

RECEIVED:	REVIEWER:	TYPE:	APP NO:
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ABOVE THIS TABLE FOR OCD DIVISION USE ONLY

**NEW MEXICO OIL CONSERVATION DIVISION**  
 - Geological & Engineering Bureau -  
 1220 South St. Francis Drive, Santa Fe, NM 87505



**ADMINISTRATIVE APPLICATION CHECKLIST**

THIS CHECKLIST IS MANDATORY FOR ALL ADMINISTRATIVE APPLICATIONS FOR EXCEPTIONS TO DIVISION RULES AND REGULATIONS WHICH REQUIRE PROCESSING AT THE DIVISION LEVEL IN SANTA FE

**Applicant:** Trove Energy and Water, LLC **OGRID Number:** 372488  
**Well Name:** PSE Federal SWD No.4 **API:** 30-015-xxxxx  
**Pool:** Proposed: SWD; Devonian-Silurian **Pool Code:** 97869

**SUBMIT ACCURATE AND COMPLETE INFORMATION REQUIRED TO PROCESS THE TYPE OF APPLICATION INDICATED BELOW**

- 1) **TYPE OF APPLICATION:** Check those which apply for [A]  
 A. Location – Spacing Unit – Simultaneous Dedication  
☐ NSL ☐ NSP (PROJECT AREA) ☐ NSP (PRORATION UNIT) ☐ SD  
 B. Check one only for [I] or [II]  
 [I] Commingling – Storage – Measurement  
☐ DHC ☐ CTB ☐ PLC ☐ PC ☐ OLS ☐ OLM  
 [II] Injection – Disposal – Pressure Increase – Enhanced Oil Recovery  
☐ WFX ☐ PMX ☒ SWD ☐ IPI ☐ EOR ☐ PPR

- 2) **NOTIFICATION REQUIRED TO:** Check those which apply.  
 A. ☒ Offset operators or lease holders  
 B. ☐ Royalty, overriding royalty owners, revenue owners  
 C. ☒ Application requires published notice  
 D. ☐ Notification and/or concurrent approval by SLO  
 E. ☒ Notification and/or concurrent approval by BLM  
 F. ☒ Surface owner  
 G. ☒ For all of the above, proof of notification or publication is attached, and/or,  
 H. ☐ No notice required

**FOR OCD ONLY**

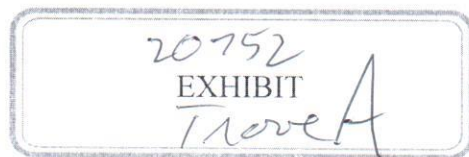
- ☐ Notice Complete  
☐ Application Content Complete

- 3) **CERTIFICATION:** I hereby certify that the information submitted with this application for administrative approval is **accurate** and **complete** to the best of my knowledge. I also understand that **no action** will be taken on this application until the required information and notifications are submitted to the Division.

**Note: Statement must be completed by an individual with managerial and/or supervisory capacity.**

Ben Stone

Print or Type Name



4/02/2019

Date

903-488-9850

Phone Number

Signature

ben@sosconsulting.us

e-mail Address



April 2, 2019

New Mexico Oil Conservation Division  
1220 South St. Francis Drive  
Santa Fe, New Mexico 87505

Attn: Mr. Gabriel Wade Acting Director

*Re: Application of Trove Energy and Water, LLC to permit for salt water disposal the proposed PSE Federal SWD No.4, to be located in Section 30, Township 24 South, Range 32 East, NMPM, Eddy County, New Mexico.*

Dear Mr. Wade,

Please find the enclosed form C-108 Application for Authority to Inject, supporting the above-referenced request for salt water disposal. The well will be operated as a commercial endeavor offering operators in the area additional options for produced water disposal.

Trove Energy and Water is a developing salt water disposal services to operators in southeast New Mexico and seeks to optimize efficiency, both economically and operationally, of all its operations. Approval of this application is consistent with that goal as well as the NMOCD's mission of preventing waste and protection of correlative rights.

This application for a proposed Devonian SWD interval includes the currently mandated increased One-Mile Area of Review including pertinent and available seismic information for the area and region. Published legal notice ran April 3, 2019 in the Hobbs News-Sun and all offset operators and other interested parties have been notified individually. The legal notice affidavit is included with this application. The application also includes a wellbore schematic, area of review maps, affected party plat and other required information for a complete Form C-108. The proposed well is located on federal surface and minerals and the Bureau of Land Management CFO and offset operators have been notified of this application.

I respectfully request that the approval of this salt water disposal well proceed swiftly and if you or your staff requires additional information or has any questions, please do not hesitate to call or email me.

Best regards,

A handwritten signature in blue ink, appearing to read "Ben Stone".

Ben Stone, Partner  
SOS Consulting, LLC  
Agent for Trove Energy and Water, LLC

Cc: Application attachment and file



**APPLICATION FOR AUTHORIZATION TO INJECT**

- I. PURPOSE: *Salt Water Disposal* and the application *QUALIFIES* for administrative approval.
- II. OPERATOR: *Trove Energy and Water, LLC*  
ADDRESS: *1919 North Turner, Hobbs, NM 88240*
- CONTACT PARTY: *Agent: SOS Consulting, LLC – Ben Stone (903) 488-9850*
- III. WELL DATA: *All well data and applicable wellbore diagrams are ATTACHED.*
- IV. *This is not an expansion of an existing project.*
- V. *A map is attached* that identifies all wells and leases within two miles of any proposed injection well with a *ONE-Mile* radius circle drawn around each proposed injection well. This circle identifies the well's area of review.
- \*VI. A tabulation is attached of data on all wells of public record within the area of review which penetrate the proposed injection zone. *There are NO (0) Wells in the subject AOR which Penetrate the proposed Devonian interval.* The data includes a description of each well's type, construction, date drilled, location, depth, and a schematic of any plugged well illustrating all plugging detail. *NO P&A Wells penetrate.*
- VII. *The following data is ATTACHED* on the proposed operation, including:
1. Proposed average and maximum daily rate and volume of fluids to be injected;
  2. Whether the system is open or closed;
  3. Proposed average and maximum injection pressure;
  4. Sources and an appropriate analysis of injection fluid and compatibility with the receiving formation if other than reinjected produced water; and,
  5. If injection is for disposal purposes into a zone not productive of oil or gas at or within one mile of the proposed well, attach a chemical analysis of the disposal zone formation water (may be measured or inferred from existing literature, studies, nearby wells, etc.).
- \*VIII. *Appropriate geologic data on the injection zone is ATTACHED* including appropriate lithologic detail, geologic name, thickness, and depth. Give the geologic name, and depth to bottom of all underground sources of drinking water (aquifers containing waters with total dissolved solids concentrations of 10,000 mg/l or less) overlying the proposed injection zone as well as any such sources known to be immediately underlying the injection interval.
- IX. *Stimulation program – a conventional acid job may be performed to clean and open the formation.*
- \*X. Attach appropriate logging and test data on the well. (If well logs have been filed with the Division, they need not be resubmitted). *Well Logs will be filed with OCD.*
- \*XI. *There are NO water wells within one mile of the proposed salt water disposal well. Representative analyses are ATTACHED.*
- XII. *An affirmative statement is ATTACHED that available geologic and engineering data has been examined and no evidence was found* of open faults or any other hydrologic connection between the disposal zone and any underground sources of drinking water.
- XIII. *"Proof of Notice" section on the next page of this form has been completed and ATTACHED. There are 3 offset lessees and/or mineral owners within 1 mile and federal minerals - all have been noticed. Well location is Federal.*
- XIV. Certification: I hereby certify that the information submitted with this application is true and correct to the best of my knowledge and belief.

NAME: *Ben Stone* TITLE: *SOS Consulting, LLC agent for Trove Energy and Water, LLC*

SIGNATURE:  DATE: *4/02/2019*

E-MAIL ADDRESS: *ben@sosconsulting.us*

- \* If the information required under Sections VI, VIII, X, and XI above has been previously submitted, it need not be resubmitted. Please show the date and circumstances of the earlier submittal:



**FORM C-108 – APPLICATION FOR AUTHORIZATION TO INJECT (cont.)**

III. WELL DATA – *The following information and data is included (See ATTACHED Wellbore Schematic):*

A. The following well data must be submitted for each injection well covered by this application. The data must be both in tabular and schematic form and shall include:

- (1) Lease name; Well No., Location by Section, Township and Range; and footage location within the section.
- (2) Each casing string used with its size, setting depth, sacks of cement used, hole size, top of cement, and how such top was determined.
- (3) A description of the tubing to be used including its size, lining material, and setting depth.
- (4) The name, model, and setting depth of the packer used or a description of any other seal system or assembly used.

Division District Offices have supplies of Well Data Sheets which may be used or which may be used as models for this purpose. Applicants for several identical wells may submit a "typical data sheet" rather than submitting the data for each well.

B. The following must be submitted for each injection well covered by this application. All items must be addressed for the initial well. Responses for additional wells need be shown only when different. Information shown on schematics need not be repeated.

- (1) The name of the injection formation and, if applicable, the field or pool name.
- (2) The injection interval and whether it is perforated or open-hole.
- (3) State if the well was drilled for injection or, if not, the original purpose of the well.
- (4) Give the depths of any other perforated intervals and detail on the sacks of cement or bridge plugs used to seal off such perforations.
- (5) Give the depth to and the name of the next higher and next lower oil or gas zone in the area of the well, if any.

XIV. PROOF OF NOTICE *pursuant to the following criteria is ATTACHED.*

All applicants must furnish proof that a copy of the application has been furnished, by certified or registered mail, to the owner of the surface of the land on which the well is to be located and to each leasehold operator within one-half mile of the well location.

