## Blackbuck Resources LLC Olive Branch SWD FED 1

Fault Slip Potential Analysis



## FSP Methodology

- Stress gradients and pore pressure gradients derived from published papers (Snee and Zoback 2018).
- Mexico OCD 2019). Injection interval thickness, porosity, and permeability derived from nearby geophysical logs penetrating the injection interval (New
- No known sedimentary or Precambrian faults in the 100 square mile area of review (USGS 2019 and Wilson 2018).
- known New Mexico faults (USGS 2019, Snee and Zoback 2018). Random faults generated using strike and dip consistent with
- 2019). Advanced geological parameters derived from well logs and confirmed with previous expert testimony in the region (Reynolds



### **Parameters**

	Rock Compressibility (Pa^-1)	riaid compressibility (Pa^-1)	Fluid Comprosibility (Fd 3)	Dynamic Viscosity (Pa*c)	Density (kg/m^2)	Fault Dip Maximum (degrees)	rauit Dip Minimum (degrees)	Fair Dis Na: (degrees)	Fault Strike Maximum (docume)	Fault Strike Minimum (degrees)	Permeability (mD)	Down - 1.11. (2)	Porosity (%)	Injection Interval Thickness (ft)	יייבניסוו כספווונופוונ	Friction Coofficient	A Phi	Initial Réservoir Pressure Gradient (psi/ft)	Kelerence Depth (ft)	Poforce S circum (deglees dzimuln)	Horizontal Stress Direction (degrees asimusts)	Vertical Stress Gradient (nsi/ft)	Parameter
	8.70E-10	4.70E-10	0.0003	TUUU	1900	80	60	190	041	1/10	10-100	5-10	2	100-250	0.7	0./	0.7	0.44	17000	/5	1.1	1 1	Value
(2013) silia like yilolus	All Research and Reymolds (2010)	ALL Research and Reynolds (2019)	ALL Research and Reynolds (2019)	ALL Research and Reynolds (2019)	Snee and Zoback (2018)	Slice alla Zondck (2018)	Spee and Tohack (2018)	Snee and Zoback (2018)	Snee and Zoback (2018)		Well Logs NMOCD (2019)	Well Logs NMOCD (2019)	AACII FORD IMINIOCO (5018)	Well Logs NIMOCD (2010)	Snee and Zoback (2018)	Snee and Zoback (2018)	Silee dilu Zoback (2018)	Spoops 7-k-1 (2010)	Well Logs NMOCD (2019)	Snee and Zoback (2018)	Snee and Zoback (2018)	Source	Course

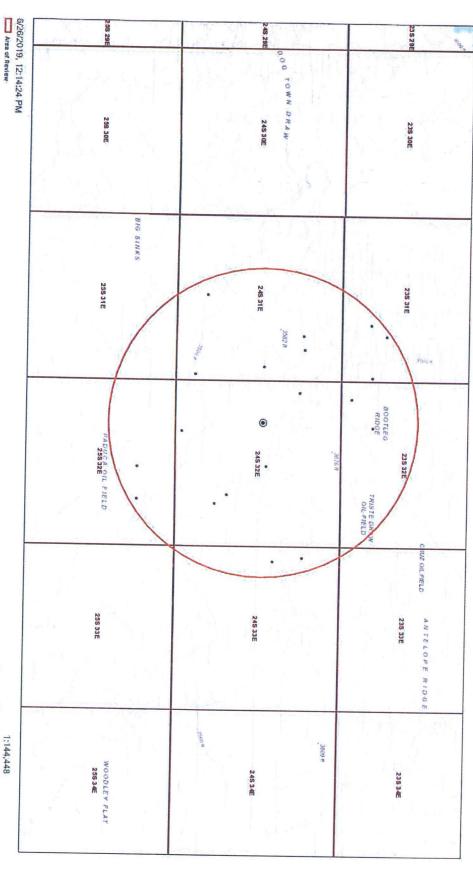


## Injection Data

- 100 square mile area of review. 19 class II injection wells active in 2019 within
- year averages for these nearby wells. Monthly injection rates calculated from 10-
- Olive Branch SWD FED 1 assumed to inject at 15,000 bpd.



