Additional Information

Mack Energy
Glacier SWD-2617

List of Deficiencies, Proof of Notice, & Induced Seismicity Request
Received 9-17-2024

From: Deana Weaver
To: Harris, Anthony, EMNRD; Jerry Sherrell
Cc: Goetze, Phillip, EMNRD; Gebremichael, Million, EMNRD; Sandoval, Stacy, EMNRD; Chavez, Carl, EMNRD
Subject: [EXTERNAL] RE: Mack Energy Glacier SWD#1 - List of deficiencies and clarification required.
Date: Tuesday, September 17, 2024 9:42:24 AM
Attachments: additional Information.pdf

Anthony- Attached is the additional information requested below. A deep injection seismicity report will be forwarded once completed.

Thank you

Deana Weaver
Regulatory Technician II
Mack Energy Corporation
575-748-1288

From: Harris, Anthony, EMNRD <Anthony.Harris@emnrd.nm.gov>
Sent: Friday, August 30, 2024 1:26 PM
To: Jerry Sherrell <jerrys@mec.com>
Cc: Deana Weaver <dweaver@mec.com>; Goetze, Phillip, EMNRD <phillip.goetze@emnrd.nm.gov>; Gebremichael, Million, EMNRD <Million.Gebremichael@emnrd.nm.gov>; Sandoval, Stacy, EMNRD <Stacy.Sandoval@emnrd.nm.gov>; Chavez, Carl, EMNRD <Carlj.Chavez@emnrd.nm.gov>
Subject: Mack Energy Glacier SWD#1 - List of deficiencies and clarification required.
Importance: High

Good Day, Jerry

Below are the list of deficiencies and or items requiring clarification before the application can be reviewed. If possible, I would like to take 30 mins to review some of these items with you before I send this to Mack.

1. Page 3/61 – C-108 Section VII
    a. Please provide chemical analysis for the disposal zone formation water (Item VII.5)

2. Page 3/61 – C-108 Section VIII

a. Provide the geologic name, and depth to bottom of all USDW overlying the proposed injection zone as per C-108 Section VIII
b. Provide the geologic name, and depth to bottom of all USDW underlying the proposed injection zone as per C-108 Section VIII

3. Page 7/61 Section VII.4
   a. Please specify the Source of the Produced Water – San Andres? Other?

4. Page 18/61- "Before" Wellbore diagram for proposed Glacier SWD#1 well
   a. No plugging details included on wellbore diagram. Please provide plugging details if available.

5. Page 22/61 – No Label / Titles included on the Map. AOR is less than 1 mile
   a. 1-Mile AOR not shown on this map.
      i. Refer to attached map labelled "***Page 22.. AOR deficiencies***" illustrating the unit letters (denoted by X's) that need to be included to encompass the 1-mile AOR
         1. Please update the map on Page 22 to include a circle clearly showing the 1-mile AOR.
         2. Please update "proof of notice" requirement to verify that the surface owner and lease operators (ie. including the 30 Unit letters denoted by an "X" in the attached map) have been notified (**Refer to item 5b below**)
         3. Please provide a separate map (**with label / Title**) that clearly identifies the Surface Owner upon which the proposed well is located
         4. Please provide a separate map (**with label / Title**) that clearly identifies the Leasehold Operators within 1 mile radius of the proposed well.

   b. Refer to Eastern portion of map that identifies Grizzly Operating as an owner
      i. Ownership of well 30-015-30667 was transferred from Grizzly to Contango effective 1-29-2021 (ie. prior to Mack Energy Glacier Application being submitted)
         1. Please submit "proof of notice" requirements to verify that Contango has been notified.

6. Refer to Page 52/61 – Water Analysis Report
   a. No Label / Title include on this Water Sample
      i. Is this a Fresh Water Sample ?
   b. Report lists the sample point as *"Glacier SWD#1- Wellhead Sample"*

i. If the sample was collected from the Glacier well, please clarify how the sample was collected along with details of the zone that was sampled.

ii. If this is a fresh water sample, please clarify (with appropriate Label / Title) the location of the well and date the sample was collected (Refer to C-108 Item XI)

7. General notes:
    a. Proposed cement volume for Production casing (885 sks) is not sufficient to reach surface
        i. If there is a DV tool(s) planned for cement job, please clarify and update the wellbore diagram?
    b. CBL will be required for the Surface casing (set and cemented in 2001)
        i. Note that well is in high Karst area, and surface casing cement quality has to be confirmed by CBL.
    c. Please provide a brief description of the planned workover operations to convert this well
    d. Provide a technical narrative and geologic assessment to demonstrate how the injected fluids will be contained within the Devonian

Induced Seismicity Potential (Minimum requirements)

The well is proposed for disposal into the Devonian and is located near, and along the trend line of, the Dagger Draw SRA (refer to attached image). Considering the ongoing seismic activity in the southern region of New Mexico, OCD requests an assessment of the Induced Seismicity potential. Below is an outline of the minimum requirements to assess the risks of Induced Seismicity for wells in close proximity to a known Seismic Response Area.

Minimum Requirements (for shallow injection wells)

1. General Information / overview:
    a. Operator to provide a brief narrative on the location of the proposed SWD well (Section, township, range, County etc)
    b. Geologic description (ie. Interbedded carbonate, limestones, siltstones, sandstones etc) of the proposed injection interval
    c. Proposed formation and the depth of the injection interval
    d. Statement on potential for communication with the Precambrian via faulting or other geologic features
    e. Statement on potential for communication with USDW.
2. Seismic Risk assessment based on USGS data
    a. Statement on the Historical seismicity in the area of the proposed SWD
        i. Number of earthquakes above 2.5 magnitude within 10 miles of the proposed well
        ii. Location and depth of nearest earthquake and the distance to the

proposed well.

b. Subsurface Conditions / Faulting
    i. Distance and depth to the nearest basement-penetrating fault(s)
    ii. Narrative on the maximum stress direction, the stress regime and potential for communication with basement-penetrating faults.

Deep Injection – Minimum requirements Provide all items listed for Shallow injection, in addition to the following:

1. 1-mile AOR required for all Devonian-Silurian injection wells
2. Include a structural contour map of the Precambrian basement
    a. Highlight basement-penetrating faults on the map as applicable
    b. Include a 2 Mile radius around the proposed well showing proximity to basement-penetrating faults if applicable
3. If basement penetrating faults are identified, include an analysis of Fault Slip Potential utilizing Stanford-Zoback model which should include the following:
    a. Construction of a hydrologic model to simulate the impact of injection from the proposed well (and nearby injection wells) over a 30 year period to estimate the Fault-slip potential associated with injection.
        i. Simulate injection scenarios based on maximum proposed injection rate for the well, and offset wells if applicable
        ii. An example of parameters to be utilized in the model are included in Table 8,9 & 10 below
    b. Identification of subsurface faults and a description of the faults (strike direction, type of fault – normal, extensional, etc)
    c. Include a record of all USGS documented seismic events of magnitude 2.5 or greater within a 10 mile radius, including details on the depth (focus) and epicenter
    d. A narrative on whether injection in the vicinity the faults will result in an elevated risk for injection-induced fault slip

Table 8. Input parameters and source material for FSP simulations

Modeled Parameter	Input Value	Variability (+/-)	UOM	Source
Stress				
Vertical Stress Gradient	1.05	0.105	psi ft^{-1}	Nearby well estimate
Max Horizontal Stress Direction	N75E	5	Deg.	Lund Snee & Zoback, 2018
Reference Depth	7,000	100	ft	Nearby well evaluation
Initial Res. Pressure Gradient	0.43	0.043	psi ft^{-1}	Lund Snee & Zoback, 2018
A_ϕ Parameter	0.6	0.06	-	Lund Snee & Zoback, 2018
Reference Friction Coefficient (μ)	0.6	0.06	-	Standard Value
Hydrologic				
Aquifer Thickness	1170	100	ft	Nearby well evaluation
Porosity	4	0.5	%	Nearby well evaluation
Permeability	25	2.5	mD	Nearby well evaluation
Material properties				
Density (Water)	1040	20	kg m^{-3}	Standard Value
Dynamic Viscosity (Water)	0.0008	0.0001	Pa.s	Standard Value
Fluid Compressibility (water)	3.6×10^{-10}	0	Pa^{-1}	Standard Value
Rock Compressibility	1.08×10^{-9}	0	Pa^{-1}	Standard Value

Table 9. Location and characteristics of injection wells simulated in FSP assessment

Well #	API	Well Name	Lat. (NAD83)	Long. (NAD83)	Vol. (bbls/day)	Start	End
1	30-025-[redacted]	[redacted] SWD #012	[redacted]	-103.[redacted]	7,000	2022	2052
2	30-025-[redacted]	[redacted] SWD #026	[redacted]	-103.[redacted]	5,000	2022	2052
3	30-025-[redacted]	[redacted] SWD #002	[redacted]	-103.[redacted]	20,000	2022	2052
4	N/A	[redacted] SWD #1	[redacted]	-103.[redacted]	15,000	2022	2052

Table 10. Summary of model simulation results showing the required pore pressure change to induced fault slip, actual change in pressure (as predicted by the FSP model), and probability of fault slip at the end of the simulated injection scenario.

Fault Segment #	ΔPressure Necessary to Induce Fault Slip	Actual ΔPressure at fault midpoint in 2052	Fault Slip Potential in 2052
1	2842	156	0.00
2	1956	157	0.00
3	2859	156	0.00
4	1764	151	0.00
5	531	166	0.02
6	832	152	0.00
7	496	137	0.03
8	446	116	0.03
9	1840	141	0.00
10	2515	152	0.00
11	894	166	0.00
12	1769	180	0.00

Conclusion – Induced Seismicity potential:

Operator representative(s), with skills and competencies suitable to assess the risk of induced seismicity, to provide an affirmative statement / summary on the potential for Induced seismicity based upon the parameter listed above. Example wording included below

1. "After examination of publicly available / Operator's geologic and engineering data, there (is / is not) evidence of open faults or other hydrologic connections between the proposed

disposal zone and any USDW.

2. “After examination of publicly available / Operator data, it is concluded that there is (low/high) risk for induced seismicity based upon the following parameters”:
    i. Vertical separation between the proposedinjection zone and the pre-cambrian
    ii. Narrative on the existance of basement-penetrating faults in the area of the proposed SWD
    iii. Distance from proposed well to the nearest known basement-penetrating fault(s)
    iv. Distance from the closest historic earthquake
    v. Summary of Fault Slip potential based on Stanford-Zoback model.
    vi. Other items as applicable..

Regards
Tony Harris
Petroleum Specialist
Anthony.harris@emnrd.nm.gov
505 549 8131.

Revised March 23, 2017

RECEIVED:	REVIEWER:	TYPE:	APP NO:

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: _____ **OGRID Number:** _____
Well Name: _____ **API:** _____
Pool: _____ **Pool Code:** _____

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

FOR OCD ONLY
☐ Notice Complete
☐ Application Content Complete

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

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.

_____ Date

_____ Print or Type Name

_____ Phone Number

Deana Weaver
_____ Signature

_____ e-mail Address

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

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

FORM C-108
Revised June 10, 2003

APPLICATION FOR AUTHORIZATION TO INJECT

I. PURPOSE: _____Secondary Recovery _____Pressure Maintenance ___X___Disposal _____Storage
Application qualifies for administrative approval? ___X___Yes _____No

II. OPERATOR: Mack Energy Corporation

ADDRESS: P.O. Box 960 Artesia, NM 88210

CONTACT PARTY: Deana Weaver PHONE: 575-748-1288

III. WELL DATA: Complete the data required on the reverse side of this form for each well proposed for injection. Additional sheets may be attached if necessary.

IV. Is this an expansion of an existing project? _____Yes ___X___No
If yes, give the Division order number authorizing the project: _____

V. Attach a map that identifies all wells and leases within two miles of any proposed injection well with a one-half mile radius circle drawn around each proposed injection well. This circle identifies the well's area of review.

VI. Attach a tabulation of data on all wells of public record within the area of review which penetrate the proposed injection zone. Such data shall include a description of each well's type, construction, date drilled, location, depth, record of completion, and a schematic of any plugged well illustrating all plugging detail.

VII. Attach data 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. Attach appropriate geologic data on the injection zone 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. Describe the proposed stimulation program, if any.