Where an application is subject to administrative approval, a proof of publication must be submitted. Such proof shall consist of a copy of the legal advertisement which was published in the county in which the well is located. The contents of such advertisement must include:

- (1) The name, address, phone number, and contact party for the applicant;
- (2) The intended purpose of the injection well; with the exact location of single wells or the Section, Township, and Range location of multiple wells;
- (3) The formation name and depth with expected maximum injection rates and pressures; and,
- (4) A notation that interested parties must file objections or requests for hearing with the Oil Conservation Division, 1220 South St. Francis Dr., Santa Fe, New Mexico 87505, within 15 days.

**NO ACTION WILL BE TAKEN ON THE APPLICATION UNTIL PROPER PROOF OF NOTICE HAS BEEN SUBMITTED.**

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NOTICE: Surface owners or offset operators must file any objections or requests for hearing of administrative applications within 15 days from the date this application was mailed to them.



## **C-108 - Items III, IV, V**

### **Item III - Subject Well Data**

Wellbore Diagram - PROPOSED

### **Item IV – Tabulation of AOR Wells**

NO wells penetrate the proposed injection interval.

### **Item V – Area of Review Maps**

1. Two Mile AOR Map with One-Mile Fresh Water Well Radius
2. One-Half Mile AOR Map

All Above Exhibits follow this page.

# WELL SCHEMATIC - PROPOSED PSE Federal SWD Well No.4



API 30-015-xxxxx

145' FNL & 5' FEL, SEC. 30-T24S-R32E  
EDDY COUNTY, NEW MEXICO

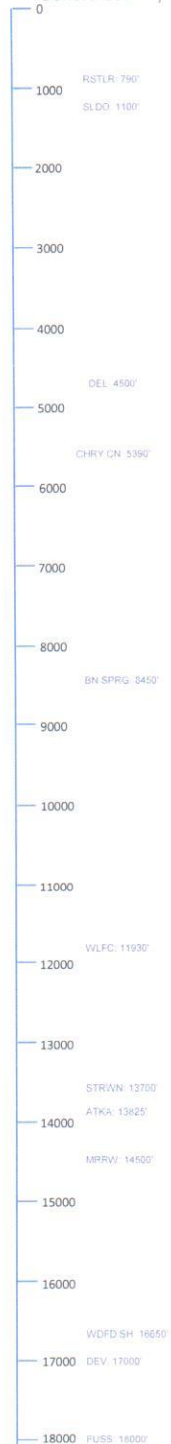
SWD; Devonian-Silurian (97869)

Spud Date: 11/01/2019

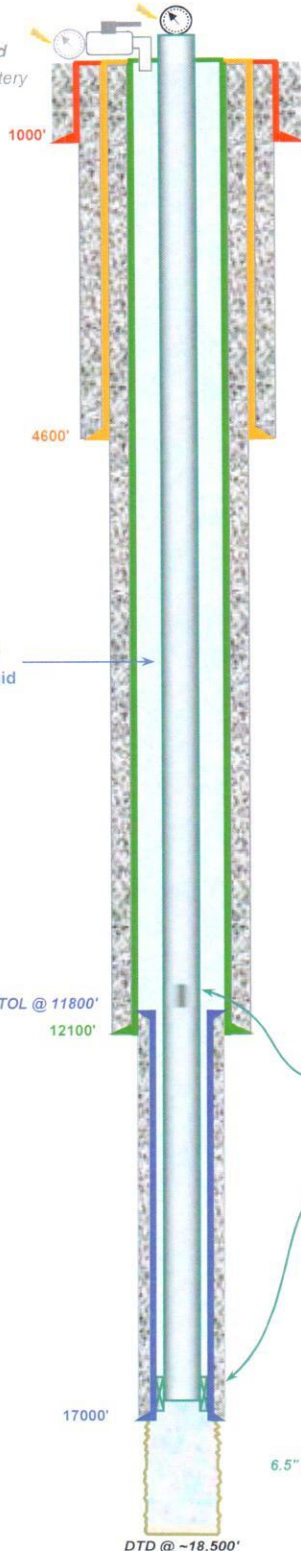
SWD Config Dt: 12/15/2019

Injection Pressure Regulated and Volumes Reported  
3400 psi Max. Surface (0.2 psi per foot)

Generalized Tops



Annulus Monitored  
via Remote Telemetry



## Surface Casing

20.0", 94.0# J-55 Csg. (26.0" Hole) @ 1000'  
1500 sx - Circulated to Surface

## Intermediate Casing

13.375", 68.0# Csg. (17.5" Hole) @ 4600'  
3200 sx - Circulated to Surface  
(DV @ 2400' est.)

## Trove Energy & Water, LLC

Drill and set casing as designed w/ all strings cemented to surface. Install 7.625" liner @ ~17,000 w/ 500 sx to TOL.  
Drill 6.5" openhole to approx. 18,500' TD w/ mudlog for interval/formation verification. Acidize formation;  
run 5.5" (5.0" FI inside liner) injection TBG on PKR set at 16,900'.+  
Conduct OCD witnessed MIT.  
Well ready for injection upon completion of surface facilities.

## Production Casing

9.625", 53.5# P-110 Csg. (12.25" Hole) @ 12100'  
3100 sx - Staged; Circulate to Surface  
(DV @ 5000' est.)

Split String Tubing Transition ~11740'

5.5" Tubing w/ 5.0" Flush Joint inside liner  
IPC Tubing set in PKR ~16,900'  
(Within 100' of Uppermost Disposal Interval)

## Liner Casing

7.625", 39.0# P-110 Csg (8.5" Hole) 11800' to 17,000'  
500 sx CIs H - TOC @ Top of LNR

6.5" Openhole Interval: 17,000' to 18,500' (Maximum)

DTD @ ~18,500'

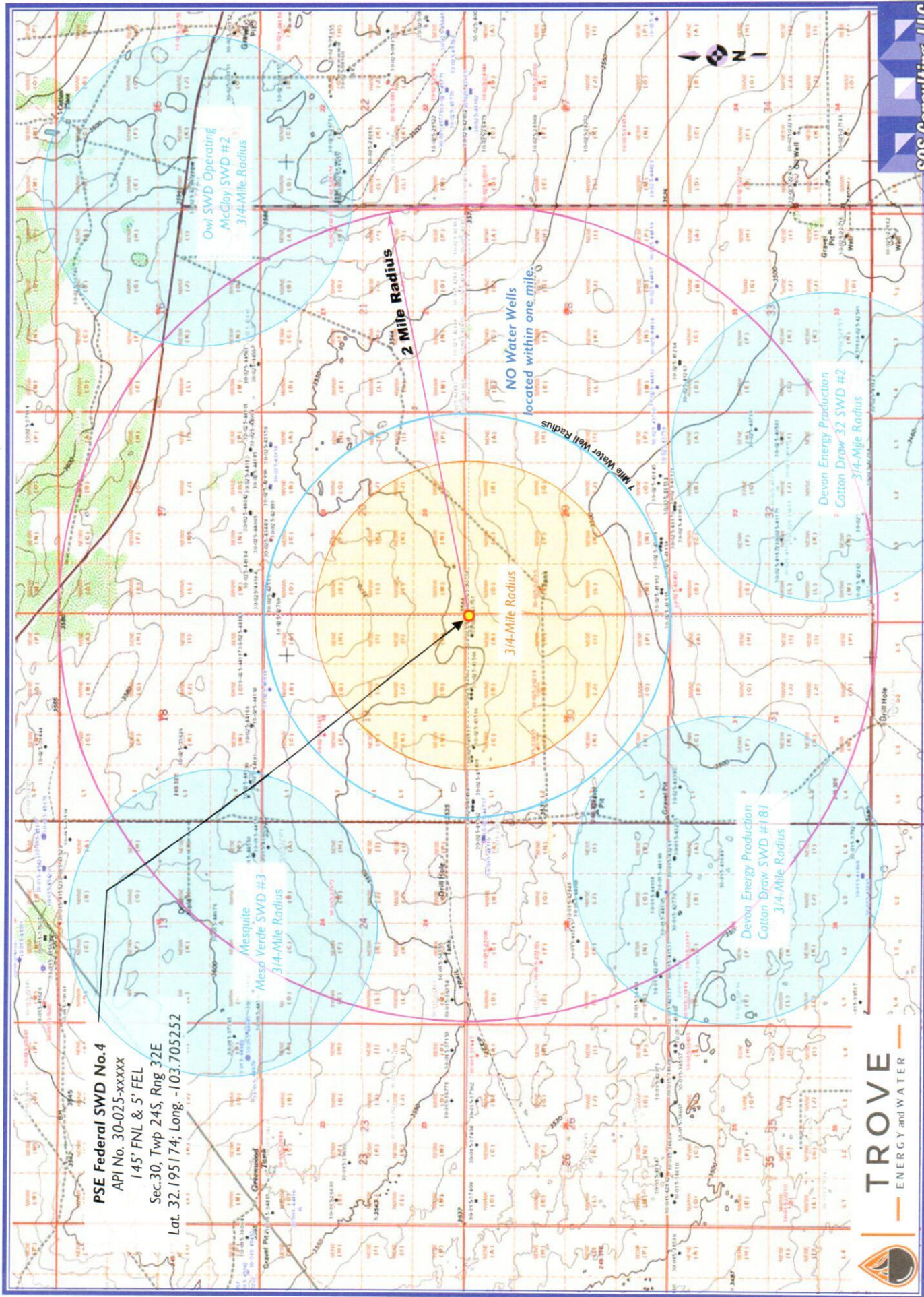
Drawn by: Ben Stone, 4/02/2019





# PSE Federal SWD No.4 - Area of Review / 2 Miles

(Attachment to NMOCD Form C-108 - Item V)





(Attachment to NMOCD Form C-108, Application for Authority to Inject.)



