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June 24, 2022

Stephen H. Lee, Director
Louisiana Department of Natural Resources
Injection and Mining Division
617 N. 3rd Street
Baton Rouge, Louisiana 70802

Re: Response to Compliance Order No. IMD 2022-027
Eagle US 2, LLC – Wells 6X (SN 971286) & Well 7B (SN 67270)

Dear Mr. Lee,

This response letter is submitted on behalf of Eagle US 2, LLC ("Westlake") who received Compliance Order No. IMD 2022-027 on April 25, 2022. The order listed certain findings of fact, and orders requiring a response by June 24, 2022.

Orders:

1. Eagle is ordered to pay a Civil Penalty in the amount of **$32,500.00** in reference to PPG 006-X (SN 57788) for the failure to provide the required 24-hour notice and the required 5-day written notice in accordance with LAC 43:XVII.3309.1.8.
2. Eagle is ordered to pay a Civil Penalty in the amount of **$32,500.00** in reference to PPG 007B (SN 67270) for the failure to give the required 24-hour notice and the required 5-day written summary in accordance with LAC 43:XVII.3309. 1.8.
3. Payment of the total Civil Penalty of **$65,000.00** shall be made online or by check and made out to the Office of Conservation and shall be received no later than 20 days from your receipt of this Order. Please submit your payment with the attached invoice. Eagle is ordered within 60 days to prepare and submit a robust plan to determine the source of anomalous pressure in all affected caverns.
4. Eagle is ordered within 60 days to prepare and submit a plan to evaluate historical and current subsidence at the Sulphur Mines salt dome using InSAR subsidence monitoring.
5. Eagle is ordered within 60 days to prepare and submit a plan to monitor seismic activity on and around the Sulphur Mines salt dome.
6. The Commissioner of Conservation reserves the right to require further investigative and remedial actions as may be deemed necessary.
7. The Commissioner reserves the right, pursuant to La R.S. 30:1 et seq., more specifically La R.S. 30:18(A)(6), to levy additional civil penalties or other sanctions as provided by law.

Responses to Applicable Orders:

1. Westlake has paid the civil penalty.
2. Westlake has paid the civil penalty.
3. Westlake has paid the civil penalty within the required time period, and has the following comments regarding the plan to determine the source/cause of the anomalous pressure event.
    a) Westlake has performed the following diagnostic analysis in consideration of "on-dome" sources of the anomalous pressure event:
        - A review of surface pressure and solution mining flow rate operating data for all Westlake caverns was completed.
            - Other than the reported anomalous pressure event on Cavern 6 and 7, there were no other sustained anomalous pressure events identified on other Westlake caverns.
            - There was no evidence identified that the anomalous pressure event on Cavern 6 and 7 was caused by the operation of any other active or inactive Westlake cavern.
        - A review of historical sonar surveys for Cavern 6 and 7 were completed, and compared to recent sonar surveys completed in March 2022. Additionally, a review of cavern-to-cavern and cavern-to-flank geospatial measurements were completed.
            - No indications of a cavern geometry change were identified that would cause an anomalous pressure event.
            - No indications of a significant change in geospatial measurements were identified.
            - Additional details of the above analysis are presented within *Attachment No. 3*.
        - Westlake was not provided data from Boardwalk Pipeline (the other operator on the dome with active hydrocarbon storage caverns), however, verbal communication with Boardwalk indicated that no anomalous pressure events were observed on their caverns.
        - Westlake did not review any pressure data from the abandoned caverns on the Sulphur dome (Liberty Gas No. 1, Liberty Gas No. 2, Vista No. 1-A, and Sasol No. A-1) because those caverns do not have the ability for surface pressure acquisition or entry into the cavern.
    b) Westlake has performed a cursory review of certain "off-dome" wellbores and operations based on publicly available date, and how those assets/operations may have interacted with the Sulphur dome in potentially causing the observed anomalous pressure event on Cavern 6 and 7. These preliminary findings were presented to the DNR on June 13, 2022 via video-call.

- To further investigate the findings and theories, Westlake requested of the DNR to support in the acquisition of certain data that would otherwise be unavailable to Westlake. The DNR was supportive of this request and continuing the investigation; therefore, Westlake is currently developing a formal data request to submit to the DNR.

4. Westlake has developed a plan to evaluate historical and current subsidence at the Sulphur Mines salt dome using InSAR subsidence monitoring.
    a) This plan is included as *Attachment No. 1*.
5. Westlake has developed a plan to monitor seismic activity on and around the Sulphur Mines salt dome.
    a) This plan is included as *Attachment No. 2*.
        - This plan was presented to the LDNR on June 13, 2022.
6. Since the most recent referenced document and date within the Findings of Fact section of the compliance order (March 10, 2022), Westlake has completed additional investigative actions on the subject wells/caverns as follows:
    a) Completed a pressure/temperature/density log (each well)
        - No anomalies identified.
    b) Completed a directional survey log (each well)
        - Utilized in geo-spatial displacement verification.
    c) Completed a sonar survey (each cavern)
        - Utilized in historical sonar overlay evaluation.
    d) Withdrawal of the existing gas cap on PPG 7B
    e) Completed a nitrogen interface Casing and Cavern MIT (each well/cavern)
        - MIT results confirm mechanical integrity at the time of the tests, at effective casing shoe pressure gradients of 0.63 psia/ft (PPG 6X) and 0.62 psia/ft (PPG 7B).
    f) Completed in-depth historical evaluation of sonar surveys and geo-spatial displacements (each cavern)
        - Included as *Attachment No. 3*
    g) As discussed with the DNR during the June 13 conference call, an ongoing oil withdrawal operation on Cavern 7 will continue until all recoverable oil is withdrawn. This oil is presumed to be residual oil from historic solution mining and/or storage operations.

If there are any questions, please contact Josh Bradley (Eagle US 2, LLC) or Coleman Hale (Lonquist & Co., LLC).

Sincerely,

R. Coleman Hale
Vice President
Lonquist & Co., LLC

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ATTACHMENT NO. 1

INSAR SUBSIDENCE MONITORING PLAN

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InSAR Analysis of Ground Displacement