### 100 Square Mile Area of Review



GOVERNMENT ELATIONS - ENERGY - PANENDA - TECHNOLOGY ENGLISHED - ENVIRONMENTAL

Plugged

\* Cancelled

· New

· Active

 Olive Branch SWD Fed 1 Well Locations - Small Scale

New Mexico Oil Conservation Division

New Mexico Oil Conservation Division

New OCD Oil and Gas Map, http://new-entrid.maps.arcgis.com/apps/webappy/etwer/; New Mexico Oil Conservation Division

Sources Eath PERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, PAO, IMPS, NRCANI, Gebäse, Idil, Kadaster NL, Ordnance Surey, Esti. "Sign., METL, Esti. China. (Horp., Korp.), Cip. OpenStreeMap contributors, and the GIS User Community; OCD,

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## FSP Modeling

- Exact geologic conditions of the area are unknown.
- logs. geologic conditions based on nearby geophysical Two scenarios modeled using range of possible
- Scenario 1 uses low end of possible geologic conditions
- conditions Scenario 2 uses high end of possible geologic
- intervals. Each scenario modeled at 10, 20, and 25 year



### Scenario 1

Low end of possible geologic conditions

Permeability: 10 mD

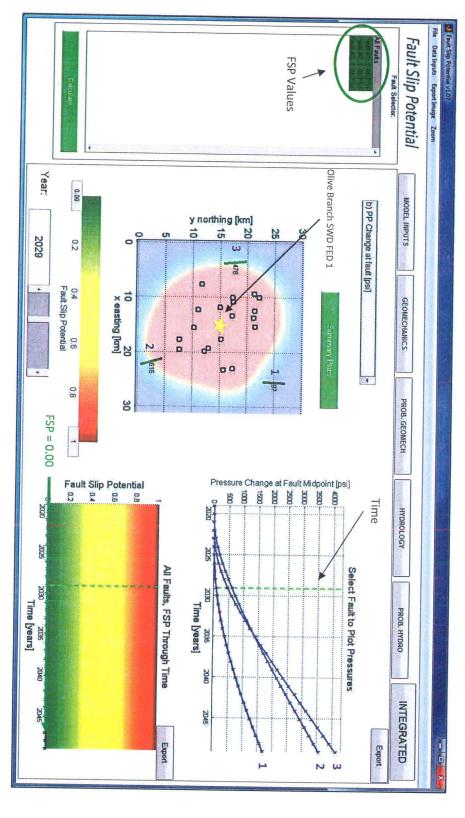
Porosity: 5%

Injection interval thickness: 100 ft



# FSP After 10 Years

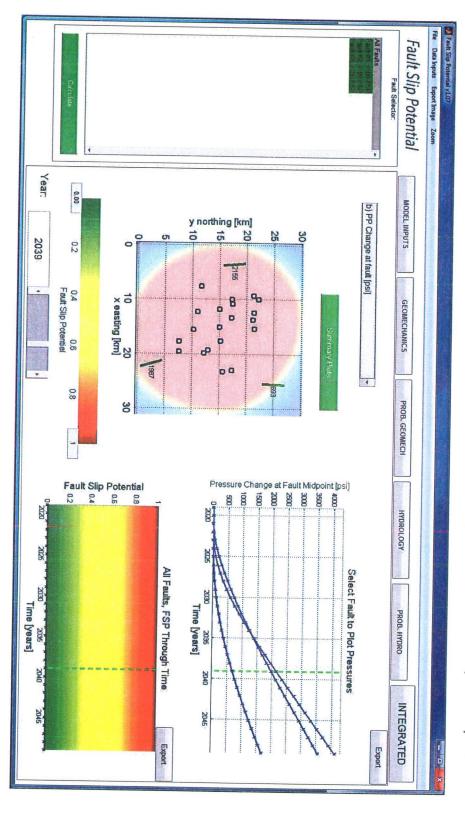
Low permeability (10 mD), porosity (5%), and aquifer thickness (100 ft)