Lea County, New Mexico



## **C-108 ITEM X**

### **LOGS and AVAILABLE TEST DATA**

A Standard Suite of Logs will be run after  
drilling the well and submitted to the Division.

## **C-108 ITEM VII – PROPOSED OPERATION**

### **Trove PSE Federal SWD #4**

#### ***Commercial SWD Facility***

Upon approval of all permits for SWD, operations would begin within 30 days. Completion of the well operations will take approximately 6-8 weeks. Facility construction including installation of the tank battery, berms, plumbing and other and associated equipment would be occurring during the same interval but at a different location from the well. In any event, it is not expected for the construction phase of the project to last more than 60 days, depending on availability of contractors and equipment.

#### ***Configure for Salt Water Disposal***

Prior to commencing any work, an NOI sundry(ies) will be submitted to configure the well for SWD and will detail the completion workover including all work otherwise described above, any change to the procedure noted herein and to perform mechanical integrity pressure test per OCD test procedures. (Notify NMOCD 24 hours prior.) The casing/tubing annulus will be monitored for communication with injection fluid or loss of casing integrity.

#### ***Operational Summary***

The SWD facility will not be fenced so that trucks may access for load disposal 24/7.

Future plans would include tying the SWD into a pipeline so the well and injection equipment will be a closed system and equipped with pressure limiting devices and volume meters. The annulus, loaded with an inert, anti-corrosion packer fluid, will be monitored for pressure.

The facility and tanks will be equipped with telemetry devices and visual alarms to alert the operator and customers of full tanks or an overflow situation.

Anticipated daily maximum volume is 30,000 bpd and an average of 17,500 bpd at a maximum surface injection pressure of 3400 psi (.2 psi/ft gradient – maximum pressure will be adjusted if the top of interval is modified after well logs are run).

Potential releases will be contained and cleaned up immediately. The operator shall repair or otherwise correct the situation within 48 hours before resuming operations. OCD will be notified within 24 hours of any release greater than 5 bbls. If required, remediation will start as soon as practicable. Operator shall comply with 19.15.29 NMAC and 19.15.30 NMAC; as necessary and appropriate and OCD form C-141 will be submitted promptly.



## **C-108 ITEM VII – PRODUCED WATER ANALYSES**

### **Item VII.4 – Water Analysis of Source Zone Water**

Glorieta/ Yeso

Bone Spring

Wolfcamp

### **Item VII.5 – Water Analysis of Disposal Zone Water**

Devonian

*Analyses follow this page.*

**C-108 Item VII.5 - Produced Water Data**  
**Trove Energy & Water, LLC - PSE Area SWD Project**

**SOURCE ZONE**

**GLO/YESO**

<b>API No</b>	3001524754	<b>Lab ID</b>	
<b>Well Name</b>	PLATT PA 009	<b>Sample ID</b>	1146
		<b>Sample No</b>	
<b>Location</b>	ULSTR 26 18 S 26 E 330 S 990 W	<b>Lat / Long</b>	32.71216 -104,35742
		<b>County</b>	Eddy
<b>Operator (when sampled)</b>	Yates Petroleum Corp.		
	Field ATOKA	<b>Unit</b>	M
<b>Sample Date</b>	8/4/1984	<b>Analysis Date</b>	
	<b>Sample Source Wellhead</b>	<b>Depth (if known)</b>	
	Water Typ Produced Water		
ph	7.5	alkalinity_as_caco3_mgL	
ph_temp_F		hardness_as_caco3_mgL	
specificgravity		hardness_mgL	1800
specificgravity_temp_F		resistivity_ohm_cm	
tds_mgL	120382	resistivity_ohm_cm_temp	
tds_mgL_180C		conductivity	
chloride_mgL	113000	conductivity_temp_F	
sodium_mgL	71415	carbonate_mgL	0
calcium_mgL	2560	bicarbonate_mgL	476
iron_mgL	0	sulfate_mgL	2001
barium_mgL		hydroxide_mgL	
magnesium_mgL	0	h2s_mgL	0
potassium_mgL		co2_mgL	
strontium_mgL		o2_mgL	
manganese_mgL		anionremarks	

Remarks

*(Produced water data courtesy of NMT Octane NM WAIDS database.)*





**C-108 Item VII.5 - Produced Water Data**  
**Trove Energy & Water, LLC - PSE Area SWD Project**

**SOURCE ZONE**

**GLO/YESO**

<b>API No</b>	3001524619	<b>Lab ID</b>	
<b>Well Name</b>	PLATT PA 008	<b>Sample ID</b>	1207
		<b>Sample No</b>	
<b>Location</b>	ULSTR 26 18 S 26 E 430 S 2260 W	<b>Lat / Long</b>	32.71245 -104.35329
		<b>County</b>	Eddy
<b>Operator (when sampled)</b>	Yates Petroleum Corporation		
	Field ATOKA	<b>Unit</b>	N
<b>Sample Date</b>	1/19/1985	<b>Analysis Date</b>	
	<b>Sample Source</b> well head	<b>Depth (if known)</b>	
	<b>Water Typ</b> Produced Water		
ph	6	alkalinity_as_caco3_mgL	
ph_temp_F		hardness_as_caco3_mgL	
specificgravity		hardness_mgL	11500
specificgravity_temp_F		resistivity_ohm_cm	
tds_mgL	136324	resistivity_ohm_cm_temp	
tds_mgL_180C		conductivity	
chloride_mgL	121000	conductivity_temp_F	
sodium_mgL	61571	carbonate_mgL	
calcium_mgL	4160	bicarbonate_mgL	104
iron_mgL	0	sulfate_mgL	3720
barium_mgL		hydroxide_mgL	
magnesium_mgL	7340	h2s_mgL	
potassium_mgL		co2_mgL	
strontium_mgL		o2_mgL	
manganese_mgL		anionremarks	

Remarks

*(Produced water data courtesy of NMT Octane NM WAIDS database.)*



**C-108 Item VII.5 - Produced Water Data**  
**Trove Energy & Water, LLC - PSE Area SWD Project**

**SOURCE ZONE**

**BONE SPRING**

<b>API No</b>	3001520225	<b>Lab ID</b>	
<b>Well Name</b>	BIG EDDY UNIT	<b>Sample ID</b>	5847
	012	<b>Sample No</b>	
<b>Location</b>	ULSTR 21 20 S 31 E	<b>Lat / Long</b>	32.56399 -103.87994
	660 N 660 W	<b>County</b>	Eddy
<b>Operator (when sampled)</b>	MALLON OIL COMPANY		
	Field BIG EDDY	<b>Unit D</b>	
<b>Sample Date</b>	8/27/1999	<b>Analysis Date</b>	8/31/1999
<b>Sample Source</b>		<b>Depth (if known)</b>	
<b>Water Typ</b>			
ph	5.2	alkalinity_as_caco3_mgL	
ph_temp_F		hardness_as_caco3_mgL	
specificgravity	1.125	hardness_mgL	
specificgravity_temp_F		resistivity_ohm_cm	
tds_mgL	181697	resistivity_ohm_cm_temp	
tds_mgL_180C		conductivity	
chloride_mgL	123750	conductivity_temp_F	
sodium_mgL	73895.6	carbonate_mgL	
calcium_mgL	5625	bicarbonate_mgL	13.725
iron_mgL	337.5	sulfate_mgL	787.5
barium_mgL		hydroxide_mgL	
magnesium_mgL		h2s_mgL	0
potassium_mgL		co2_mgL	
strontium_mgL		o2_mgL	
manganese_mgL		anionremarks	

Remarks

*(Produced water data courtesy of NMT Octane NM WAIDS database.)*





**C-108 Item VII.5 - Produced Water Data**  
**Trove Energy & Water, LLC - PSE Area SWD Project**

**SOURCE ZONE**

**WOLFCAMP**

<b>API No</b>	3001520138	<b>Lab ID</b>	
<b>Well Name</b>	MAHUN STATE 001	<b>Sample ID</b>	5688
		<b>Sample No</b>	
<b>Location</b>	ULSTR 16 22 S 22 E 1800 N 1980 W	<b>Lat / Long</b>	32.39340 -104.70979
		<b>County</b>	Eddy
<b>Operator (when sampled)</b>			
	Field ROCKY ARROYO	<b>Unit</b>	F
<b>Sample Date</b>	5/17/1968	<b>Analysis Date</b>	
	<b>Sample Source</b> DST	<b>Depth (if known)</b>	
	<b>Water Type</b>		
ph	8.6	alkalinity_as_caco3_mgL	
ph_temp_F		hardness_as_caco3_mgL	
specificgravity		hardness_mgL	
specificgravity_temp_F		resistivity_ohm_cm	
tds_mgL	35495	resistivity_ohm_cm_temp_	
tds_mgL_180C		conductivity	
chloride_mgL	19000	conductivity_temp_F	
sodium_mgL		carbonate_mgL	
calcium_mgL		bicarbonate_mgL	830
iron_mgL		sulfate_mgL	2500
barium_mgL		hydroxide_mgL	
magnesium_mgL		h2s_mgL	
potassium_mgL		co2_mgL	
strontium_mgL		o2_mgL	
manganese_mgL		anionremarks	