Historical Investigation and Future Monitoring

Sulphur Dome
Westlake Chemical

June 2022

Westlake Chemical

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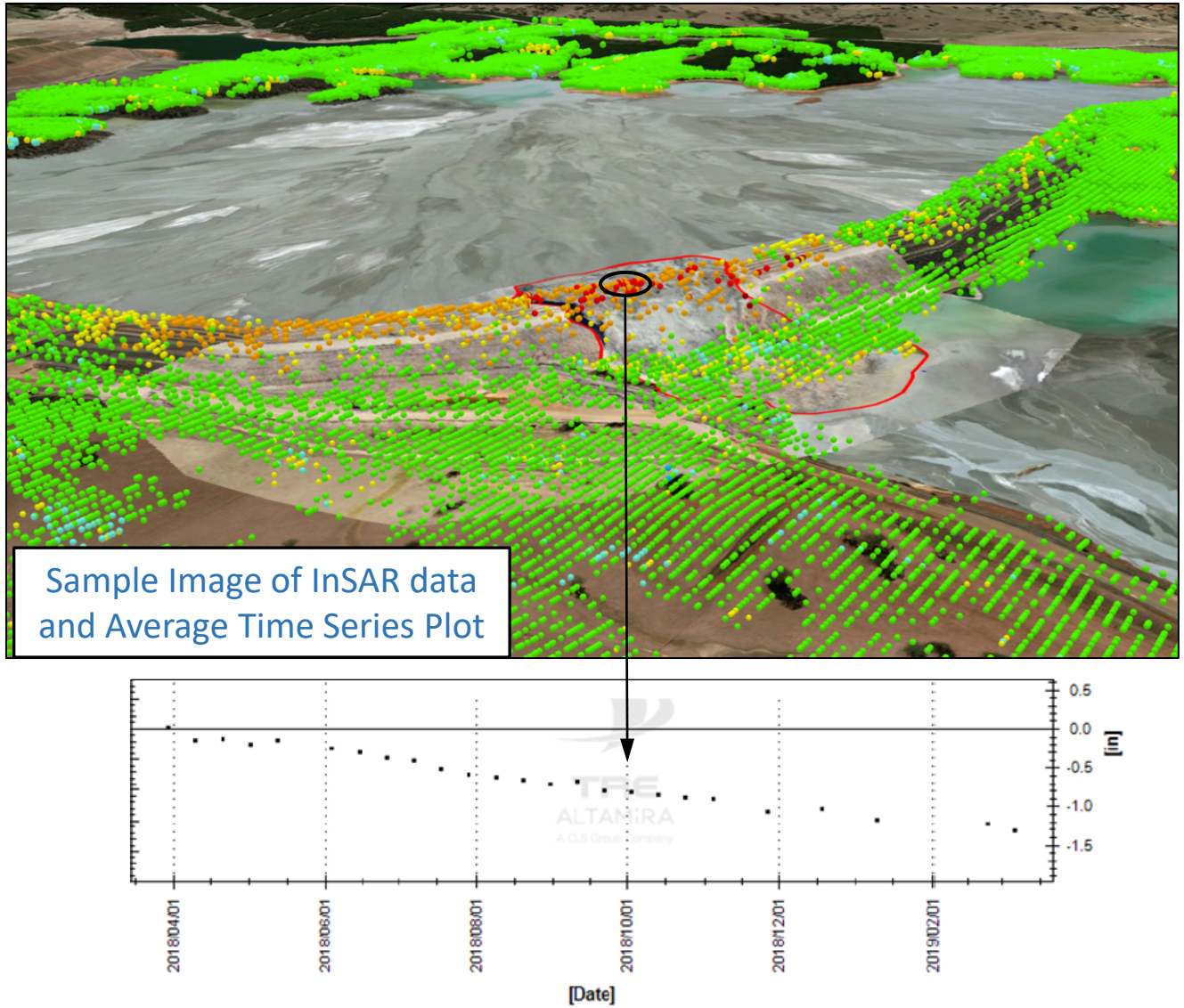
InSAR Evaluation Method Technical Information

Overview of InSAR Monitoring Technique

- InSAR analysis identifies and monitors the movement of natural targets on the ground
- Point cloud of measurement points (MP) is generated in analysis
- MP Attributes:
  - Annual displacement rate [in/yr]
  - Time Series of displacement [in]
  - 1-D (Line of Sight - LOS)
- Measurement precision
  - Rate: ±0.01 in/yr
  - Single measurement: ±0.20 in



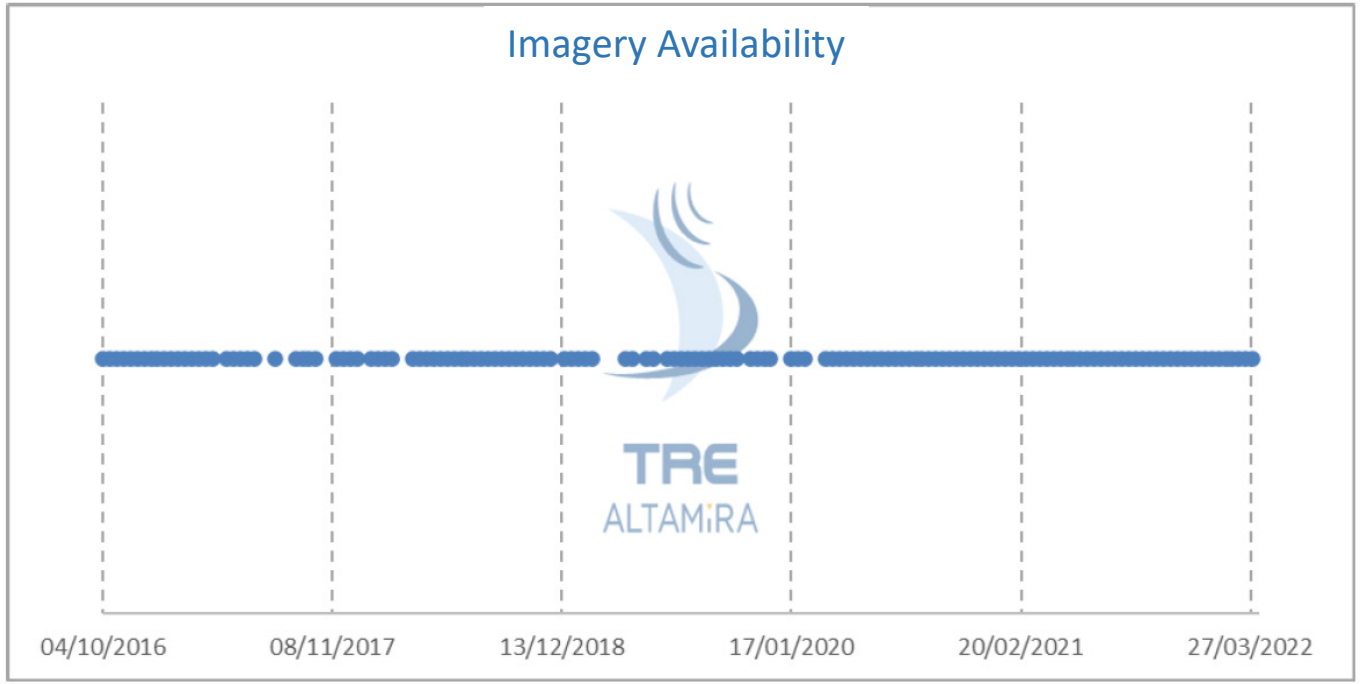
Data Coverage and Point Density

- The density and coverage of measurement points (MP) depends on the satellite signal parameters, surface characteristics and changes over time in the investigation area:
  - MP density increases with the satellite resolution
  - MP density and coverage is generally low over:
    - Vegetated areas and low reflectivity areas (i.e. areas where the signal backscattered to the satellite is low)
    - Areas affected by temporal decorrelation (i.e. radar signal is not coherent over time), which is generally associated with:
      - Seasonal surface changes, such as intermittent flooding in marshes and wetlands
      - Rapid surface changes, such as active operations areas
      - Fast movement (displacement rate >1 meter/yr)
  - No measurement of ground displacement is possible beneath water bodies