*X. Attach appropriate logging and test data on the well. (If well logs have been filed with the Division, they need not be resubmitted).

*XI. Attach a chemical analysis of fresh water from two or more fresh water wells (if available and producing) within one mile of any injection or disposal well showing location of wells and dates samples were taken.

XII. Applicants for disposal wells must make an affirmative statement that they have examined available geologic and engineering data and find no evidence of open faults or any other hydrologic connection between the disposal zone and any underground sources of drinking water.

XIII. Applicants must complete the "Proof of Notice" section on the reverse side of this form.

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: Deana Weaver TITLE: Regulatory Tech II

SIGNATURE: Deana Weaver DATE: 1/30/2023

E-MAIL ADDRESS: dweaver@mec.com

* 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: _____

DISTRIBUTION: Original and one copy to Santa Fe with one copy to the appropriate District Office

Side 2

III. WELL DATA

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

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.

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.

Side 1

INJECTION WELL DATA SHEET

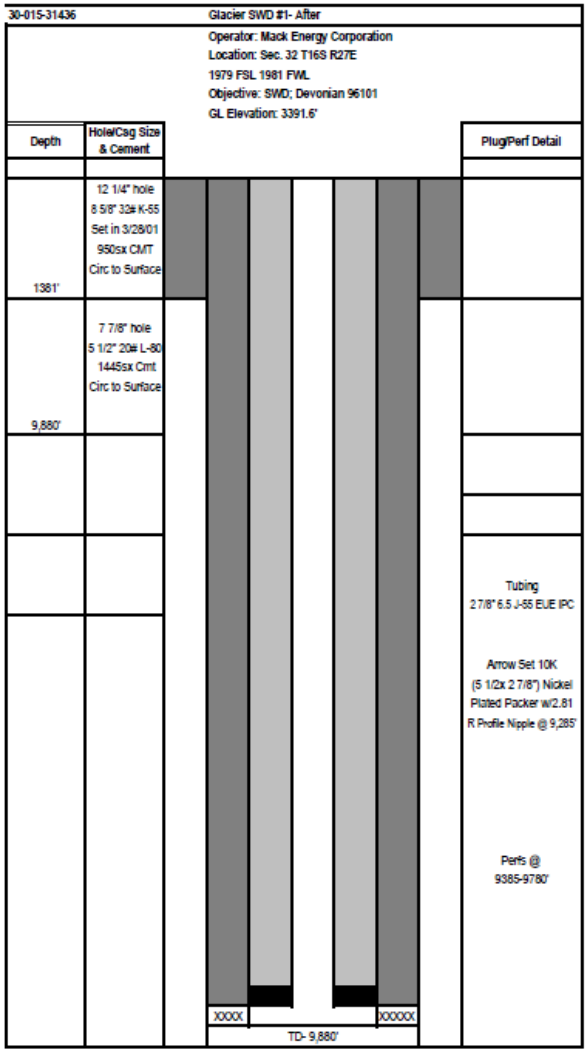
OPERATOR: Mack Energy Corporation

WELL NAME & NUMBER: Glacier SWD #1

WELL LOCATION: 1979 FSL 1981 FWL | K | 36 | 16S | 27E

FOOTAGE LOCATION | UNIT LETTER | SECTION | TOWNSHIP | RANGE

WELLBORE SCHEMATIC



WELL CONSTRUCTION DATA

Surface Casing

Hole Size: 12 1/4" Casing Size: 8 5/8" (existing 3/28/01)

Cemented with: 950 sx. ***or*** _____ ft^3

Top of Cement: 0 Method Determined: Circ

Intermediate Casing

Hole Size: _____ Casing Size: _____

Cemented with: _____ sx. ***or*** _____ ft^3

Top of Cement: _____ Method Determined: _____

Production Casing

Hole Size: 7 7/8" Casing Size: 5 1/2"

Cemented with: 1445 sx. ***or*** _____ ft^3

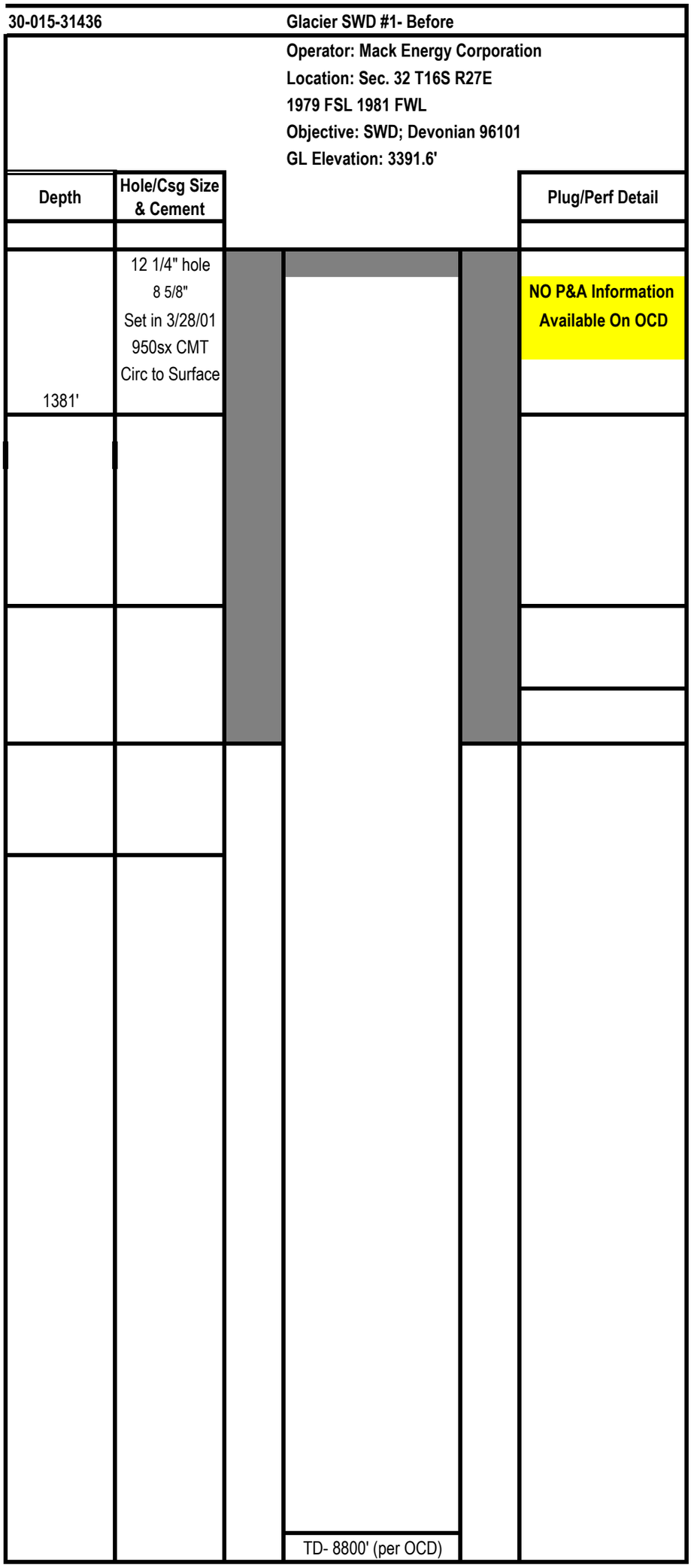
Top of Cement: 0 Method Determined: Circ

Total Depth: 9,880'

Injection Interval

9385' feet to 9780' Perforated

(Perforated or Open Hole; indicate which)



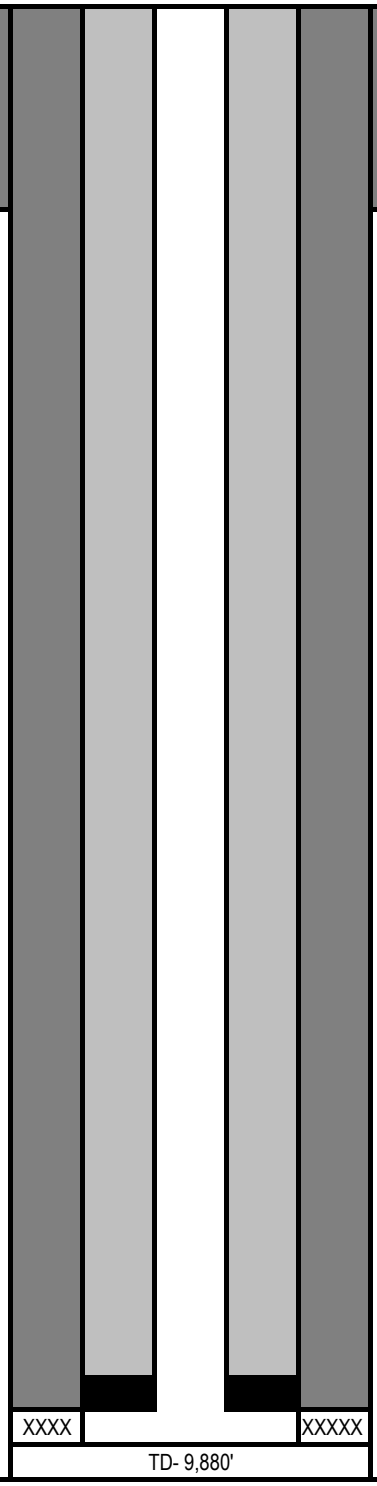
The Well file in the OCD online system is incomplete.

Should this re-entry be unsuccessful Mack Energy will P&A per OCD regulations

30-015-31436 **Glacier SWD #1- After**

Operator: Mack Energy Corporation
Location: Sec. 32 T16S R27E
1979 FSL 1981 FWL
Objective: SWD; Devonian 96101
GL Elevation: 3391.6'

Depth	Hole/Csg Size & Cement	Plug/Perf Detail
1381'	12 1/4" hole 8 5/8" 32# K-55 Set in 3/28/01 950sx CMT Circ to Surface	
9,880'	7 7/8" hole 5 1/2" 20# L-80 1445sx Cmt Circ to Surface	
		Tubing 2 7/8" 6.5 J-55 EUE IPC
		Arrow Set 10K (5 1/2x 2 7/8") Nickel Plated Packer w/2.81 R Profile Nipple @ 9,285'
		Perfs @ 9385-9780'



MACK ENERGY CORPORATION
Glacier SWD #1 (Re-Entry)
Sec 32-T16s-R27e
API #30-015-31436

Well Information

Original Well Information.

Operator: Concho Resources Inc.
Well Name: Dorsey "32" State #1
TD: 8,800'
P&A: 04/14/2001

Existing Casing:

Hole	MD (ft)	Casing	Weight	Grade	Coupling	Comments
25"	0'- 40'	20"				Conductor
12 ¼"	0'- 1,350'	8 5/8"	32#	J-55	STC	Pumped 400 sacks + 200 sacks. Circulated 150 sacks
7 7/8"	8,800'	N/A				

New Production Casing

Hole	MD (ft)	Casing	Weight	Grade	Coupling	Comments
7 7/8"	0'-9,800'	5 1/2"	20#	L-80	LT&C	

Production Casing: OD - 5 ½" 20#- L-80 ID: 4.892" Drift: 4.653 Burst: 9,190 psi

Procedure

Objective: Drill out cement plugs to casing in/out plug and test casing to insure the casing test good, run CBL. If casing/cement is good, move in drill rig, finish drilling out cement plugs, Deepen well from 8,800'-9,880', log well, run 5 ½" casing to bottom.

1. Remove Dry Hole Marker. Dig out old Cellar. Find 8 5/8" casing stub. Inspect casing for pits and holes. Install 8 5/8"x11"x 5K Wellhead and test.
2. MIRU PU.
3. Nipple up BOPE and test.
4. PU 7 7/8" bit, DC's w/2 7/8" L-80 work string.
5. Drill out cement plugs. Plug #1 surface plug from 0' to 60', Test casing to 500 psi for 15 minutes. Tag plug at 1,300' Test casing to 500 psi for 15 minutes.
6. TOH and lay down 2 7/8" tubing and drill collars.
7. RU Wireline truck and Run CBL with 1000psi
8. Nipple down BOPE.
9. Install B-1 adaptor with valve and gauge.
10. Rig Down Pulling Unit. Wait on Drilling Rig.
11. Rig Up Drilling Rig.