Remarks

*(Produced water data courtesy of NMT Octane NM WAIDS database.)*



**C-108 Item VII.5 - Produced Water Data**  
**Trove Energy & Water, LLC - PSE Area SWD Project**

**DISPOSAL ZONE**

**DEVONIAN**

<b>API No.</b>	3001510280	<b>Lab ID</b>	
<b>Well Name</b>	JURNEGAN POINT 001	<b>Sample ID</b>	6170
		<b>Sample No</b>	
<b>Location</b>	ULSTR 05 24 S 25 E	<b>Lat / Long</b>	32.24037 -104.42375
	660 S 660 W	<b>County</b>	Eddy
<b>Operator (when sampled)</b>			
	Field WILDCAT	<b>Unit</b>	M
<b>Sample Date</b>	12/14/1964	<b>Analysis Date</b>	
	<b>Sample Source</b> DST	<b>Depth (if known)</b>	
	<b>Water Type</b>		
ph	7	alkalinity_as_caco3_mgL	
ph_temp_F		hardness_as_caco3_mgL	
specificgravity		hardness_mgL	
specificgravity_temp_F		resistivity_ohm_cm	
tds_mgL	229706	resistivity_ohm_cm_temp_	
tds_mgL_180C		conductivity	
chloride_mgL	136964	conductivity_temp_F	
sodium_mgL		carbonate_mgL	
calcium_mgL		bicarbonate_mgL	198
iron_mgL		sulfate_mgL	2511
barium_mgL		hydroxide_mgL	
magnesium_mgL		h2s_mgL	
potassium_mgL		co2_mgL	
strontium_mgL		o2_mgL	
manganese_mgL		anionremarks	

Remarks

*(Produced water data courtesy of NMT Octane NM WAIDS database.)*





## **C-108 – Item VIII**

### **Geologic Information**

The Devonian and Silurian consist of carbonates including light colored dolomite and chert intervals interspersed with some tight limestone intervals. Several thick sections of porous dolomite capable of taking water are believed present within the subject formations in the area. Depth control data was inferred from deep wells to the south and east. If the base of Devonian and top of Silurian rocks come in as expected the well will only be drilled deep enough for adequate logging rathole.

At a proposed depth of 18,500' BGL (Below Ground Level) the well will TD approximately 1,500' below the estimated top of the Devonian. Mud logging through the interval will ensure the target interval remains in Devonian and Silurian. Once Devonian is determined, the casing shoe depth will be set at an approximate maximum upper depth of 17,000' BGL. Injection will occur through the resulting openhole interval. Should mud or other logs indicate depth adjustment is required to exploit the desired formation as described; sundries with appropriate data will be filed with the OCD.

The Devonian is overlain by the Woodford Shale and Mississippian Lime and underlain by the Middle and Lower Ordovician; Simpson, McKee and Ellenburger.

Fresh water in the area is generally available from Rustler mainly from dolomite beds of the Culebra Member. State Engineer's records show water wells in the area with a depth to groundwater of 160 to 205 feet with an average depth to groundwater of 182 feet.

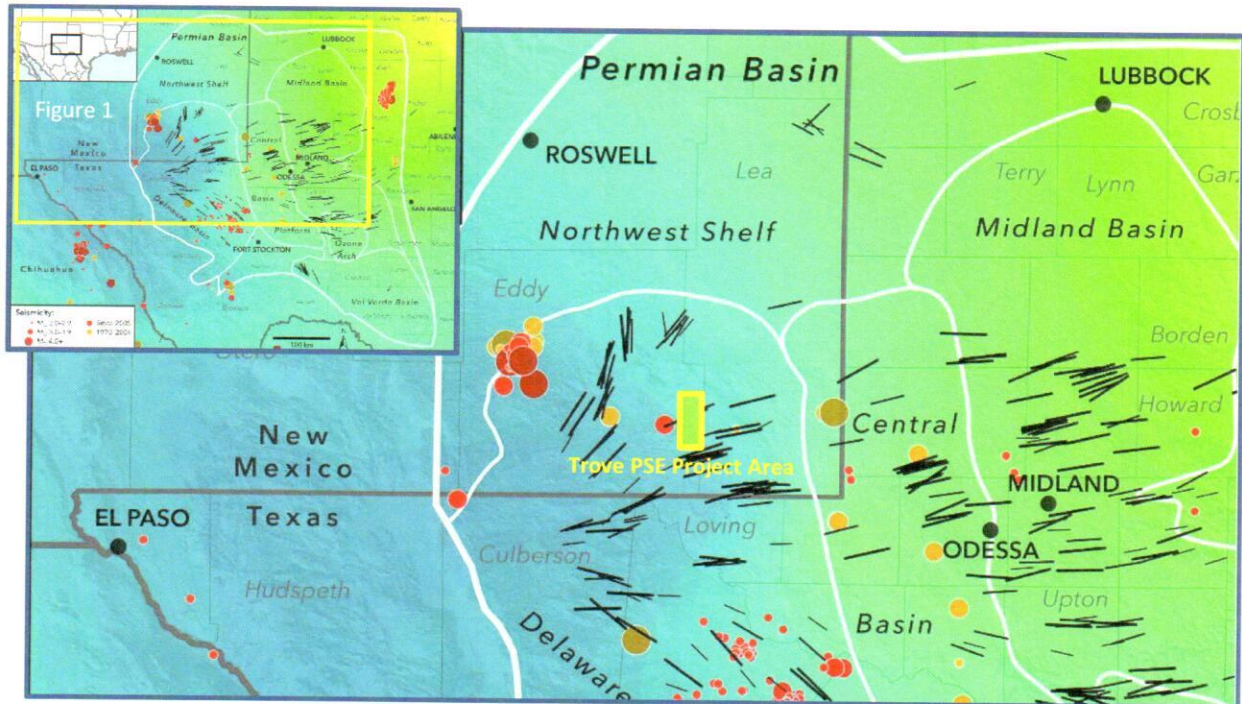
There are NO water wells (PODs) located within one mile of the proposed SWD.

# C-108 - Item VIII

## Geological Data

### EARTHQUAKE / SEISMIC INFORMATION SUPPLEMENT

Map Source: State of stress in the Permian Basin, Texas and New Mexico: Implications for induced seismicity (Figure 1); Jens-Erik Lund Snee/ Mark Zoback, February 2018



TROVE PSE PROJECT VICINITY

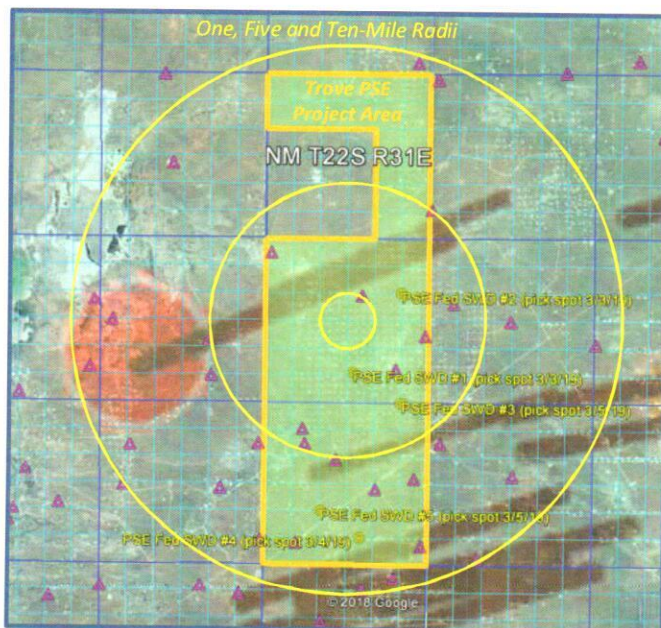


Figure 1. State of stress in the Permian Basin, Texas and New Mexico. Black lines are the measured orientations of the maximum horizontal stress (SHmax), with line length scaled by data quality. The colored background is an interpolation of measured relative principal stress magnitudes (faulting regime) expressed using the  $A\phi$  parameter (see text for details) of Simpson (1997). Blue lines are fault traces known to have experienced normal-sense offset within the past 1.6 Ma, from the USGS Quaternary Faults and Folds Database (Crone and Wheeler, 2000). The boundary between the Shawnee and Mazatzal basement domains is from Lund et al. (2015), and the Precambrian Grenville Front is from Thomas (2006). The Permian Basin boundary is from the U.S. Energy Information Administration, and the subbasin boundaries are from the Texas Bureau of Economic Geology Permian Basin Geological Synthesis Project. Earthquakes are from the USGS National Earthquake Information Center, the TexNet Seismic Monitoring Program, and Gan and Frohlich (2013). Focal mechanisms are from Saint Louis University (Herrmann et al., 2011).