Parameters of Historical InSAR Evaluation at Sulphur Dome

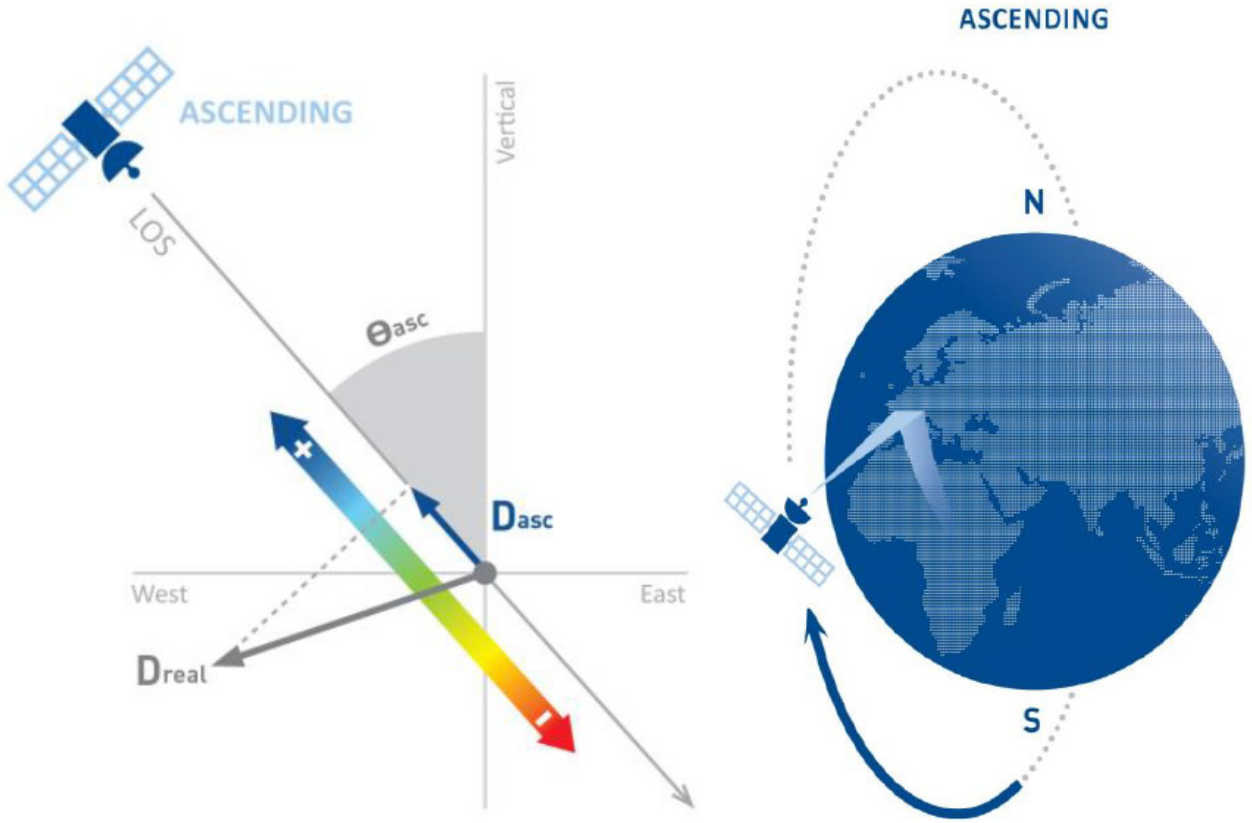
- 1-D Analysis
  - Line-of-sight (LOS) displacement results
- Imagery:
  - Satellite: Sentinel 1 (SNT)
  - Resolution: 66 x 16 ft
  - Acquisition Frequency: 12 days
  - Orbit: Ascending
- Historical Analysis:
  - October 4, 2016 – April 12, 2022
  - ~5.5-year time period

Satellite	Orbit	Wavelength	Resolution	Acquisition Frequency	LOS Date Range	# Images
Sentinel-1 (SNT)	Ascending Θ = 42.59°	C-band	Low-res 66x16 ft	12-day	04 Oct 2016 – 12 Apr 2022	146



Parameters of Historical InSAR Evaluation at Sulphur Dome

- Ascending satellite orbit views the Sulphur Dome from the West
- Ground displacement is only reported with respect to changes in the distance between the satellite and the measurement point
  - The first image to the right is meant to clarify this, showing a side view of the measurement method with the satellite to the west
  - The perpendicular projection of a hypothetical "real" movement (D_{real}) on the ascending satellite Line-of-sight (D_{asc}) is what is captured
  - The same "real" movement produces different readings from the LOS of different satellites



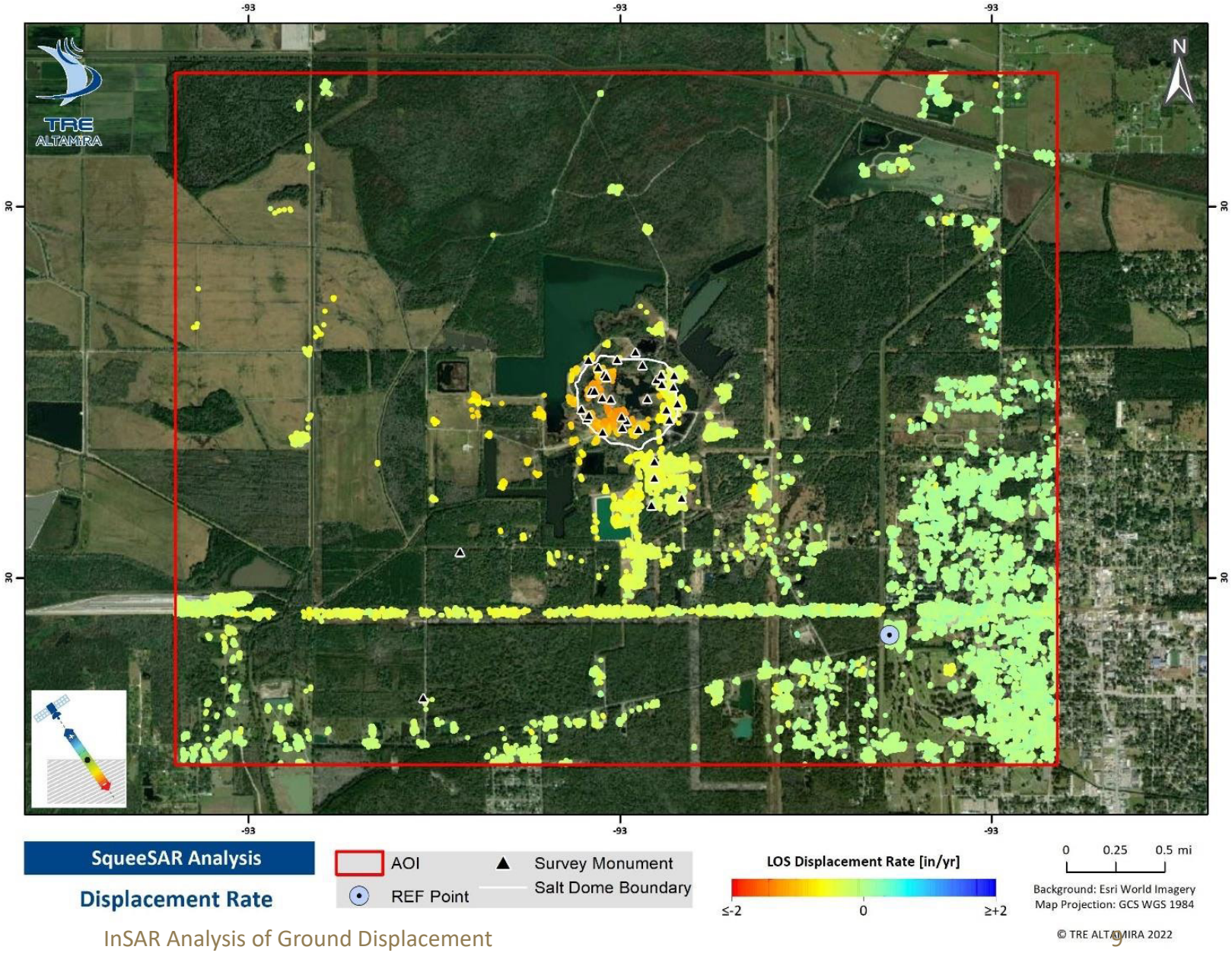
InSAR Subsidence Evaluation Plan

Historical InSAR Subsidence Evaluation

- Westlake proposes to evaluate historical InSAR data across the Sulphur Dome covering the time period from October 2016 - April 2022
  - First objective: Determine if there is recent ground displacement that diverges from historical trends leading up to or following the pressure loss event in PPG 6X and PPG 7B in the vicinity of those wells
    - Analysis has been performed by TRE-Altamira (May 24, 2022)
    - No evidence of recent change in subsidence trend across measurement points evaluated on west side of dome