MACK ENERGY CORPORATION
Glacier SWD #1 (Re-Entry)
Sec 32-T16s-R27e
API #30-015-31436

12. NU BOPE & Test
13. Finish Drilling out cement plugs.
14. Deepen well from 8,800'-9,980'
15. TOH
16. RU Wireline Truck and log well
17. Run 5 ½" casing to bottom & Cement to surface. A Packer stage tool will be used if losses are encountered. Cement volumes will change after caliper log is ran.

EM 9/6/2024

PROPETRO®
CEMENT DEPT

MACK ENERGY

GLACIER SWD #1

PRODUCTION CASING

ROBINSON #3

COUNTY

API: TBD

PREPARED BY: CARLOS CASAREZ

DATE: 9/06/2024

Version 8.6

PROPETRO®
CEMENT DEPT

MACK ENERGY
GLACIER SWD #1
ROBINSON #3
PRODUCTION CASING

WELL INFORMATION				
PRODUCTION CASING	5 1/2 20.0#		Set @ 9880 ft	
PREVIOUS CASING	8 5/8 32.0#		Set @ 1350 ft	
HOLE SIZE	7 7/8		Set @ TD	
FLUID NAME	**DENSITY (LB/GAL)**	**VOLUME (BBL)**	**EXCESS (%)**	**TOP OF FLUID (FT)**
MUD WASH	8.3	20	0%	0
GEL SPACER	8.3	20	0%	0
SCAVENGER	11.0	25	0%	0
LEAD SLURRY	11.5	108.0	35%	0
TAIL SLURRY	14.2	293.5	35%	2883
DISPLACEMENT	8.33	218	0%	0
LEAD SLURRY	**215 SACKS**	**11.5 PPG**	**2.82 CU/FT/SK**	**16.42 GAL/SK**
PRO-ECO H				
10% P-201				
5% P-402				
0.5% P-202				
3 LBS PER SACK P-305				
0.4 LBS PER SACK P-724				
0.125 LBS PER SACK P-309				
TAIL SLURRY	**1230 SACKS**	**14.2 PPG**	**1.34 CU/FT/SK**	**6.09 GAL/SK**
PRO-ECO H				
5% P-402				
2% P-201				
0.2% P-103				
0.2% P-18				
0.1% P-720				
0.4 GALS PER SACK P-724				

PUMP SCHEDULE		
FLUID NAME	**PUMP RATE (BBLS/MIN)**	**ESTIMATED TIME (HH:MM)**
MUD WASH	5	0:00
GEL SPACER	6	0:10
SCAVENGER	6	0:10
LEAD SLURRY	6	0:20
TAIL SLURRY	6	0:50
DISPLACEMENT	6	0:40
TOTAL ESTIMATED TIME NEEDED (HH:MM)		2:10

Version 8.6

PROPETRO®
CEMENT DEPT

MACK ENERGY
GLACIER SWD #1
ROBINSON #3
PRODUCTION CASING

DECRIPTION	QTY	UNIT	RATE	DISCOUNT	AMOUNT
PUMP TRUCK MILEAGE	60	MILES	$7.84	13%	$409.25
CREW TRUCK MILEAGE	60	MILES	$4.41	13%	$230.20
PUMP CHARGE	9880	FT	$0.71	13%	$6,102.88
DATA ACQUISITION	1	1 EACH	$385.00	13%	$334.95
BLENDING CHARGE	1454	FT3	$1.23	13%	$1,556.03
DELIVERY CHARGE	1984	TM	$0.88	13%	$1,519.23
CEMENT SERVICE SUPERVISOR - PRODUCTION	1	1 EACH	$1,975.00	13%	$1,718.25
CEMENT CREW PERSONNEL - PRODUCTION	1	1 CREW	$3,150.00	13%	$2,740.50
CEMENT LOGISTICAL SUPPORT - PRODUCTION	1	1 EACH	$2,650.00	13%	$2,305.50
LAB & TECHNICAL SUPPORT	1	1 EACH	$415.00	13%	$361.05
IRON CERTIFICATION	1	1 EACH	$625.00	13%	$543.75
FUEL SURCHARGE	100	GAL	$4.45	13%	$388.63
5 1/2 RUBBER PLUG	1	1 EACH	$99.00	13%	$86.13
ADDITIONAL HOURS		HOURS	$1,150.00	13%	$0.00
LEAD CEMENT W/ ADDITIVES					
PRO-ECO H	215	SKS	$17.06	17%	$3,044.36
P-201	1860	LBS	$0.17	17%	$262.45
P-402	1471	LBS	$0.20	17%	$244.19
P-202	93	LBS	$2.50	17%	$192.98
P-305	645	LBS	$1.02	17%	$546.06
P-724	86	LBS	$1.26	17%	$89.94
P-309	27	LBS	$2.58	17%	$57.82
TAIL CEMENT W/ ADDITIVES					
PRO-ECO H	1230	SKS	$17.06	17%	$17,416.55
P-402	3118	LBS	$0.20	17%	$517.59
P-201	2067	LBS	$0.17	17%	$291.65
P-103	207	LBS	$3.46	17%	$594.46
P-18	207	LBS	$11.90	17%	$2,044.54
P-720	104	LBS	$8.89	17%	$767.38
P-724	492	LBS	$1.26	17%	$514.53
MISC.					
SUGAR	200	LBS	$1.80	17%	$298.80
P-623	110	LBS	$4.05	17%	$369.77
P-618	30	GAL	$33.86	17%	$843.11
PRO-ECO C	50	SKS	$17.44	17%	$723.76
P-201	420	LBS	$0.17	17%	$59.26
P-402	342	LBS	$0.20	17%	$56.77
P-202	21	LBS	$2.50	17%	$43.58
P-302	150	LBS	$0.46	17%	$57.27
P-724	20	LBS	$1.26	17%	$20.92
P-309	7	LBS	$2.58	17%	$14.99
				TOTAL ESTIMATED COST:	$47,369.06

Side 2

INJECTION WELL DATA SHEET

Tubing Size: _____2 7/8"_____Lining Material: _____IPC_____

Type of Packer: Arrow Set 10K (5 ½" x 2 7/8") Nickel Plated Packer with a 2.81 R Profile Nipple set @ 9285'

Packer Setting Depth: _____9285'_____

Other Type of Tubing/Casing Seal (if applicable): _____

Additional Data

1. Is this a new well drilled for injection? _____Yes __X__No

   If no, for what purpose was the well originally drilled? Gas Well

2. Name of the Injection Formation: Devonian

3. Name of Field or Pool (if applicable): SWD; Devonian

4. Has the well ever been perforated in any other zone(s)? List all such perforated intervals and give plugging detail, i.e. sacks of cement or plug(s) used. _____

   ____Nothing Listed on OCD Website. Should this re-entry be unsuccessful Mack Energy will P&A per OCD regulations.

5. Give the name and depths of any oil or gas zones underlying or overlying the proposed injection zone in this area: U. Miss 8805', L. Miss 9002', Devonian 9685', Montoya 9780', Simpson 10,074'

   The Glacier SWD #1 injected fluid will be contained within the Devonian formation. Above the Devonian, the Woodford Shale and Mississippian Lime Formations are low porosity and low permeability and are in excess of 100 feet combined. Below the Devonian, the top 50 feet of the Montoya Formation is low porosity and low permeability and will be the bottom seal and contain the Devonian injected fluid.

CATALYST Oilfield Services

Catalyst Oilfield Services
11999 E Hwy 158
Gardendale, TX 79758
(432) 563-0727
Fax: (432) 224-1038

Water Analysis Report

Customer:	Mack Energy Corporation	Sample #:	228768
Area:	Artesia	Analysis ID #:	177464
Lease:	Glacier	BOPD:	
Location:	SWD #1	BWPD:	
Sample Point:	Wellhead POD # RA-01078-ST fresh water sample was taken at surface on 1/11/2023. (32.900685°, -104.347437°)		

Sampling date:	1/11/2023
Analysis date:	1/19/2023
Analysis:	Catalyst
TDS (mg/l or g/m3):	5570
Density (g/cm3):	1.006
Hydrogen Sulfide:	7.14
Carbon Dioxide:	115
Comments:	

Anions	mg/l	meq/l
Chloride:	2292.6	64.65
Bicarbonate:	195.2	3.20
Carbonate:		0.00
Sulfate:	1200.0	24.96
Borate:	2.6	0.02
Phosphorus:		0.00
pH at time of sampling:		7.55
pH at time of analysis:		
pH used in Calculation:		7.55
Temperature @ lab conditions(F):		75

Cations	mg/l	meq/l
Sodium:	1099.0	47.80
Magnesium:	194.9	16.03
Calcium:	578.4	28.86
Potassium:	6.6	0.17
Strontium:	0.4	0.01
Barium:	0.2	0.00
Iron:	0.1	0.00
Manganese:	0.1	0.00
Conductivity (micro-ohms/cm):		8171
Resistivity (ohm meter):		1.2238

	Values Calculated at the Given Conditions - Amounts of Scale in lb/1000 bbl									
Temp	Calcite CaCO3		Gypsum CaSo4*2H2O		Anhydrite CaSO4		Celestite SrSO4		Barite BaSO4	
°F	Index	Amount	Index	Amount	Index	Amount	Index	Amount	Index	Amount
80	0.66	11.15	-0.30	0.00	-0.37	0.00	-1.76	0.00	1.07	0.00
100	0.76	13.94	-0.31	0.00	-0.31	0.00	-1.75	0.00	0.92	0.00
120	0.86	17.08	-0.30	0.00	-0.22	0.00	-1.72	0.00	0.80	0.00
140	0.97	20.57	-0.28	0.00	-0.12	0.00	-1.69	0.00	0.70	0.00
160	1.08	24.05	-0.26	0.00	0.01	8.71	-1.65	0.00	0.63	0.00
180	1.20	27.89	-0.23	0.00	0.15	125.48	-1.61	0.00	0.57	0.00
200	1.32	31.72	-0.20	0.00	0.30	225.52	-1.56	0.00	0.53	0.00
220	1.45	35.21	-0.17	0.00	0.47	308.48	-1.51	0.00	0.51	0.00

The Glacier SWD #1 injected fluid will be contained within the Devonian formation. Above the Devonian, the Woodford Shale and Mississippian Lime Formations are low porosity and low permeability and are in excess of 100 feet combined. Below the Devonian, the top 50 feet of the Montoya Formation is low porosity and low permeability and will be the bottom seal and contain the Devonian injected fluid.

VII. DATA SHEET: PROPOSED OPERATIONS

1. Proposed average and maximum daily rate and volume of fluids to be injected;
Respectively, 15,000 BWPD and 20,000 BWPD
2. The system is closed or open;
Closed
3. Proposed average and maximum injection pressure;
0-4,489#
4. Sources and an appropriate analysis of injection fluid and compatibility with the receiving formation if other than re-injected produced water;
We will be re-injecting produced water

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; **N/A-- There is not a Devonian well in the area to get a sample. Can we provide the sample during completion. We can perf and swab the well to provide a sample.**

6. List of Aquifers- Overlying- Artesian 1,120' ,
Underlying- N/A
7. Well Procedures- See Attached
8. Seismic- Attached

VIII. GEOLOGICAL DATA

1. Lithologic Detail; **Dolomite**
2. Geological Name; **Devonian**
3. Thickness; **395'**
4. Depth; **9880'TD (9385-9780' Perforated)**

