

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

APPLICATION OF 3BEAR FIELD SERVICES, LLC
FOR APPROVAL OF A SALT WATER DISPOSAL WELL,
LEA COUNTY, NEW MEXICO

CASE NO. 20586

SUPPLEMENTAL AND REVISED EXHIBITS

3Bear Field Services, LLC ("3Bear") provides the following supplemental and revised exhibits as requested by the examiner at hearing on January 23, 2020:

1. **Exhibit 11.** In pdf format, a file showing step-by-step completion of the seismicity model simulation presented at hearing by Mr. David White, as well as the model scenario .MAT file that can be run utilizing the Stanford FSP software. The typographical error for the injection period for the Okeanos SWD #1 originating from the model input parameters has not been corrected to remain consistent with the pressure increase values that were presented at hearing. The .MAT file may be manipulated by the examiner in his review of this application using parameters other than those used and presented by Mr. White at hearing.
2. **Exhibit 12.** A revised wellbore and casing diagram for the proposed Grama State SWD #2 to address concerns regarding the proximity of an Enstor gas storage unit and protection of fresh water resources voiced by the examiner at hearing.

Respectfully submitted,
BEATTY & WOZNIAK, P.C.

By: _____


Candace Callahan

500 Don Gaspar Avenue
Santa Fe, New Mexico 87505
(505) 983-8764

ccallahan@bwenergylaw.com

Attorneys for 3Bear Field Services, LLC

CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing was served on the following counsel of record by electronic mail on January 31, 2020.

310 Old Santa Fe Trail
Santa Fe, New Mexico 87504
(505) 827-5752
(505) 827-4262 (fax)
aaantillon@slo.state.nm.us

*Attorney for the Commissioner of Public Lands,
New Mexico State Land Office*

Dana S. Hardy
P. O. Box 2068
Santa Fe, NM 87504-2068
Phone: (505) 982-4554
Facsimile: (505) 982-8623
dhardy@hinklelawfirm.com

Attorneys for V-F Petroleum Inc.

Deana M. Bennett
Post Office Box 2168
500 Fourth Street NW, Suite 1000
Albuquerque, New Mexico 87103-2168
Telephone: (505) 848-1800
dmb@modrall.com

Attorneys for NGL Water Solutions Permian, LLC

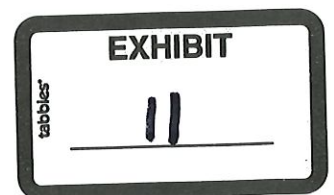

Candace Callahan

GRAMA STATE SWD #2 FSP MODEL RESULTS

Presented in Hearing before the New Mexico
Oil Conservation Division

Case #20586

January 23, 2020



Fault Slip Potential

MODEL INPUTS

GEOMECHANICS

PROB. GEOMECH

HYDROLOGY

PROB. HYDRO

INTEGRATED

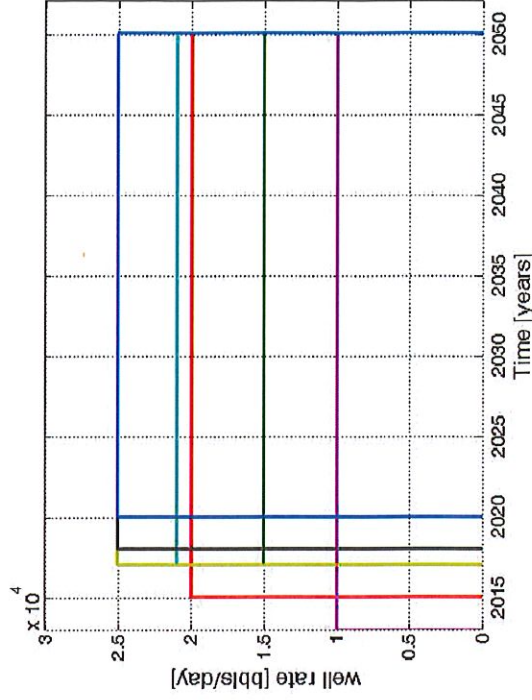
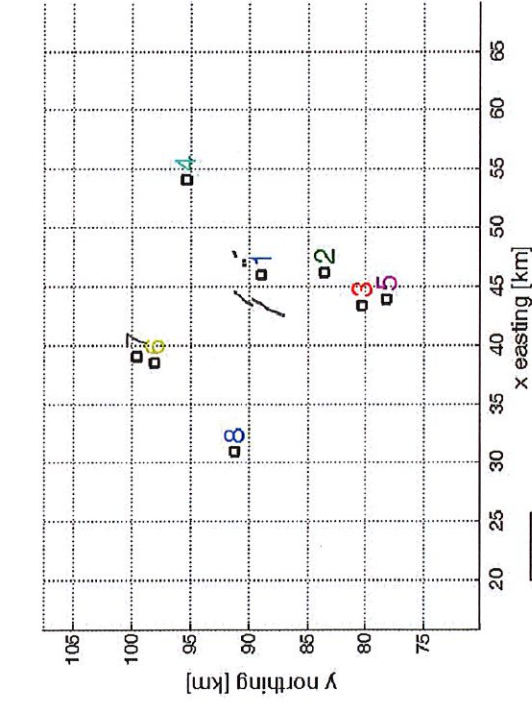
Fault Selector:

- All Faults
- Fault #1
- Fault #2
- Fault #3
- Fault #4
- Fault #5
- Fault #6
- Fault #7
- Fault #8
- Fault #9
- Fault #10
- Fault #11
- Fault #12
- Fault #13
- Fault #14
- Fault #15

Stress Regime: Normal Faulting

Select Well:

All



Calculate

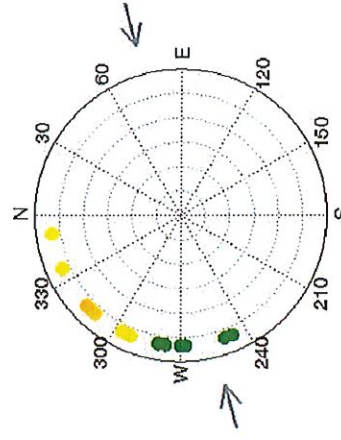
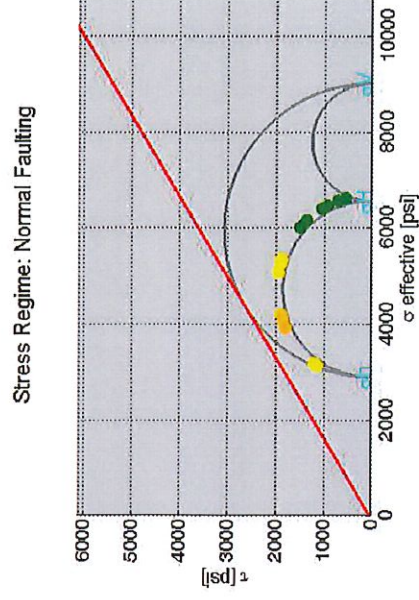
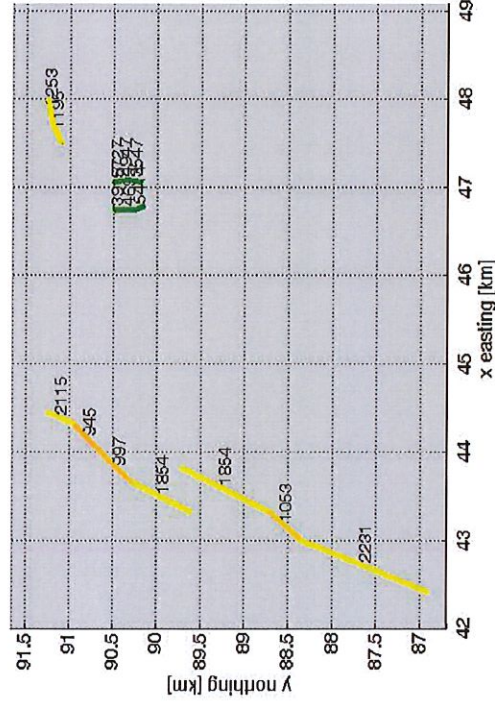
Fault Slip Potential

Fault Selector:

- | All Faults |
|------------|
| Fault #1 |
| Fault #2 |
| Fault #3 |
| Fault #4 |
| Fault #5 |
| Fault #6 |
| Fault #7 |
| Fault #8 |
| Fault #9 |
| Fault #10 |
| Fault #11 |
| Fault #12 |
| Fault #13 |
| Fault #14 |
| Fault #15 |

