State Implementation Plans; Interstate Visibility Transport State Implementation; Plan to Address Pollution Affecting Visibility and Regional Haze; Federal Implementation; Plan for Regional Haze,” 2009, https://www.epa.gov/sites/production/files/2015-12/documents/tx-ok-rh-sip-final-disapproval-and-fip-disclaimer_signed_.pdf.

15 Marc L. Pitchford et al. “Big Bend Regional Aerosol and Visibility Observational (BRAVO) Study,” Sep 2014, <http://vista.cira.colostate.edu/Improve/wp-content/uploads/2016/05/BRAVOFinalReport.pdf>.

16 Wermund, “New Law.”

17 Jim Malewitz, “For Astronomers’ Sake, Some Drillers Cut Their Lights,” [The Texas Tribune](http://www.texastribune.org/2015/06/30/mcdonald-observatorys-plea-drillers-cut-lights), 30 June 2015, <http://www.texastribune.org/2015/06/30/mcdonald-observatorys-plea-drillers-cut-lights>.

18 Bill Wren, “Upgraded Rig Lighting Provides Night Time Visibility While Reducing Stray Light and the Threat to the Dark Skies in West Texas” (paper presented at the SPE E&P Health, Safety, Security and Environmental Conference, Denver, Colorado, March 2015), https://mcdonaldobservatory.org/sites/default/files/oilfield_lighting_can_coexist.pdf.

19 See Ersela Kripa and Stephen Mueller “Contested Energies,” in [Bracket \[takes action\]](https://brackettakesaction.org), ed. Mason White and Neeraj Bhatia (forthcoming).

20 John Waters, “No Compression Stations Planned for Trans-Pecos Pipeline,” [Big Bend Gazette](http://bigbendgazette.com/2015/04/07/no-compression-stations-planned-for-transpecos-pipeline), 7 April 2015, <http://bigbendgazette.com/2015/04/07/no-compression-stations-planned-for-transpecos-pipeline>.

21 Sierra Club, “Motion to Intervene,” <https://assets.documentcloud.org/documents/2157777/tx-sierra-club-motion-to-intervene.pdf>.

22 Damian Carrington, “Animals See Power Lines as Glowing, Flashing Bands, Research Reveals,” [The Guardian](http://www.theguardian.com/environment/2014/mar/12/animals-powerlines-sky-wildlife), 12 March 2014, <https://www.theguardian.com/environment/2014/mar/12/animals-powerlines-sky-wildlife>.

23 TPP, “Route,” <http://transpecospipelinefacts.com/#route>.

24 TPP, “Environment,” <http://transpecospipelinefacts.com/environment.html>.

25 Waters, “No Compression Stations.”

26 TPP, “Environment.”

27 Sarah Laskow, “A Gas Pipeline Could Make Marfa’s Mystery Lights Disappear,” [Atlas Obscura](http://www.atlasobscura.com/articles/a-gas-pipeline-could-make-marfas-mystery-lights-disappear), 21 March 2016, <http://www.atlasobscura.com/articles/a-gas-pipeline-could-make-marfas-mystery-lights-disappear>.

28 See Railroad Commission of Texas, “Permit to Operate a Pipeline—No 09352,” 6 April 2015, <https://assets.documentcloud.org/documents/2062745/transpecos-pipeline-t4-permit.pdf>.

29 Federal Energy Regulatory Commission (FERC), “Order Issuing Presidential Permit and Granting Authorization Under Section 3 of the Natural Gas Act,” Docket No. CP15–500–000, 5 May 2016.

30 FERC, “Notice of Intent to Prepare an Environmental Assessment for the Proposed Presidio Border Crossing Project,” 23 July 2015, <http://www.ferc.gov/alendarFiles/20150723172653-CP15-500-000.pdf>.

31 FERC, <https://assets.documentcloud.org/documents/2671328/Trans-Pecos-Pipeline-FERC-Environmental-Assessment.pdf>.

32 FERC, “Order Issuing...,” 5 May 2016.

33 FERC, “Order Issuing Presidential Permit and Granting Authorization Under Section 3 of the Natural Gas Act, Docket No CP15–503–000. 19 May 2016.

34 Travis Bubenik, “Pipeline Files Land Condemnation Lawsuits,” Marfa Public Radio 93.5 FM, 18 February 2016, <http://marfapublicradio.org/blog/pipeline-company-files-land-condemnation-lawsuits>.

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