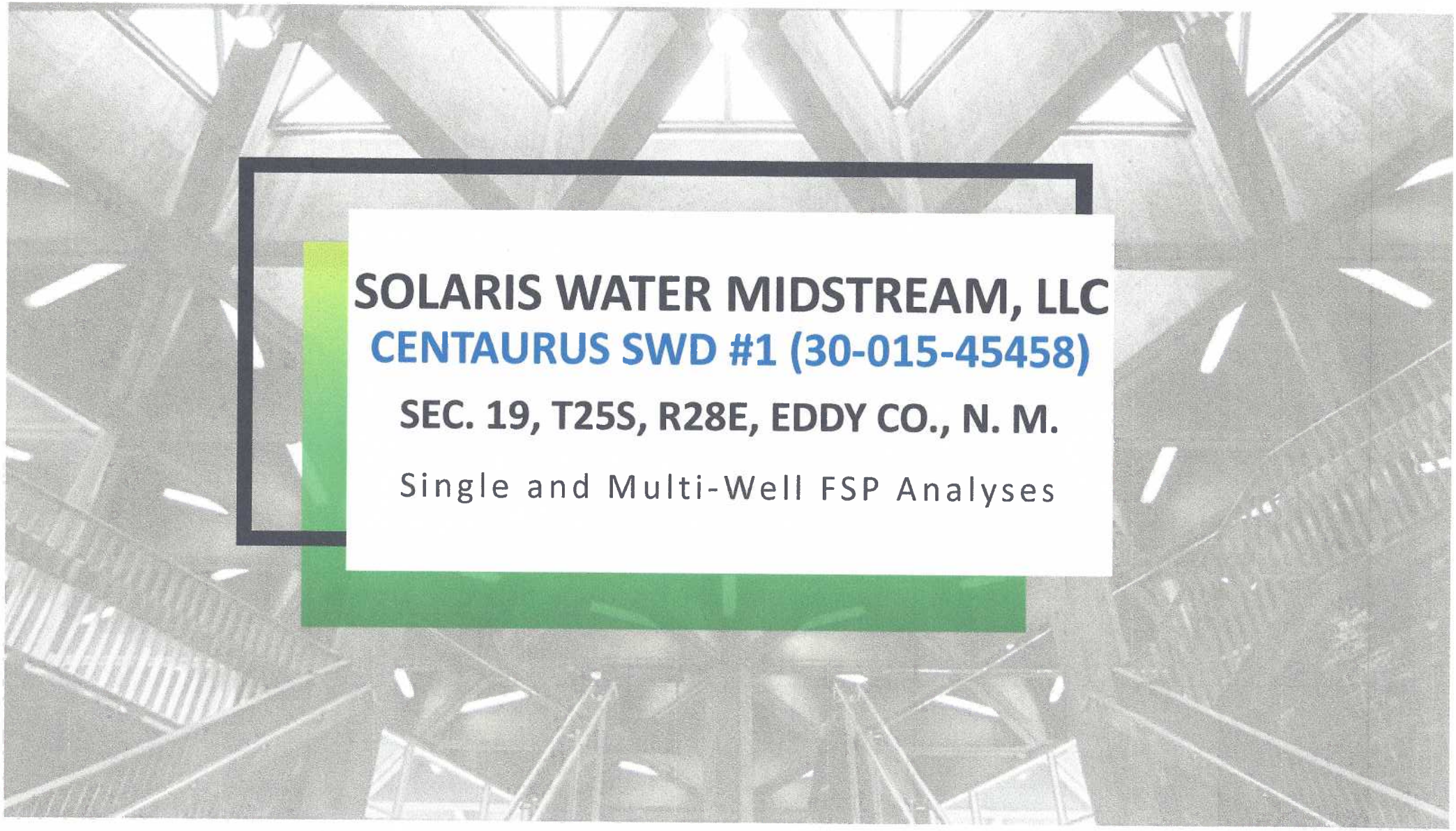
Additional Information

FSP Modeling 2/12/21

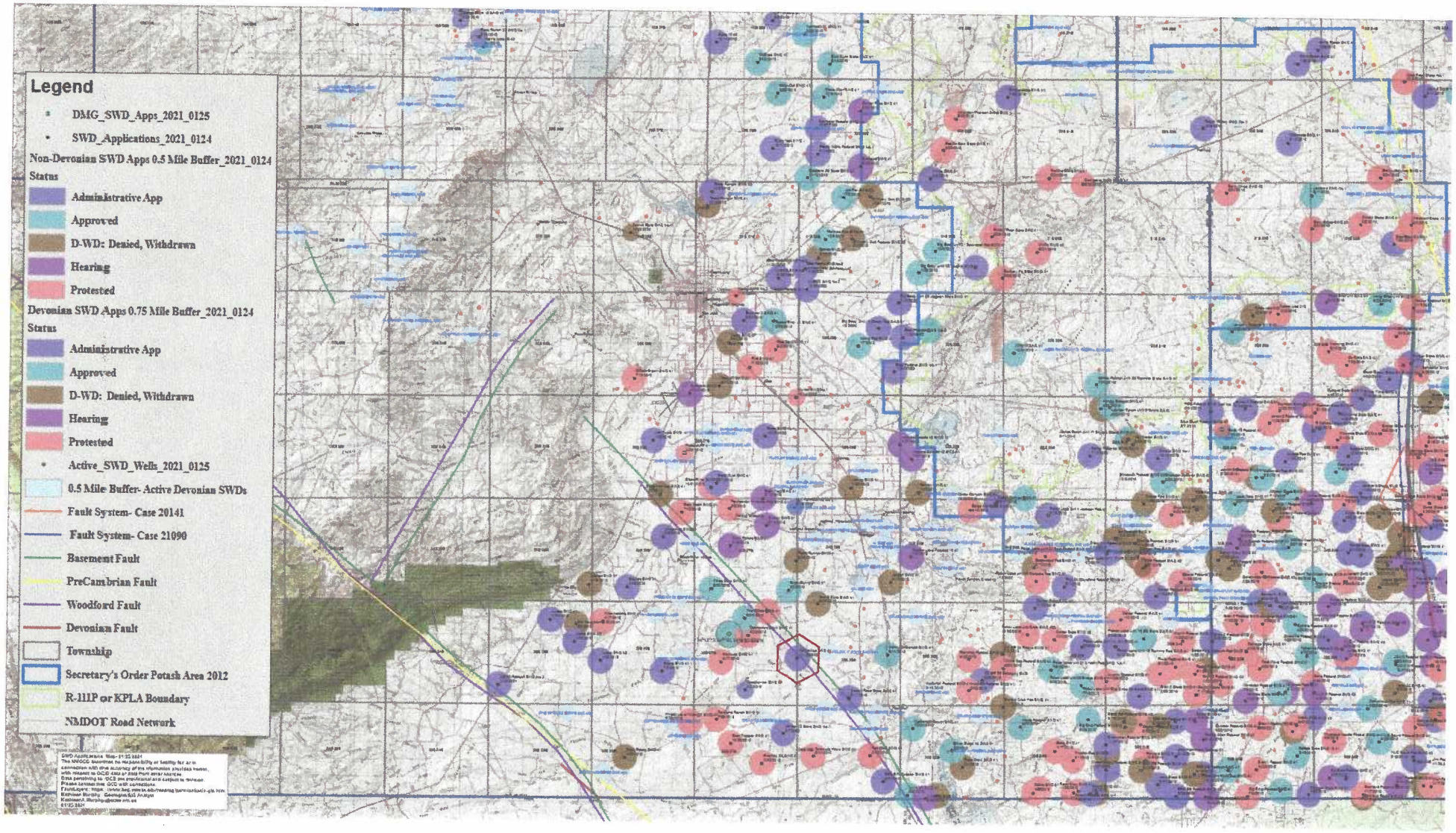


SOLARIS WATER MIDSTREAM, LLC

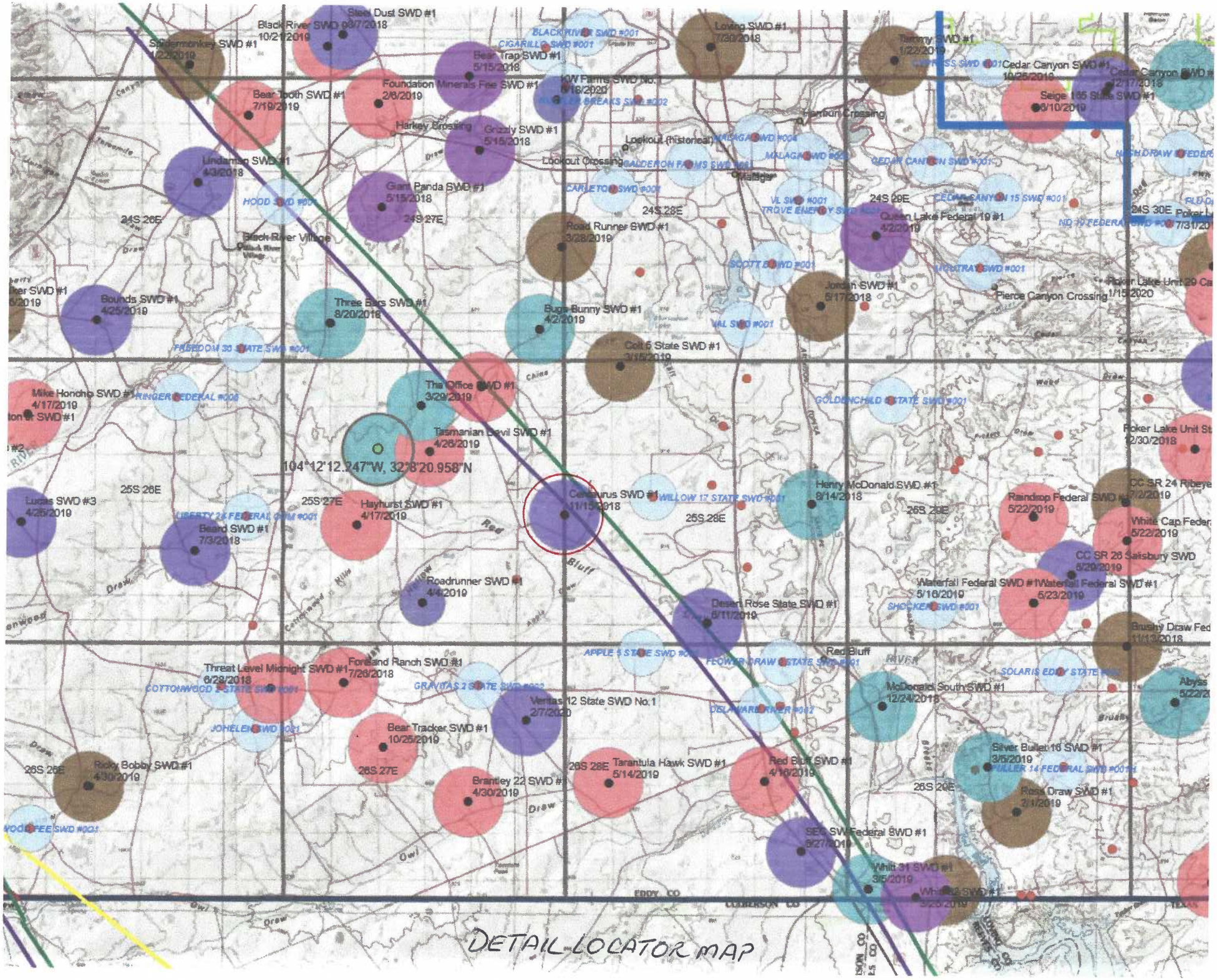
CENTAURUS SWD #1 (30-015-45458)

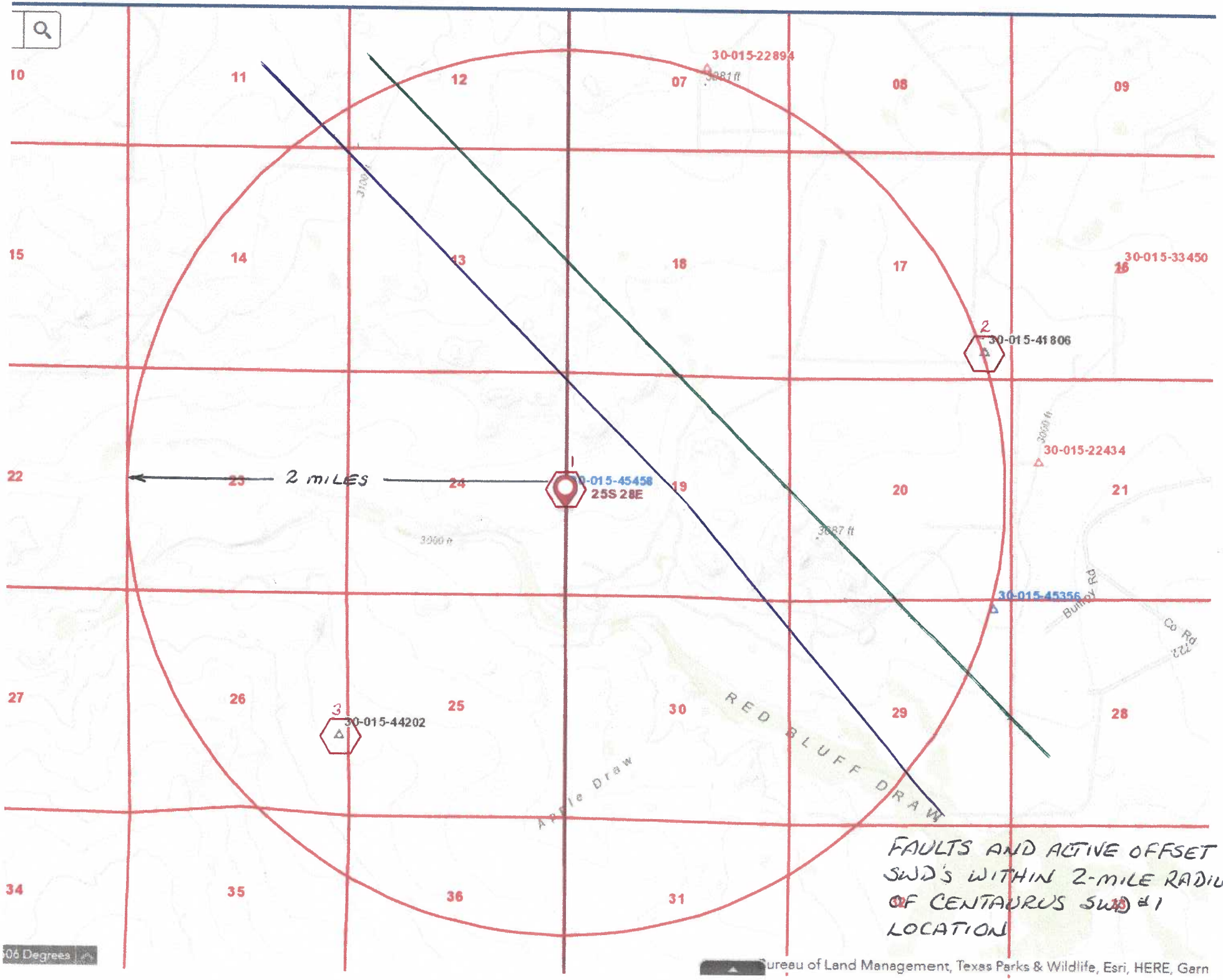
SEC. 19, T25S, R28E, EDDY CO., N. M.