IX. PROPOSED STIMULATION PROGRAM

1. To be treated with 10000 gallons 15% acid

X. LOGS AND TEST DATA

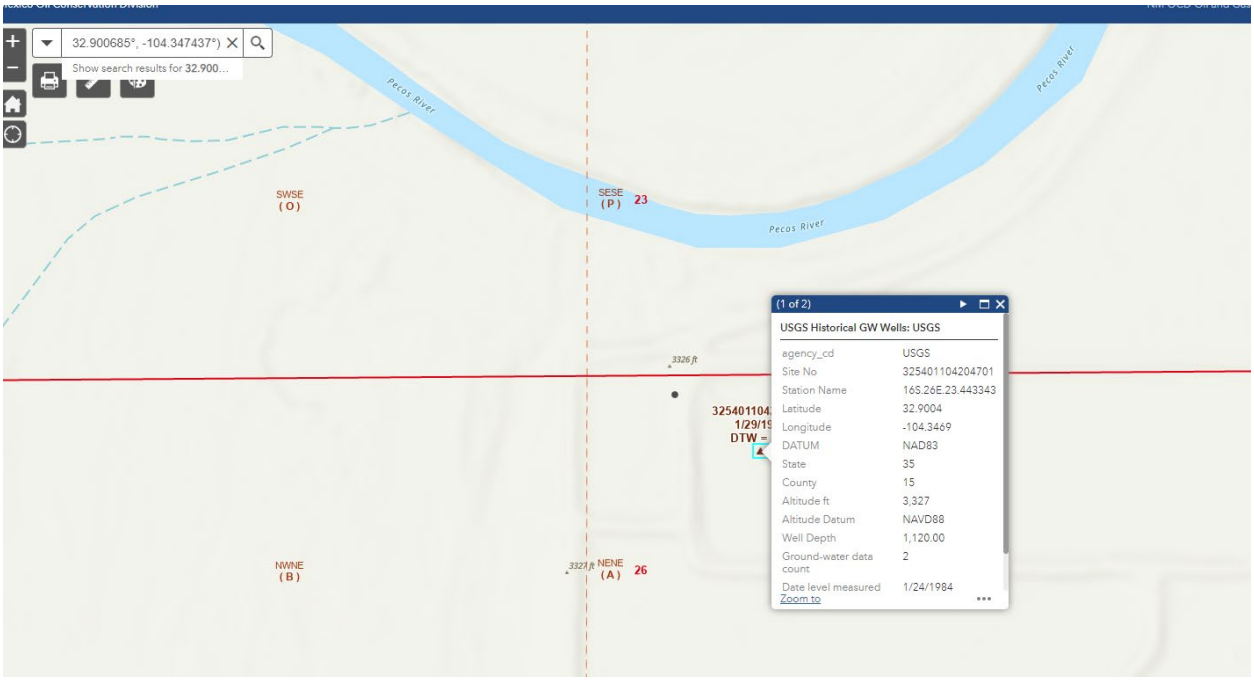
1. Well data will be filed with the OCD.

XI. ANALYSIS OF FRESHWATER WELLS

See attached
Additional Information
Waters Injected: **San Andres**

USDW

POD # RA-01078-ST fresh water sample was taken at surface on 1/11/2023. (32.900685°, -104.347437°)
Overlying Geologic Name- Artesian
Overlying Depth- 1,120’
Underlying Geologic Name- N/A
Underlying Depth- N/A



XII. AFFIRMATIVE STATEMENT

RE: Glacier SWD #1

We have examined the available geologic and engineering data and find no evidence of open faults or any other hydraulic connection between the disposal zone and any underground source of drinking water.

Mack Energy Corporation

Date: 10/3/22

Charles Sadler, Geologist

Glacier SWD #1
1980 FSL 1980 FWL
Sec. 32 T16S R27E
Formation Tops

Quaternary	Surface
Seven Rivers	30’
Queen	520’
Grayburg	850’
San Andres	1220’
Glorieta	2650’
Tubb	3931’
Abo	4645’
Wolfcamp	5900’
Cisco	7014’
Strawn	7920’
Atoka	8299’
Morrow	8519’
U. Miss	8805’
L. Miss	9002’
Devonian	9385’
Montoya	9780’
Simpson	10,074’

Catalyst Oilfield Services
11999 E Hwy 158
Gardendale, TX 79758
(432) 563-0727
Fax: (432) 224-1038

Water Analysis Report

Customer:	Mack Energy Corporation	Sample #:	81463
Area:	Artesia	Analysis ID #:	80383
Lease:	Prince Rupert		
Location:	Fed #4H 0		
Sample Point:	Wellhead San Andres		

		Anions	mg/l	meq/l	Cations	mg/l	meq/l
Sampling Date:	1/10/2019	**Chloride:**	**89383.7**	**2521.19**	**Sodium:**	**53970.0**	**2347.56**
Analysis Date:	1/22/2019	**Bicarbonate:**	**175.7**	**2.88**	**Magnesium:**	**1013.0**	**83.33**
Analyst:	Catalyst	**Carbonate:**			**Calcium:**	**2725.0**	**135.98**
TDS (mg/l or g/m3):	150968.6	**Sulfate:**	**2800.0**	**58.3**	**Potassium:**	**644.4**	**16.48**
Density (g/cm3):	1.102	**Borate*:**	**190.4**	**1.2**	**Strontium:**	**55.6**	**1.27**
		Phosphate*			**Barium:**	**0.9**	**0.01**
Hydrogen Sulfide:	5				**Iron:**	**9.0**	**0.32**
Carbon Dioxide:	97	***Calculated based on measured elemental boron and phosphorus.**			**Manganese:**	**0.857**	**0.03**
Comments:		pH at time of sampling:		6.65			
		pH at time of analysis:					
		pH used in Calculation:		**6.65**			
		Temperature @ lab conditions (F):		**75**	**Conductivity (micro-ohms/cm):**		**200079**
					Resistivity (ohm meter):		**.0500**

	Values Calculated at the Given Conditions - Amounts of Scale in lb/1000 bbl									
Temp	Calcite $CaCO_3$		Gypsum $CaSO_4*2H_2O$		Anhydrite $CaSO_4$		Celestite $SrSO_4$		Barite $BaSO_4$	
°F	Index	Amount	Index	Amount	Index	Amount	Index	Amount	Index	Amount
80	0.05	0.91	-0.13	0.00	-0.13	0.00	-0.11	0.00	1.22	0.60
100	0.13	2.72	-0.20	0.00	-0.13	0.00	-0.13	0.00	1.02	0.30
120	0.22	4.84	-0.26	0.00	-0.11	0.00	-0.15	0.00	0.84	0.30
140	0.30	7.26	-0.30	0.00	-0.06	0.00	-0.15	0.00	0.69	0.30
160	0.37	9.68	-0.34	0.00	0.00	6.96	-0.15	0.00	0.56	0.30
180	0.45	12.70	-0.37	0.00	0.08	166.07	-0.14	0.00	0.45	0.30
200	0.52	15.73	-0.40	0.00	0.18	328.81	-0.13	0.00	0.36	0.30
220	0.60	18.75	-0.42	0.00	0.28	485.19	-0.11	0.00	0.28	0.30

Catalyst Oilfield Services
11999 E Hwy 158
Gardendale, TX 79758
(432) 563-0727
Fax: (432) 224-1038

Water Analysis Report

Customer:	Mack Energy Corporation	Sample #:	78595
Area:	Artesia	Analysis ID #:	76096
Lease:	Chilliwack		
Location:	Fed Com 1H 0		
Sample Point:	Wellhead San Andres		

Sampling Date:	11/28/2018
Analysis Date:	12/3/2018
Analyst:	Catalyst
TDS (mg/l or g/m3):	175963.5
Density (g/cm3):	1.118
Hydrogen Sulfide:	4
Carbon Dioxide:	108
Comments:	

Anions	mg/l	meq/l
Chloride:	**104292.8**	**2941.72**
Bicarbonate:	**131.8**	**2.16**
Carbonate:		
Sulfate:	**3200.0**	**66.62**
Borate*:	**108.1**	**0.68**
Phosphate*		

***Calculated based on measured elemental boron and phosphorus.**

pH at time of sampling:	6.95
pH at time of analysis:	
pH used in Calculation:	**6.95**
Temperature @ lab conditions (F):	**75**

Cations	mg/l	meq/l
Sodium:	**63550.0**	**2764.27**
Magnesium:	**1027.0**	**84.49**
Calcium:	**2882.0**	**143.81**
Potassium:	**707.0**	**18.08**
Strontium:	**63.7**	**1.45**
Barium:	**0.8**	**0.01**
Iron:	**0.1**	**0.**
Manganese:	**0.189**	**0.01**

Conductivity (micro-ohms/cm):	**200381**
Resistivity (ohm meter):	**.0499**

Values Calculated at the Given Conditions - Amounts of Scale in lb/1000 bbl

Temp	Calcite $CaCO_3$		Gypsum $CaSO_4*2H_2O$		Anhydrite $CaSO_4$		Celestite $SrSO_4$		Barite $BaSO_4$	
°F	Index	Amount	Index	Amount	Index	Amount	Index	Amount	Index	Amount
80	0.28	2.95	-0.07	0.00	-0.05	0.00	-0.04	0.00	1.17	0.30
100	0.32	3.84	-0.14	0.00	-0.06	0.00	-0.07	0.00	0.97	0.30
120	0.36	5.02	-0.21	0.00	-0.05	0.00	-0.09	0.00	0.79	0.30
140	0.39	6.20	-0.26	0.00	-0.01	0.00	-0.10	0.00	0.63	0.30
160	0.43	7.38	-0.31	0.00	0.05	111.64	-0.10	0.00	0.50	0.30
180	0.46	9.16	-0.34	0.00	0.12	261.08	-0.09	0.00	0.38	0.30
200	0.50	10.93	-0.38	0.00	0.21	418.50	-0.08	0.00	0.29	0.30
220	0.55	12.99	-0.41	0.00	0.31	573.26	-0.07	0.00	0.21	0.30

Water Analysis- San Andres

Catalyst Oilfield Services
11999 E Hwy 158
Gardendale, TX 79758
(432) 563-0727
Fax: (432) 224-1038

Water Analysis Report

Customer:	Mack Energy Corporation	Sample #:	81533
Area:	Artesia	Analysis ID #:	80615
Lease:	Saskatoon		
Location:	Fed Com 1H 0		
Sample Point:	Wellhead San Andres		

Sampling Date:	1/10/2019
Analysis Date:	1/23/2019
Analyst:	Catalyst
TDS (mg/l or g/m3):	151377.2
Density (g/cm3):	1.105
Hydrogen Sulfide:	4
Carbon Dioxide:	90
Comments:	

Anions	mg/l	meq/l
Chloride:	**91681.1**	**2585.99**
Bicarbonate:	**153.7**	**2.52**
Carbonate:		
Sulfate:	**700.0**	**14.57**
Borate*:	**144.3**	**0.91**
Phosphate*		

***Calculated based on measured elemental boron and phosphorus.**

pH at time of sampling:	7.23
pH at time of analysis:	
pH used in Calculation:	**7.23**
Temperature @ lab conditions (F):	**75**

Cations	mg/l	meq/l
Sodium:	**54050.0**	**2351.04**
Magnesium:	**1173.0**	**96.5**
Calcium:	**2767.0**	**138.07**
Potassium:	**647.0**	**16.55**
Strontium:	**60.1**	**1.37**
Barium:	**0.6**	**0.01**
Iron:	**0.0**	**0.**
Manganese:	**0.416**	**0.02**

Conductivity (micro-ohms/cm):	**197210**
Resistivity (ohm meter):	**.0507**

Values Calculated at the Given Conditions - Amounts of Scale in lb/1000 bbl

Temp	Calcite $CaCO_3$		Gypsum $CaSO_4*2H_2O$		Anhydrite $CaSO_4$		Celestite $SrSO_4$		Barite $BaSO_4$	
°F	Index	Amount	Index	Amount	Index	Amount	Index	Amount	Index	Amount
80	0.57	6.35	-0.72	0.00	-0.71	0.00	-0.66	0.00	0.45	0.30
100	0.57	7.26	-0.79	0.00	-0.72	0.00	-0.69	0.00	0.25	0.00
120	0.58	8.77	-0.84	0.00	-0.69	0.00	-0.70	0.00	0.07	0.00
140	0.59	10.28	-0.89	0.00	-0.65	0.00	-0.71	0.00	-0.08	0.00
160	0.60	12.10	-0.93	0.00	-0.59	0.00	-0.70	0.00	-0.21	0.00
180	0.63	13.91	-0.96	0.00	-0.51	0.00	-0.70	0.00	-0.32	0.00
200	0.66	16.03	-0.99	0.00	-0.41	0.00	-0.69	0.00	-0.42	0.00
220	0.71	18.45	-1.01	0.00	-0.31	0.00	-0.67	0.00	-0.49	0.00

Catalyst Oilfield Services
11999 E Hwy 158
Gardendale, TX 79758
(432) 563-0727
Fax: (432) 224-1038

Water Analysis Report

Customer:	Mack Energy Corporation	Sample #:	118208
Area:	Artesia	Analysis ID #:	107555
Lease:	Montreal		
Location:	1H 0		
Sample Point:	Wellhead	San Andres	