# FSP After 20 Years

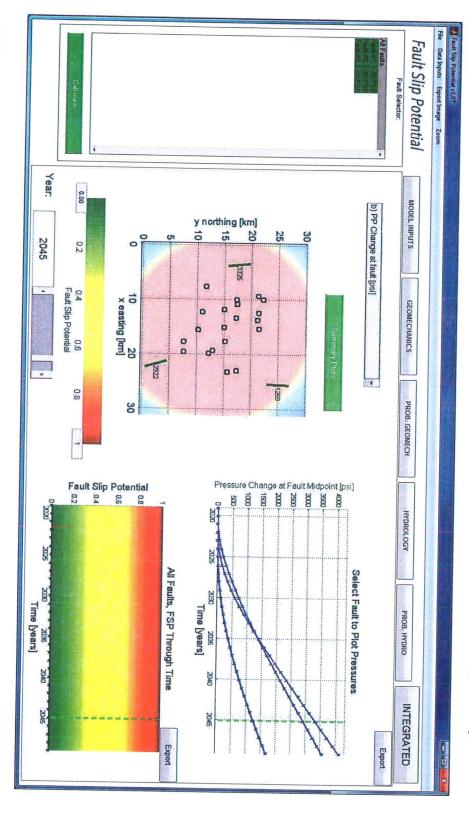
Low permeability (10 mD), porosity (5%), and aquifer thickness (100 ft)





# FSP After 25 Years

Low permeability (10 mD), porosity (5%), and aquifer thickness (100 ft)





### Scenario 2

High end of possible geologic conditions

Permeability: 100 mD

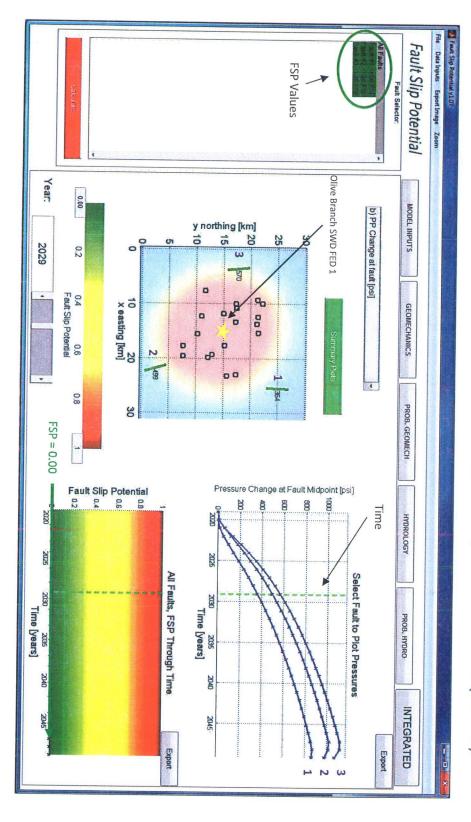
Porosity: 10%

Injection interval thickness: 250 ft



# FSP After 10 Years

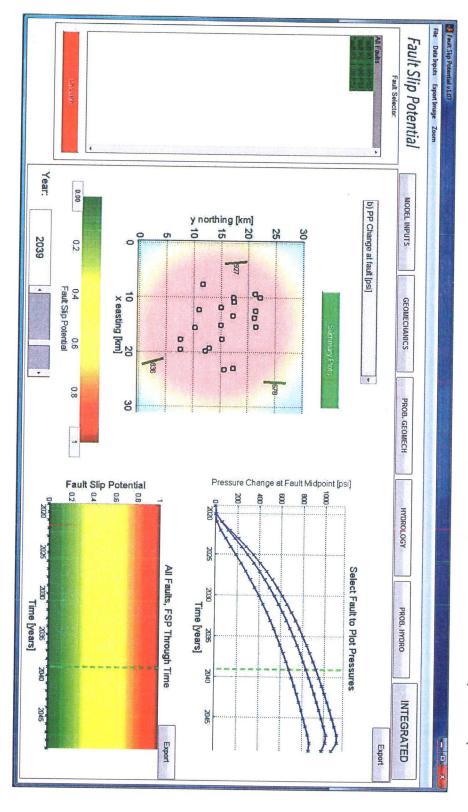
High permeability (100 mD), porosity (10%), and aquifer thickness (250 ft)