Single and Multi-Well FSP Analyses



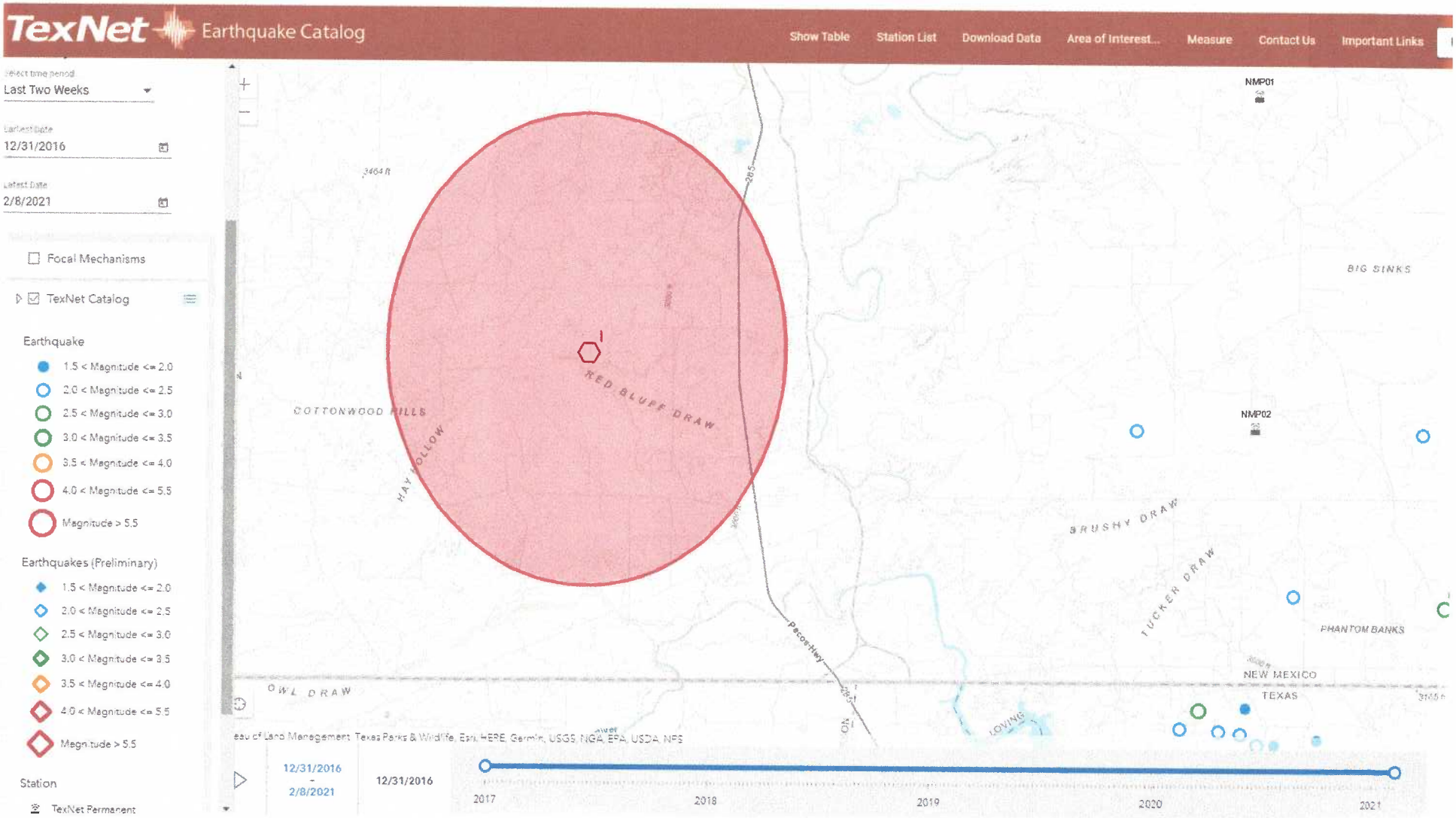
LOCATOR MAP: CENTAURUS SWD #1 (RED OUTLINE) AND PROXIMAL BASEMENT AND WOODFORD INVOLVED FAULTS


Steel Dust SWD #1
Black River SWD #1 10/2/2019
Spidermonkey SWD #1
Bear Trap SWD #1 5/15/2018
Foundation Minerals Fee SWD #1 2/6/2019
Bear Tooth SWD #1 7/19/2019
Harkey Crossing
Grizzly SWD #1 5/15/2018
Lookout Crossing
Lindamon SWD #1 4/3/2018
Giant Panda SWD #1 5/15/2018
24S 26E
24S 27E
Black River Village
Bounds SWD #1 4/25/2019
Three Bars SWD #1 8/20/2018
Road Runner SWD #1 3/28/2019
Bugs Bunny SWD #1 4/2/2019
Colt 5 State SWD #1 3/15/2019
24S 28E
Loving SWD #1 7/30/2018
Tammy SWD #1 1/22/2019
Cedar Canyon SWD #1 10/25/2019
Seige 16S State SWD #1 9/10/2019
Queen Lake Federal 19 #1 4/2/2019
24S 29E
24S 30E
Jordan SWD #1 5/17/2018
Pierce Canyon Crossing 1/15/2020
Mike Honcho SWD #1 4/17/2019
The Office SWD #1 3/29/2019
Tasmanian Devil SWD #1 4/26/2019
104°12'12.947"W, 32°8'20.958"N
25S 26E
25S 27E
Hayhurst SWD #1 4/17/2019
Lucas SWD #3 4/25/2019
Beard SWD #1 7/3/2018
Castlerus SWD #1 11/15/2018
25S 28E
Henry McDonald SWD #1 8/14/2018
Raindrop Federal SWD #1 5/22/2019
26S 28E
White Cap Federal 5/22/2019
CC SR 26 Salisbury SWD 5/29/2019
Waterfall Federal SWD #1 5/16/2019
Waterfall Federal SWD #1 5/23/2019
Roadrunner SWD #1 4/4/2019
Desert Rose State SWD #1 5/11/2019
Poker Lake Unit St 12/30/2018
Brushy Draw Fed 11/13/2018
Red Bluff
Threat Level Midnight SWD #1 6/28/2018
Foreland Ranch SWD #1 7/26/2018
Veritas 12 State SWD No.1 2/7/2020
Bear Tracker SWD #1 10/25/2019
26S 27E
26S 28E
Tarantula Hawk SWD #1 5/14/2019
Brantley 22 SWD #1 4/30/2019
Ricky Bobby SWD #1 4/30/2019
Red Bluff SWD #1 4/10/2019
McDonald South SWD #1 12/24/2018
Silver Bullet 16 SWD #1 3/5/2019
Rose Draw SWD #1 2/1/2019
SEC SW Federal SWD #1 9/27/2019
Whitt 31 SWD #1 3/5/2019
EDDY CO
DETAIL LOCATOR MAP

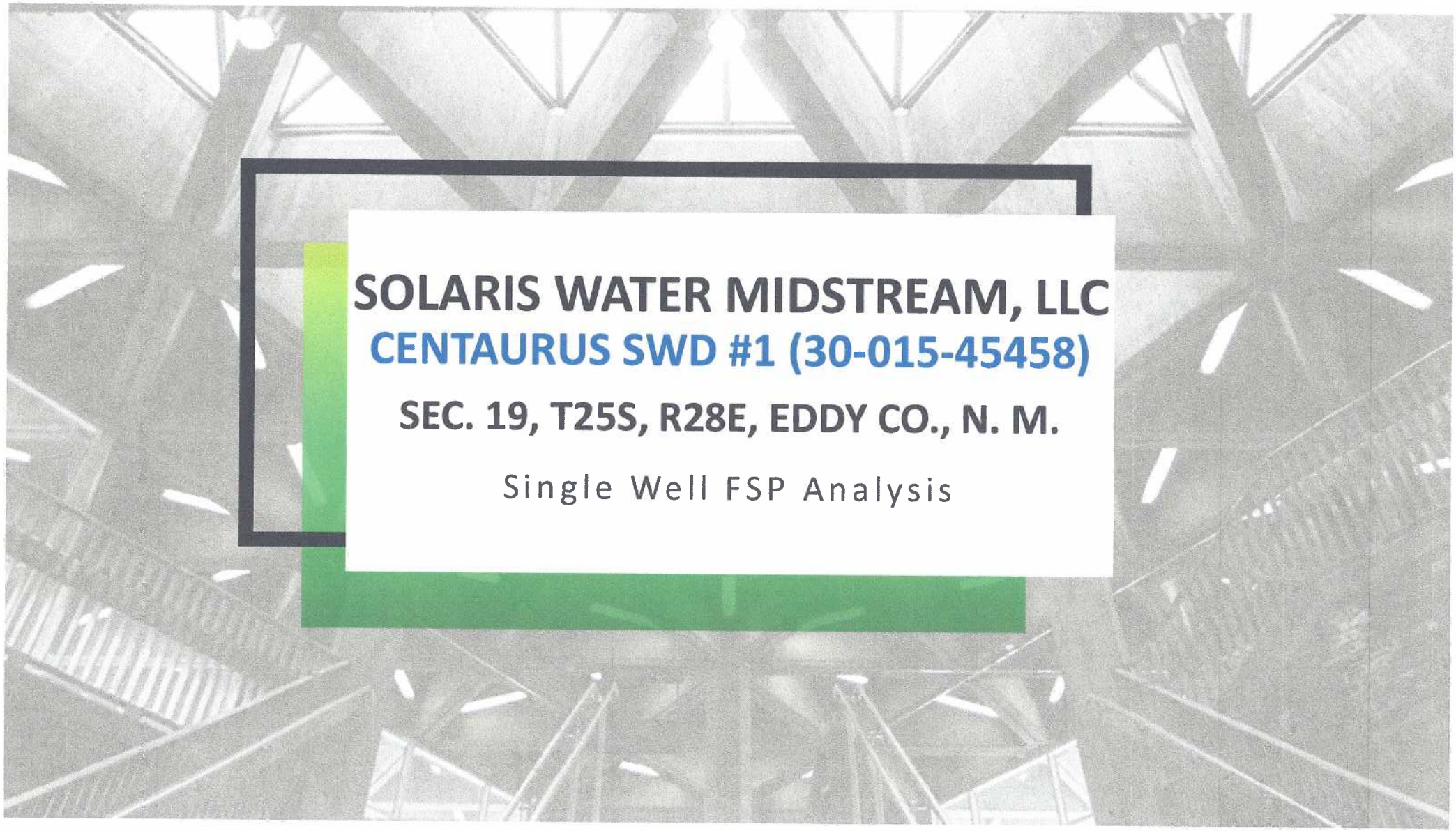

30-015-22894
3081 ft
30-015-33450
30-015-41806
30-015-22434
30-015-45458
25S 28E
30-015-45356
30-015-44202
2 MILES
RED BLUFF DRAW
Apple Draw
Bullock Rd
Co Rd 222
3687 ft
3000 ft
FAULTS AND ACTIVE OFFSET SWD'S WITHIN 2-MILE RADIUS OF CENTAURUS SWD #1 LOCATION
Bureau of Land Management, Texas Parks & Wildlife, Esri, HERE, Garn

Centaurus SWD #1 and Offset SWD's in 2-Mile AOI

Well #	Operator	Well Name	API	Maximum Inj. Vol.	First Inj. Date
1	Solaris Water Midstream, LLC	Centaurus SWD #1	30-015-45458	35,000 bpd	Aug-21
2	Solaris Water Midstream, LLC	Willow 17 State SWD #1	30-015-41806	25,000 bpd	Jun-14
3	Chevron USA, Inc.	Dignitas 26 State SWD #1	30-015-44202	86,000 bpd	Dec-19



SEISMIC EVENTS > 2.0 MAGNITUDE RELATIVE TO 100 SQ. MILE (9.08 KM RADIUS) AOI AROUND CENTAURUS SWD #1 LOCATION



SOLARIS WATER MIDSTREAM, LLC

CENTAURUS SWD #1 (30-015-45458)

SEC. 19, T25S, R28E, EDDY CO., N. M.