Sampling Date:	2/13/2020
Analysis Date:	3/4/2020
Analyst:	Catalyst
TDS (mg/l or g/m3):	172020.9
Density (g/cm3):	1.116
Hydrogen Sulfide:	7.4
Carbon Dioxide:	102
Comments:	

Anions	mg/l	meq/l
Chloride:	101615.8	2866.21
Bicarbonate:	197.6	3.24
Carbonate:		
Sulfate:	3400.0	70.79
Borate*:	110.4	0.7
Phosphate*		

*Calculated based on measured elemental boron and phosphorus.

pH at time of sampling:	7.14
pH at time of analysis:	
pH used in Calculation:	7.14
Temperature @ lab conditions (F):	75

Cations	mg/l	meq/l
Sodium:	62440.0	2715.99
Magnesium:	965.3	79.41
Calcium:	2569.0	128.19
Potassium:	660.8	16.9
Strontium:	57.8	1.32
Barium:	3.4	0.05
Iron:	0.2	0.01
Manganese:	0.550	0.02

Conductivity (micro-mhos/cm):	199270
Resistivity (ohm meter):	.0502

Values Calculated at the Given Conditions - Amounts of Scale in lb/1000 bbl

Temp	Calcite $CaCO_3$		Gypsum $CaSO_4*2H_2O$		Anhydrite $CaSO_4$		Celestite $SrSO_4$		Barite $BaSO_4$	
°F	Index	Amount	Index	Amount	Index	Amount	Index	Amount	Index	Amount
80	0.58	8.60	-0.09	0.00	-0.08	0.00	-0.05	0.00	1.83	1.78
100	0.59	10.08	-0.16	0.00	-0.08	0.00	-0.08	0.00	1.63	1.78
120	0.60	11.86	-0.23	0.00	-0.07	0.00	-0.10	0.00	1.45	1.78
140	0.61	13.93	-0.28	0.00	-0.03	0.00	-0.10	0.00	1.30	1.78
160	0.63	16.01	-0.32	0.00	0.03	69.97	-0.10	0.00	1.16	1.78
180	0.65	18.38	-0.36	0.00	0.11	226.51	-0.10	0.00	1.05	1.78
200	0.68	21.05	-0.39	0.00	0.19	391.65	-0.09	0.00	0.95	1.48
220	0.73	24.01	-0.42	0.00	0.29	555.31	-0.08	0.00	0.87	1.48

Catalyst Oilfield Services
11999 E Hwy 158
Gardendale, TX 79758
(432) 563-0727
Fax: (432) 224-1038

Water Analysis Report

Customer:	Mack Energy Corporation	Sample #:	100487
Area:	Drilling	Analysis ID #:	94751
Lease:	Maple Ridge		
Location:	Fed #1 0		
Sample Point:	Wellhead San Andres		

Sampling Date:	7/29/2019
Analysis Date:	8/8/2019
Analyst:	Catalyst
TDS (mg/l or g/m3):	144232
Density (g/cm3):	1.097
Hydrogen Sulfide:	14
Carbon Dioxide:	162.8
Comments:	

Anions	mg/l	meq/l
Chloride:	84902.3	2394.79
Bicarbonate:	241.6	3.96
Carbonate:		
Sulfate:	3300.0	68.71
Borate*:	173.9	1.1
Phosphate*		

*Calculated based on measured elemental boron and phosphorus.

Cations	mg/l	meq/l
Sodium:	51250.0	2229.25
Magnesium:	1177.0	96.82
Calcium:	2566.0	128.04
Potassium:	564.2	14.43
Strontium:	53.5	1.22
Barium:	1.5	0.02
Iron:	1.5	0.05
Manganese:	0.460	0.02

pH at time of sampling:	6.41
pH at time of analysis:	
pH used in Calculation:	6.41
Temperature @ lab conditions (F):	75
Conductivity (micro-mhos/cm):	194536
Resistivity (ohm meter):	.0514

Values Calculated at the Given Conditions - Amounts of Scale in lb/1000 bbl

Temp	Calcite $CaCO_3$		Gypsum $CaSO_4*2H_2O$		Anhydrite $CaSO_4$		Celestite $SrSO_4$		Barite $BaSO_4$	
°F	Index	Amount	Index	Amount	Index	Amount	Index	Amount	Index	Amount
80	-0.09	0.00	-0.09	0.00	-0.09	0.00	-0.04	0.00	1.52	0.91
100	0.01	0.30	-0.15	0.00	-0.08	0.00	-0.06	0.00	1.33	0.91
120	0.10	3.96	-0.20	0.00	-0.06	0.00	-0.08	0.00	1.15	0.61
140	0.21	8.22	-0.25	0.00	-0.01	0.00	-0.08	0.00	1.00	0.61
160	0.31	12.48	-0.28	0.00	0.06	131.82	-0.08	0.00	0.87	0.61
180	0.41	17.35	-0.31	0.00	0.14	299.86	-0.07	0.00	0.76	0.61
200	0.51	21.92	-0.33	0.00	0.24	471.86	-0.06	0.00	0.67	0.61
220	0.61	26.79	-0.35	0.00	0.35	637.46	-0.04	0.00	0.60	0.61

Water Analysis- San Andres

CATALYST Oilfield Services

Catalyst Oilfield Services
11999 E Hwy 158
Gardendale, TX 79758
(432) 563-0727
Fax: (432) 224-1038

Water Analysis Report

Customer:	Mack Energy Corporation	Sample #:	55880
Area:	Artesia	Analysis ID #:	53988
Lease:	White Rock		
Location:	Federal #1H 0		
Sample Point:	Wellhead San Andres		

Sampling Date:	12/21/2017
Analysis Date:	1/6/2018
Analyst:	Catalyst
TDS (mg/l or g/m3):	161820.5
Density (g/cm3):	1.107
Hydrogen Sulfide:	11
Carbon Dioxide:	242
Comments:	

Anions	mg/l	meq/l
Chloride:	**93901.4**	**2648.62**
Bicarbonate:	**241.6**	**3.96**
Carbonate:		
Sulfate:	**5000.0**	**104.1**
Borate*:	**229.5**	**1.45**
Phosphate*		

***Calculated based on measured elemental boron and phosphorus.**

pH at time of sampling:	6.9
pH at time of analysis:	
pH used in Calculation:	**6.9**
Temperature @ lab conditions (F):	**75**

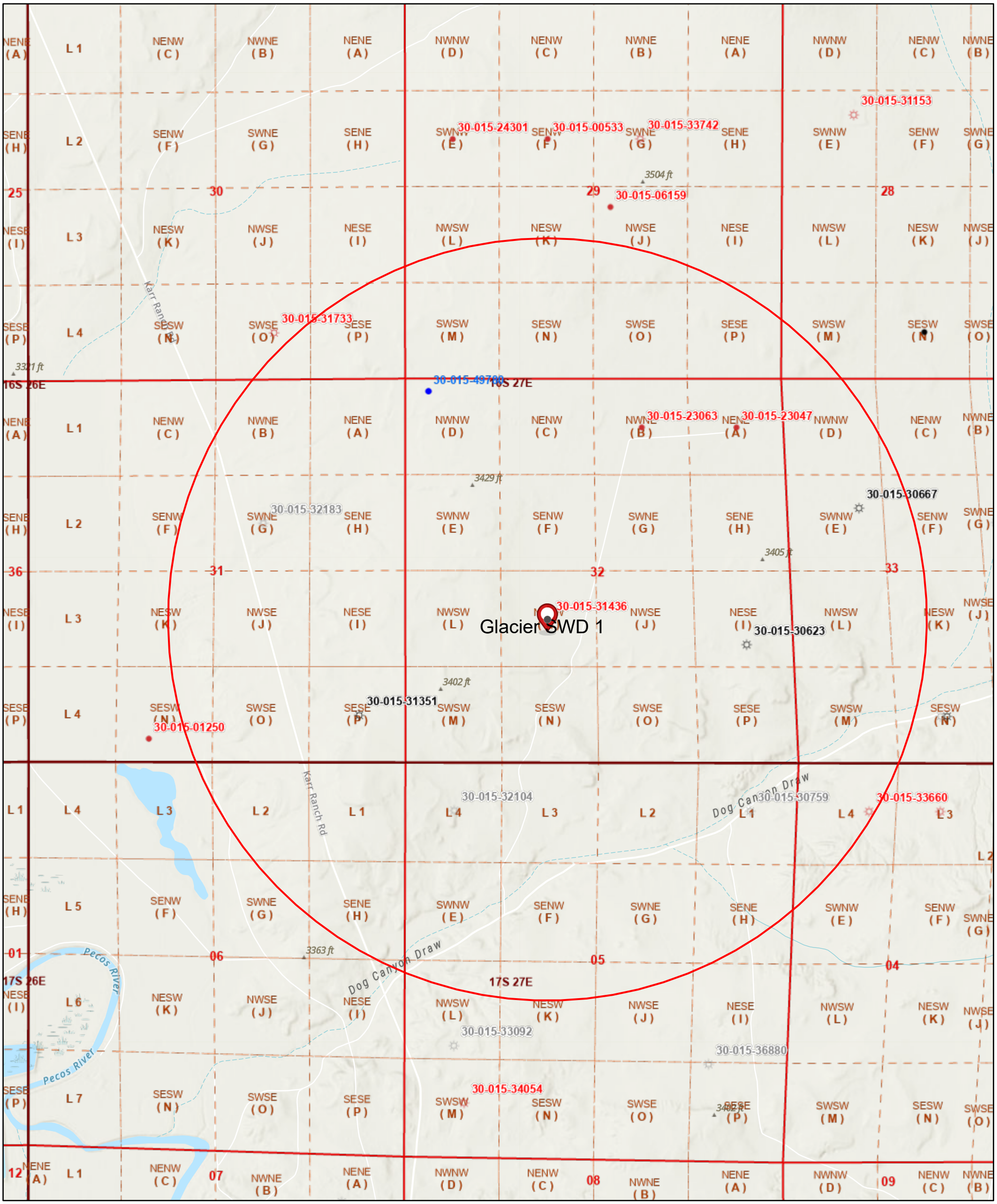
Cations	mg/l	meq/l
Sodium:	**58100.0**	**2527.21**
Magnesium:	**969.6**	**79.76**
Calcium:	**2737.0**	**136.58**
Potassium:	**571.6**	**14.62**
Strontium:	**66.0**	**1.51**
Barium:	**0.0**	**0.**
Iron:	**3.8**	**0.14**
Manganese:	**0.000**	**0.**

Conductivity (micro-ohms/cm):	**176042**
Resistivity (ohm meter):	**.0568**

Values Calculated at the Given Conditions - Amounts of Scale in lb/1000 bbl

Temp	Calcite $CaCO_3$		Gypsum $CaSO_4 * 2H_2O$		Anhydrite $CaSO_4$		Celestite $SrSO_4$		Barite $BaSO_4$	
°F	Index	Amount	Index	Amount	Index	Amount	Index	Amount	Index	Amount
80	0.43	9.88	0.10	359.72	0.11	305.55	0.18	14.96	0.00	0.00
100	0.49	12.27	0.03	111.03	0.10	296.88	0.16	13.17	0.00	0.00
120	0.55	14.96	-0.03	0.00	0.13	355.53	0.14	11.97	0.00	0.00
140	0.60	17.96	-0.08	0.00	0.17	467.16	0.13	11.67	0.00	0.00
160	0.64	20.95	-0.12	0.00	0.23	615.30	0.14	11.67	0.00	0.00
180	0.69	24.54	-0.15	0.00	0.31	784.69	0.14	12.27	0.00	0.00
200	0.75	28.13	-0.18	0.00	0.40	962.15	0.15	12.87	0.00	0.00
220	0.80	31.72	-0.20	0.00	0.51	1137.23	0.17	13.77	0.00	0.00