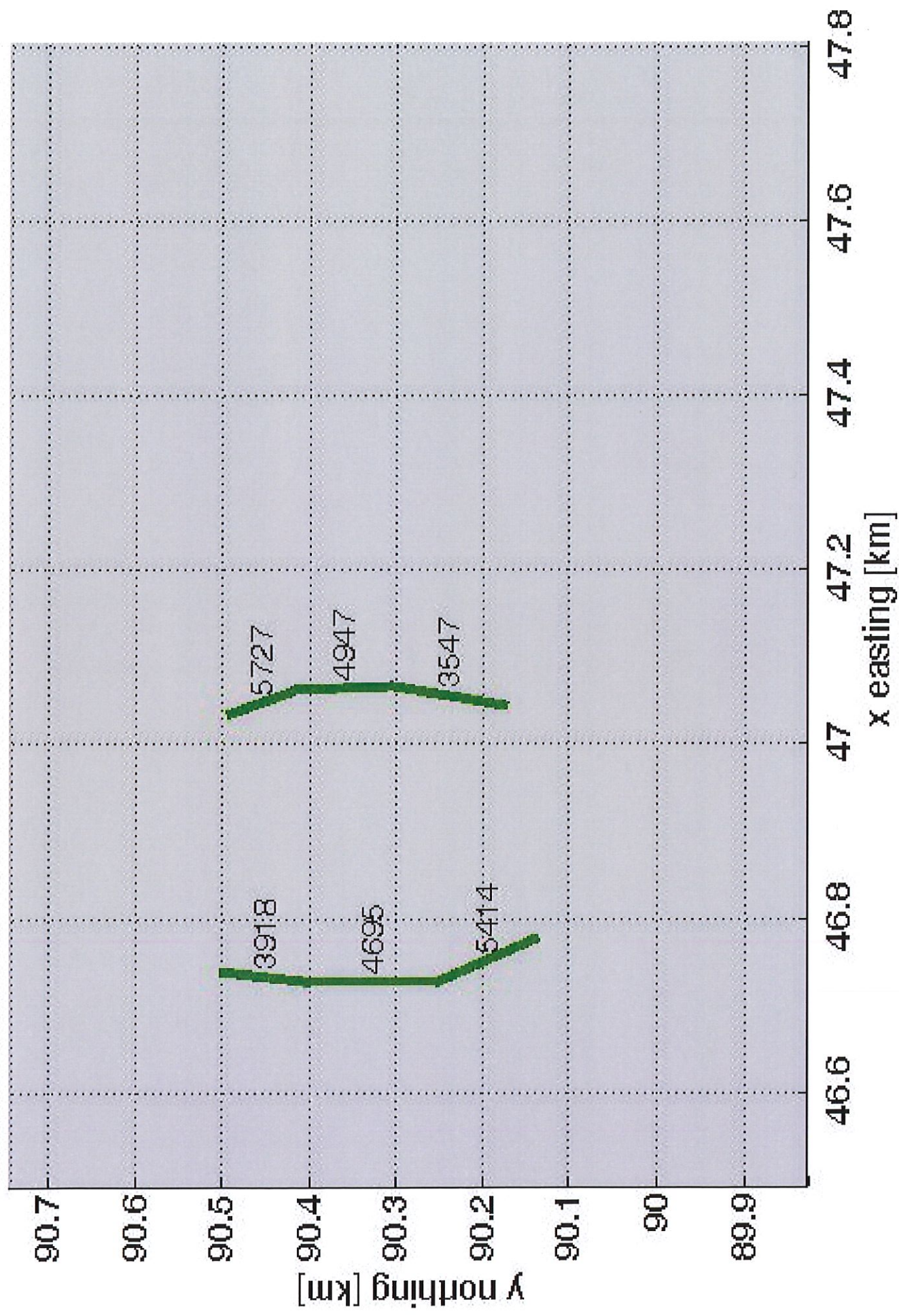


Help



Stereonet Show:

Fault Normals



Fault Slip Potential

Fault Selector:

- All Faults
- Fault #1
- Fault #2
- Fault #3
- Fault #4
- Fault #5
- Fault #6
- Fault #7
- Fault #8
- Fault #9
- Fault #10
- Fault #11
- Fault #12
- Fault #13
- Fault #14
- Fault #15