Single Well FSP Analysis

Stress Data

- ◉ Specify All Three Stress Gradients [psi/ft]
- ○ Use A-Phi Model

Vertical Stress Gradient [psi/ft]	1.1
Max Horiz. Stress Gradient [psi/ft]	1.2
Min Horiz. Stress Gradient [psi/ft]	0.74
Max Hor Stress Direction [deg N CW]	35
Initial Res. Pressure Gradient [psi/ft]	0.43
Reference Depth for Calculations [ft]	14350

OK

STRESS DATA

Hydrology Data

◉ Enter Hydrologic Parameters

○ Load External Hydrologic Model

Aquifer Thickness [ft]	1000
Porosity [%]	7
Permeability [mD]	125

OK

HYDROLOGY DATA

Injection Wells

◉ Enter Wells Manually

○ Load Wells Complete .csv

Number of wells: 1

	x [km]	y [km]	Inj. Rate [bbl/day]	Start Year [yr]	End Year [yr]
1	0	0	35000	2021	2041
2					
3					
4					
5					
6					
7					
8					

OK

CENTAURUS SWD #1 MAXIMUM DAILY DISPOSAL VOLUME
(20-YEAR MODEL TIME)

Fault Data

Number of faults (max 500): 6

Friction Coefficient mu: 0.58

○ Random Faults

◉ Enter Faults

Select to type in faults or load a .csv file

	X [East km]	Y [North km]	Strike [Deg]	Dip [Deg]	Length [km]
1	2.7000	-0.9400	315	88	3
2	0.7500	1	315	88	2.5000
3	-0.7000	2.4500	315	88	1.6700
4	1.8500	-1.2800	320	88	3
5	-0.1700	0.9200	315	88	3
6	-1.8200	2.5800	315	88	1.7000

Load File | Help

OK

FAULT SEGMENT LOCATIONS RELATIVE TO CENTAURUS SWD #1 LOCATION AND SEGMENT ORIENTATIONS

Fault Slip Potential vFSP 2.0

File Data Inputs Export Image Zoom

Fault Slip Potential

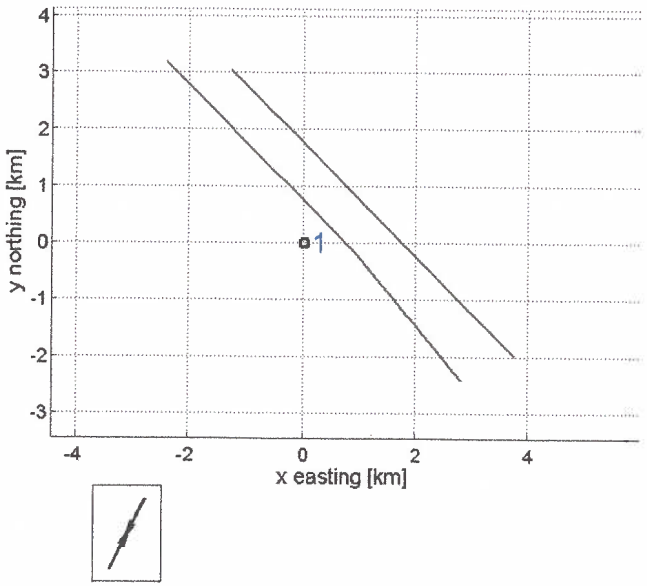
MODEL INPUTS | GEOMECHANICS | PROB. GEOMECH | HYDROLOGY | PROB. HYDRO | INTEGRATED

Fault Selector:

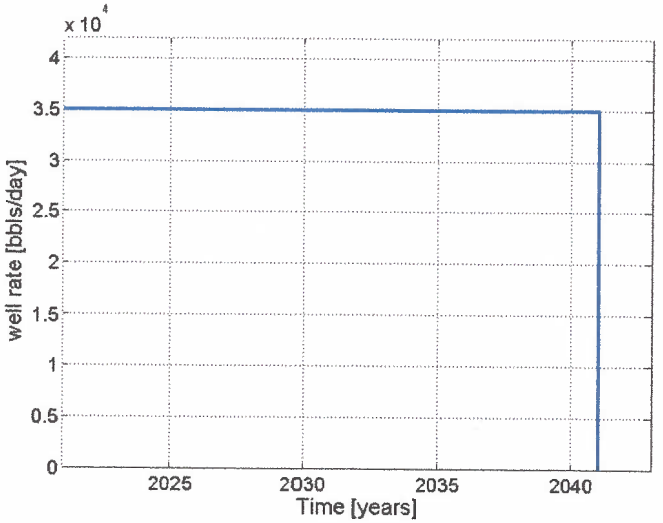
- All Faults
- Fault #1
- Fault #2
- Fault #3
- Fault #4
- Fault #5
- Fault #6