# FSP After 20 Years

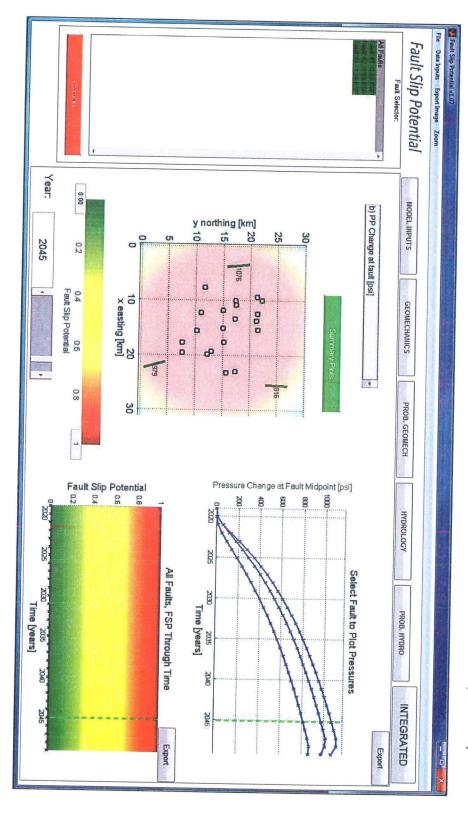
High permeability (100 mD), porosity (10%), and aquifer thickness (250 ft)





# FSP After 25 Years

High permeability (100 mD), porosity (10%), and aquifer thickness (250 ft)





### Conclusions

- review. Precambrian faults in the 100 square mile area of There are no mapped or known sedimentary or
- likely to slip. align with the horizontal stress field, and are not Known faults in southeast New Mexico do not
- FSP modeling through 25 years, with injection of potential fault slip in the area. rates that are likely overestimated, show no risk
- This area presents little to no risk for injection induced seismicity.



### References

https://earthquake.usgs.gov/earthquakes/byregion/newmexico.php (Accessed April 18, 2019) U.S. Geological Survey. "Information by Region-New Mexico."

U.S. Geological Survey. "Faults." https://earthquake.usgs.gov/hazards/qfaults/ (Accessed April 18, 2019)

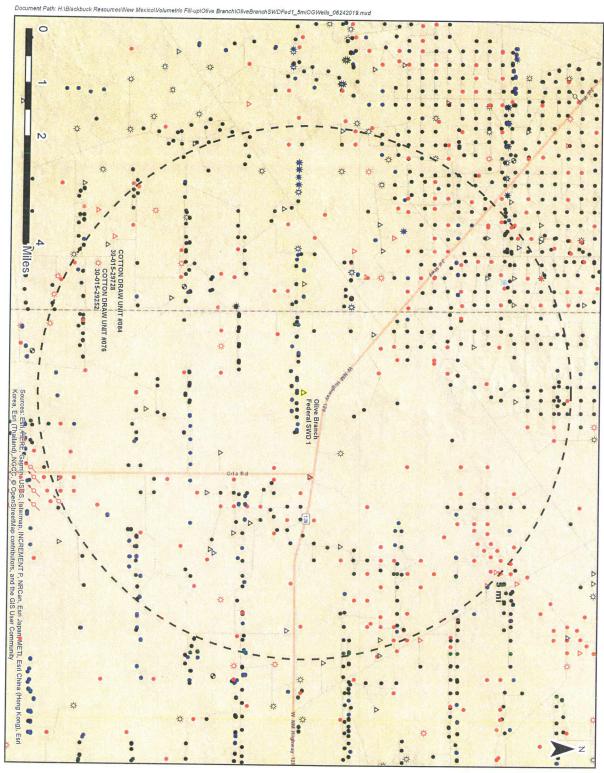
EMNRD Oil Conservation Division. "Welcome to the New Mexico Mining & Minerals Division." http://www.emnrd.state.nm.us/OCD/ocdonline.html (Accessed April 22, 2019)

Snee, Jens-Erik Lund, and Mark D. Zoback. 2018. "State of Stress in the Permian Basin, Texas and New Mexico: Implications for Induced Seismicity." The Leading Edge 37, no. 2 (February 2018): 127-34.