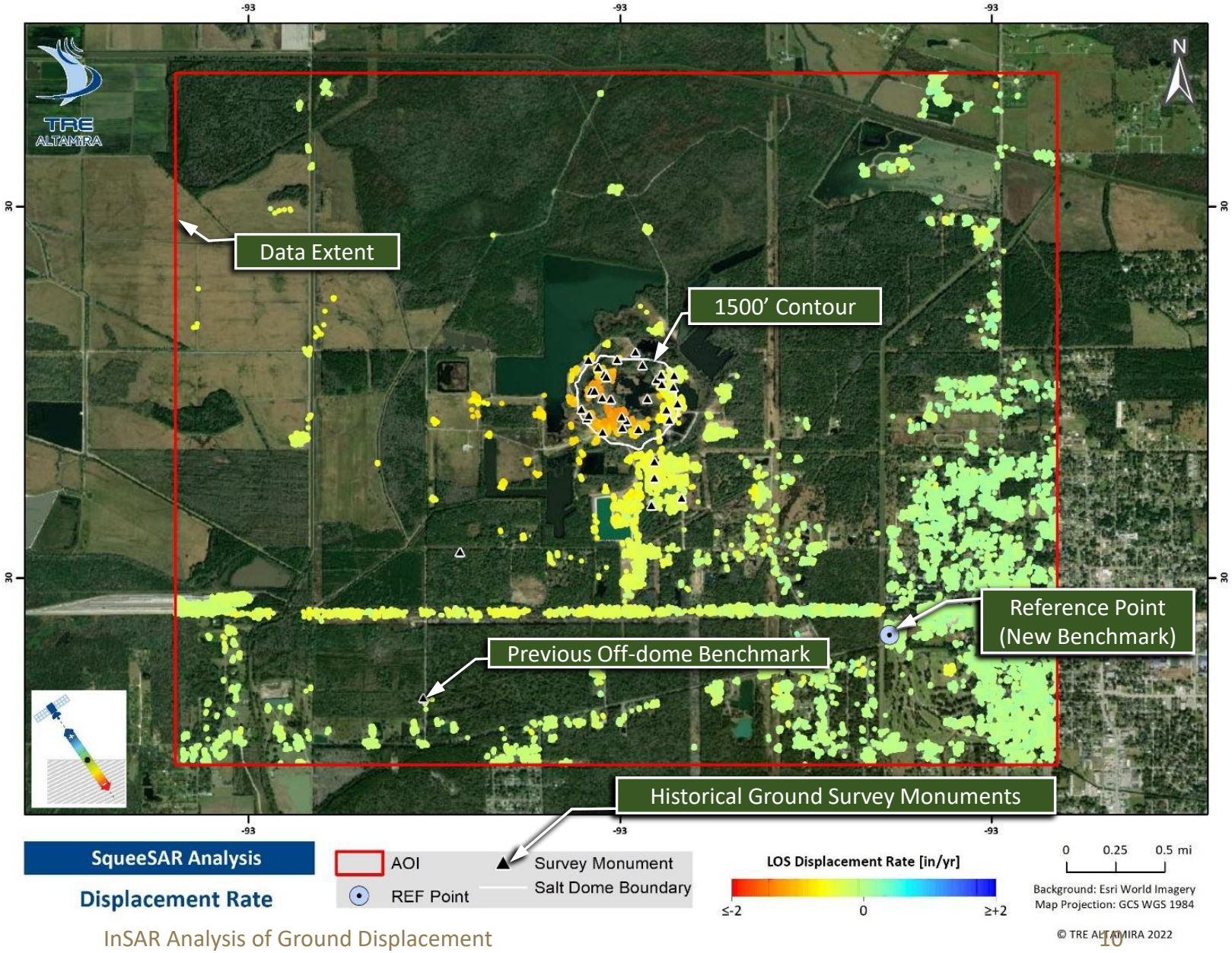
Historical InSAR Subsidence Evaluation

- Overview map from TRE-Altamira Historical Ground Displacement Evaluation



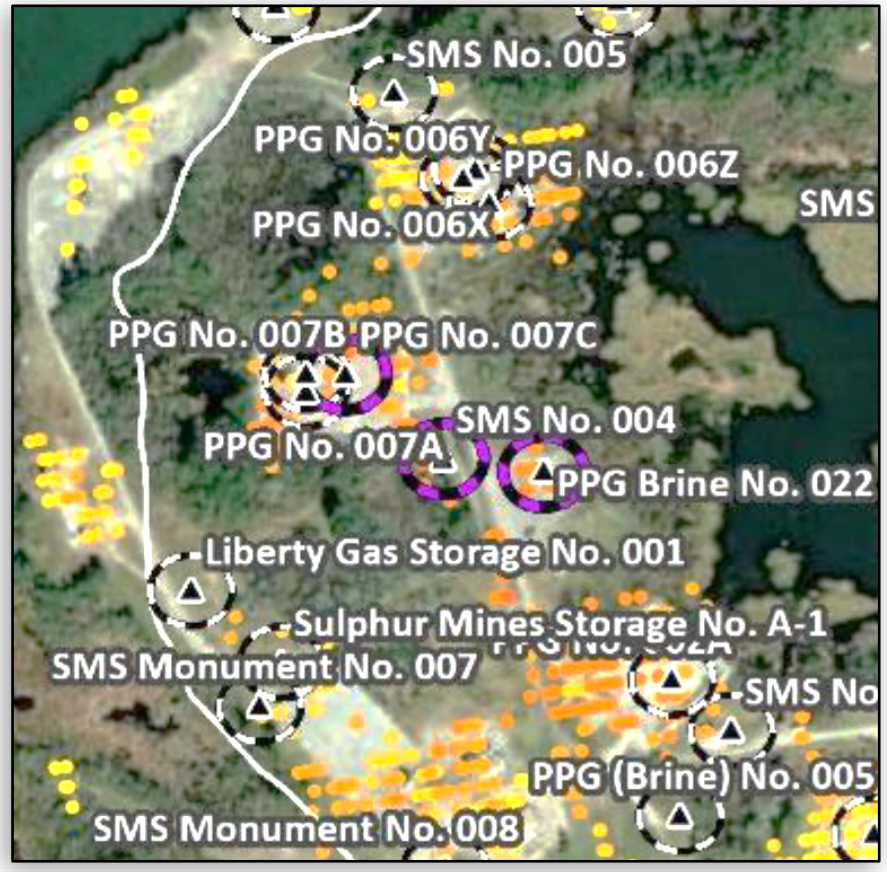
Historical InSAR Subsidence Evaluation

- Overview map from TRE-Altamira Historical Ground Displacement Evaluation
- Evaluation area encompasses full extent of historical ground survey monuments including off-dome benchmark
- Coverage density is heavily affected by ground cover
- Previous off-dome benchmark area was found to be subsiding too much to use as reference point



Historical InSAR Subsidence Evaluation

- Time plot from report highlighting 5.5-year ground deformation trends for three point groups on west side of dome. Pressure loss date has been notated on plot.