Calculate

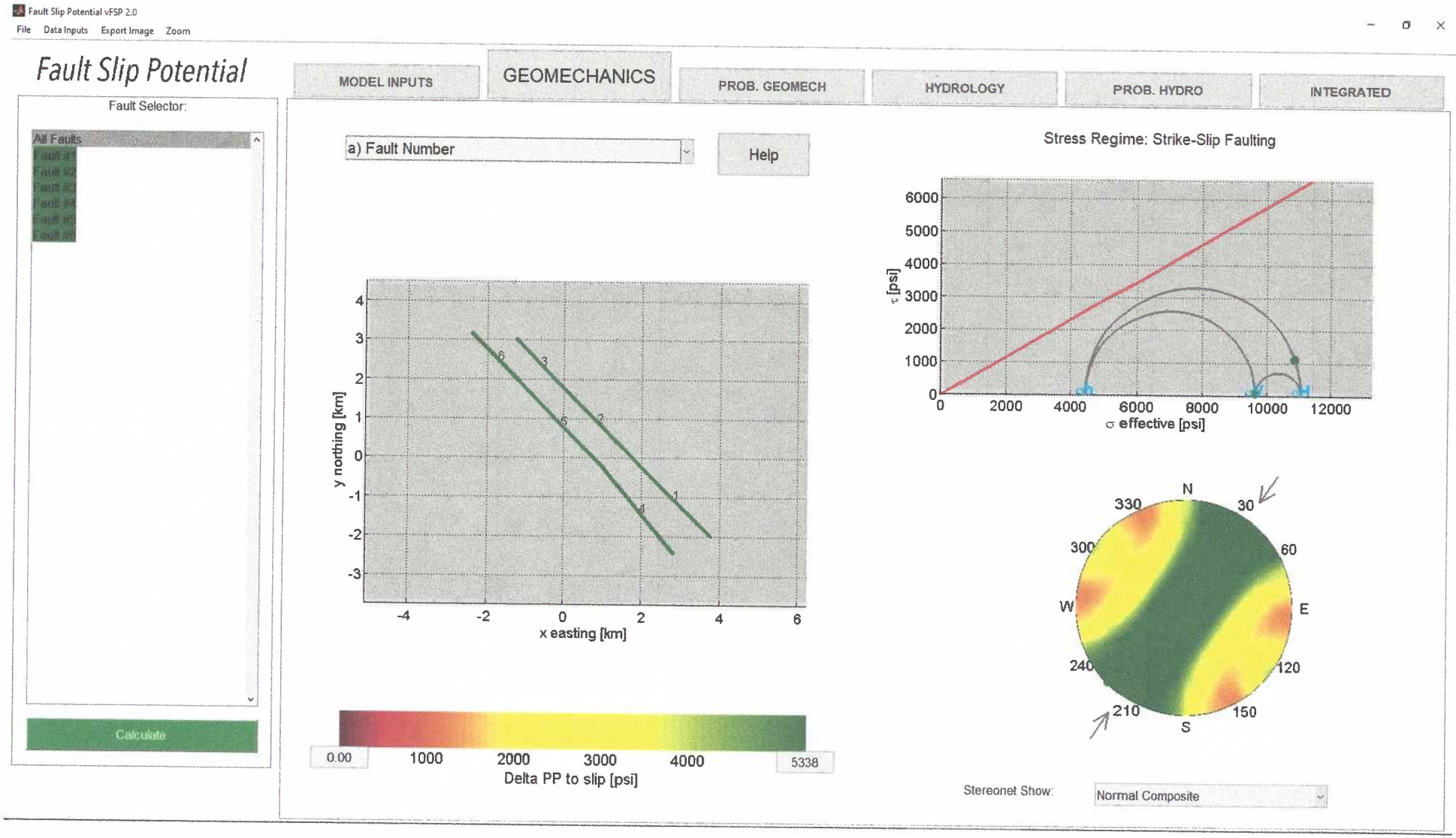
Stress Regime: Strike-Slip Faulting



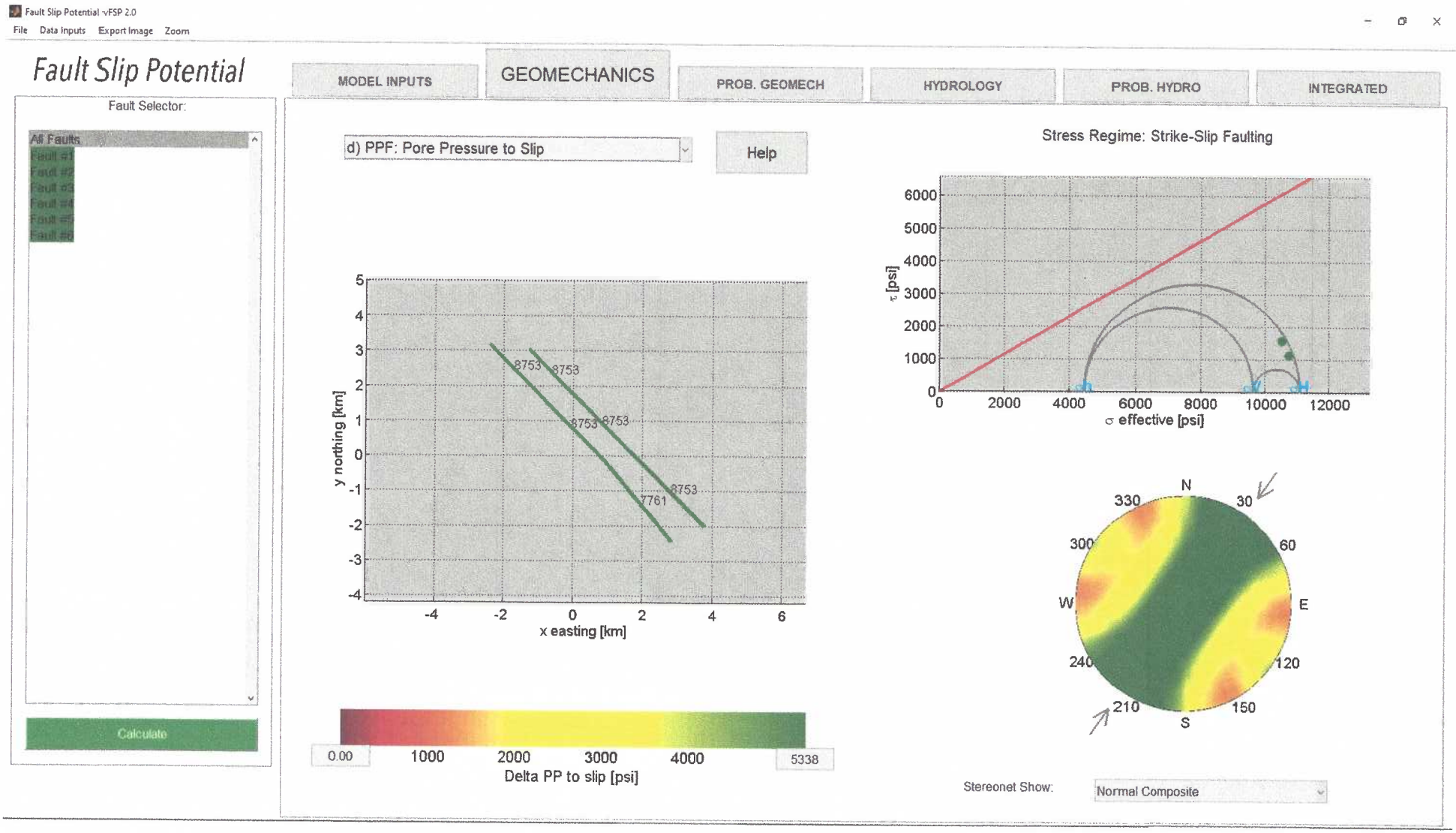
Select Well: All



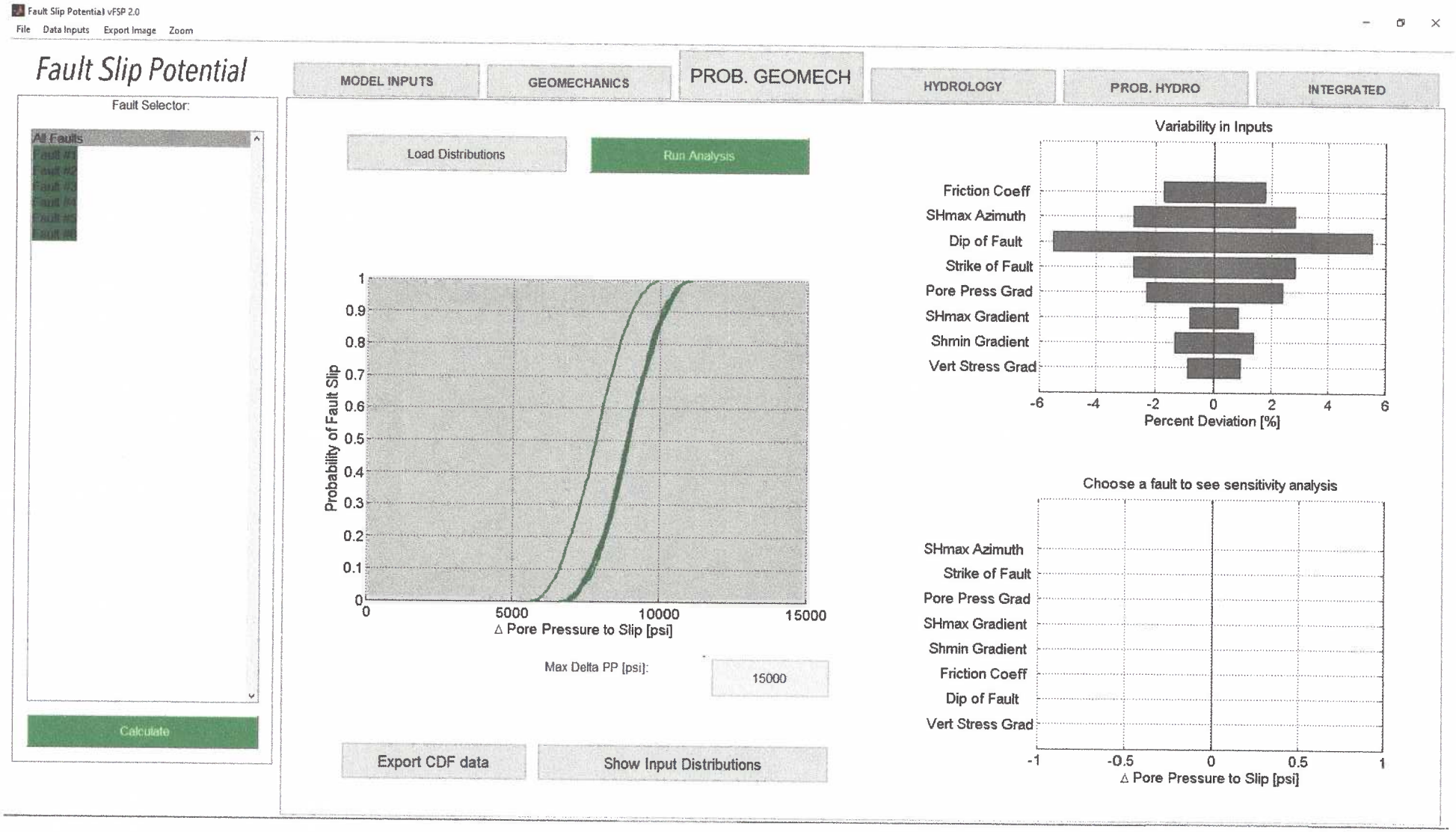
CENTAURUS SWD #1 LOCATION, FAULTS, AND MODELLED DISPOSAL VOLUME



FAULT SEGMENTS (NUMBERS AT SEGMENT MIDPOINTS)



CALCULATED PORE PRESSURE INCREASE NEEDED TO GENERATE FAULT SLIP AT FAULT SEGMENT MIDPOINTS



FAULT SLIP PROBABILITY AS FUNCTION OF PORE PRESSURE INCREASE

Fault Slip Potential vFSP 2.0

Data Inputs Export Image Zoom

Fault Slip Potential

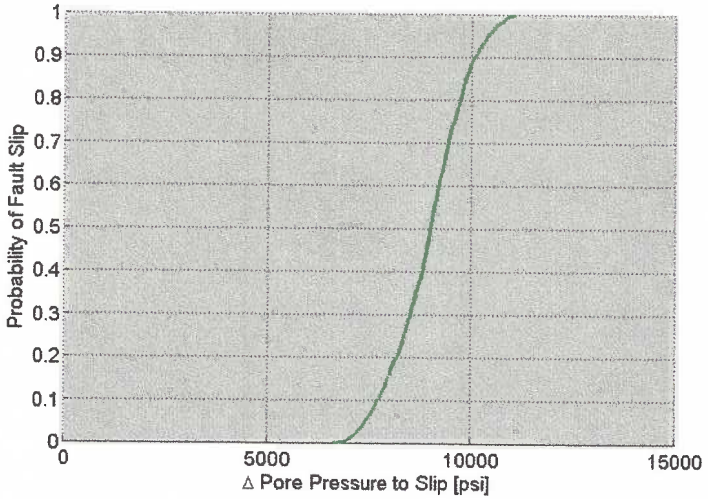
MODEL INPUTS | GEOMECHANICS | PROB. GEOMECH | HYDROLOGY | PROB. HYDRO | INTEGRATED

Fault Selector:

All Faults
Fault #1
Fault #2
Fault #3
Fault #4
Fault #5
Fault #6

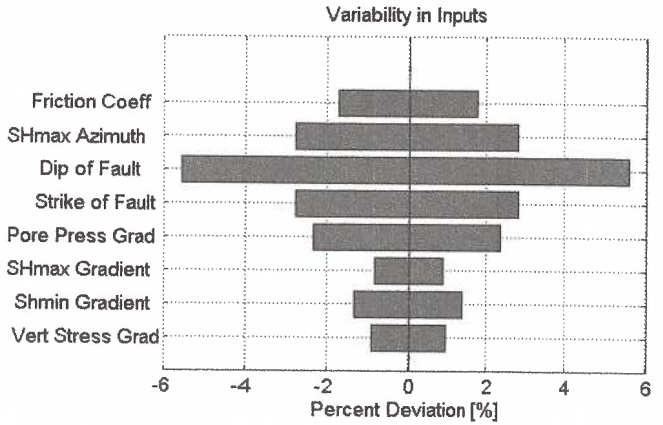
Calculate

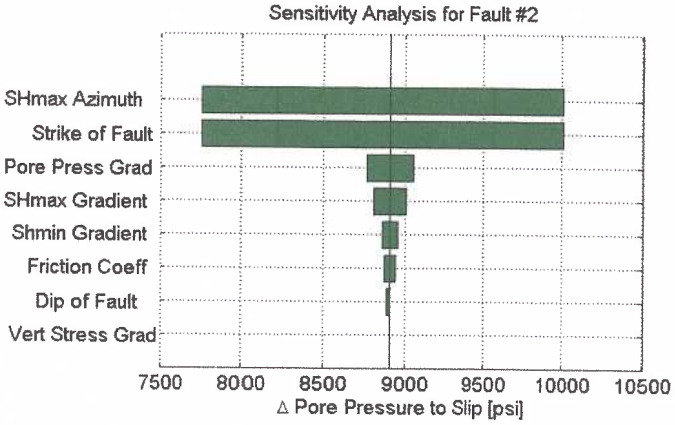
Load Distributions Run Analysis



Max Delta PP [psi]: 15000

Export CDF data Show Input Distributions





FAULT SEGMENT 2 CASE SENSITIVITIES

Fault Slip Potential vFSP 2.0

File Data Inputs Export Image Zoom

Fault Slip Potential

MODEL INPUTS | GEOMECHANICS | PROB. GEOMECH | HYDROLOGY | PROB. HYDRO | INTEGRATED

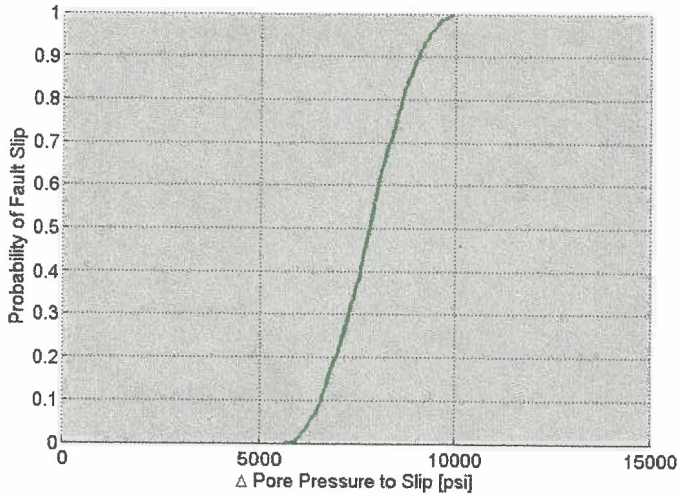
Fault Selector:

All Faults

Fault #1
Fault #2
Fault #3
Fault #4
Fault #5
Fault #6

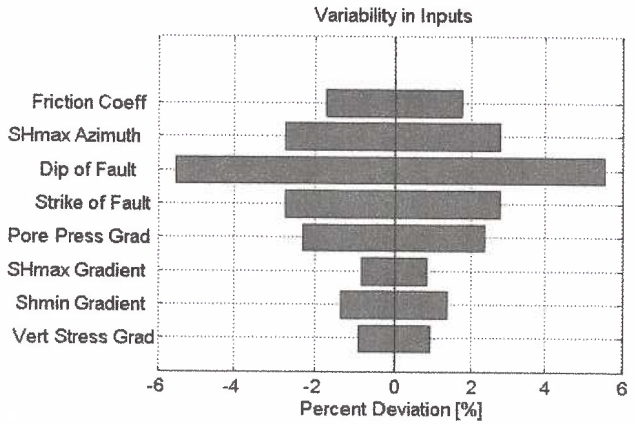
Calculate

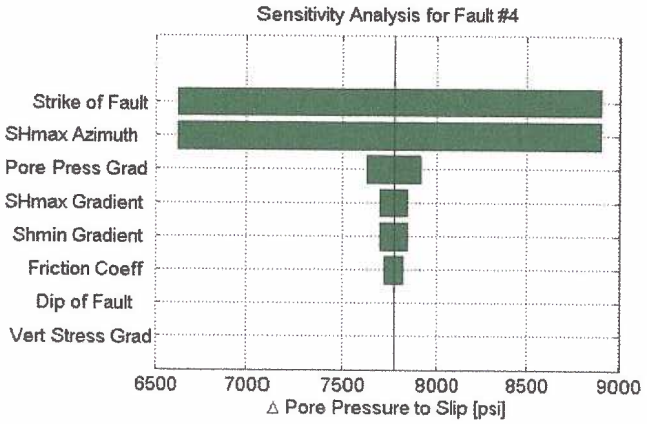
Load Distributions | Run Analysis



Max Delta PP [psi]: 15000

Export CDF data | Show Input Distributions





FAULT SEGMENT 4 CASE SENSITIVITIES

Fault Slip Potential vFSP 2.0

Data Inputs Export Image Zoom

Fault Slip Potential

MODEL INPUTS | GEOMECHANICS | PROB. GEOMECH | HYDROLOGY | PROB. HYDRO | INTEGRATED

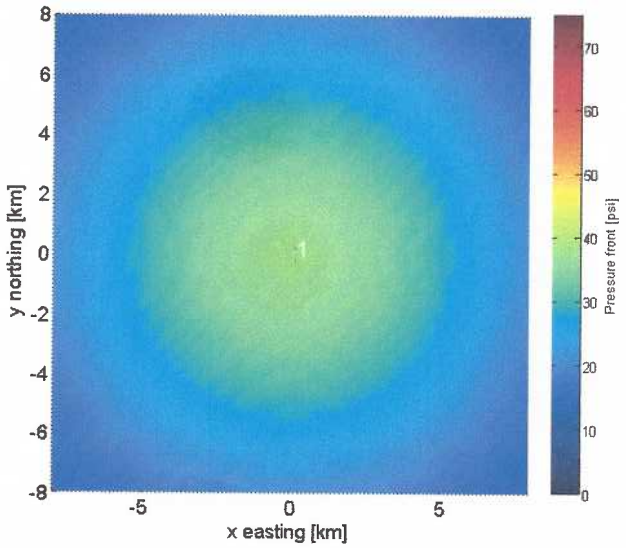
Fault Selector:

All Faults
Fault #1
Fault #2
Fault #3
Fault #4
Fault #5
Fault #6

Calculate

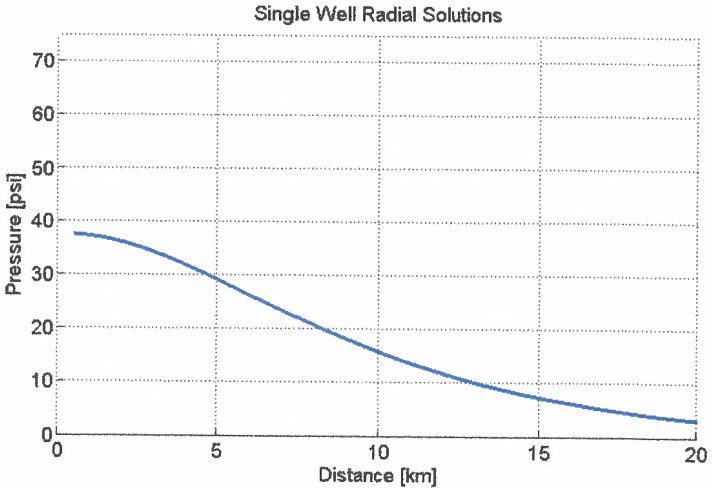
Max plot DP [psi]: 75

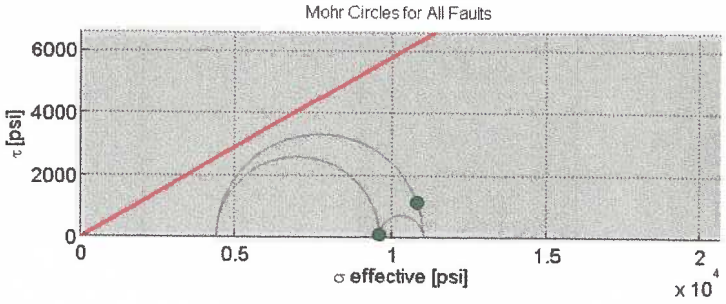
Select Well: All



Export Hydrology

Year: 2043





GENERATED PRESSURE FRONT AFTER MODELLED 20+ YEAR DISPOSAL

Fault Slip Potential vFSP 2.0

File Data Inputs Export Image Zoom

Fault Slip Potential

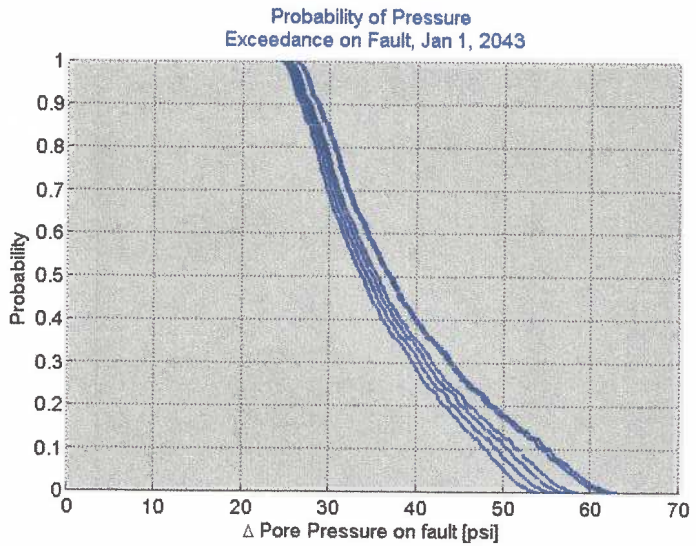
MODEL INPUTS | GEOMECHANICS | PROB. GEOMECH | HYDROLOGY | PROB. HYDRO | INTEGRATED