## C-108 - Item VIII

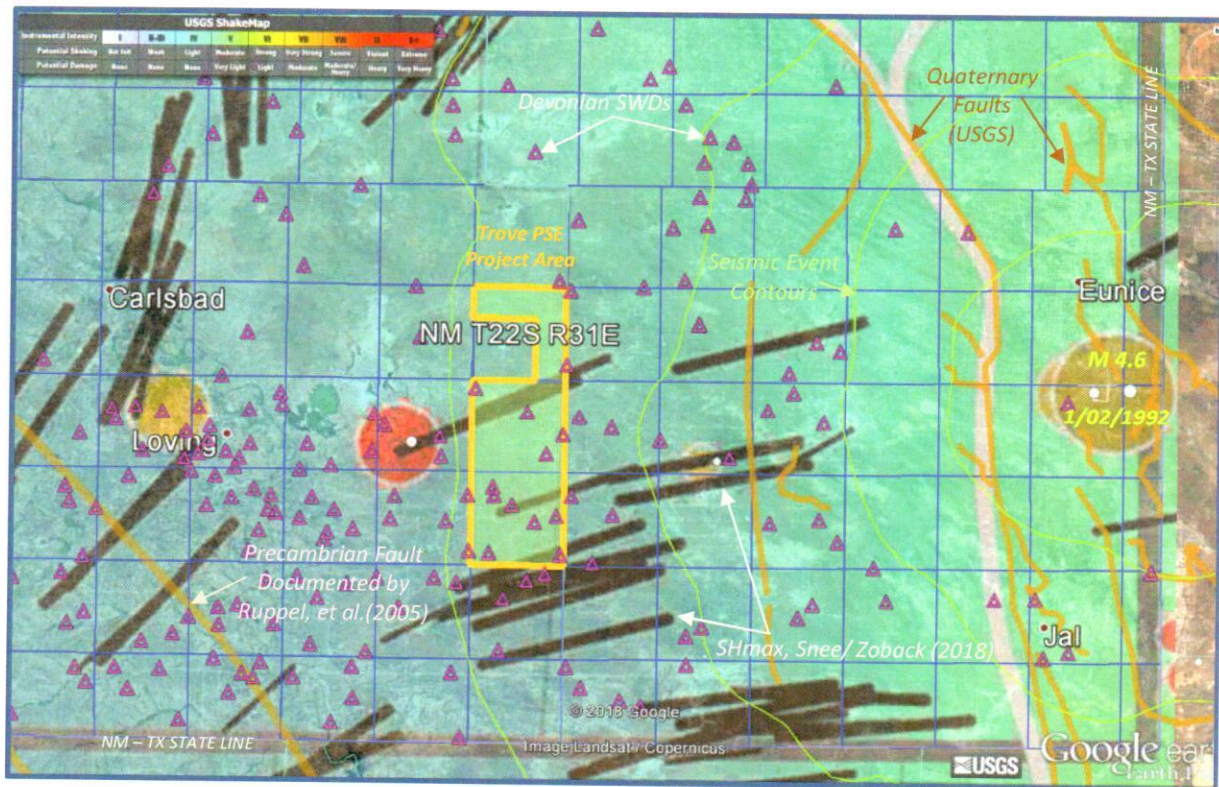
### Geological Data

#### EARTHQUAKE / SEISMIC INFORMATION SUPPLEMENT (cont.)

In the following map, a layer with USGS historical earthquake data is overlaid and, a layer showing lines to represent Precambrian faults as documented by Ruppel, et al. (2005). Finally, a layer showing all currently permitted SWDs completed or proposed to be completed in the Devonian (Silurian) formation.

The USGS earthquakes shown are well known to the area. The 2012 quake located approximately 13 miles due east of Loving is also shown (8.5 miles). This was perhaps the most significant of the area in recent years but was determined to not be related to oil and gas activity.

The Precambrian faults and existing Devonian SWDs are discussed in more detail on the next page.



REGIONAL VIEW - DEVONIAN SWD LOCATIONS, PRECAMBRIAN FAULTS,  $S_{Hmax}$ , USGS MAGNITUDE



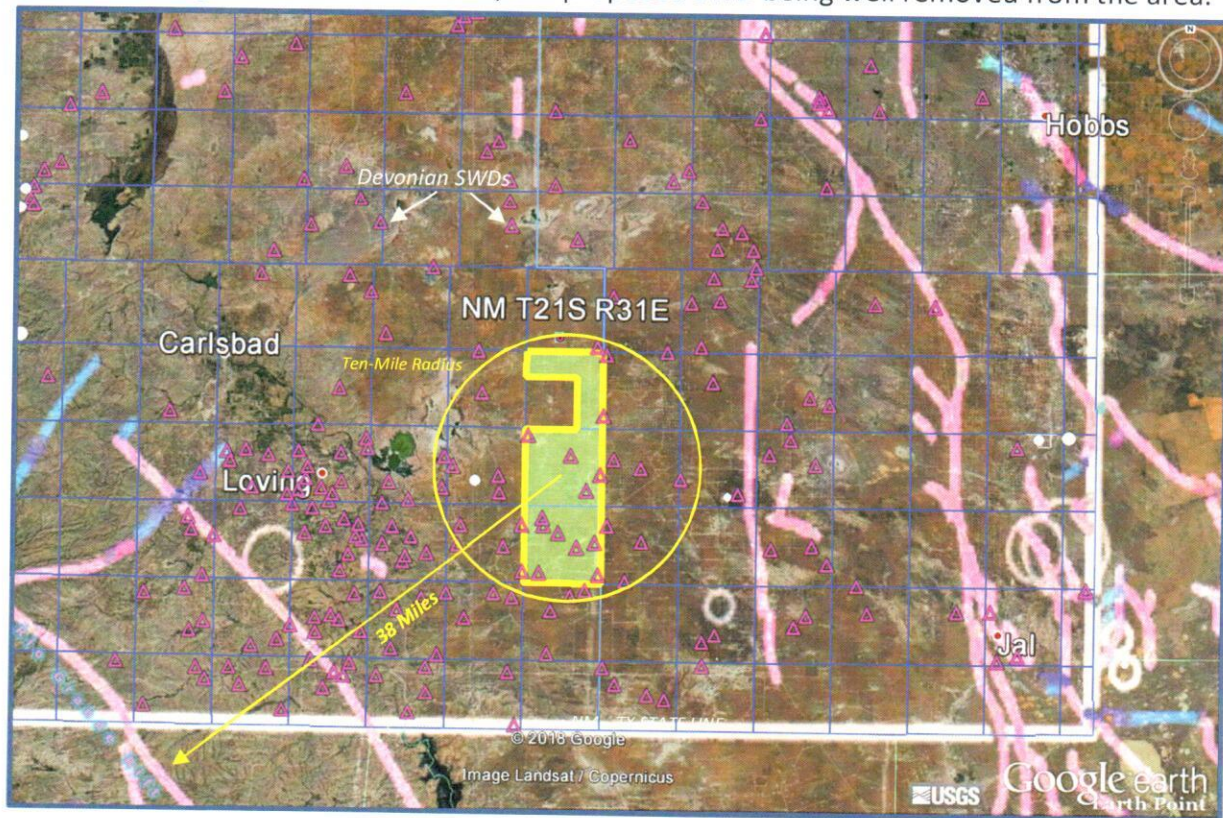
## C-108 - Item VIII

### Geological Data

#### EARTHQUAKE / SEISMIC INFORMATION SUPPLEMENT (cont.)

The primary Precambrian faults in the area as documented by Ruppel, et al. (2005) is represented on this map by the thick, pink colored lines. The most significant of these is the fault associated with the Rio Grande Rift, running southeast to northwest and, runs adjacent to a portion of Hwy 285 however; only a small portion the associated fault which runs parallel approximately 15 miles northeast is depicted below. The Trove PSE Project SWD Area is located some 38 miles from the fault. Other documented faults (USGS, 2000) are shown for eastern Lea County and extending into west Texas. Other Devonian SWDs in the area are also shown (small purple triangles) completed or proposed to be completed in the Devonian (Silurian) formation.

The previously referenced study by Snee and Zoback (shown on previous exhibits) evaluated the strike-slip probability using probabilistic FSP (Fault Slip Potential) analysis of known faults in the Permian Basin. The study predicts that the Precambrian fault shown here has less than a 10% probability of being critically stressed to the point of creating an induced seismicity event. The main reason for the low probability is due to the relationship of the strike of the fault to the regional  $S_{Hmax}$  orientation; the proposed SWD being well removed from the area.



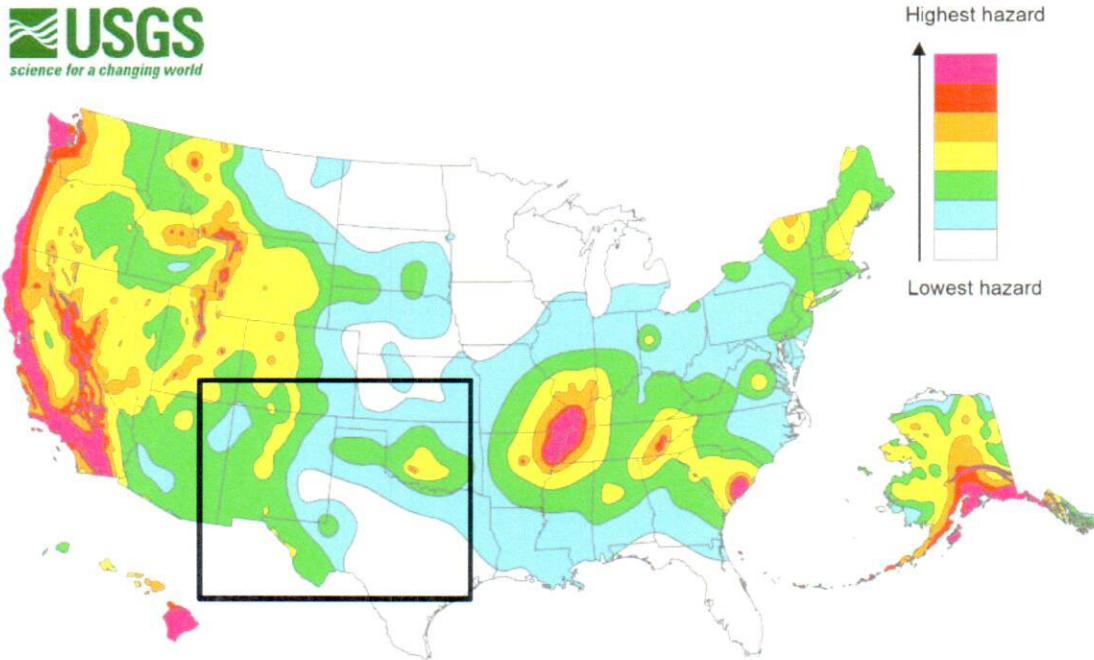
VICINITY - PERMITTED DEVONIAN SWDs, COMPOSITE FAULTS