Calculate

MODEL INPUTS

GEOMECHANICS

PROB. GEOMECH

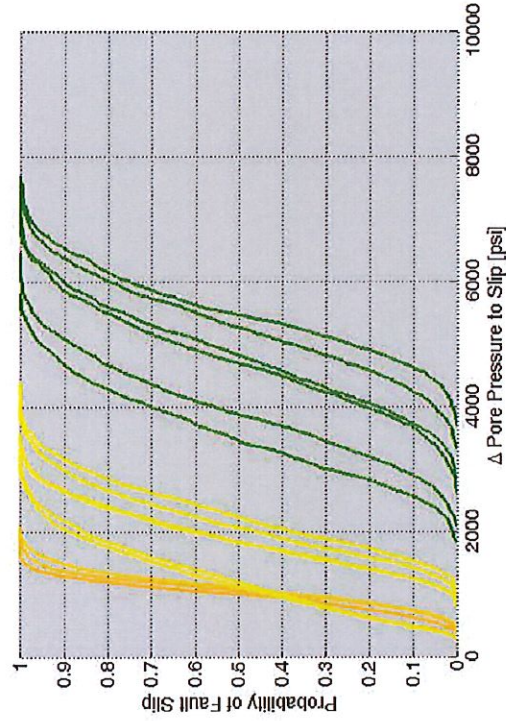
HYDROLOGY

PROB. HYDRO

INTEGRATED

Load Distributions

Risk Analysis



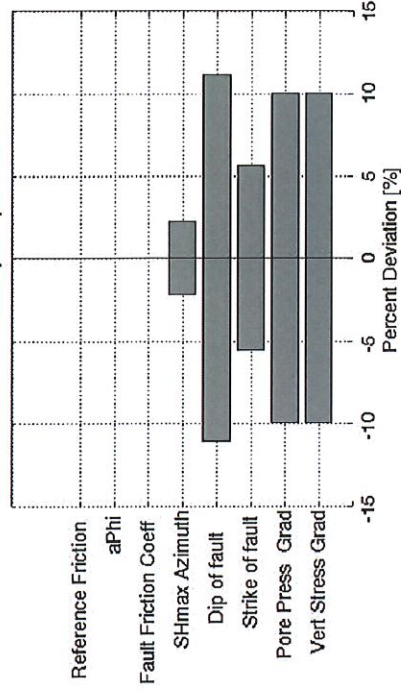
Max Delta PP [psi]:

10000

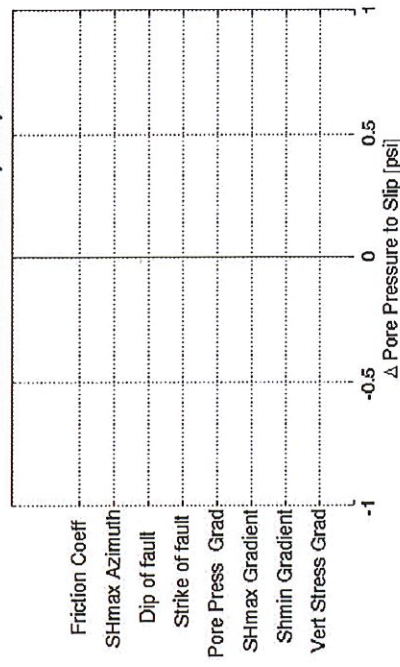
Export CDF data

Show Input Distributions

Variability in Inputs



Choose a fault to see sensitivity analysis



Fault Slip Potential

Fault Selector:

- All Faults
- Fault #1
- Fault #2
- Fault #3
- Fault #4
- Fault #5
- Fault #6
- Fault #7
- Fault #8
- Fault #9
- Fault #10
- Fault #11
- Fault #12
- Fault #13
- Fault #14
- Fault #15

Calculate

MODEL INPUTS

GEOMECHANICS

PROB. GEOMECH

HYDROLOGY

PROB. HYDRO

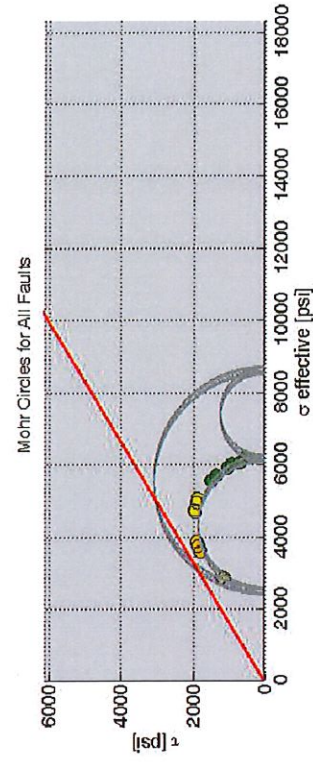
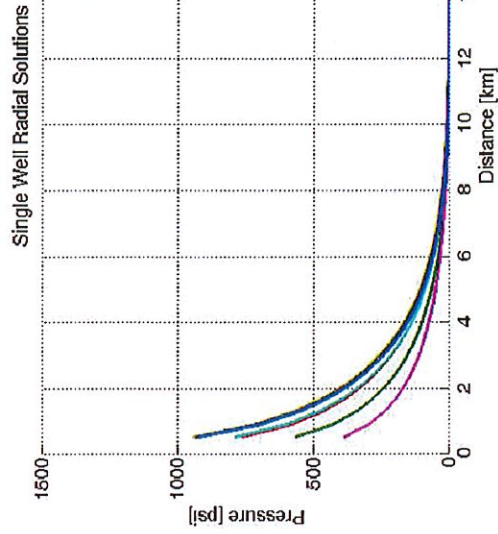
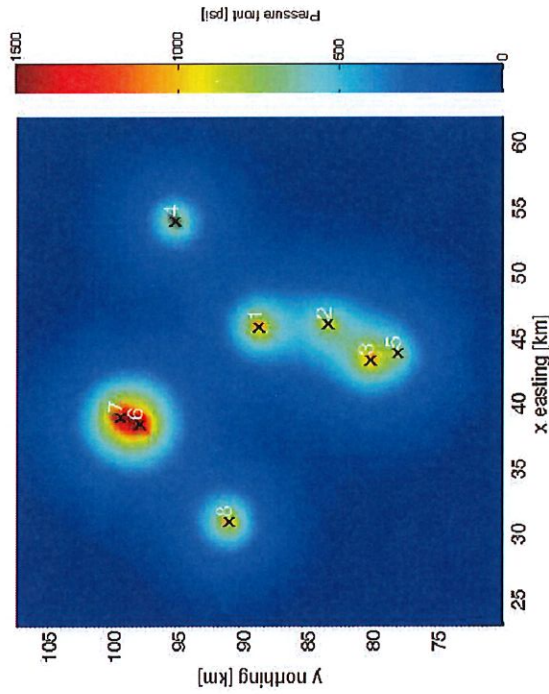
INTEGRATED