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

Calculate

Load Distributions | Run Analysis



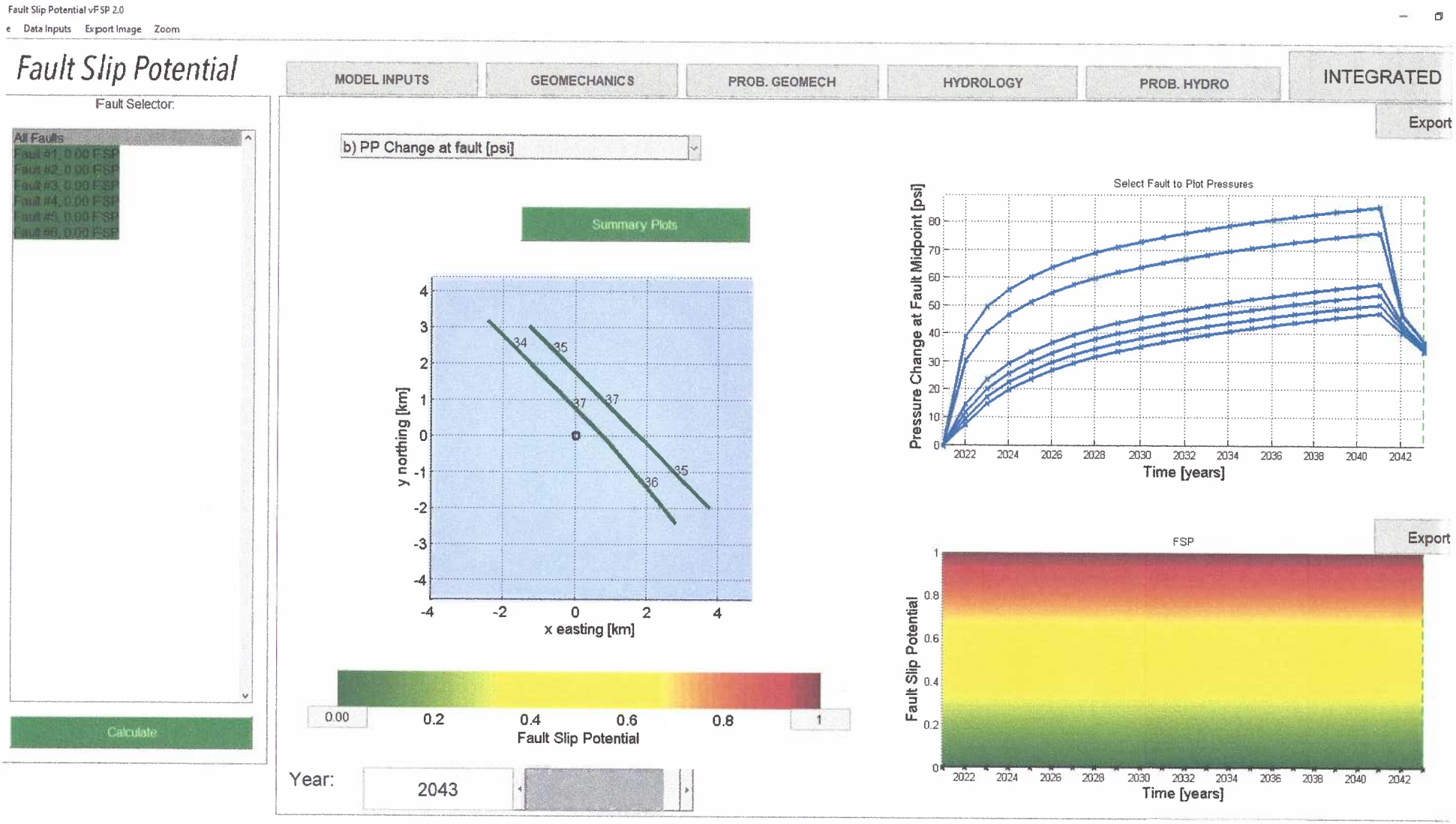
Max Delta PP [psi]: 70

Year: 2043

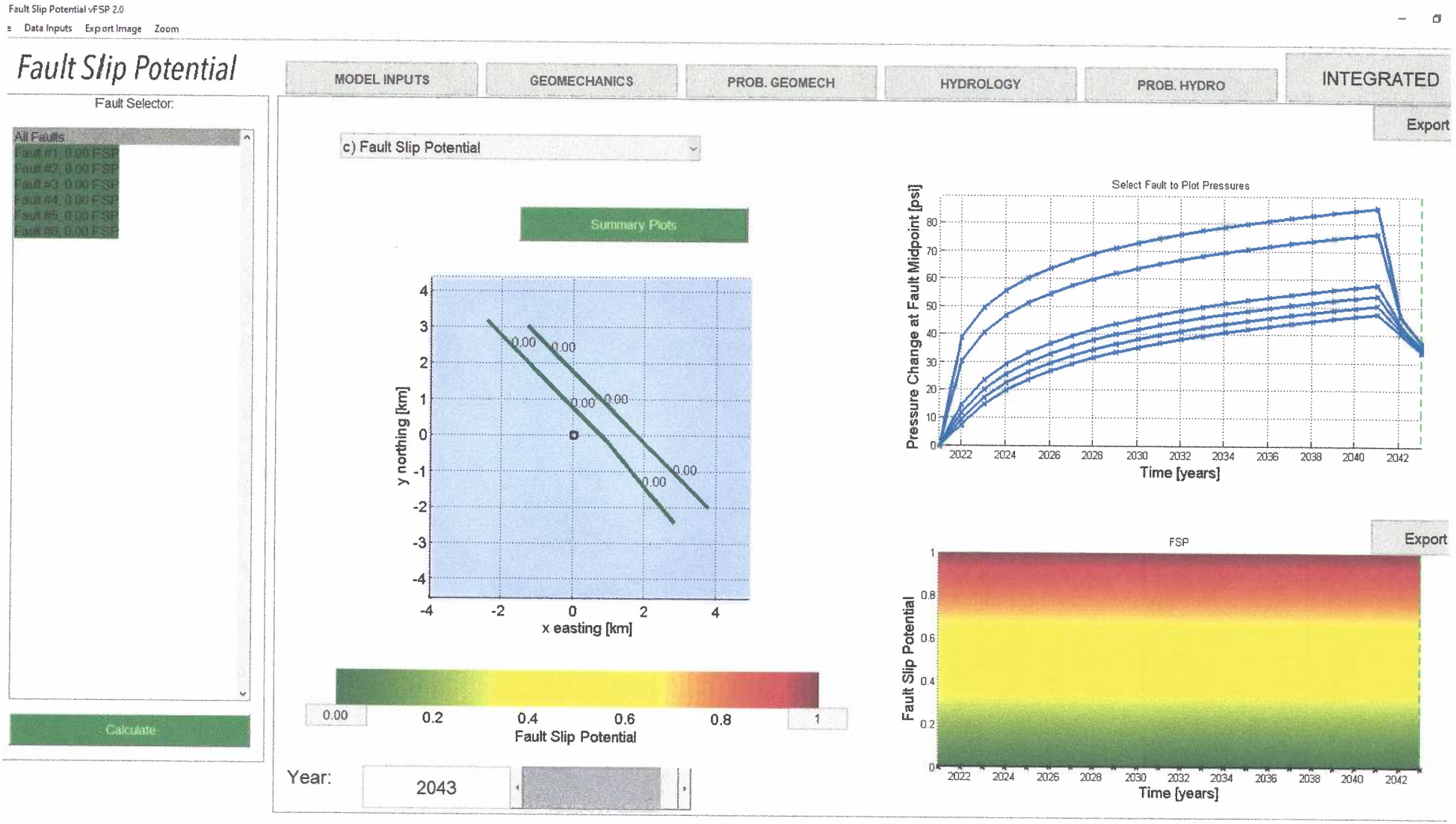
Export Blue Curves | Show Input Distributions

PROBABILITY OF PRESSURE EXCEEDANCE ON FAULT SEGMENTS IS SIGNIFICANTLY LESS THAN CONDITIONAL PROBABILITY OF SLIP

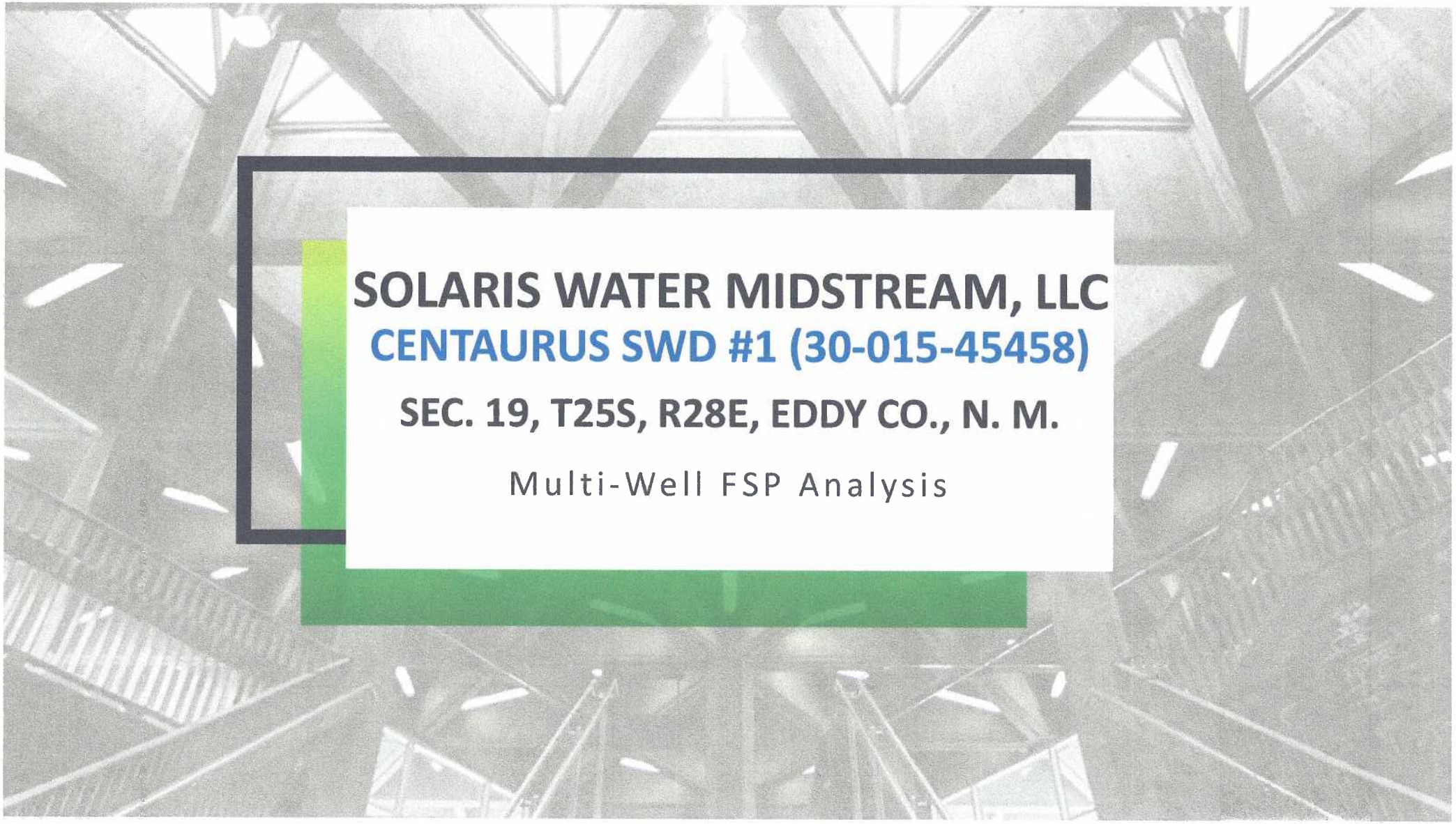
PROBABILITY OF PRESSURE EXCEEDANCE



PORE PRESSURE INCREASE AT FAULT SEGMENT MIDPOINTS OVER CENTAURUS SWD #1 MODELLED WELL LIFE



FAULT SLIP POTENTIAL AT SEGMENT MIDPOINTS



SOLARIS WATER MIDSTREAM, LLC

CENTAURUS SWD #1 (30-015-45458)

SEC. 19, T25S, R28E, EDDY CO., N. M.