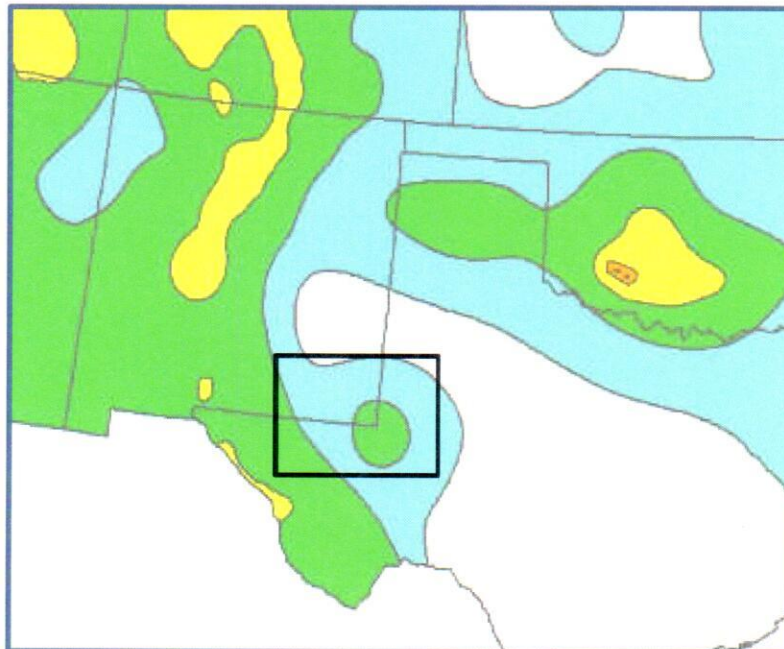
## C-108 - Item VIII

### Geological Data

#### EARTHQUAKE / SEISMIC INFORMATION SUPPLEMENT (cont.)



**2014 map data:** The USGS notes in its report that fracking may be to blame for a sizeable uptick in earthquakes in places like Oklahoma. "Some states have experienced increased seismicity in the past few years that may be associated with human activities such as the disposal of wastewater in deep wells," the report says. USGS hopes to use that data in future maps but it isn't included in this one. "Injection-induced earthquakes are challenging to incorporate into hazard models because they may not behave like natural earthquakes and their rates change based on man-made activities," the report says.

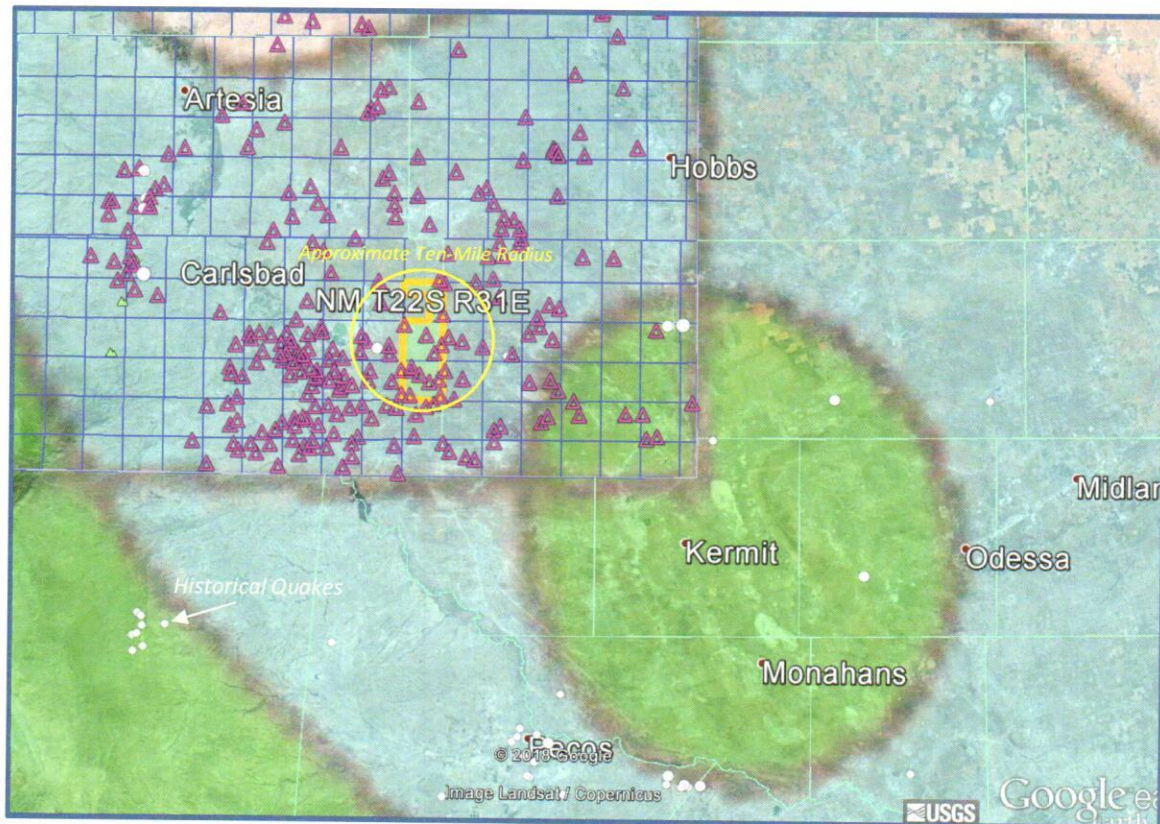


## C-108 - Item VIII

### Geological Data

#### EARTHQUAKE / SEISMIC INFORMATION SUPPLEMENT (cont.)

USGS 2014 REGIONAL MAP DATA OVERLAY IN GOOGLE EARTH W/ HISTORICAL EARTHQUAKES



An updated USGS map for 2018 is on the next page. While methodology remained essentially the same according to USGS, the interpreted results and color-coding did have some modification. However, the subject area in southeast New Mexico on both maps remains very low and on the 2018 map, the area is assigned a value of <1% of “potentially minor-damage ground shaking”.