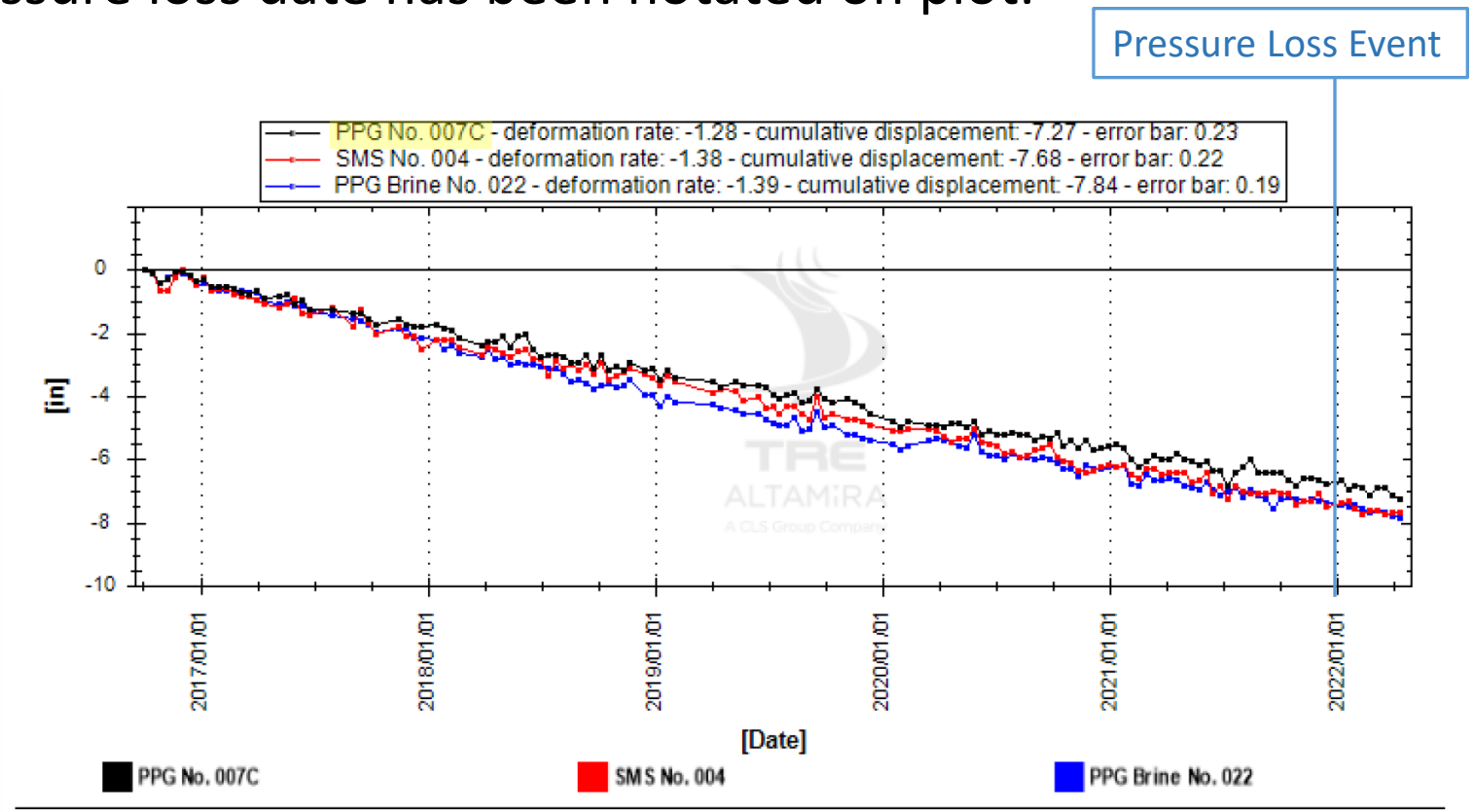


Figure 10. ATS polygons showing the most subsidence near monuments over the west side of the salt dome.

Historical InSAR Subsidence Evaluation

- A detailed follow-up analysis of the historical evaluation is planned that will:
  - Compare historical subsidence evaluations to the results of the InSAR evaluation
  - Provide displacement time plots, trend comparisons, velocities and accelerations for all monuments or areas of interest in the vicinity of PPG 6 & 7
  - Discuss the analysis parameters, i.e. signal wavelength and resolution, line-of-sight (LOS) angle, spatial data gaps and propose best options for annual monitoring based on lessons learned

Annual InSAR Subsidence Evaluation

- Westlake proposes to continue InSAR monitoring on an annual basis
  - Higher resolution satellite will be used to increase measurement point density
  - Based on evaluation and discussions related to historical analysis, various other adjustments to analysis method may be proposed:
    - Satellite selection based on Line-of-sight (LOS) angle
    - Methods to reduce measurement point gaps across the dome
      - i.e. Installation of Corner Reflectors
    - Establish boundaries and locations for point groups that will be averaged to imitate traditional survey of wellhead monuments

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ATTACHMENT NO. 2

MICRO-SEISMIC MONITORING PLAN

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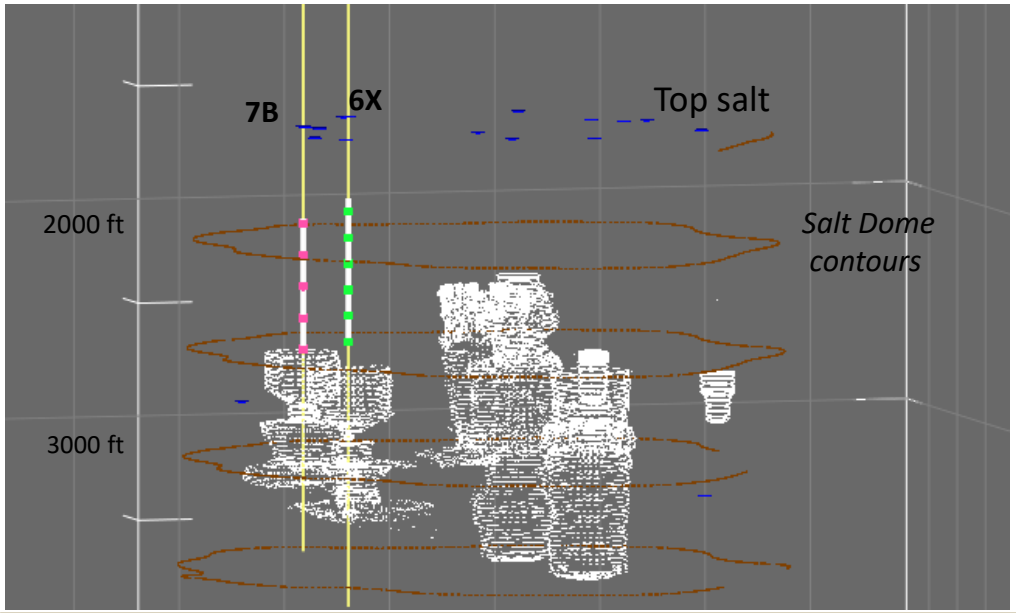
Draft Plan to Monitor Seismic Activity on and around the Sulphur Mines Dome, Louisiana