Multi-Well FSP Analysis

Stress Data

◉ Specify All Three Stress Gradients [psi/ft]

○ Use A-Phi Model

Vertical Stress Gradient [psi/ft]	1.1
Max Horiz. Stress Gradient [psi/ft]	1.2
Min Horiz. Stress Gradient [psi/ft]	0.74
Max Hor Stress Direction [deg N CW]	35
Initial Res. Pressure Gradient [psi/ft]	0.43
Reference Depth for Calculations [ft]	14350

OK

STRESS DATA

Hydrology Data

- (•) Enter Hydrologic Parameters
- ( ) Load External Hydrologic Model

Aquifer Thickness [ft]	1000
Porosity [%]	7
Permeability [mD]	125

OK

HYDROLOGY DATA

Injection Wells

◉ Enter Wells Manually

○ Load Wells Complete .csv

Number of wells: 3

	x [km]	y [km]	Inj. Rate [bbl/day]	Start Year [yr]	End Year [yr]
1	0	0	35000	2021	2041
2	3.2	0.4	25000	2014	2034
3	-1.67	-1.92	86000	2019	2039
4					
5					
6					
7					
8					

OK

CENTAURUS SWD #1 AND OFFSET SWD's - MODELLED VOLUMES AND WELL LIFE

Fault Data

Number of faults (max 500): 6

Friction Coefficient mu: 0.58

○ Random Faults

◉ Enter Faults

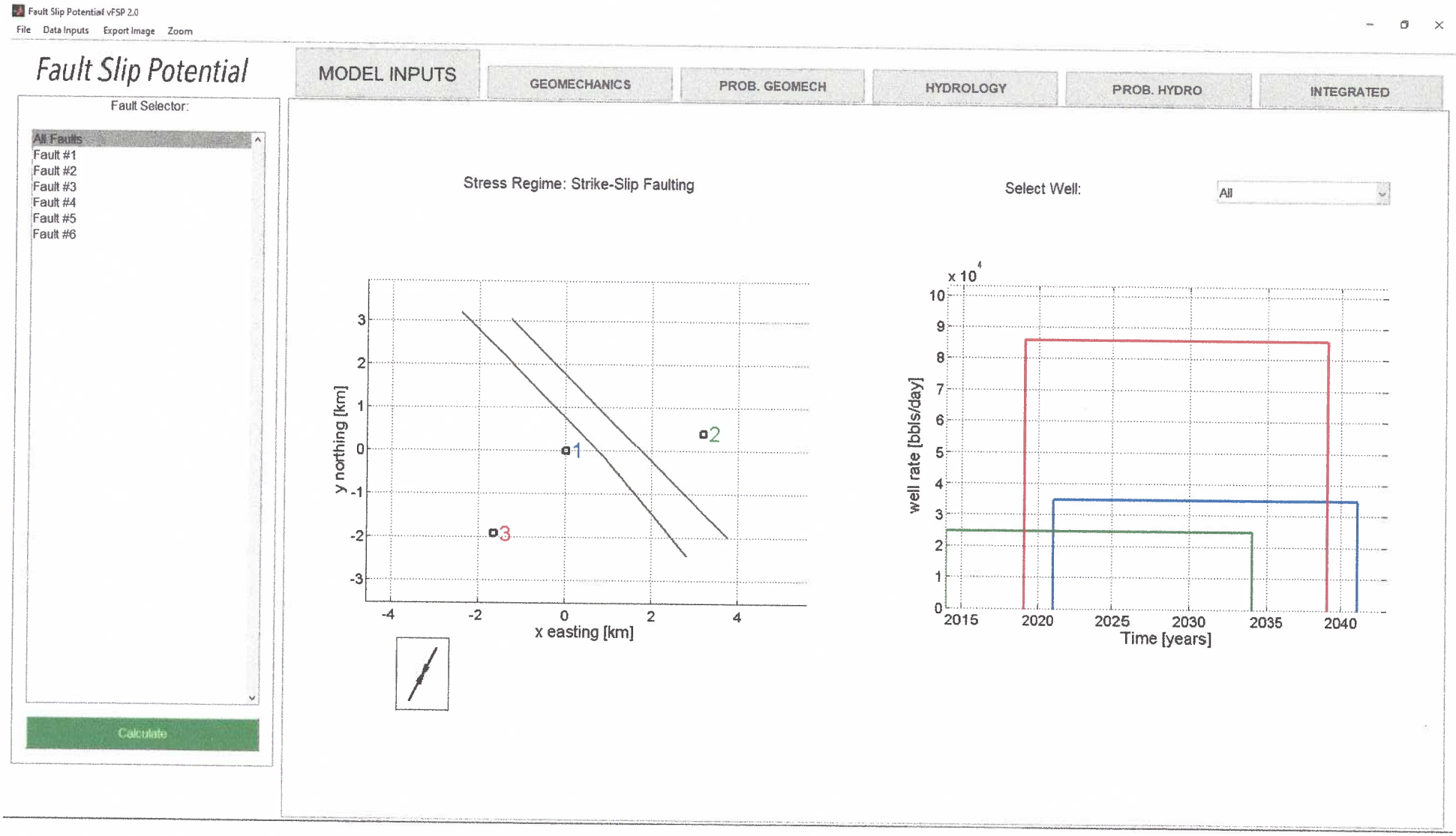
Select to type in faults or load a .csv file

	X [East km]	Y [North km]	Strike [Deg]	Dip [Deg]	Length [km]
1	2.7000	-0.9400	315	88	3
2	0.7500	1	315	88	2.5000
3	-0.7000	2.4500	315	88	1.6700
4	1.8500	-1.2800	320	88	3
5	-0.1700	0.9200	315	88	3
6	-1.8200	2.5800	315	88	1.7000

Load File | Help

OK

FAULT SEGMENTS AND ORIENTATIONS RELATIVE TO CENTAURUS SWD #1



LOCATION OF CENTAURUS SWD #1 AND OFFSET SWD'S RELATIVE TO FAULT SEGMENTS, AND MAXIMUM DAILY DISPOSAL VOLUMES OVER MODELLED TIME

Fault Slip Potential vFSP 2.0

File Data Inputs Export Image Zoom

Fault Slip Potential

MODEL INPUTS | GEOMECHANICS | PROB. GEOMECH | HYDROLOGY | PROB. HYDRO | INTEGRATED

Fault Selector:

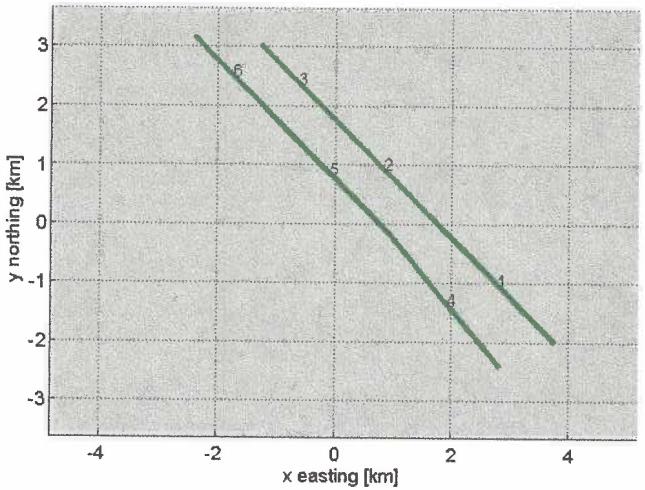
All Faults

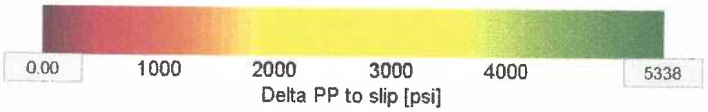
Fault #1
Fault #2
Fault #3
Fault #4
Fault #5
Fault #6