1 Mile Map



9/4/2024, 8:48:38 AM

Wells - Large Scale

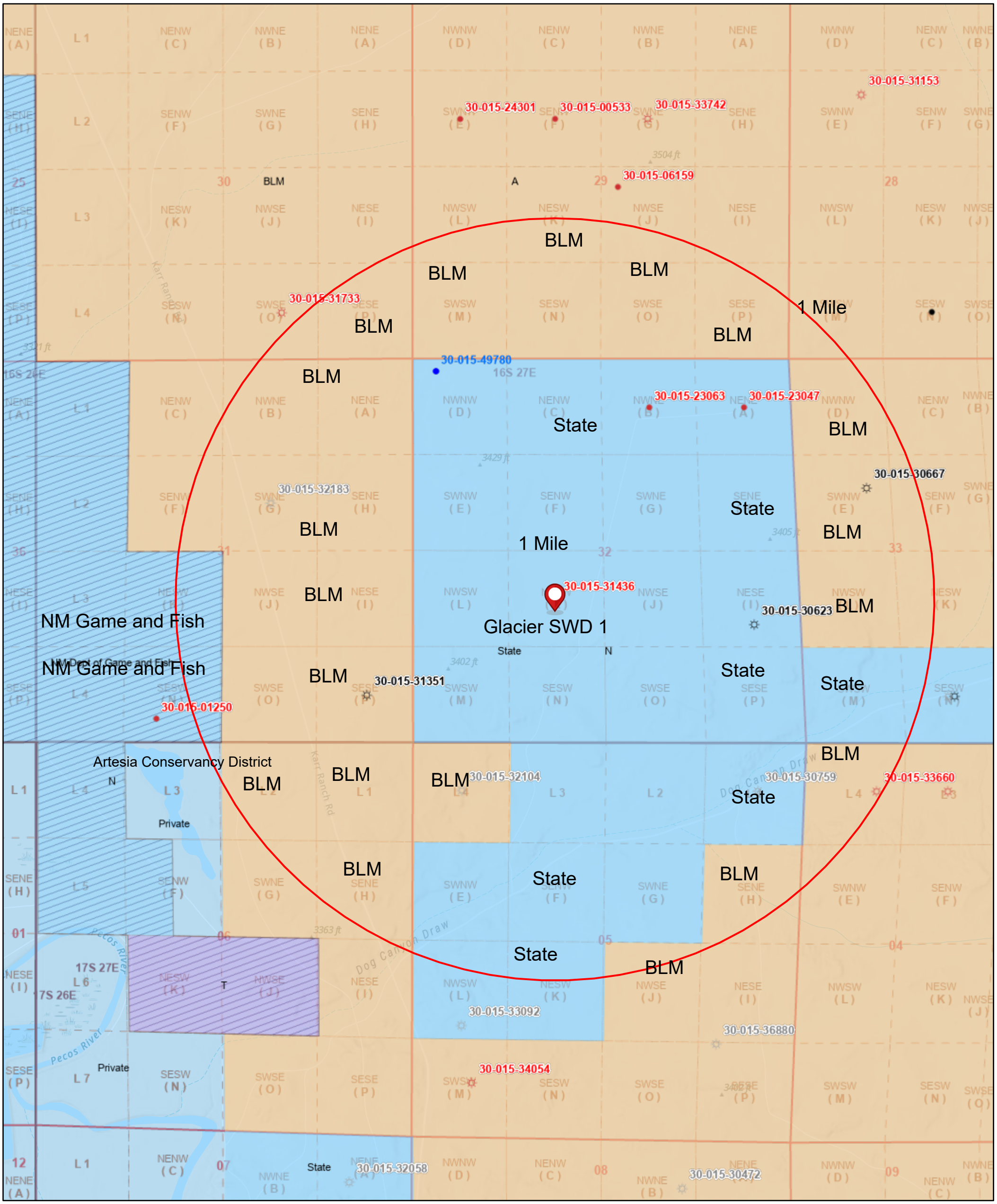
- Gas, Active
- Gas, Cancelled
- Gas, Plugged
- Oil, Active
- Oil, New
- Oil, Plugged
- PLSS Second Division
- PLSS First Division
- PLSS Townships

1:18,056

0 0.17 0.35 0.7 mi

0 0.28 0.55 1.1 km

1 mile Surface Owner Map



9/4/2024, 8:17:32 AM

Wells - Large Scale

- Oil, Plugged
- Gas, Active
- Gas, Cancelled
- Gas, Plugged
- Oil, Active
- Oil, New

Mineral Ownership

- A-All minerals are owned by U.S.
- N-No minerals are owned by the U.S.
- T-Other minerals are owned by the U.S.

Land Ownership

- BLM
- P
- S
- SGF
- PLSS Second Division
- PLSS First Division
- PLSS Townships

1:18,056

0 0.17 0.35 0.7 mi

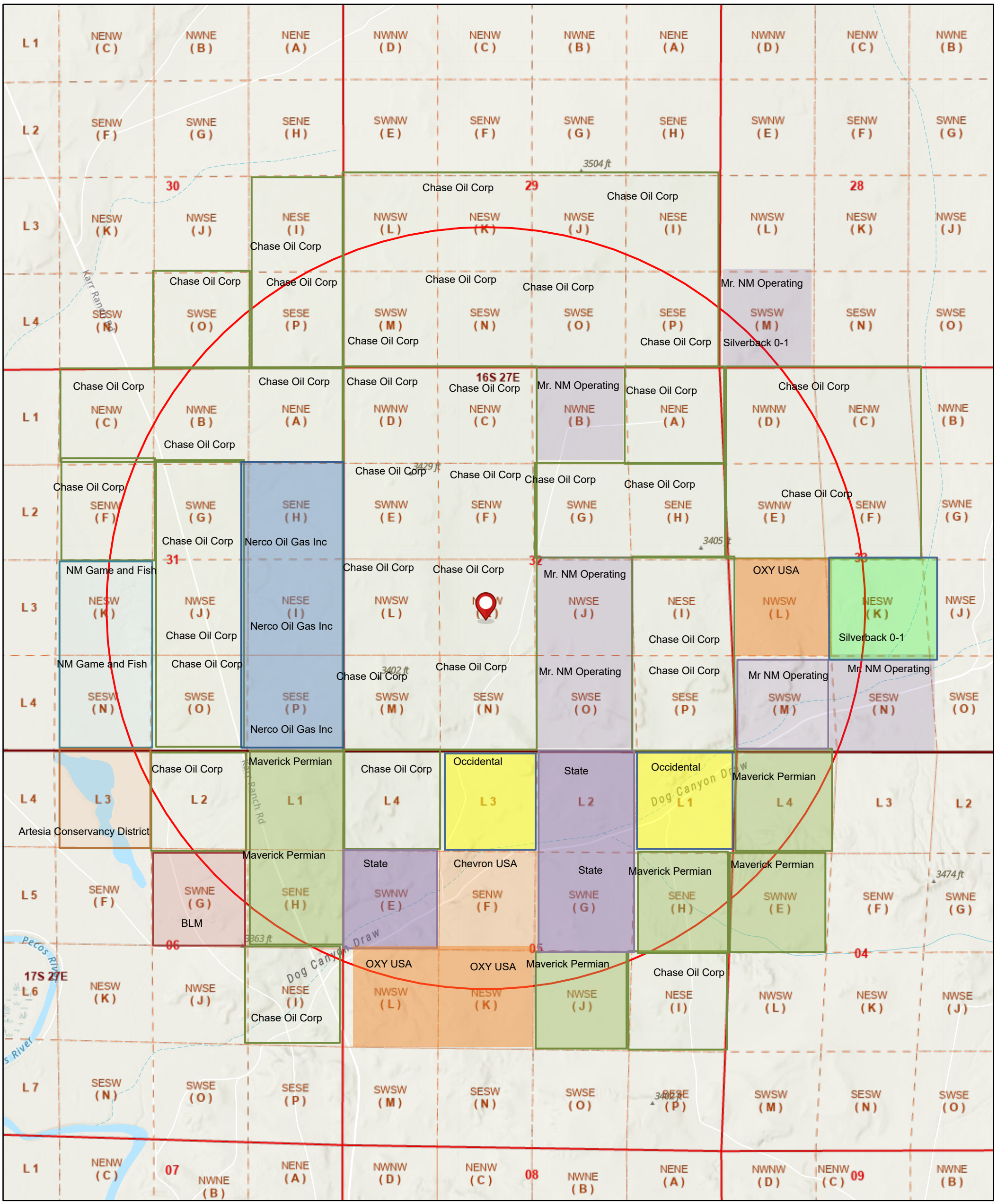
0 0.28 0.55 1.1 km

U.S. BLM, Esri, NASA, NGA, USGS, FEMA, Oil Conservation Division of the New Mexico Energy, Minerals and Natural Resources Department., OCD, Esri Community Maps Contributors, New Mexico State University, Texas Parks & Wildlife, Esri, TomTom, Garmin, SafeGraph,

NM OCD Oil and Gas Map. http://nm-emnrd.maps.arcgis.com/apps/webappviewer/index.html?id=4d017f2306164de29fd2fb9f8f35ca75: New Mexico Oil Conservation Division

New Mexico Oil Conservation Division

1 Mile Leasehold Operators



9/4/2024, 8:44:04 AM

Areas
Override 1
Override 2
Override 3
Override 4
Override 5
Override 6
Override 7
Override 8
Override 9
Override 10
Override 11
Override 12
Override 13
Override 14
PLSS Second Division
PLSS First Division
PLSS Townships

1:18,056

0 0.17 0.35 0.7 mi

0 0.28 0.55 1.1 km

Name	Address	City	State	Zip	Certified Mail Id
Chase Oil Corporation	11352 Lovington HWY	Artesia	NM	88210	
Mack Energy Corportion	P.O. Box 960	Artesia	NM	88210	
Merit Energy Company LLC	13727 Noel Rd Ste 1200	Dallas	TX	75240-7362	7021 1970 0000 5914 6178
Mr. NM Operating LLC	5950 Berkshire Lane Suite 1000	Dallas	TX	75225	7021 1970 0000 5914 6161
Grizzly Operating LLC	5847 San Felipe St Ste 3000	Houston	TX	77098	7021 1970 0000 5914 6154
Nerco Oil & Gas Inc	P.O. Box 9931	Vancouver	WA	98668	7021 1970 0000 5914 6147
Oxy USA Inc	6 Desta Dr.	Midland	TX	79705-5520	7021 1970 0000 5914 6130
Occidental Permian LTD	P.O. Box 4294	Houston	TX	77210-4294	7021 1970 0000 5914 6123
Chevron USA Inc	6301 Deauville Blvd	Midland	TX	79706	7021 1970 0000 5914 6116
Commissioner of Public Lands					
New Mexico State Land Office	P.O. Box 1148	Santa Fe	NM	87504-1148	7018 1130 0002 2208 6771
Bureau of Land Management	620 E. Greene St	Carlsbad	NM	88220-6292	7021 1970 0000 5914 6185
Silverback 0-1 LLc	19707 IH 10 West Suite 201	San Antonio	TX	78257	9589 0710 5270 0175 5638 64
NM Game & Fish Dept.	1 Wildlife Way	Santa Fe	NM	87507	9589 0710 5270 0175 5636 28
Maverick Permian Agent Corp	1111 Bagby St. Ste 1600	Houston	TX	77002	9589 0710 5270 0175 5636 35
Oxy USA WTP Limited Partnership	P.O. Box 4294	Houston	TX	77210-4294	9589 0710 5270 0175 5634 75
Contango Resources Inc	3230 Camp Bowie Blvd Suite 810	Fort Worth	TX	76107	9589 0710 5270 0175 5634 82
Riley Permian Operating Company LLC	29 E. Reno Ave Suite 500	Oklahoma City	OK	73104	9589 0710 5270 0175 5634 99
Artesia Conservancy District	P.O. Box 1346	Roswell	NM	88202-1346	9589 0710 5270 0175 5635 05
c/o Pecos Valley Artesian Conservancy					

MACK Energy Corporation

P.O. Box 960
Artesia, NM 88211-0960
Office (575) 748-1288
Fax (575) 746-9539

September 4, 2024

Via Certified Mail 9589 0710 5270 0175 5636 35
Return Receipt Requested

Maverick Permian Agent Corp
1111 Bagby St. Ste 1600
Houston, TX 77002

To all Interest Owners:

Enclosed for you review is a copy of Mack Energy Corporation's application for a Devonian SWD well. Produced water will be injected at a proposed depth of 9,385-9,780'. The Glacier SWD #1 located 1979 FSL & 1981 FWL, Sec. 32 T16S R27E, Eddy County.