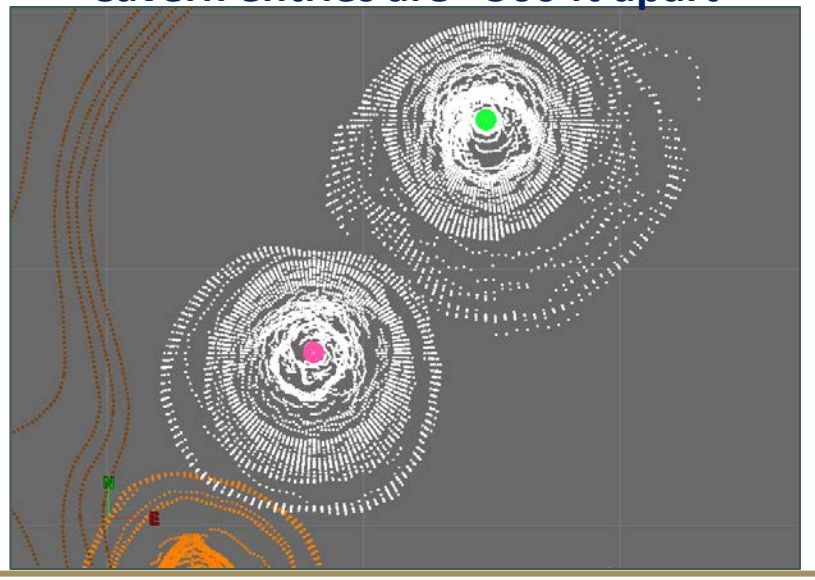
June 13, 2022

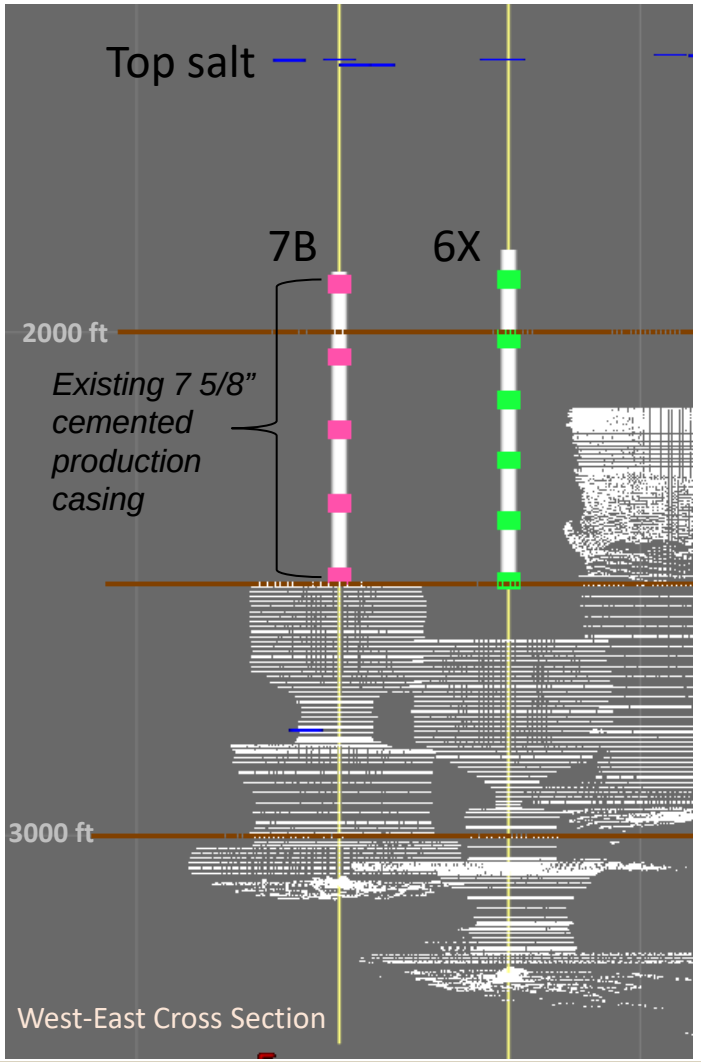
Draft plan for monitoring seismic activity on and around the Sulphur Mines Dome

- Place analog geophones in the existing 7-5/8” cemented production casing on inactive cavern wellbore entries PPG 6X & 7B (operated by Eagle US 2, LLC) to monitor seismicity on and around the the Sulphur Mines salt dome.
  - PPG 6X: Six 3C geophones
  - PPG 7B: Five 3C geophones
  - 600 foot geophone array aperture in each well
  - Top sensors ~1,900 ft depth; bottom sensors ~2,500 ft depth (near the 7 5/8” casing shoe)



Cavern entries are ~560 ft apart





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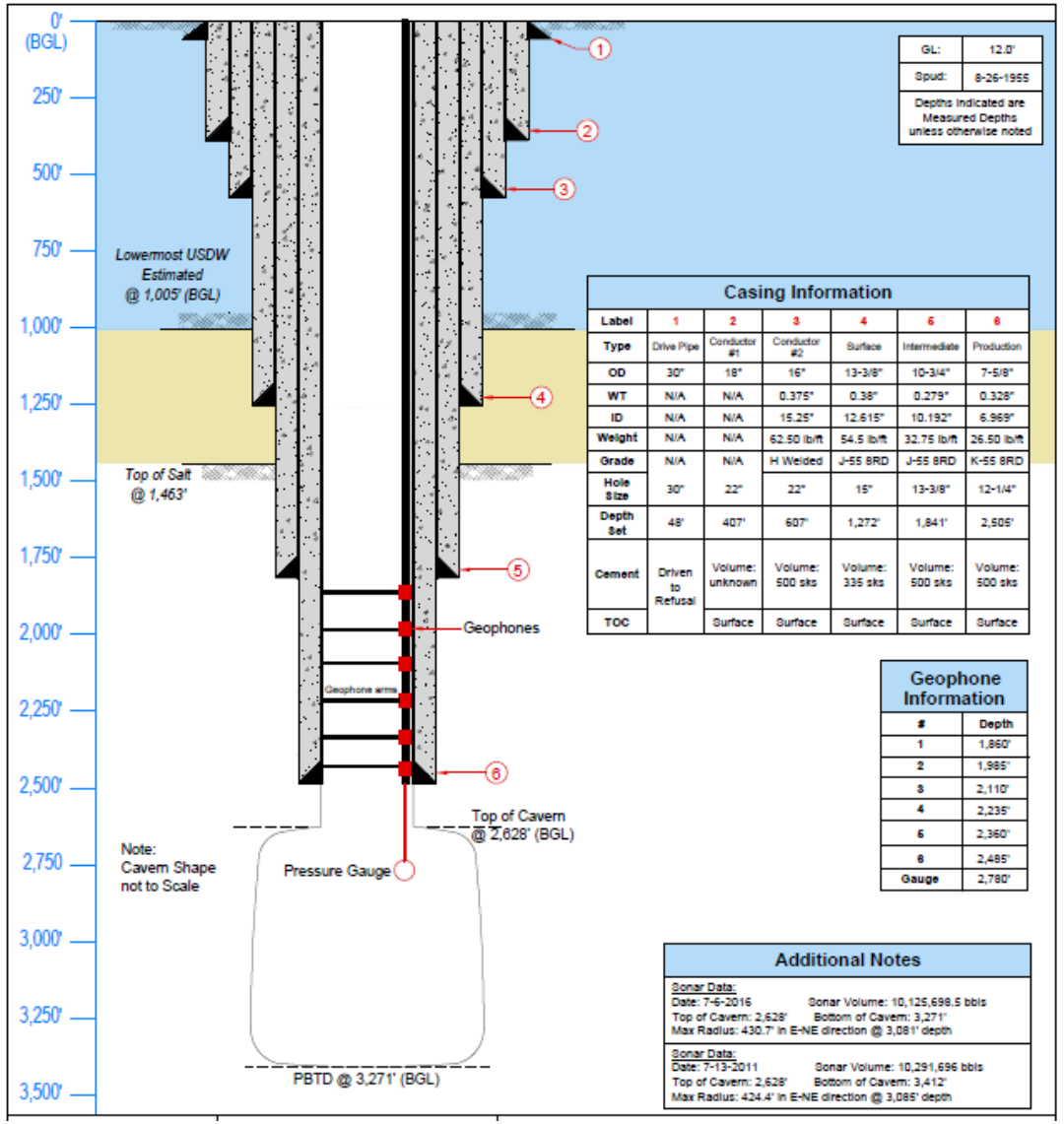
Wellbore Drawings/Geophone Array Placement



Casing Information

Label	1	2	3	4	5	6
Type	Drive Pipe	Conductor #1	Conductor #2	Surface	Intermediate	Production
OD	30"	18"	16"	13-3/8"	10-3/4"	7-5/8"
WT	N/A	N/A	0.375"	0.38"	0.279"	0.328"
ID	N/A	N/A	15.25"	12.615"	10.192"	6.969"
Weight	N/A	N/A	62.50 lb/ft	54.5 lb/ft	32.75 lb/ft	26.50 lb/ft
Grade	N/A	N/A	H Welded	J-55 8RD	J-55 8RD	K-55 8RD
Hole Size	30"	22"	22"	15"	13-3/8"	12-1/4"
Depth Set	48'	407'	607'	1,272'	1,841'	2,505'
Cement	Driven to Refusal	Volume: unknown	Volume: 500 sks	Volume: 335 sks	Volume: 500 sks	Volume: 500 sks
TOC		Surface	Surface	Surface	Surface	Surface