Max plot DP [psi]:

1500

Select Well:

All



Export Hydrology

Year:

2050

Fault Slip Potential

Fault Selector:

- All Faults
- Fault #1: 0.00 FSP
- Fault #2: 0.00 FSP
- Fault #3: 0.00 FSP
- Fault #4: 0.00 FSP
- Fault #5: 0.00 FSP
- Fault #6: 0.00 FSP
- Fault #7: 0.00 FSP
- Fault #8: 0.00 FSP
- Fault #9: 0.00 FSP
- Fault #10: 0.00 FSP
- Fault #11: 0.00 FSP
- Fault #12: 0.00 FSP
- Fault #13: 0.00 FSP
- Fault #14: 0.00 FSP
- Fault #15: 0.00 FSP

Calculate

MODEL INPUTS

GEOMECHANICS

PROB. GEOMECH

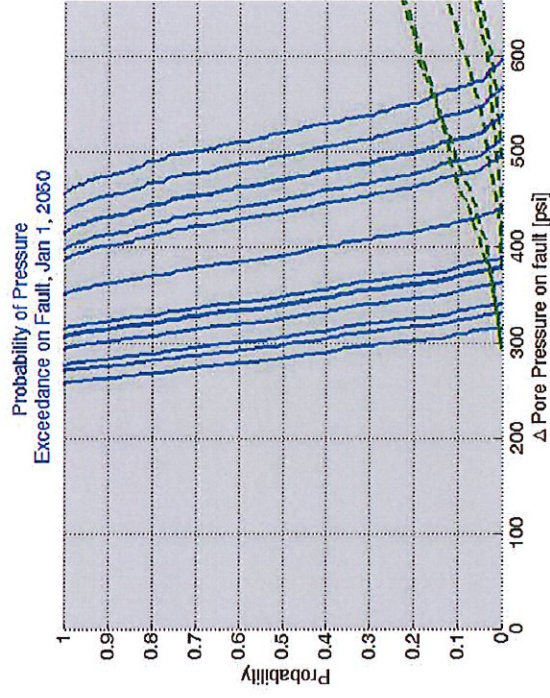
HYDROLOGY

PROB. HYDRO

INTEGRATED

Load Distributions

Run Analysis



Year:

2050

Export Blue Curves

Show Input Distributions

Fault Slip Potential

Fault Selector:

- All Faults
- Fault #1: 0.00 FSP
- Fault #2: 0.00 FSP
- Fault #3: 0.00 FSP
- Fault #4: 0.00 FSP
- Fault #5: 0.00 FSP
- Fault #6: 0.00 FSP
- Fault #7: 0.00 FSP
- Fault #8: 0.00 FSP
- Fault #9: 0.00 FSP
- Fault #10: 0.00 FSP
- Fault #11: 0.00 FSP
- Fault #12: 0.00 FSP
- Fault #13: 0.00 FSP
- Fault #14: 0.00 FSP
- Fault #15: 0.00 FSP

Calculate

MODEL INPUTS GEOMECHANICS PROB. GEOMECH HYDROLOGY PROB. HYDRO INTEGRATED

Uniform Distribution bounds:

⊙ Probabilistic Hydrology

○ Deterministic Hydrology

Aquifer Thickness [700 ft]

Porosity [3 %]

Perm [10 mD]

fluid density [1040 kg/(m^3)]

dynamic viscosity [0.0008 Pa.s]

Fluid Compressibility [3.6e-10 Pa^-1]

Rock Compressibility [1.08e-09 Pa^-1]

#Hydrologic iterations=200, change?

Plus/Minus:

70

0.3

1

0

0

0

0

Change Computations?