Conservation Division Case No, 16438 and Case No. 16440. Permian, LLC for Approval of Saltwater Disposal Wells in Lea County, New Mexico." New Mexico Oil Wilson, Scott J. 2018. "Affidavit of Scott J. Wilson, Amended Applications of NGL Water Solutions

Reynolds, Todd. 2019. "FSP Analysis (Fault Slip Potential) Exhibits." New Mexico Oil Conservation Division Case No. 20313, Case No. 20314, and Case No. 20472.





### Blackbuck - Olive Branch Federal SWD 1 Blackbuck Resources 5-mile Oil & Gas Well Map

- Legend Miscellaneous
- Gas, Active
- Gas, New
- Gas, Plugged
- Injection, Plugged

Injection, Active

- Injection, Temporarily Abandoned
- Oil, Active
- Oil, New
- Oil, Plugged
- Oil, Temporarily Abondoned
- Salt Water Injection, Active
- Salt Water Injection, New

Salt Water Injection, Plugged

- Pending Deep DevonianSilurian SWD

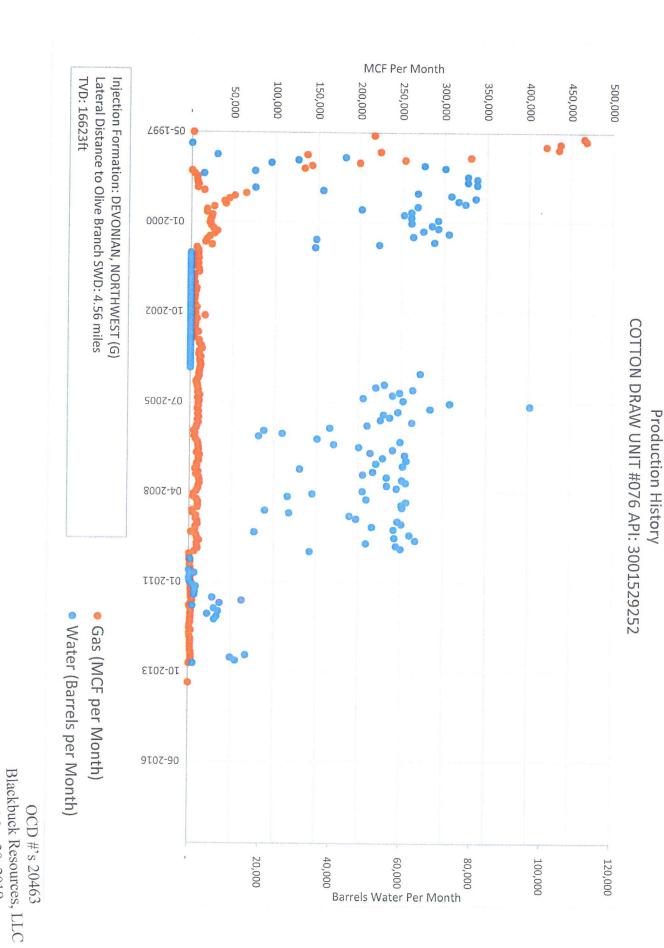
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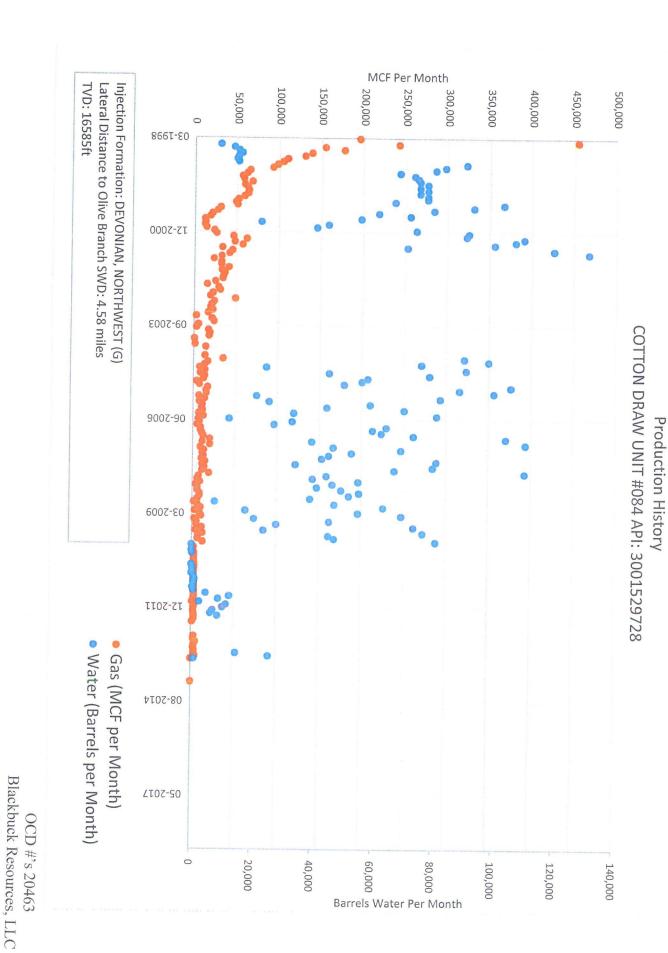
OCD #'s 20463