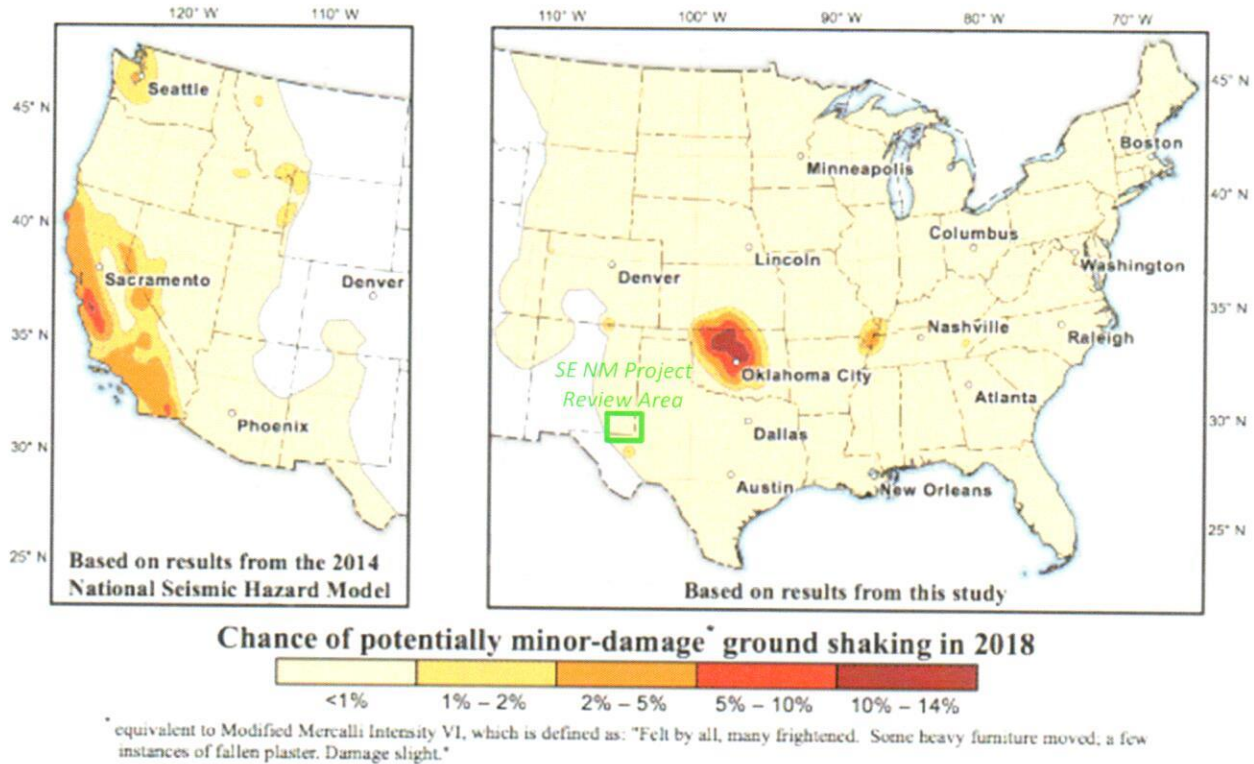


## C-108 - Item VIII

### Geological Data

#### EARTHQUAKE / SEISMIC INFORMATION SUPPLEMENT (cont.)

##### USGS 2018 ONE-YEAR MODEL



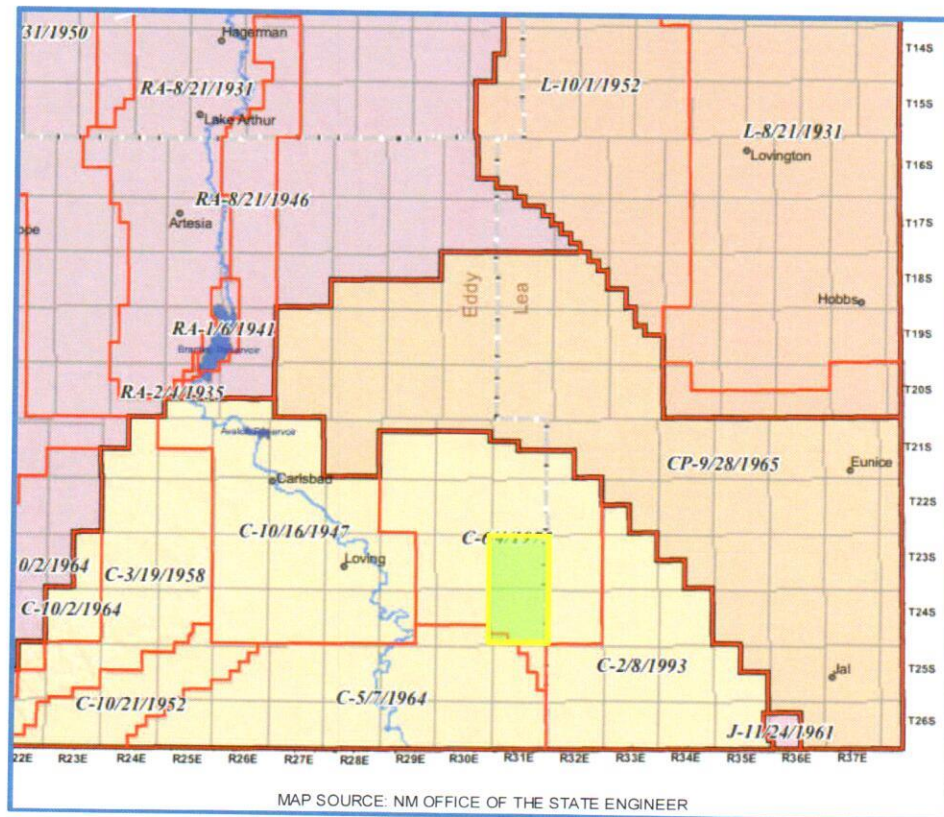
Map showing chance of damage from an earthquake in the Central and Eastern United States during 2018. Percent chances are represented as follows: pale yellow, less than 1 percent; dark yellow, 1 to 2 percent; orange, 2 to 5 percent; red, 5 to 10 percent; dark red, 10 to 12 percent. See Hazard from the western United States from the [2014 National Seismic Hazard Maps](#) (Petersen et al., 2014) for comparison.

The USGS has produced the 2018 one-year probabilistic seismic hazard forecast for the central and eastern United States from induced and natural earthquakes. For consistency, the updated 2018 forecast is developed using the same probabilistic seismicity-based methodology as applied in the two previous forecasts.

***Based on publicly available data for the subject area, it is reasonable to believe the risk of induced seismic activity due to disposal injection into this well is extremely low.***

## C-108 - Item XI

### Groundwater Basins - Water Column / Depth to Groundwater



The subject well is located within the Carlsbad Basin.

Fresh water in the area is generally available from Rustler mainly from dolomite beds of the Culebra Member. State Engineer's records show water wells in the area with a depth to groundwater of 160 to 205 feet with an average depth to groundwater of 182 feet.

There are NO water wells located within one mile of the proposed SWD.



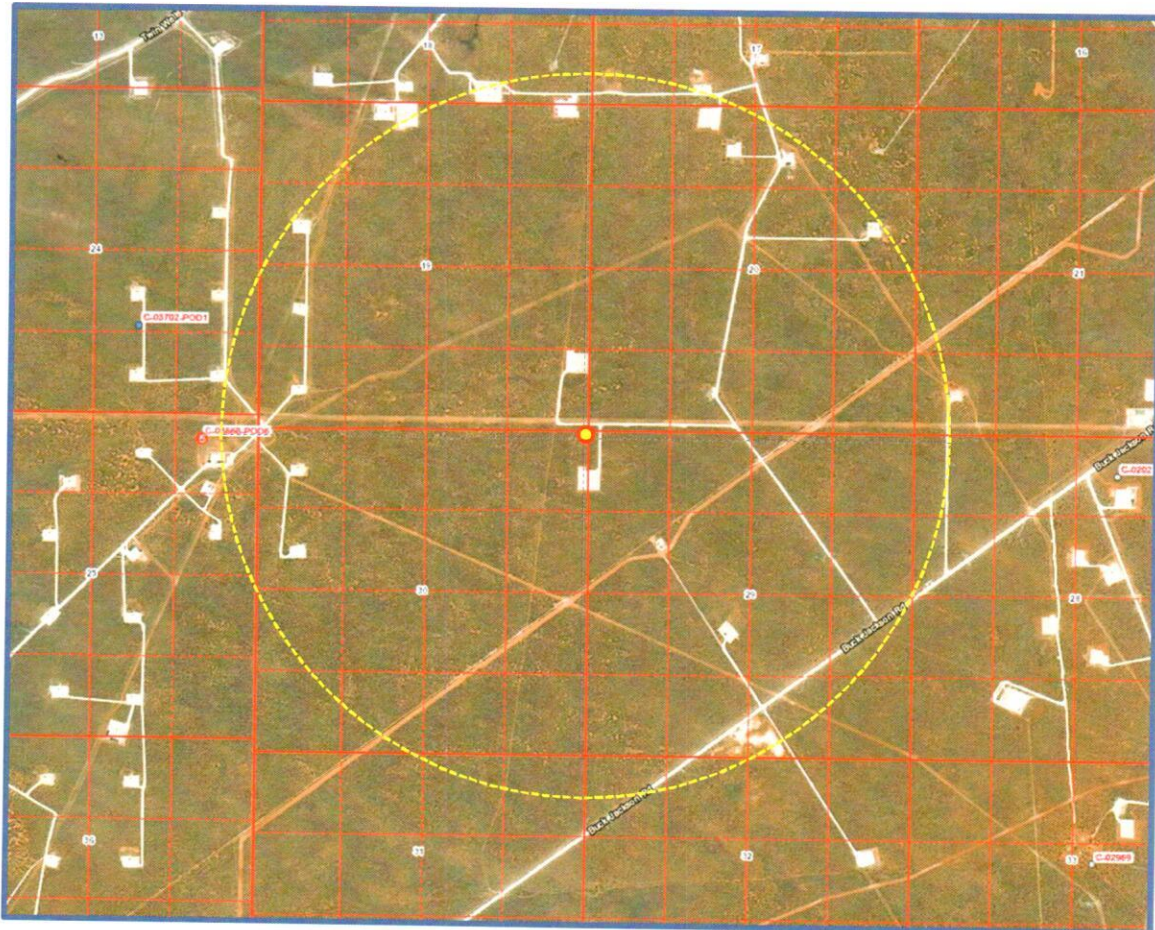
## C-108 Item XI

### Water Wells Within One Mile

#### PSE Federal SWD No.4 - Water Well Locator Map

*There are NO water wells (PODs) within a one-mile radius of the proposed SWD.*

*Representative analyses of wells with similar depth are included.*



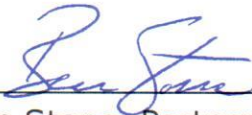
*Data from NM Office of the State Engineer displayed in OSE-GIS System.*



## **C-108 ITEM XII**

### Geologic Affirmation

We have examined available geologic and engineering data and have found no evidence of open faults or other hydrologic connection between the disposal interval and any underground sources of drinking water.



---

Ben Stone, Partner  
SOS Consulting, LLC

Project: Trove Energy and Water, LLC  
PSE Project Area  
Reviewed 3/4/2019

## **C-108 ITEM XIII – PROOF OF NOTIFICATION**

### IDENTIFICATION AND NOTIFICATION OF INTERESTED PARTIES

#### **Exhibits for Section**

Affected Parties Map

List of Interested Parties

Notification Letter to Interested Parties

Proof of Certified Mailing

Published Legal Notice



PSE Federal SWD Well No.4 – Affected Parties Plat  
(Attachment to NMOCD Form C-108, Application for Authority to Inject.)



### LEGEND

- T.1 – NMNM-120908 – COG Operating, LLC
- T.2 – NMNM-057274 – EOG Resources, Inc.
- T.3 – NMNM-116575 – Devon Energy Prod. Co.
- T.4 – NMNM-108968 – EOG Resources, Inc.

## **C-108 ITEM XIII – PROOF OF NOTIFICATION AFFECTED PARTIES LIST**

**SOS Consulting is providing electronic delivery of C-108 applications.**  
**ALL APPLICABLE AFFECTED PARTIES ARE PROVIDED A LINK IN THE NOTICE LETTER**  
**TO A SECURE SOS/ CITRIX SHAREFILE® SITE TO VIEW AND DOWNLOAD**  
**A FULL COPY OF THE SUBJECT C-108 APPLICATION IN PDF FORMAT.**

"AFFECTED PERSON" MEANS THE DIVISION DESIGNATED OPERATOR; IN THE ABSENCE OF AN OPERATOR, A LESSEE WHOSE INTEREST IS EVIDENCED BY A WRITTEN CONVEYANCE DOCUMENT EITHER OF RECORD OR KNOWN TO THE APPLICANT AS OF THE DATE THE APPLICANT FILES THE APPLICATION; OR IN THE ABSENCE OF AN OPERATOR OR LESSEE, A MINERAL INTEREST OWNER WHOSE INTEREST IS EVIDENCED BY A WRITTEN CONVEYANCE DOCUMENT EITHER OF RECORD OR KNOWN TO THE APPLICANT AS OF THE DATE THE APPLICANT FILED THE APPLICATION FOR PERMIT TO INJECT.; PER OCD RULES NMAC 19.15.26.7, A. AND 19.15.26.8, B.2.