200

OK

Year: 2050 Export Blue Curves Show Input Distributions

Fault Slip Potential

Fault Selector:

All Faults

Fault #1: 0.00 FSP

Fault #2: 0.00 FSP

Fault #3: 0.00 FSP

Fault #4: 0.00 FSP

Fault #5: 0.00 FSP

Fault #6: 0.00 FSP

Fault #7: 0.00 FSP

Fault #8: 0.00 FSP

Fault #9: 0.00 FSP

Fault #10: 0.00 FSP

Fault #11: 0.00 FSP

Fault #12: 0.00 FSP

Fault #13: 0.00 FSP

Fault #14: 0.00 FSP

Fault #15: 0.00 FSP

Calculate

MODEL INPUTS

GEOMECHANICS

HYDROLOGY

PROB. HYDRO

INTEGRATED

b) PP Change at fault [psi]

Summary Plots

92

91

90

89

88

87

86

43

44

45

46

47

48

y northing [km]

x easting [km]

0.00

0.2

0.4

0.6

0.8

1

Fault Slip Potential

Year: 2050

Pressure Change at Fault Midpoint [psi]

Time [years]

2015

2020

2025

2030

2035

2040

2045

2050

0

50

100

150

200

250

300

350

400

450

500

Select Fault to Plot Pressures

Export

Fault Slip Potential

Time [years]

2015

2020

2025

2030

2035

2040

2045

2050

0

0.1

0.2

0.3

0.4

0.5

0.6

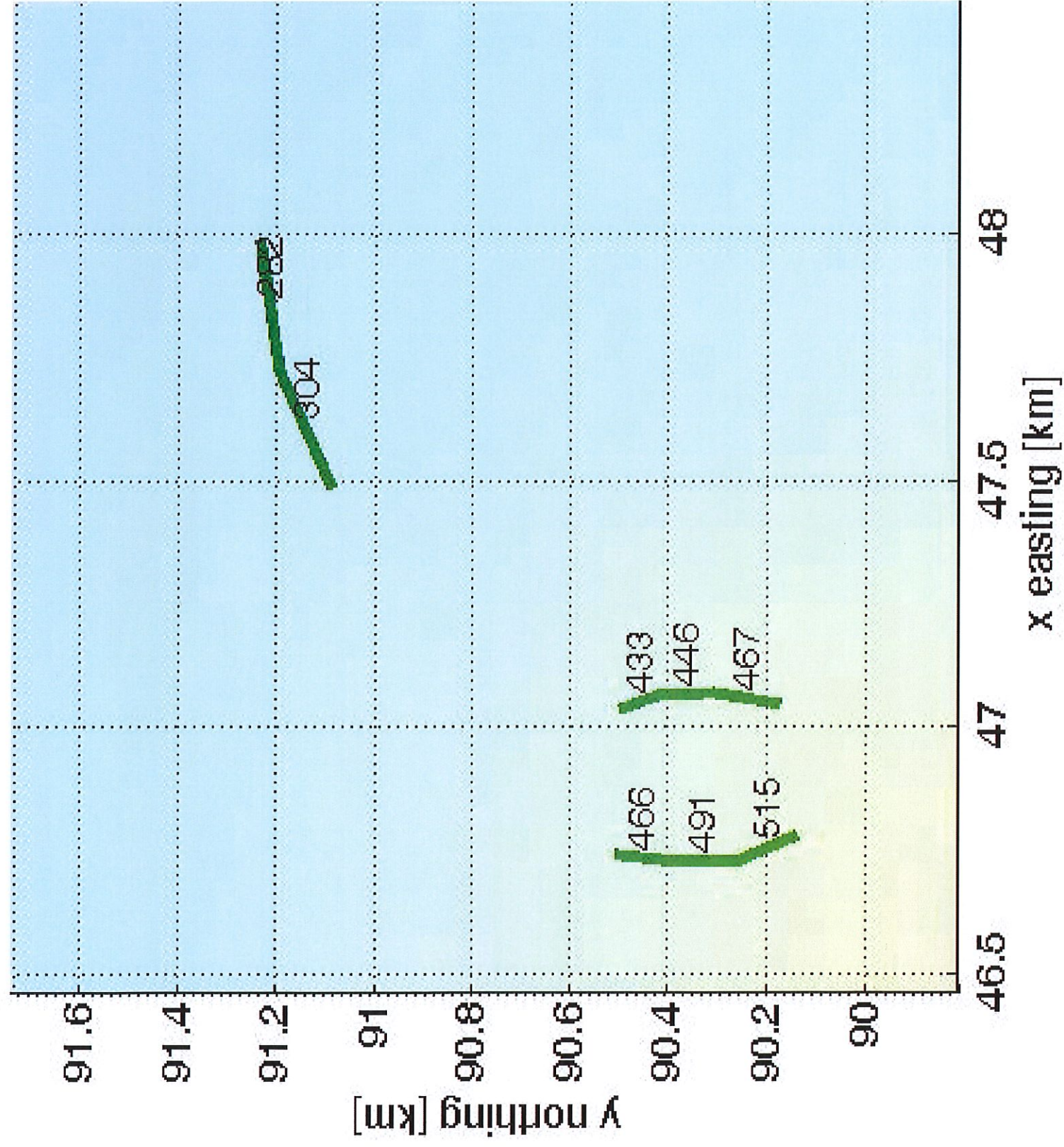
0.7

0.8

0.9

1

Export



GRAMA STATE SWD #2 FSP MODEL RESULTS

FSP MODEL INPUT PARAMETERS

Vertical Stress Gradient [psi/ft]