Date: 6/24/2019

Blackbuck Resources, LLC May 30, 2019 Ex# 10



May 30, 2019 Ex# 11



May 30, 2019 Ex# 12

### Comparison of Produced Water Generation and Disposal within 5 miles of the Olive Branch SWD Fed #1 John (November 2018)

Data S	ource: Nev	Data Source: New Mexico OCD 2019	
Saltwater Disposal		Produced Water Generation	Ä
Active Saltwater Disposal Wells	21	Active Producing Wells	389
Total Disposal Volume	15 006 244	Total Produced Water	
(BBLs)	15,020,544	(BBLs)	20,477,424
Avg Disposal per SWD	715.540	Avg Produced Water/Well	52 641
(BBLs)	1 10,010	(BBLs)	32,041
Ratio Produced Water C	eneration to	Ratio Produced Water Generation to Produced Water Disposal	136.30%
	の対方は、株子の種の一の中の人の様の質にはなります。 でい		

### STATE OF NEW MEXICO ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT OIL CONSERVATION DIVISION

APPLICATION OF BLACKBUCK RESOURCES, LLC FOR A SALT WATER DISPOSAL WELL, IN EDDY COUNTY, NEW MEXICO.

Case No. 20463

### **AFFIDAVIT**

STATE OF NEW MEXICO }
State of New Mexico }
COUNTY OF SANTA FE }

AFFIANT, ERNEST L. PADILLA, first being duly sworn on oath states:

Ernest L. Padilla, attorney for Blackbuck Resources, LLC, the Applicant herein, states that notice of the above referenced Application was mailed to the interested parties at the last known address as shown on Exhibit "A" attached hereto in accordance with Oil Conservation Division Rules, and that true and correct copies of the notice letter and proof of notice are attached hereto.

ERNEST L. PADILLA

SWORN TO AND SUBCRIBED to before me this day of May, 2019, by

ERNEST L. PADILLA.