### **SURFACE OWNER**

- 1 U.S. DEPARTMENT OF INTERIOR  
Bureau of Land Management  
Oil & Gas Division  
620 E. Greene St.  
Carlsbad, NM 88220  
Certified: 7018 0360 0001 8569 7061

### **OFFSET MINERALS LESSEES and OPERATORS (All Notified via USPS Certified Mail)**

#### **BLM Lease NMNM-120908 (T.1 on Map)**

##### **Lessee & Operator**

- 2 COG OPERATING, LLC  
Attn: NM Land/ Leases  
600 W. Illinois Avenue  
Midland, TX 79701  
Certified: 7018 0360 0001 8569 7054

#### **BLM Leases NMNM-057274, 108968 (T.2 and T.4 on Map)**

##### **Lessee & Operator**

- 3 EOG RESOURCES, INC.  
105 S. 4th St.  
Artesia, NM 88210  
Certified: 7018 0360 0001 8569 7047

#### **BLM Leases NMNM-116575 (T.3 on Map)**

##### **Lessee & Operator**

- 4 DEVON ENERGY PRODUCTION CO., LP  
333 W. Sheridan Avenue  
OKC, OK 73102-5010  
Certified: 7018 0360 0001 8569 7030

### **OFFSET MINERALS OWNERS (Notified via USPS Certified Mail)**

U.S. DEPARTMENT OF INTERIOR  
Bureau of Land Management  
Oil & Gas Division  
620 E. Greene St.  
Carlsbad, NM 88220



**C-108 ITEM XIII – PROOF OF NOTIFICATION**  
**AFFECTED PARTIES LIST (cont.)**

**REGULATORY**

NEW MEXICO OIL CONSERVATION DIVISION (FedEx'ed original and copy)  
1220 S. St. Francis Dr.  
Santa Fe, NM 87505

NEW MEXICO OIL CONSERVATION DIVISION (FedEx'ed copy)  
811 South First St.  
Artesia, NM 88210

PSE #4

PSE #2



April 2, 2019

**NOTIFICATION TO INTERESTED PARTIES**  
**via U.S. Certified Mail – Return Receipt Requested**

To Whom It May Concern:

Trove Energy and Water, LLC, Hobbs, New Mexico, is preparing applications to the New Mexico Oil Conservation Division to drill and complete for salt water disposal the PSE Federal SWD Well No.4. The proposed commercial operation will be for produced water disposal from area operators. As indicated in the notice below, the well will be located in Section 30, Township 24 South, Range 32 East in Eddy County, New Mexico.

The published notice states that the interval will be from 17,000 feet to 18,500 feet into the Devonian and Silurian formations.

Following is the notice published in the Hobbs News-Sun, Hobbs, New Mexico on or about April 3, 2018.

**LEGAL NOTICE**

Trove Energy and Water, LLC, 1919 North Turner, Hobbs, NM 88240, is filing Form C-108 (Application for Authority to Inject) with the New Mexico Oil Conservation Division seeking administrative approval for a salt water disposal well. The proposed well, the PSE Federal SWD Well No.4 will be located 145' FNL & 5' FWL, Section 30, Township 24 South, Range 32 East, Lea County, New Mexico; approximately 21.4 miles east of Malaga, NM.

Produced water from area production will be commercially disposed into the Devonian and Silurian formations at a maximum interval depth of 17,000' to 18,500' at a maximum surface pressure of 3400 psi and a rate limited only by such pressure. Mudlogging and e-logs will confirm final interval depths.

Interested parties wishing to object to the proposed application must file with the New Mexico Oil Conservation Division, 1220 St. Francis Dr., Santa Fe, NM 87505, (505)476-3460 within 15 days of the date of this notice. Additional information may be obtained from the applicant's agent, SOS Consulting, LLC, (903)488-9850 or, email [info@sosconsulting.us](mailto:info@sosconsulting.us).

***You have been identified as a party who may be interested as an offset lessee or operator.***



You are entitled to a full copy of the application. A full copy in PDF format will be posted on the SOS Consulting **ShareFile** site and available for future download (posting may lag behind the notice effort).

Use the URL link: <https://sosconsulting.sharefile.com/d-s036f3bfd03146998>  
(Please Note: The ShareFile service is powered by Citrix Systems and is completely secure.\*)

*The link to this file will be active for 60 days from the date of this letter. Your company can access and download the file a maximum of five (5) times. (One copy may be downloaded and shared as needed among your company.)*

If preferred, you may call SOS Consulting, LLC at 903-488-9850, or email [info@sosconsulting.us](mailto:info@sosconsulting.us), and the same PDF file copy will be expedited to you via email.

Please use a subject like "**PSE Fed SWD #4 April 2019 PDF Copy Request**".

Thank you for your attention in this matter.

Best regards,



Ben Stone, SOS Consulting, LLC  
Agent for Trove Energy and Water, LLC

Cc: Application File

*SOS Consulting is committed to providing superior quality work using technology to assist clients and affected parties in obtaining the documentation required. SOS will continue to utilize methods which are less energy and resource intensive including, the reduction of paper copies.*

*We hope you'll partner with us and appreciate these efforts.*

\* You will be asked for your email, name and company.

This will not be used by anyone except keeping track of the file downloads.

You will not be solicited by SOS or anyone else. Data is stored on Citrix Systems servers only.

**CITRIX**



# C-108 - Item XIV

Proof of Notice (Certified Mail Receipts)

7018 0360 0001 8569 7061

U.S. Postal Service™ CERTIFIED MAIL® RECEIPT Domestic Mail Only	
For delivery information, visit our website at <a href="http://www.usps.com">www.usps.com</a> ®.	
OFFICIAL USE	
Certified Mail Fee	\$ .55
Extra Services & Fees (check box, add fee as appropriate)	
<input type="checkbox"/> Return Receipt (hardcopy)	\$ 3.50
<input type="checkbox"/> Return Receipt (electronic)	\$
<input type="checkbox"/> Certified Mail Restricted Delivery	\$
<input type="checkbox"/> Adult Signature Required	\$
<input type="checkbox"/> Adult Signature Restricted Delivery	\$
Postage	\$ 2.80
Total Postage and Fees	\$ 6.85
Sent To	
Street	Bureau of Land Management
City, State	Oil & Gas Division
PS Form	620 E. Greene St. Coronado, NM 88002

7018 0360 0001 8569 7054

U.S. Postal Service™ CERTIFIED MAIL® RECEIPT Domestic Mail Only	
For delivery information, visit our website at <a href="http://www.usps.com">www.usps.com</a> ®.	
OFFICIAL USE	
Certified Mail Fee	\$ .55
Extra Services & Fees (check box, add fee as appropriate)	
<input type="checkbox"/> Return Receipt (hardcopy)	\$ 3.50
<input type="checkbox"/> Return Receipt (electronic)	\$
<input type="checkbox"/> Certified Mail Restricted Delivery	\$
<input type="checkbox"/> Adult Signature Required	\$
<input type="checkbox"/> Adult Signature Restricted Delivery	\$
Postage	\$ 2.80
Total Postage and Fees	\$ 6.85
Sent To	
Street	COG OPERATING, LLC
City, State	Attn: NM Land/ Leases
PS Form	600 W. Illinois Avenue

7018 0360 0001 8569 7047

U.S. Postal Service™ CERTIFIED MAIL® RECEIPT Domestic Mail Only	
For delivery information, visit our website at <a href="http://www.usps.com">www.usps.com</a> ®.	
OFFICIAL USE	
Certified Mail Fee	\$ .55
Extra Services & Fees (check box, add fee as appropriate)	
<input type="checkbox"/> Return Receipt (hardcopy)	\$ 3.50
<input type="checkbox"/> Return Receipt (electronic)	\$
<input type="checkbox"/> Certified Mail Restricted Delivery	\$
<input type="checkbox"/> Adult Signature Required	\$
<input type="checkbox"/> Adult Signature Restricted Delivery	\$
Postage	\$ 2.80
Total Postage and Fees	\$ 6.85
Sent To	
Street	EOG RESOURCES, INC.
City, State	105 S. 4th St.
PS Form	Artesia, NM 88210

7018 0360 0001 8569 7030

U.S. Postal Service™ CERTIFIED MAIL® RECEIPT Domestic Mail Only	
For delivery information, visit our website at <a href="http://www.usps.com">www.usps.com</a> ®.	
OFFICIAL USE	
Certified Mail Fee	\$ .55
Extra Services & Fees (check box, add fee as appropriate)	
<input type="checkbox"/> Return Receipt (hardcopy)	\$ 3.50
<input type="checkbox"/> Return Receipt (electronic)	\$
<input type="checkbox"/> Certified Mail Restricted Delivery	\$
<input type="checkbox"/> Adult Signature Required	\$
<input type="checkbox"/> Adult Signature Restricted Delivery	\$
Postage	\$ 2.80
Total Postage and Fees	\$ 6.85
Sent To	
Street	DEVON ENERGY PROD. CO., LP
City, State, Zip	333 W. Sheridan Avenue
PS Form 380	OKC, OK 73102-5010



## No. 25050

County of Eddy:

## Danny Scott

being duly sworn says that he is the **Publisher**  
of the Artesia Daily Press, a daily newspaper of General  
circulation, published in English at Artesia, said county  
and state, and that the hereto attached

was published in a regular and entire issue of the said  
Artesia Daily Press, a daily newspaper duly qualified  
for that purpose within the meaning of Chapter 167 of  
the 1937 Session Laws of the state of New Mexico for  
1 Consecutive weeks/day on the same

First Publication March 31, 2019

## Second Publication

### Third Publication

### Fourth Publication

### Fifth Publication

### Sixth Publication

Seventh Publication

Subscribed and sworn before me this

1st day of April 2019



OFFICIAL SEAL

Latisha Romine

NOTARY PUBLIC-STATE OF NEW MEXICO

My commission expires:

5/12/2019

Katuska Remine

Latisha Romine

Notary Public, Eddy County, New Mexico

## Legal Notice

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Produced water from area production will be commercially disposed into the Devonian and Silurian formations at a maximum interval depth of 17,000' to 18,500' at a maximum surface pressure of 3400 psi and a rate limited only by such pressure. Mudlogging and e-logs will confirm final interval depths.

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2019 Legal No. 25050.