Calculate

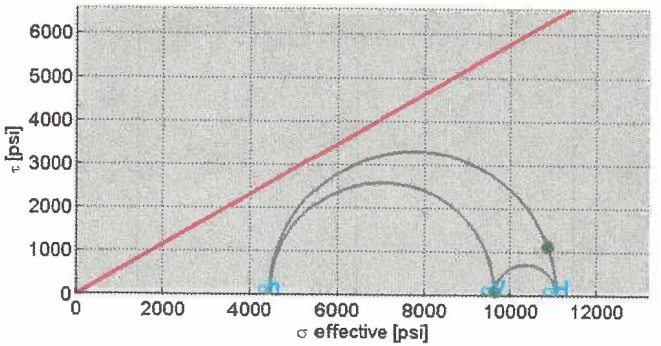
a) Fault Number

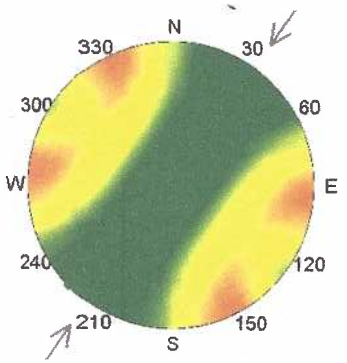
Help





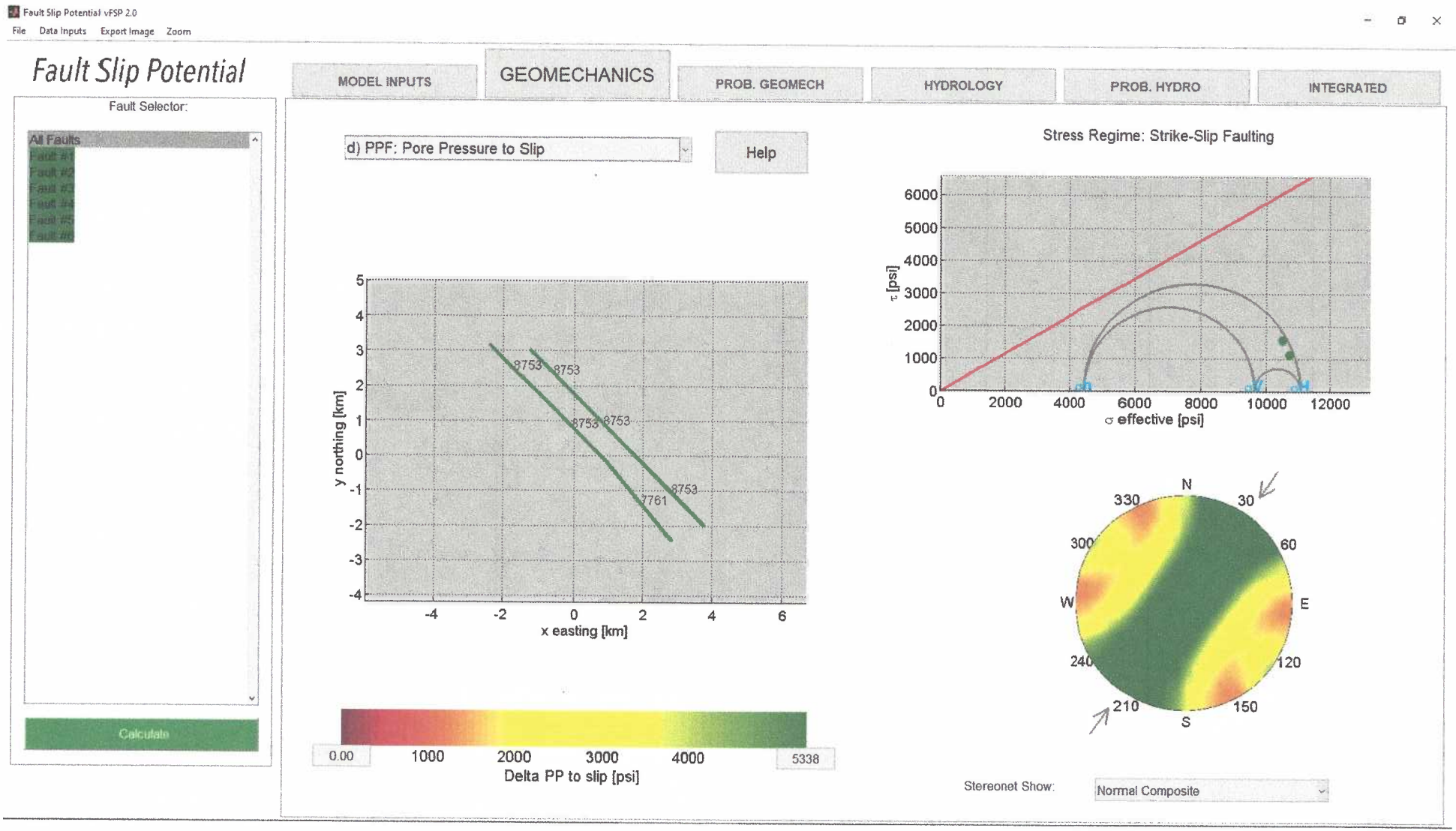
Stress Regime: Strike-Slip Faulting



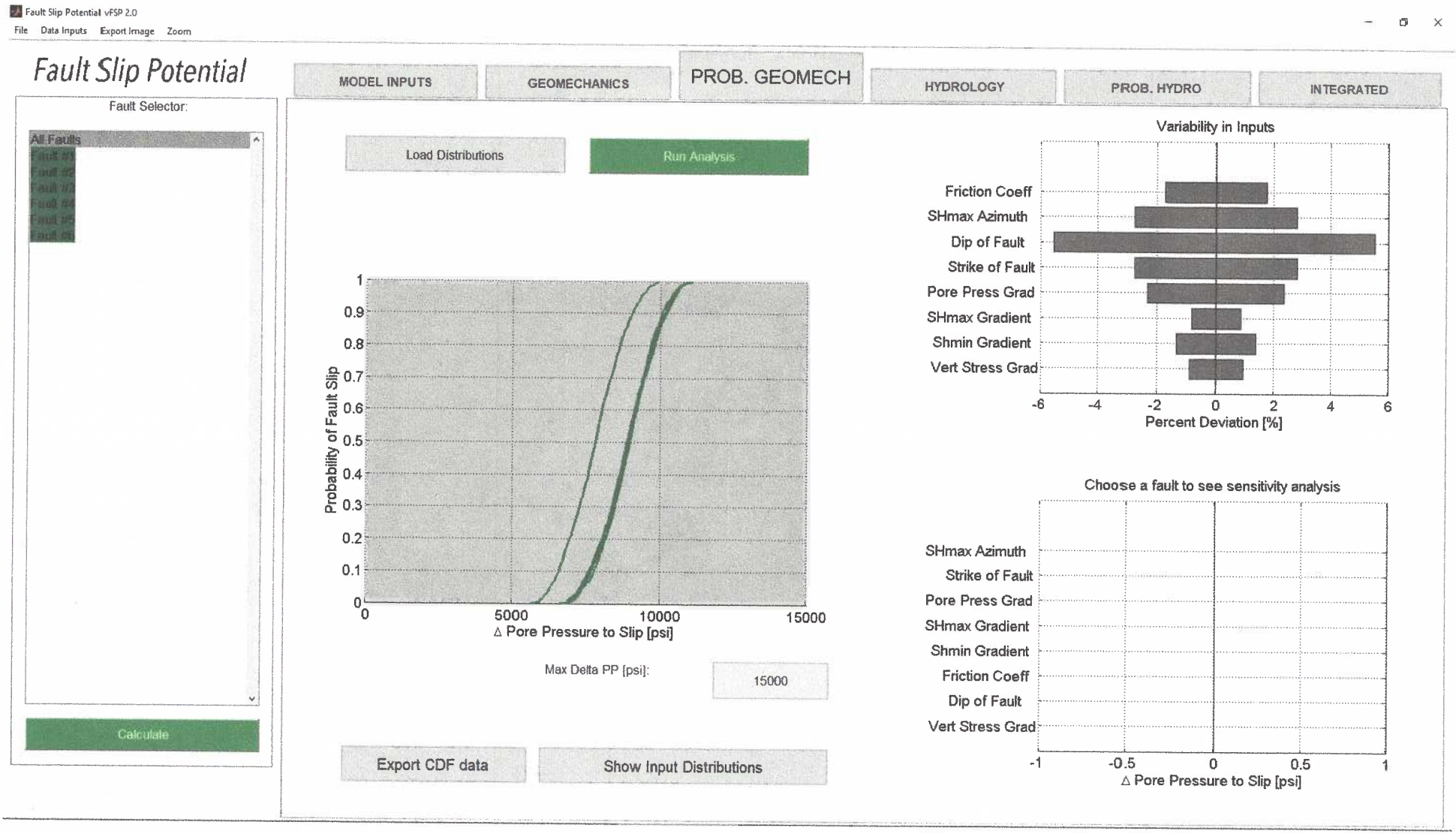


Stereonet Show: Normal Composite

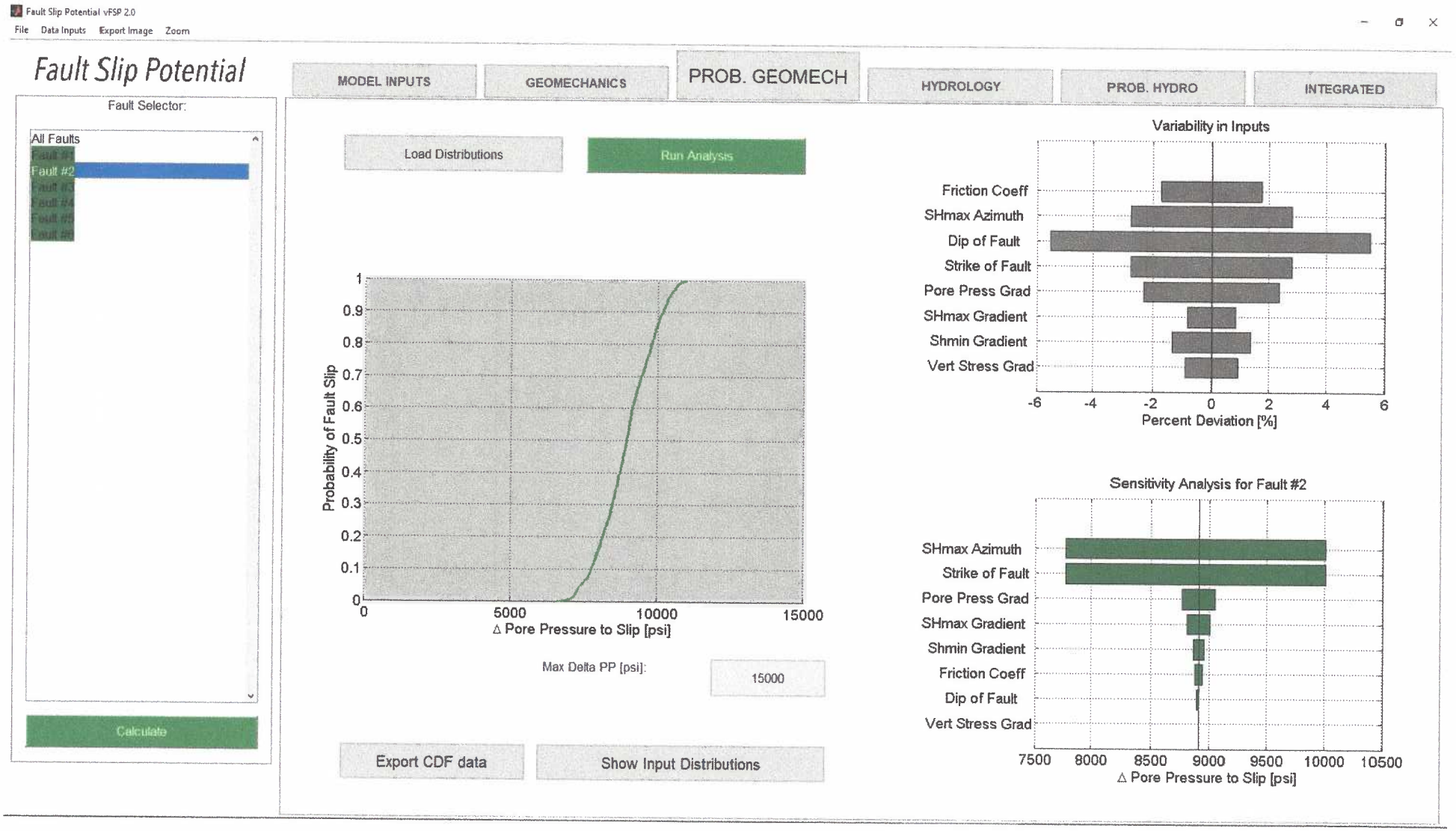
FAULT SEGMENTS



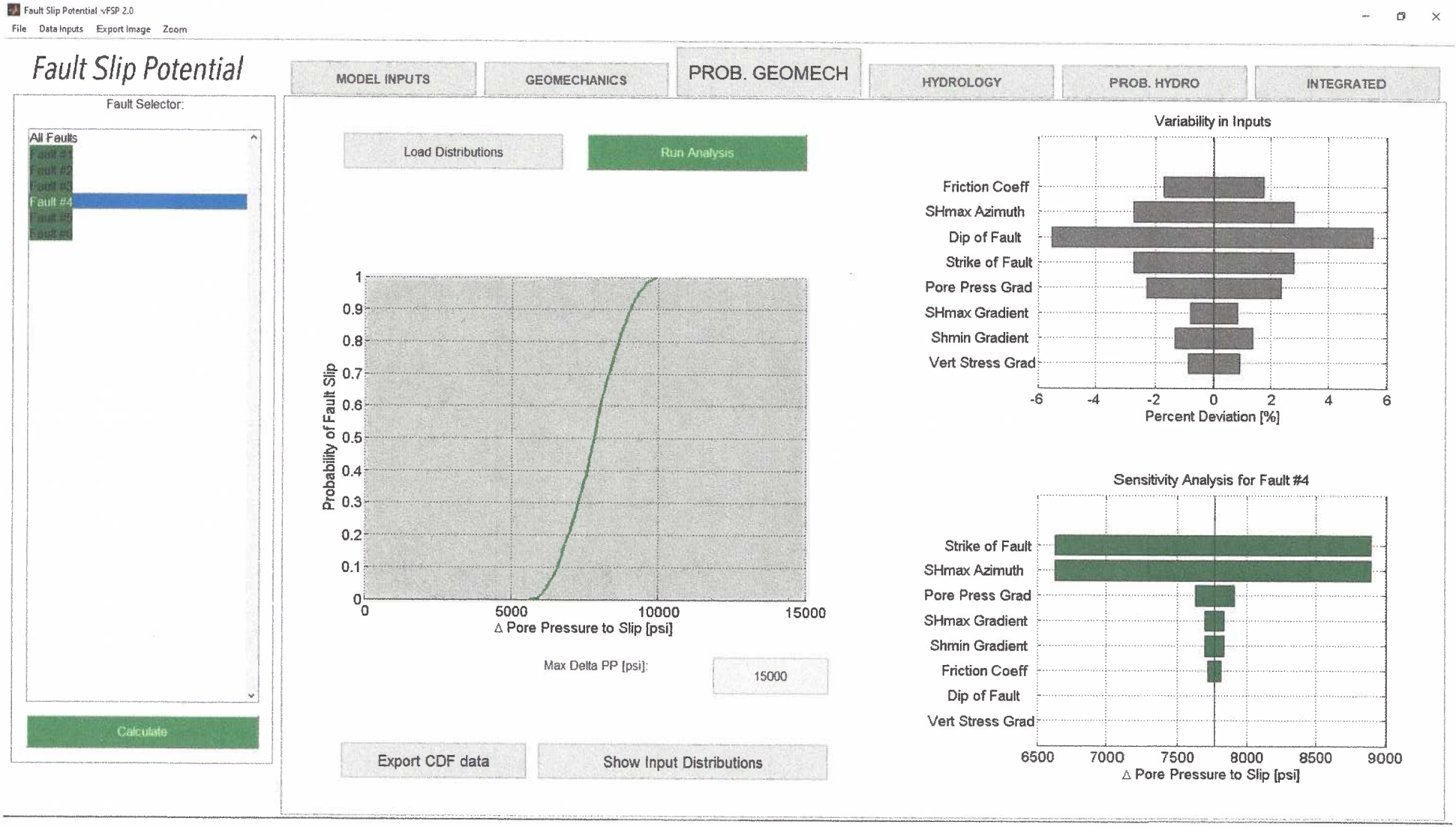
CALCULATED PORE PRESSURE INCREASE NEEDED AT FAULT SEGMENT MIDPOINTS TO GENERATE SLIP



FAULT SLIP PROBABILITY AS FUNCTION OF PORE PRESSURE INCREASE – ALL FAULT SEGMENTS



FAULT SEGMENT 2 CASE SENSITIVITIES



FAULT SEGMENT 4 CASE SENSITIVITIES

Fault Slip Potential vFSP 2.0

File Data Inputs Export Image Zoom

Fault Slip Potential

MODEL INPUTS | GEOMECHANICS | PROB. GEOMECH | HYDROLOGY | PROB. HYDRO | INTEGRATED

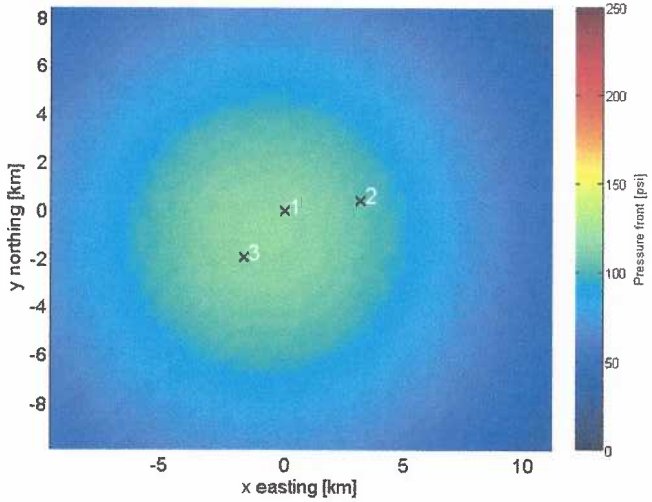
Fault Selector:

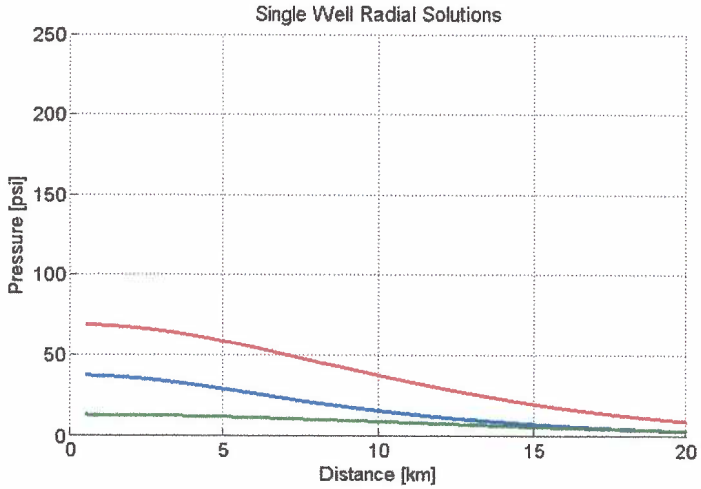
All Faults

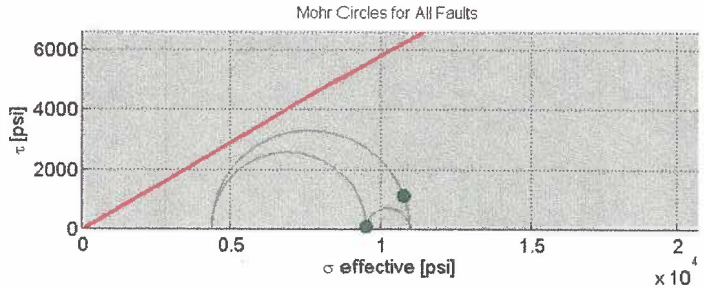
Calculate

Max plot DP [psi]: 250

Select Well: All



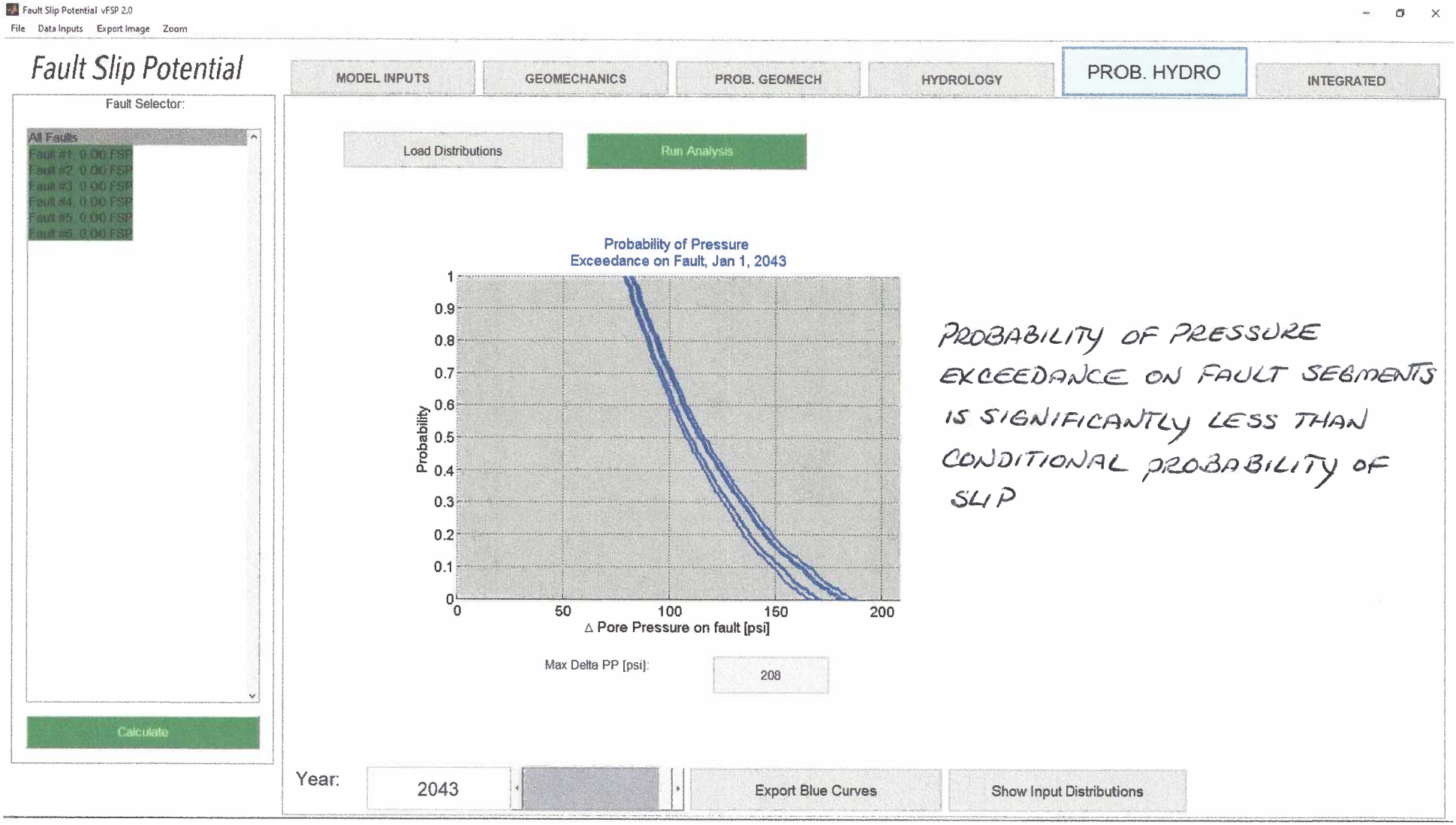




Export Hydrology

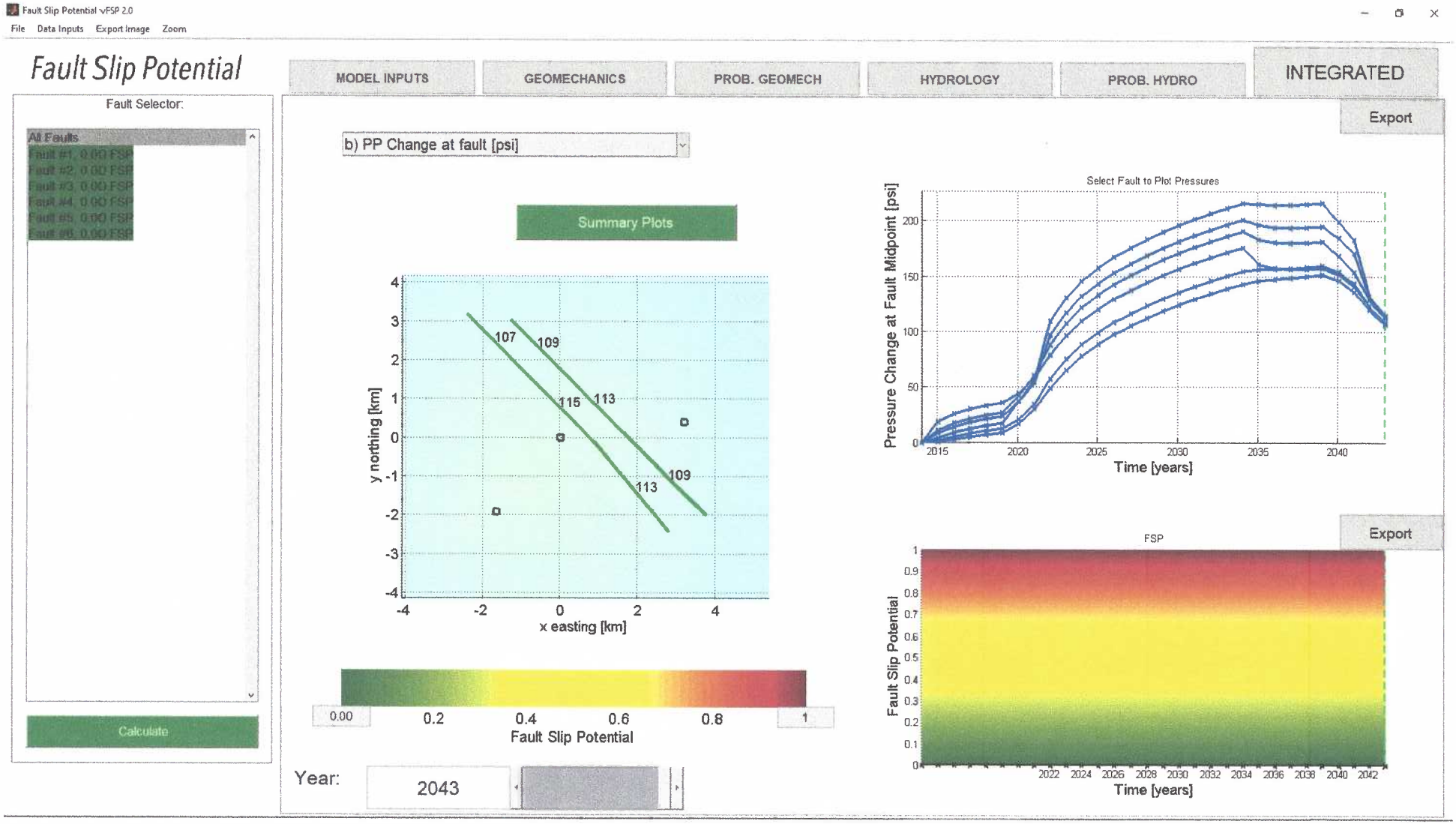
Year: 2043

PORE PRESSURE FRONT AFTER MODELLED 20+ YEARS

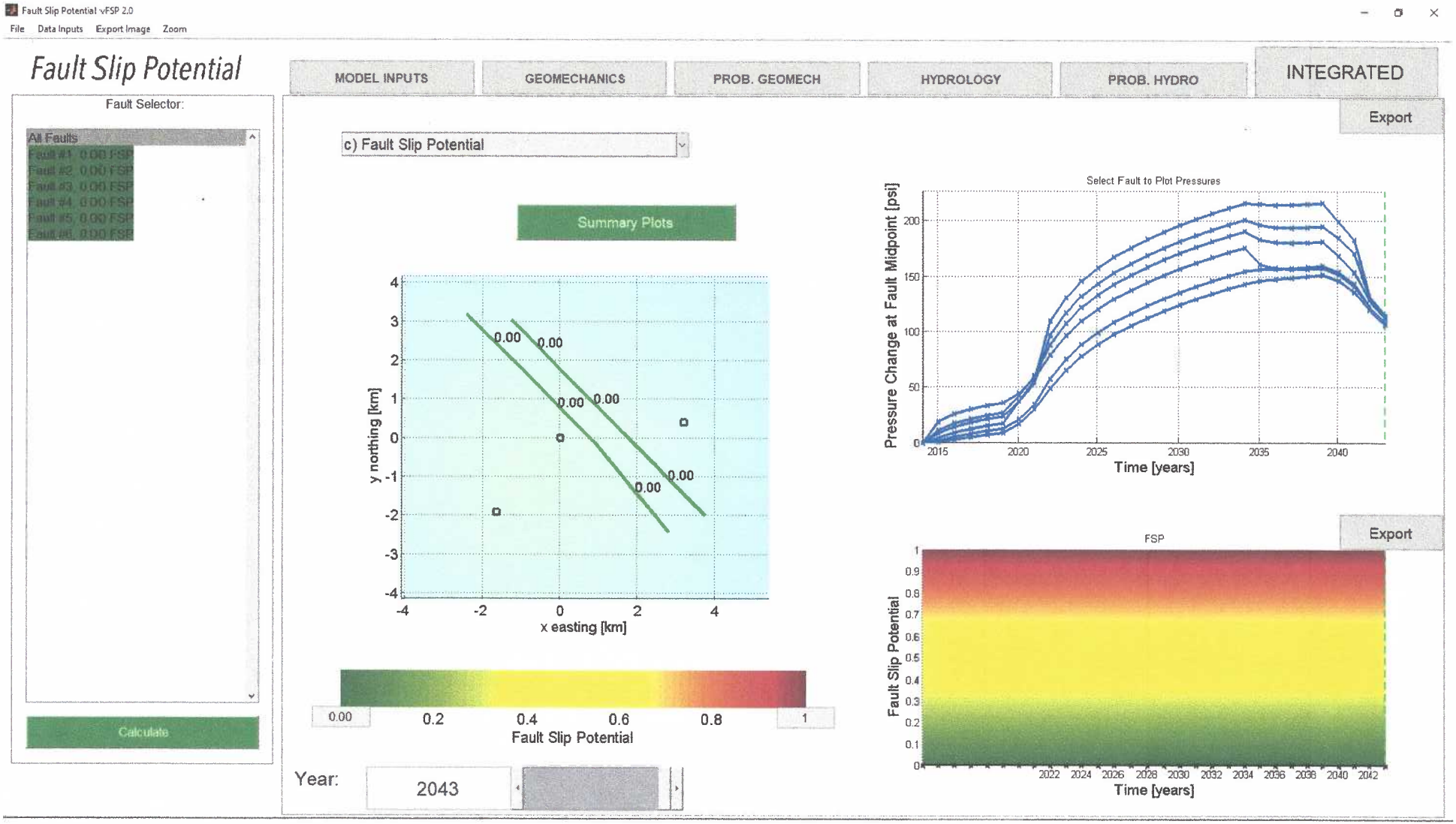


PROBABILITY OF PRESSURE EXCEEDANCE ON FAULT SEGMENTS IS SIGNIFICANTLY LESS THAN CONDITIONAL PROBABILITY OF SLIP

PROBABILITY OF PRESSURE EXCEEDANCE ON FAULT SEGMENTS



PORE PRESSURE INCREASE AT FAULT SEGMENT MIDPOINTS OVER MODELLED TIME GENERATED BY CENTAURUS SWD #1 AND OFFSET SWD's



HYDROLOGICAL AND GEOMECHANICAL CALCULATION OF FAULT SLIP POTENTIAL AT FAULT SEGMENT MIDPOINTS. SIMULATION SHOWS NO POTENTIAL FOR FAULT SLIP

SUMMARY

- Modelled faults are two USGS-BEG confirmed NW-SE trending Basement and Woodford involved faults northeast of the Centaurus SWD #1.

- The Centaurus SWD #1 and two offset SWD's within the designated two-mile radius of investigation were modelled at maximum daily permit volumes over a 20+ year well life.

- Investigation of historical seismicity in a 100 sq. mile area centered on the proposed location did not identify any seismic events of >2.0 magnitude.

- Input hydrology and reservoir parameters were derived from offset well control and regional Devonian character. Calculation reference depth is the midpoint depth of the anticipated disposal interval.

CONCLUSIONS

- Calculated pore pressure increase necessary to generate slip on projected faults varies from 7761-8753 psi contingent on fault segment length and orientation relative to regional principal stresses.

- Pore pressure increase at fault segment midpoints attributable to the single well Centaurus SWD #1 model varies from 34 to 37 psi.

- As a standalone case, there is **no potential for the Centaurus SWD #1 to induce fault slip on any fault segment**.

- Pore pressure increase at fault segment midpoints generated by Centaurus and two offset SWD's over 20+ year model life varies from 107 to 115 psi.

- Integrated geomechanical and hydrological analyses indicate **Centaurus and offset SWD's have no potential to induce fault slip on any fault segment.**

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