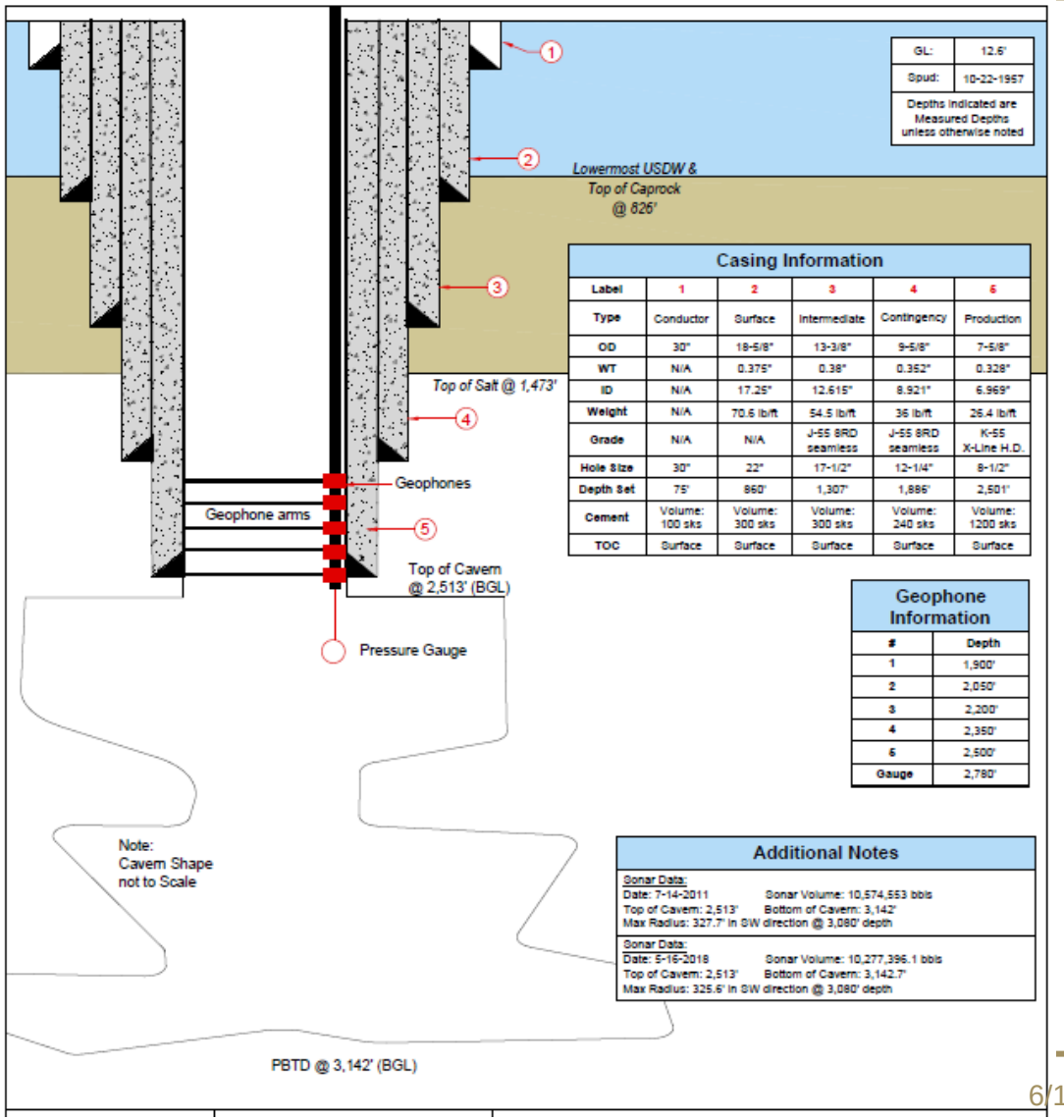
Geophone Information

#	Depth
1	1,860'
2	1,985'
3	2,110'
4	2,235'
5	2,360'
6	2,485'
Gauge	2,780'

Additional Notes

Sonar Data:
Date: 7-6-2016 Sonar Volume: 10,125,698.5 bbls
Top of Cavern: 2,628' Bottom of Cavern: 3,271'
Max Radius: 430.7' in E-NE direction @ 3,081' depth

Sonar Data:
Date: 7-13-2011 Sonar Volume: 10,291,696 bbls
Top of Cavern: 2,628' Bottom of Cavern: 3,412'
Max Radius: 424.4' in E-NE direction @ 3,085' depth



Casing Information

Label	1	2	3	4	6
Type	Conductor	Surface	Intermediate	Contingency	Production
OD	30"	18-5/8"	13-3/8"	9-5/8"	7-5/8"
WT	N/A	0.375"	0.38"	0.352"	0.328"
ID	N/A	17.25"	12.615"	8.921"	6.969"
Weight	N/A	70.6 lb/ft	54.5 lb/ft	36 lb/ft	26.4 lb/ft
Grade	N/A	N/A	J-55 8RD seamless	J-55 8RD seamless	K-55 X-Line H.D.
Hole Size	30"	22"	17-1/2"	12-1/4"	8-1/2"
Depth Set	75'	860'	1,307'	1,886'	2,501'
Cement	Volume: 100 sks	Volume: 300 sks	Volume: 300 sks	Volume: 240 sks	Volume: 1200 sks
TOC	Surface	Surface	Surface	Surface	Surface

Geophone Information

#	Depth
1	1,900'
2	2,050'
3	2,200'
4	2,350'
6	2,500'
Gauge	2,780'

Additional Notes

Sonar Data:
Date: 7-14-2011 Sonar Volume: 10,574,553 bbls
Top of Cavern: 2,513' Bottom of Cavern: 3,142'
Max Radius: 327.7' in SW direction @ 3,080' depth

Sonar Data:
Date: 5-16-2018 Sonar Volume: 10,277,396.1 bbls
Top of Cavern: 2,513' Bottom of Cavern: 3,142.7'
Max Radius: 325.6' in SW direction @ 3,080' depth

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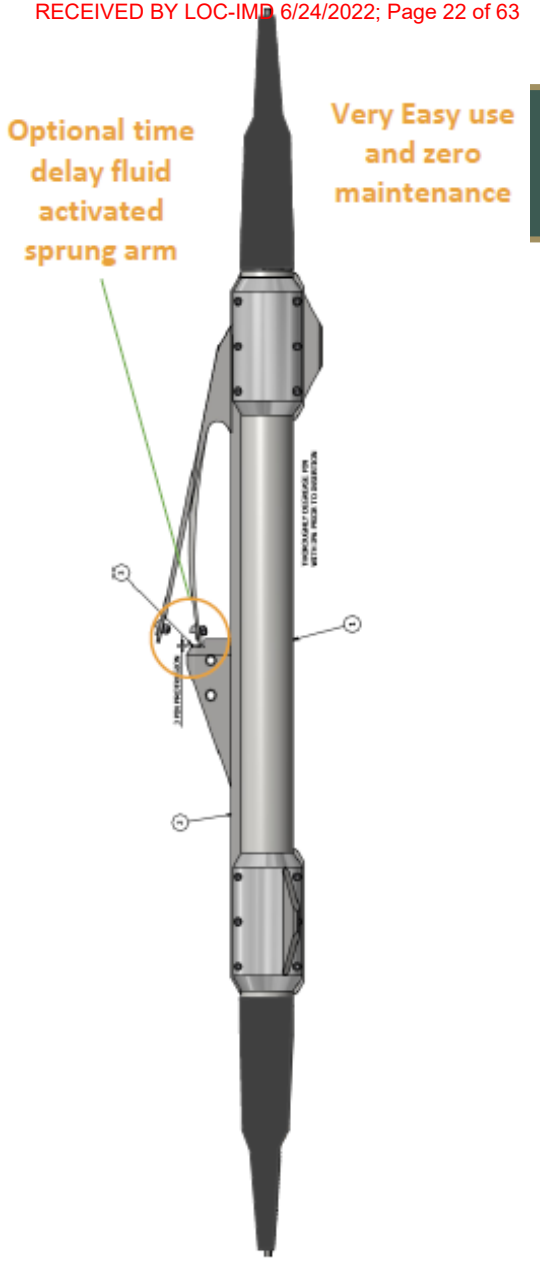
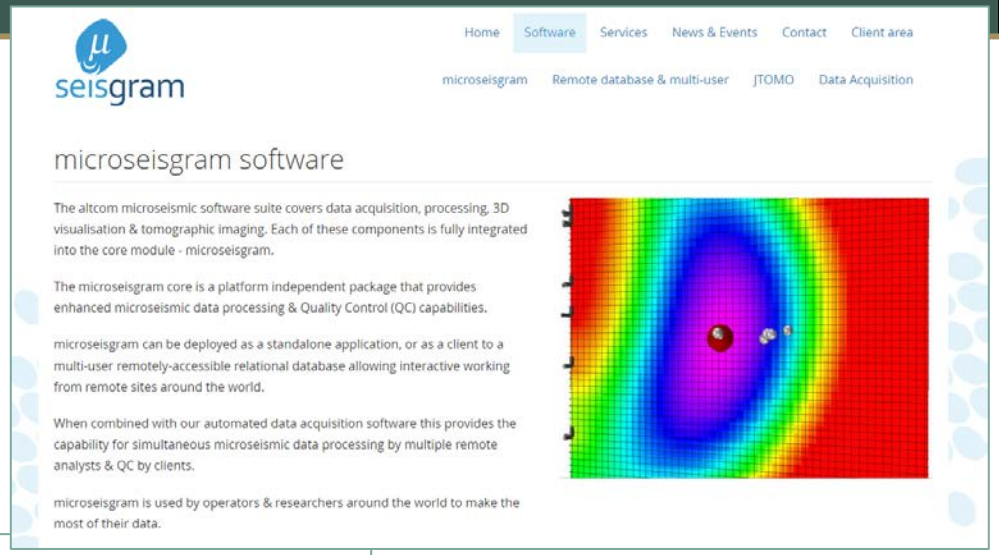
Geophone/Pressure