1.05

Max Hor Stress Direction [deg N CW]

75

Reference Depth for Calculations [ft]

14500

Initial Res. Pressure Gradient [psi/ft]

0.43

☐ Min Horiz. Stress Gradient [psi/ft]

0.62875

☐ Max Horiz. Stress Gradient [psi/ft]

0.8815

☒ A Phi Parameter

0.6

☐ Reference Friction Coefficient mu

0.6

OK

Enter Hydrologic Parameters

Load External Hydrologic Model

Aquifer Thickness [ft]

700

Porosity [%]

3

Permeability [mD]

10

Enter Wells Manually

Load Wells Complete .csv

Number of wells:

8

	x [km]	y [km]	Inj. Rate [bbl/day]	Start Year [yr]	End Year [yr]
1	45.872	88.848	25000	2020	2050
2	46.08	83.505	15000	2017	2050
3	43.299	80.251	20000	2015	2050
4	53.974	95.319	21000	2017	2050
5	43.832	78.147	10000	2013	2050
6	38.384	98.016	25000	2017	2050
7	38.933	99.54	25000	2020	2050
8	30.894	91.162	25000	2020	2050

OK

Number of faults (max 500)

- Random Faults

Enter Faults

15

	X [East km]	Y [North km]	Strike [Deg]	Dip [Deg]	Length [km]	Friction Coeff [mu]
1	44.3680	91.0800	23.4710	80	0.3288	0.6000
2	44.1230	90.7560	45.9710	80	0.4968	0.6000
3	43.7880	90.4220	43.0251	80	0.4479	0.6000
4	43.4710	89.9240	26.5650	80	0.7455	0.6000
5	43.5640	89.2090	26.5651	80	1.1075	0.6000
6	43.1540	88.5210	40.9144	80	0.5042	0.6000
7	42.6920	87.6090	22.1903	80	1.5636	0.6000
8	46.7310	90.4490	6.5819	80	0.1039	0.6000
9	46.7260	90.3250	0	80	0.1429	0.6000
10	46.7500	90.1940	336.5713	80	0.1298	0.6000
11	47.0460	90.4540	340.1448	80	0.0810	0.6000
12	47.0630	90.3600	357.7973	80	0.1101	0.6000
13	47.0540	90.2380	9.7525	80	0.1375	0.6000
14	47.8530	91.2090	81.6744	80	0.2631	0.6000
15	47.6030	91.1370	65.7090	80	0.2624	0.6000

Load File

He/p

OK

Min x [km]

22.894

Max x [km]

61.974

Min y [km]

70.147

Max y [km]

107.54

Density [kg/m³]

1040

Dynamic Viscosity [Pa.s]

0.0008

Fluid Compressibility [Pa⁻¹]

3.6e-10

Rock Compressibility [Pa⁻¹]

1.08e-09

Set Random Seed?