Notary Public

My Commission Expires:

NOTARY OF PUBLIC C

OCD Case# 20463
Blackbuck Resources, LLC
May 30, 2019
Ex#

Entity	Address	City	State	Zip Code
	Landowner		The second second	
New Mexico BLM	620 E. Greene St.	Carlsbad	NM	88220
	OCD District			
NMOCD District 1	1625 N. French Drive	Hobbs	NM	88240
	Leasehold Operators			
Burlington Resources O&G LP PTRRC	21 Desta Drive	Midland	TX	79705
Devon Energy Production Co.	333 W. Sheridan Ave.	Oklahoma City	OK	73102
OG A Resources, Inc.	P.O. Box 900	Artesia	NM	88211
OG Resources Assets LLC	104 S. 4th St.	Artesia	NM	88210
OG Resources, Inc.	104 S. 4th St.	Artesia	NM	88210
OG Y Resources, Inc.	104 S. 4th St.	Artesia	NM	88210
xxonMobil Corporation	5959 Las Colinas Boulevard	Irving	TX	75039
ohn. A Yates	105 S. 4th St.	Artesia	NM	88210
XY USA Inc.	P.O. Box 4294	Houston	TX	77210



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Complete items 1, 2, and 3.  Print your name and address on the reverse so that we can return the card to you.  Attach this card to the back of the mailpiece, or on the front if space permits.  Article Addressed to:  New Mexico BLM 620 E. Greene Street Carlsbad, NM 88220	A. Signature  X
9590 9402 3452 7275 9766 49	3. Service Type  □ Adult Signature □ Adult Signature Restricted Delivery □ Certified Mail® □ Certified Mail Restricted Delivery □ Certified Mail Restricted Delivery □ Registered Mail Restricted Delivery □ Return Receipt for

PADILLA LAW FIRM, P.A.

STREET ADDRESS
1512 S. ST. FRANCIS DRIVE
SANTA FE, NM 87505
MAILING ADDRESS
P.O. BOX 2523
SANTA FE, NEW MEXICO 87504-2523
EMAIL ADDRESS

padillalaw@gwestoffice.net

FACSIMILE 505-988-7592

April 8, 2019

### CERTIFIED MAIL/RETURN RECEIPT REQUESTED

NMOCD District 1 1625 N. French Drive Hobbs, NM 88240

TELEPHONE

505-988-7577

Re: NMOCD Case Number#20463, In the Matter of the Application of Blackbuck Resources, LLC, for a salt water disposal well, Lea County, New Mexico.

Ladies and Gentlemen:

This letter will advise that Blackbuck Resources, LLC has filed an application with the New Mexico Oil Conservation Division seeking an order for a salt water disposal well located in Lea County, New Mexico as referenced above. Copy of the application is enclosed.

This application will be set for hearing before a Division Examiner on May 2, 2019 at 8:15 a.m. at the New Mexico Oil Conservation Division, 1220 South St. Francis Drive, Santa Fe, New Mexico. You are not required to attend these hearings, but as an owner of an interest or offset operator that may be affected, you may appear and present testimony. Failure to appear at the time and become a party of record will preclude you from challenging these applications at a later time. If you intend to attend the hearing and present testimony or evidence, you must enter your appearance and serve the Division, counsel for the Applicant, and other parties with a pre-hearing statement at least four business days before the scheduled hearing date in accordance with Division Rule 1211.