The letter will serve as a notice that Mack Energy Corporation has requested administrative approval from the NMOCD to drill this well as a water disposal. If you have any objections, you must notify the Oil Conservation Division in Santa Fe in writing at 1220 South St. Francis Drive, Santa Fe, NM 87505 within fifteen (15) days of receiving this letter.

Sincerely,

Mack Energy Corporation

Deana Weaver

Deana Weaver
Regulatory Technician II

DW/

Attachments

MACK Energy Corporation

P.O. Box 960
Artesia, NM 88211-0960
Office (575) 748-1288
Fax (575) 746-9539

September 4, 2024

Via Certified Mail 9589 0710 5270 0175 5634 75
Return Receipt Requested

Oxy USA WTP Limited Partnership
P.O. 4294
Houston, TX 77010-4294

To all Interest Owners:

Enclosed for you review is a copy of Mack Energy Corporation's application for a Devonian SWD well. Produced water will be injected at a proposed depth of 9,385-9,780'. The Glacier SWD #1 located 1979 FSL & 1981 FWL, Sec. 32 T16S R27E, Eddy County.

The letter will serve as a notice that Mack Energy Corporation has requested administrative approval from the NMOCD to drill this well as a water disposal. If you have any objections, you must notify the Oil Conservation Division in Santa Fe in writing at 1220 South St. Francis Drive, Santa Fe, NM 87505 within fifteen (15) days of receiving this letter.

Sincerely,

Mack Energy Corporation

Deana Weaver

Deana Weaver
Regulatory Technician II

DW/

Attachments

MACK Energy Corporation

P.O. Box 960
Artesia, NM 88211-0960
Office (575) 748-1288
Fax (575) 746-9539

September 4, 2024

Via Certified Mail 9589 0710 5270 0175 5634 82
Return Receipt Requested

Contango Resources Inc
3230 Camp Bowie Blvd Suite 810
Fort Worth, TX 76107

To all Interest Owners:

Enclosed for you review is a copy of Mack Energy Corporation's application for a Devonian SWD well. Produced water will be injected at a proposed depth of 9,385-9,780'. The Glacier SWD #1 located 1979 FSL & 1981 FWL, Sec. 32 T16S R27E, Eddy County.

The letter will serve as a notice that Mack Energy Corporation has requested administrative approval from the NMOCD to drill this well as a water disposal. If you have any objections, you must notify the Oil Conservation Division in Santa Fe in writing at 1220 South St. Francis Drive, Santa Fe, NM 87505 within fifteen (15) days of receiving this letter.

Sincerely,

Mack Energy Corporation

Deana Weaver

Deana Weaver
Regulatory Technician II

DW/

Attachments

MACK Energy Corporation

P.O. Box 960
Artesia, NM 88211-0960
Office (575) 748-1288
Fax (575) 746-9539

September 4, 2024

Via Certified Mail 9589 0710 5270 0175 5634 99
Return Receipt Requested

Riley Permian Operating Company LLC
29 E. Reno Ave Suite 500
Oklahoma City, OK 73104

To all Interest Owners:

Enclosed for you review is a copy of Mack Energy Corporation's application for a Devonian SWD well. Produced water will be injected at a proposed depth of 9,385-9,780'. The Glacier SWD #1 located 1979 FSL & 1981 FWL, Sec. 32 T16S R27E, Eddy County.

The letter will serve as a notice that Mack Energy Corporation has requested administrative approval from the NMOCD to drill this well as a water disposal. If you have any objections, you must notify the Oil Conservation Division in Santa Fe in writing at 1220 South St. Francis Drive, Santa Fe, NM 87505 within fifteen (15) days of receiving this letter.

Sincerely,

Mack Energy Corporation

Deana Weaver

Deana Weaver
Regulatory Technician II

DW/

Attachments

MACK Energy Corporation

P.O. Box 960
Artesia, NM 88211-0960
Office (575) 748-1288
Fax (575) 746-9539

September 4, 2024

Via Certified Mail 9589 0710 5270 0175 5635 05
Return Receipt Requested

Artesia Conservancy District
c/o Pecos Valley Artesian Conservancy
P.O. Box 1346
Roswell, NM 88202-1346

To all Interest Owners:

Enclosed for you review is a copy of Mack Energy Corporation's application for a Devonian SWD well. Produced water will be injected at a proposed depth of 9,385-9,780'. The Glacier SWD #1 located 1979 FSL & 1981 FWL, Sec. 32 T16S R27E, Eddy County.

The letter will serve as a notice that Mack Energy Corporation has requested administrative approval from the NMOCD to drill this well as a water disposal. If you have any objections, you must notify the Oil Conservation Division in Santa Fe in writing at 1220 South St. Francis Drive, Santa Fe, NM 87505 within fifteen (15) days of receiving this letter.

Sincerely,

Mack Energy Corporation

Deana Weaver

Deana Weaver
Regulatory Technician II

DW/

Attachments

MACK Energy Corporation

P.O. Box 960
Artesia, NM 88211-0960
Office (575) 748-1288
Fax (575) 746-9539

September 4, 2024

Via Certified Mail 9589 0710 5270 0175 5638 64
Return Receipt Requested

Silverback 0-1 LLC
19707 IH 10 West Suite 201
San Antonio, TX 78257

To all Interest Owners:

Enclosed for you review is a copy of Mack Energy Corporation's application for a Devonian SWD well. Produced water will be injected at a proposed depth of 9,385-9,780'. The Glacier SWD #1 located 1979 FSL & 1981 FWL, Sec. 32 T16S R27E, Eddy County.

The letter will serve as a notice that Mack Energy Corporation has requested administrative approval from the NMOCD to drill this well as a water disposal. If you have any objections, you must notify the Oil Conservation Division in Santa Fe in writing at 1220 South St. Francis Drive, Santa Fe, NM 87505 within fifteen (15) days of receiving this letter.

Sincerely,

Mack Energy Corporation

Deana Weaver

Deana Weaver
Regulatory Technician II

DW/

Attachments

MACK Energy Corporation

P.O. Box 960
Artesia, NM 88211-0960
Office (575) 748-1288
Fax (575) 746-9539

September 4, 2024

Via Certified Mail 9589 0710 5270 0175 5636 28
Return Receipt Requested

NM Game & Fish Department
1 Wildlife Way
Santa Fe, NM 87507

To all Interest Owners:

Enclosed for you review is a copy of Mack Energy Corporation's application for a Devonian SWD well. Produced water will be injected at a proposed depth of 9,385-9,780'. The Glacier SWD #1 located 1979 FSL & 1981 FWL, Sec. 32 T16S R27E, Eddy County.

The letter will serve as a notice that Mack Energy Corporation has requested administrative approval from the NMOCD to drill this well as a water disposal. If you have any objections, you must notify the Oil Conservation Division in Santa Fe in writing at 1220 South St. Francis Drive, Santa Fe, NM 87505 within fifteen (15) days of receiving this letter.

Sincerely,

Mack Energy Corporation

Deana Weaver

Deana Weaver
Regulatory Technician II

DW/

Attachments

ALL CONSULTING
GOVERNMENT RELATIONS · ENERGY · PLANNING · TECHNOLOGY
ENGINEERING · ENVIRONMENTAL

March 5, 2024

PN 1904.SEIS.00

Mr. Phillip Goetze, P.G.
NM EMNRD – Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, NM 87505

Subject: **Mack Energy Corporation**
Glacier SWD #1 - Seismic Potential Letter

Dear Mr. Goetze,

At the request of Mack Energy Corporation (Mack Energy), ALL Consulting, LLC (ALL) has assessed the potential injection-induced seismicity risks in the vicinity of Mack Energy's Glacier SWD #1 (Subject SWD), a proposed saltwater disposal (SWD) facility in Eddy County, New Mexico, and summarized the findings in this letter. This assessment used publicly available data to identify the proximity and characteristics of seismic events and known faults to evaluate the potential for the operation of the Glacier SWD #1 to contribute to seismic activity in the area.

Geologic Evaluation

The Subject SWD is requesting a permit to inject into the Devonian Formation at a depth of 9,385-9,780 feet below ground surface (bgs). The Devonian Formation consists of cherty limestone and dolomites and is overlain by approximately 80 feet of low porosity and permeability Woodford Shale, which would prevent the upward migration of injection fluid and serve as the upper confining layer (see **Attachment 1**). Additionally, the Devonian Formation is underlain by various low porosity and permeability zones within the Silurian and Montoya Groups, both of which consist of limestones, dolomites, and interbedded shale zones. No geophysical logs penetrating the Silurian and Montoya Groups were available within 10 miles of the Subject SWD. A stratigraphic chart depicting the geologic setting is included as **Figure 1**.[1]

Seismic Events and Fault Data

A review of United States Geological Survey (USGS) and New Mexico Tech Seismological Observatory (NMTSO) earthquake catalogues determined that zero (0) seismic events have been recorded within a 100 square mile area [9.08-kilometer (km) radius] around the Subject SWD.

[1] Yang, K.-M., & Dorobek, S. L. (1995). The Permian Basin of west Texas and New Mexico: Tectonic history of a "composite" Foreland Basin and its effects on stratigraphic development. *Stratigraphic Evolution of Foreland Basins*, 149–174. https://doi.org/10.2110/pec.95.52.0149

Mack Energy Corporation
Glacier SWD #1 Seismic Information
March 5, 2024

The closest recorded seismic event was a M1.78 that occurred on May 25, 2021, and was located approximately 6.22 miles south of the Subject SWD (see **Attachment 2**).

Fault data from United States Geological Survey (USGS) and the Texas Bureau of Economic Geology (BEG)[2] indicates that the closest known fault is located approximately 14.71 miles south/southeast of the Subject Well (see **Attachment 2**). This identified fault is within the Precambrian basement, which is approximately 3,220 feet below the proposed injection interval.[3] A map of the seismic events and faults within 9.08 km of the Subject SWD is included as **Attachment 2.**

Figure 1 – Delaware Basin Stratigraphic Chart (Adapted from Yang and Dorobek 1995)

SYSTEM	SERIES/ STAGE	CENTRAL BASIN PLATFORM	DELAWARE BASIN
PERMIAN	OCHOAN	DEWEY LAKE RUSTLER SALADO	DEWEY LAKE RUSTLER SALADO CASTILE
	GUADALUPIAN	TANSILL YATES SEVEN RIVERS QUEEN GRAYBURG SAN ANDRES GLORIETA	DELAWARE MT GROUP BELL CANYON CHERRY CANYON BRUSHY CANYON
	LEONARDIAN	CLEAR FORK WICHITA	BONE SPRING
	WOLFCAMPIAN	WOLFCAMP	WOLFCAMP
PENNSYLVANIAN	VIRGILIAN	CISCO	CISCO
	MISSOURIAN	CANYON	CANYON
	DESMOINESIAN	STRAWN	STRAWN
	ATOKAN	ATOKA —BEND—	ATOKA —BEND—
	MORROWAN	(ABSENT)	MORROW
MISSISSIPPIAN	CHESTERIAN MERAMECIAN OSAGEAN KINDERHOOKIAN	CHESTER MERAMEC OSAGE "BARNETT"	CHESTER MERAMEC OSAGE "BARNETT"
		KINDERHOOK —WOODFORD—	KINDERHOOK —WOODFORD—
DEVONIAN		DEVONIAN	DEVONIAN
SILURIAN		SILURIAN SHALE FUSSELMAN	MIDDLE SILURIAN FUSSELMAN
ORDOVICIAN	UPPER	MONTOYA	SYLVAN MONTOYA
	MIDDLE	SIMPSON	SIMPSON
	LOWER	ELLENBURGER	ELLENBURGER
CAMBRIAN	UPPER	CAMBRIAN	CAMBRIAN
PRECAMBRIAN			

Seismic Potential Evaluation

Experience in evaluating induced seismic events indicates that most injection-induced seismicity throughout the U.S. (e.g., Oklahoma, Ohio, Texas, New Mexico, and Colorado) occurs as a result of injection into Precambrian basement rock, into overlying formations that are in hydraulic communication with the Precambrian basement rock, or as a result of injection near critically stressed and optimally oriented faults. Seismicity at basement depths occurs because critically stressed faults generally originate in crystalline basement rock and may also extend into overlying sedimentary formations. [4]

Injection into either the Precambrian basement rock or its overlying formations that are hydraulically connected to the basement rock through faulting or fracture networks can increase the pore pressure and may lead to the fault slipping, resulting in a seismic event.[4] As such, the vertical distance between the injection formation and Precambrian basement rock and the presence or lack of faulting within the injection interval are major considerations when determining the risk of injection-induced seismicity.