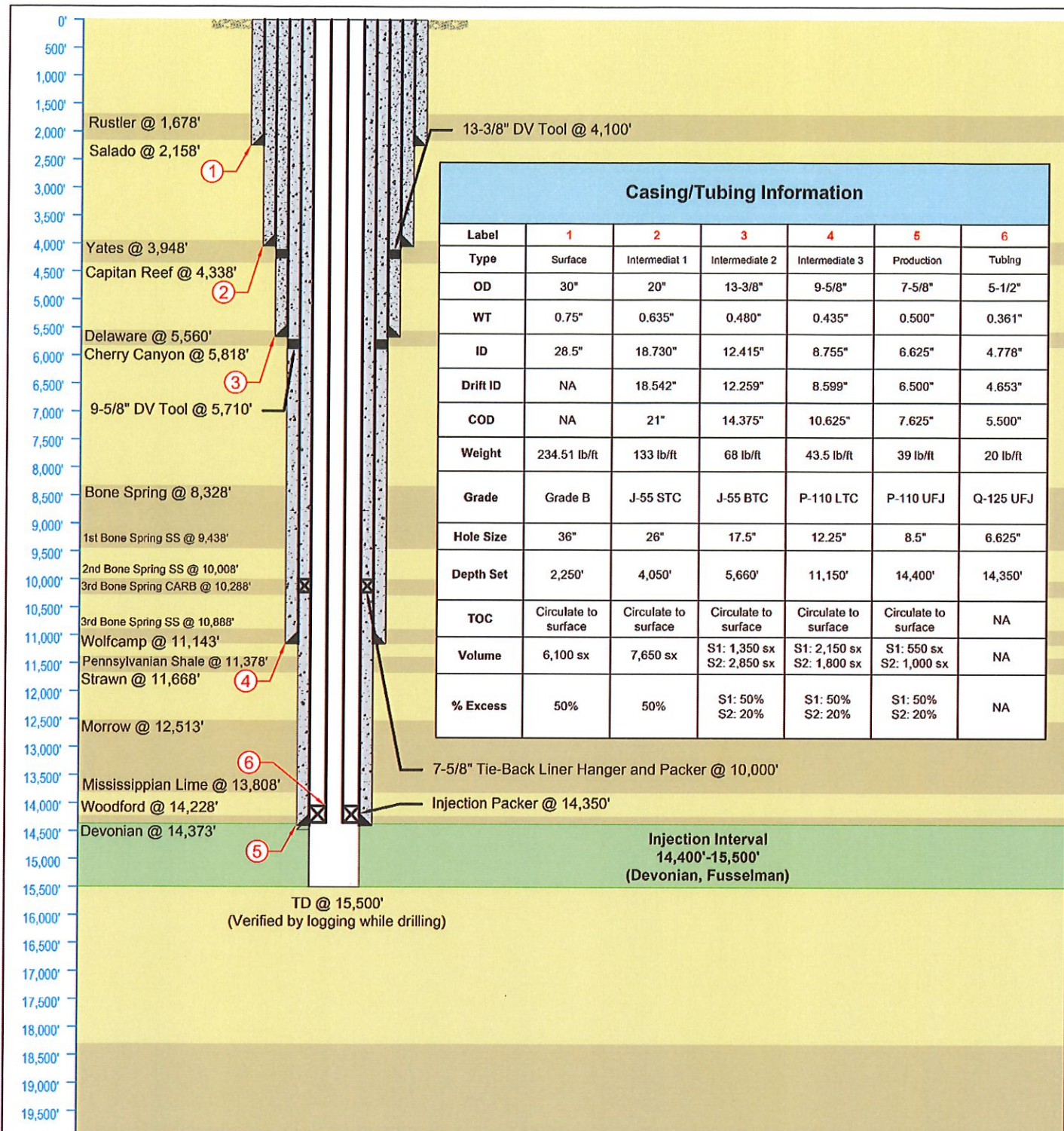
0

Choose Renderer:

OpenGL Software



OK



Casing/Tubing Information						
Label	1	2	3	4	5	6
Type	Surface	Intermediate 1	Intermediate 2	Intermediate 3	Production	Tubing
OD	30"	20"	13-3/8"	9-5/8"	7-5/8"	5-1/2"
WT	0.75"	0.635"	0.480"	0.435"	0.500"	0.361"
ID	28.5"	18.730"	12.415"	8.755"	6.625"	4.778"
Drift ID	NA	18.542"	12.259"	8.599"	6.500"	4.653"
COD	NA	21"	14.375"	10.625"	7.625"	5.500"
Weight	234.51 lb/ft	133 lb/ft	68 lb/ft	43.5 lb/ft	39 lb/ft	20 lb/ft
Grade	Grade B	J-55 STC	J-55 BTC	P-110 LTC	P-110 UFJ	Q-125 UFJ
Hole Size	36"	26"	17.5"	12.25"	8.5"	6.625"
Depth Set	2,250'	4,050'	5,660'	11,150'	14,400'	14,350'
TOC	Circulate to surface	Circulate to surface	Circulate to surface	Circulate to surface	Circulate to surface	NA
Volume	6,100 sx	7,650 sx	S1: 1,350 sx S2: 2,850 sx	S1: 2,150 sx S2: 1,800 sx	S1: 550 sx S2: 1,000 sx	NA
% Excess	50%	50%	S1: 50% S2: 20%	S1: 50% S2: 20%	S1: 50% S2: 20%	NA

LONQUIST & CO. LLC PETROLEUM ENGINEERS ENERGY ADVISORS HOUSTON CALGARY AUSTIN WICHITA DENVER	3Bear Field Services, LLC		Grama State SWD No. 2	
	Country: USA		State/Province: New Mexico	County/Parish: Lea
	Location:		Site: 351 FNL, 215 FWL	Survey: S2-T22S-R34E
	API No: N/A		Field: Devonian-Silurian	Well Type/Status: SWD
Texas License F-9147	NMOCD District No: 1	Project No: 2009	Date: 01/30/2020	
12912 Hill Country Blvd. Ste F-200 Austin, Texas 78738 Tel: 512.732.9812 Fax: 512.732.9816	Drawn: TFM/WHG	Reviewed:	Approved:	
	Rev No: 1	Notes:		

EXHIBIT