Very truly yours,

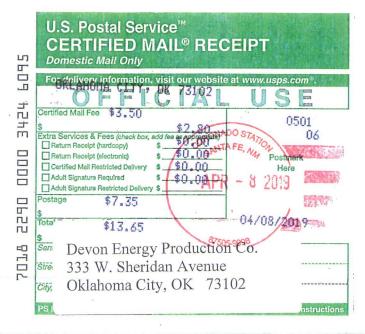
ERNEST L. PADILLA

ELP:jbg

cc: Blackbuck Resources, LLC

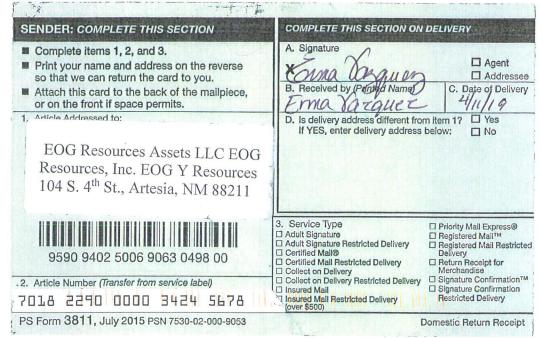


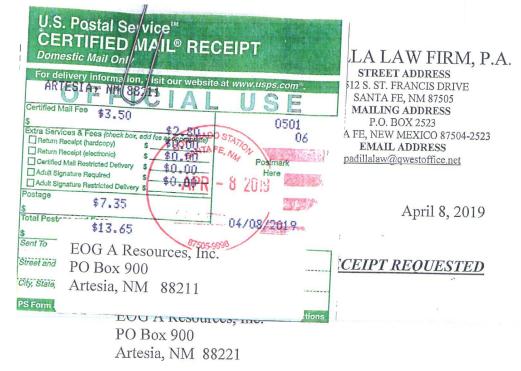




SENDER: COMPLETE THIS SECTION	COMPLETE THIS SECTION ON DELIVERY
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4. A.B A.B A.B B B B B.	D. Is delivery address different from item 1?  Yes If YES, enter delivery address below:  No
Devon Energy Production Co. 333 W. Sheridan Avenue Oklahoma City, OK 73102	TER CITY OKLATO WAS COLOR
9590 9402 5006 9063 0490 22	3. Service Type  ☐ Adult Signature ☐ Adult Signature Restricted Delivery ☐ Certified Mail Restricted Delivery ☐ Collect on Delivery ☐ Collect on Delivery ☐ Collect on Delivery
2. Article Number (Transfer from service label) 7018 2290 0000 3424 6095	□ Collect on Delivery Restricted Delivery sured Mail sured Mail Restricted Delivery ver \$500)  □ Signature Confirmation Restricted Delivery
PS Form 3811, July 2015 PSN 7530-02-000-9053	Domestic Return Receipt







FACSIMILE 505-988-7592

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Very truly yours.

ERNEST L. PADILLA

ELP:jbg

cc: Blackbuck Resources, LLC

PRESS FIRMLY TO SEAL







APR 08 19 AMOUNT PM 3-DAY SANTA FE, NM

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1 Article Addressed to

Artesia, NM 88211 PO Box 900 EOG A Resources, Inc.



2. Article Number (Transfer from service label) 7018 2290 0000 3423 4832

PS Form 3811, July 2015 PSN 7530-02-000-9053

LABEL MAY BE REQUIRED.

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B. Received by (Printed Name) A. Signature ☐ Agent☐ Addressee

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If YES, enter delivery address below: □ Yes

C. Date of Delivery

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 Adult Signature Restricted Delivery
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EOG A Resources, Inc. Artesia, NM 88211 PO Box 900

Santa Fe, New Mexico 87504-2523

PADILLA LAW FIRM, P.A.

ERNEST L. PADILLA

P.O. Box 2523



**EP14F July 2013** OD: 12.5 x 9.5

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1. Article Addressed to:	D. Is delivery address different from If YES, enter delivery address	m item 17   Yes below:  No
ExxonMobil Corporation 5959 Las Colinas Boulevard Irving, TX 75039		
9590 9402 5006 9063 0491 45 .	3. Service Type  Adult Signature  Adult Signature Restricted Delivery  Certified Mail®  Certified Mail Restricted Delivery	□ Priority Mail Express®     □ Registered Mail™     □ Registered Mail Restricts Delivery     □ Return Receipt for Merchandise
2. Article Number (Transfer from service label)	Collect on Delivery     Collect on Delivery Restricted Delivery     Insured Mail     Insured Mail Restricted Delivery	☐ Signature Confirmation™ ☐ Signature Confirmation ☐ Restricted Delivery



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1 Article Addressed to:	D. Is delivery address different from If YES, enter delivery address	
John A. Yates 105 S. 4 <sup>th</sup> Street Artesia, NM 88210		





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Restricted Delivery

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