---

[2] Horne E. A. Hennings P. H., and Zahm C. K. 2021. Basement structure of the Delaware Basin, in The Geologic Basement of Texas: A Volume in Honor of Peter Flawn, Callahan O. A., and Eichubl P., The University of Texas at Austin, Bureau of Economic Geology.

[3] G. Randy Keller, J. M. Hills &; Rabah Djeddi, A regional geological and geophysical study of the Delaware Basin, New Mexico and West Texas, Trans Pecos Region (West Texas) (1980).

[4] Ground Water Protection Council and Interstate Oil and Gas Compact Commission. *Potential Injection-Induced Seismicity Associated with Oil & Gas Development: A Primer on Technical and Regulatory Considerations Informing Risk Management and Mitigation.* 2015. 141 pages.

Geophysical data from nearby well records, aeromagnetic surveys, and gravity surveys indicates the top of the Precambrian Basement to be approximately 13,000 feet bgs at the Subject SWD, or approximately 3,220 feet below the proposed injection interval.[3] In addition, publicly available fault data does not indicate any transmissive faulting is present above the Precambrian basement around the Subject SWD.

Class II SWDs in New Mexico are administratively permitted with a maximum pressure gradient of 0.2 psi/ft. Review of New Mexico Oil Conservation Division (OCD) Order IP-537 from the Mack Energy Round Tank SWD #1, which is located approximately 16 miles east/northeast of the Subject SWD, determined the fracture gradient of the Devonian Formation in the region is 0.41 psi/ft from an approved step-rate test. Typical SWD permitting standards in New Mexico would indicate that formation parting pressure would not be exceeded by the Subject SWD.

Conclusion

As an expert on the issue of induced seismicity, seismic monitoring, and mitigation, it is my opinion that the potential for the Subject SWD to cause injection-induced seismicity is expected to be minimal, at best. This conclusion assumes the Subject SWD will be operated below formation parting pressure and is based on (1) the presence of numerous confining layers above and below the injection interval, (2) the significant vertical distance between the injection zone and Precambrian basement rock in which the nearest fault has been identified, and (3) the lack of historic seismicity or mapped faults in the vicinity of the Subject SWD.

Sincerely,
ALL Consulting

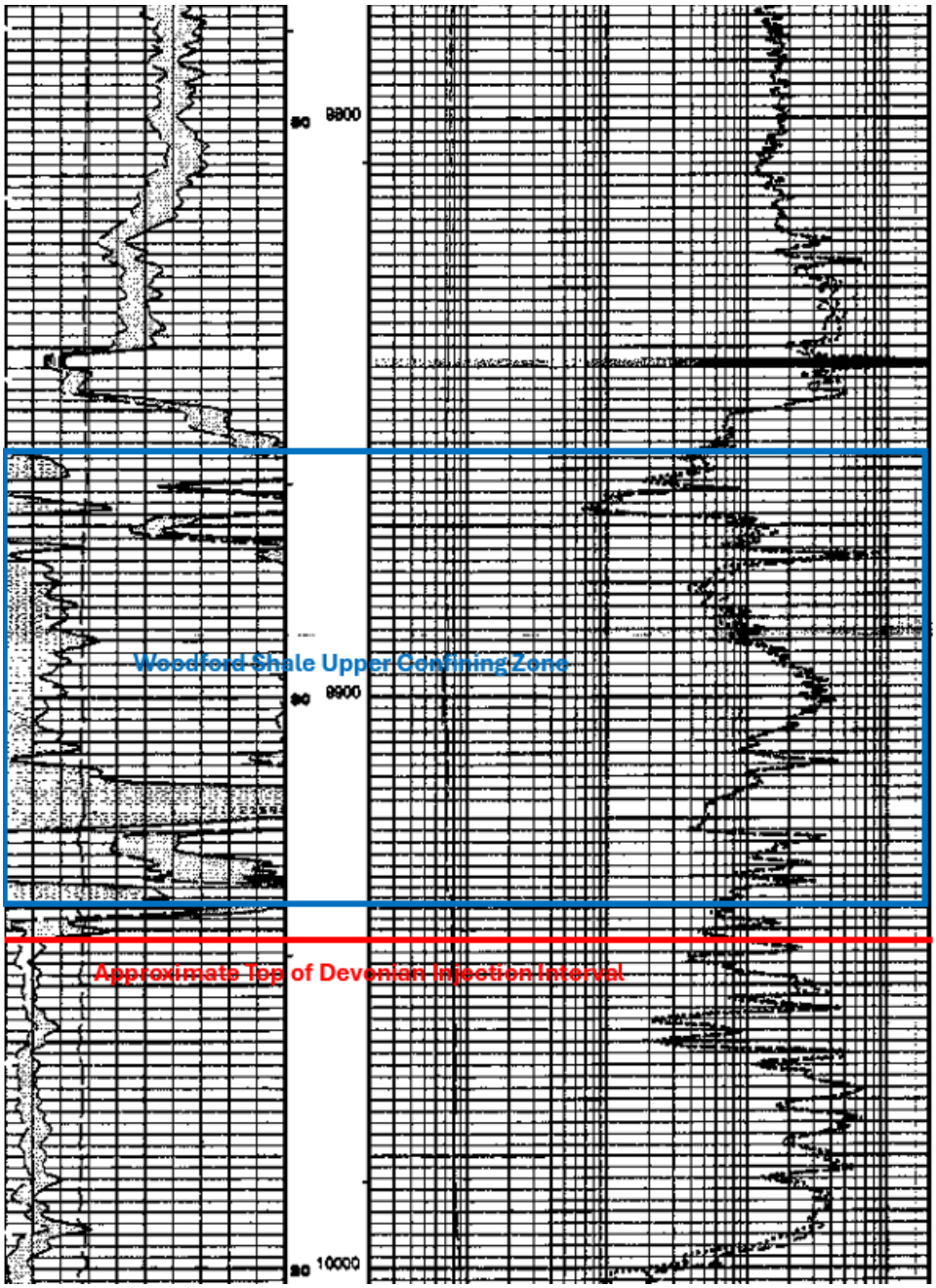
Reed Davis
Geophysicist

Mack Energy Corporation
Glacier SWD #1 Seismic Information
March 5, 2024

Attachment 1
Woodford Shale Upper Confining Zone

Mack Energy Corporation
Glacier SWD #1 Seismic Information
March 5, 2024

Woodford Shale Upper Confining Zone from API No. 015-32444

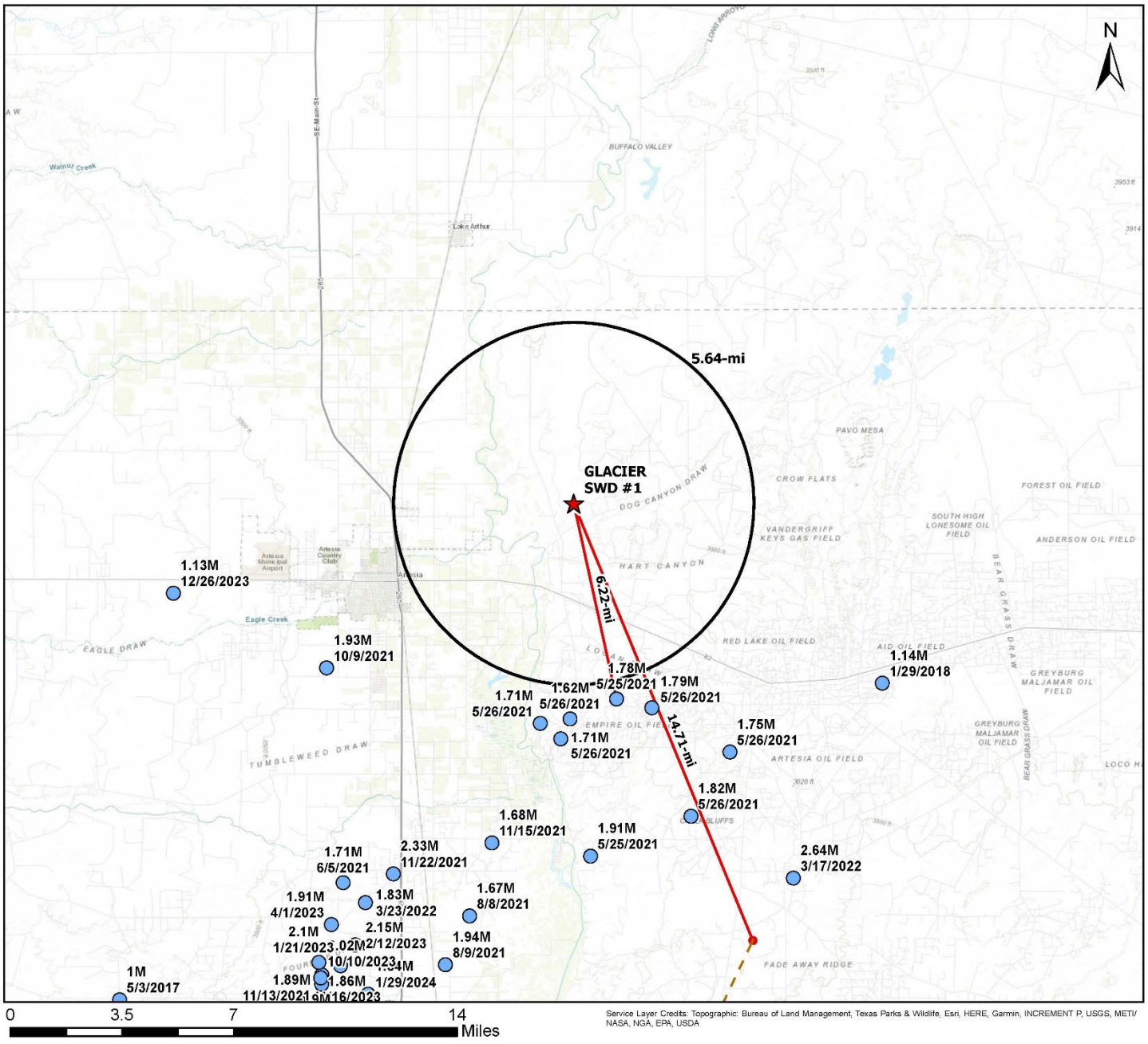


Mack Energy Corporation
Glacier SWD #1 Seismic Information
March 5, 2024

Attachment 2
Seismic Event Map

Mack Energy Corporation
Glacier SWD #1 Seismic Information
March 5, 2024

Glacier SWD #1 Nearby Seismic Events and Faults



Service Layer Credits: Topographic: Bureau of Land Management, Texas Parks & Wildlife, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, NGA, EPA, USDA

Legend

- Proposed SWD (1)
- NMTSO Seismic Events - 2/16/24 (28)
- Deep Faults (1)

Seismic Analysis Map		
GLACIER SWD #1 EDDY COUNTY, NEW MEXICO		
Proj Mgr: Oliver Seekins	February 19, 2024	Mapped by: Ben Bockelmann
Prepared for: MACK Energy Corporation		Prepared by: ALL CONSULTING

District I
1625 N. French Dr., Hobbs, NM 88240
Phone:(575) 393-6161 Fax:(575) 393-0720
District II
811 S. First St., Artesia, NM 88210
Phone:(575) 748-1283 Fax:(575) 748-9720
District III
1000 Rio Brazos Rd., Aztec, NM 87410
Phone:(505) 334-6178 Fax:(505) 334-6170
District IV
1220 S. St Francis Dr., Santa Fe, NM 87505
Phone:(505) 476-3470 Fax:(505) 476-3462

State of New Mexico
Energy, Minerals and Natural Resources
Oil Conservation Division
1220 S. St Francis Dr.
Santa Fe, NM 87505

CONDITIONS

Action 389387

CONDITIONS

Operator: MACK ENERGY CORP P.O. Box 960 Artesia, NM 882110960	OGRID: 13837
	Action Number: 389387
	Action Type: [IM-SD] Admin Order Support Doc (ENG) (IM-AAO)

CONDITIONS

Created By	Condition	Condition Date
anthony.harris	None	10/2/2024