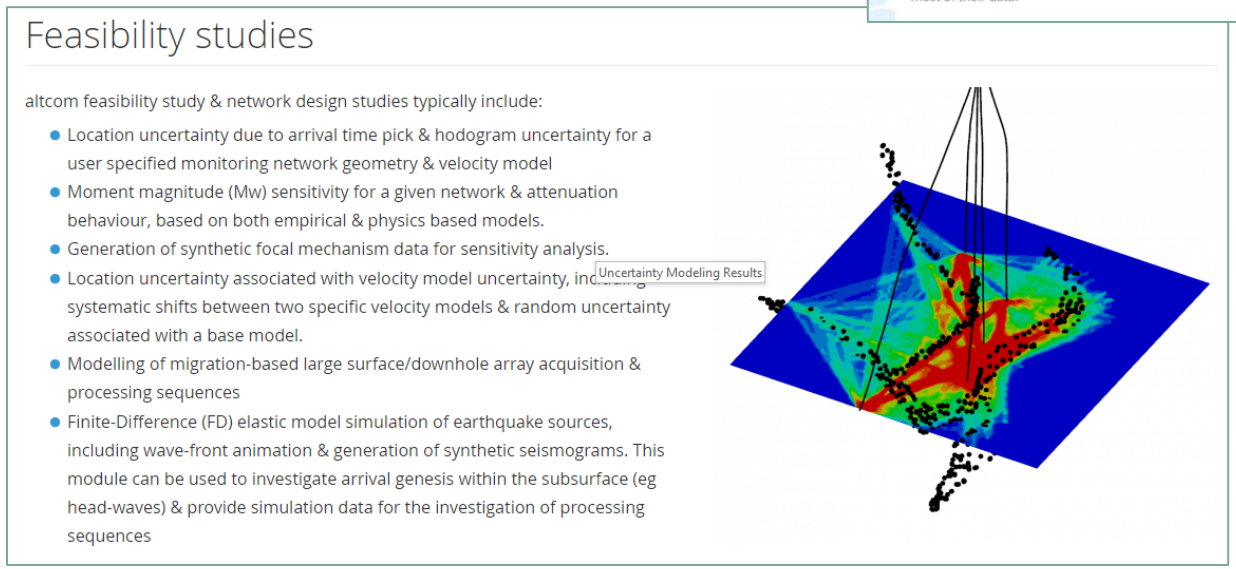
- Custom built analog Avalon geophone array for each well.
  - Geophones have time-release clamping arm.
    - Arm holds each geophone against the 7 5/8” cemented casing
  - Geophone string can be removed for cavern access or sensor maintenance. (tool string is “dragged” up the wellbore)
  - Geophone: 15 Hz, 3 component sensors.
- Pressure Gauge:
  - Incorporated into the same communications cable as the geophones.
  - Set at a depth within the cavern.
- Surface Equipment:
  - Analog/Digital equipment near wellheads to convert signal to digital.
  - Continuous data transmission to onsite computer for microseismic event-detection.
  - Off site vendor for event processing and reporting.
  - Precision GPS timing system.
  - Near real-time detection and location capability if needed.



Array Geometry Microseismic Feasibility Study Performed

- What location accuracy and magnitude detection levels can we expect geophones in the 6X and 7B wellbores?
- A feasibility study was done by “altcom” (Andy Jupe) using the “microseisgram” software package https://microseisgram.com/services
  - Company based in UK
  - Extensive experience in geothermal and oil and gas operations.





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Feasibility Study Summary

Geophone Arrays in wells 6x and 7B modeling results:

- **Location Uncertainty Modeling**:
  - Upper 1500 ft of Sulphur Mines dome- <±100 to 150 ft location uncertainty.
  - Mid cavern levels ~4000 to 5000 ft depth, uncertainty about ±200 to 300 feet.
  - Deep 5000-6000 ft, caverns below array ±200-300 ft uncertainty, location resolution drops off at deep >6000 ft near salt flanks.
    - The deep eastern area of dome has larger location uncertainties (> ±500 ft) but events can be detected and located.
  - The effects of “cavern” void spaces on the signal attenuation were not modeled.
  - Background noise levels in the proposed wellbore intervals is unknown at this time.
    - Modeling used ~2x noise level observed at a nearby microseismic observation well in salt.
- **Magnitude Detection Modeling:**
  - Excellent magnitude detectability near the arrays (to magnitude -2.5) and expected to fall off with depth to about magnitude -1.25 below 6000 ft depth.

Modeling suggests geophones placed in 6X and 7B should provide microseismic monitoring coverage over the entire Sulphur Mines salt dome.

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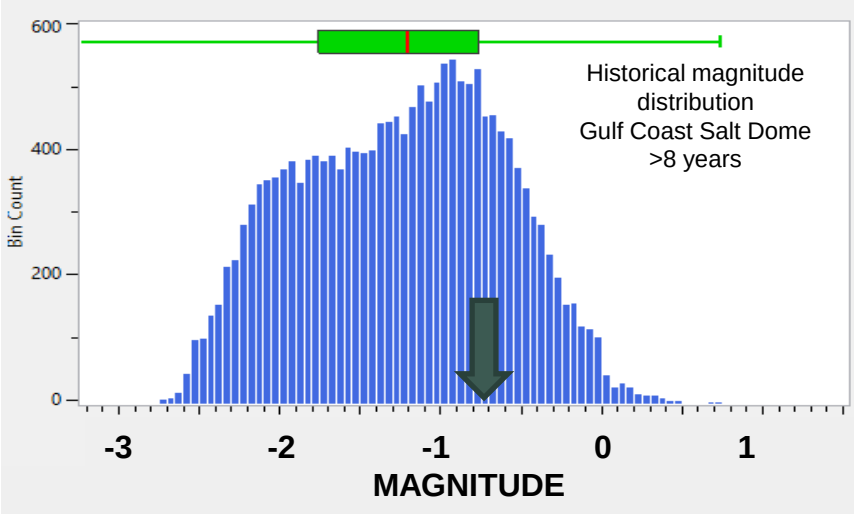
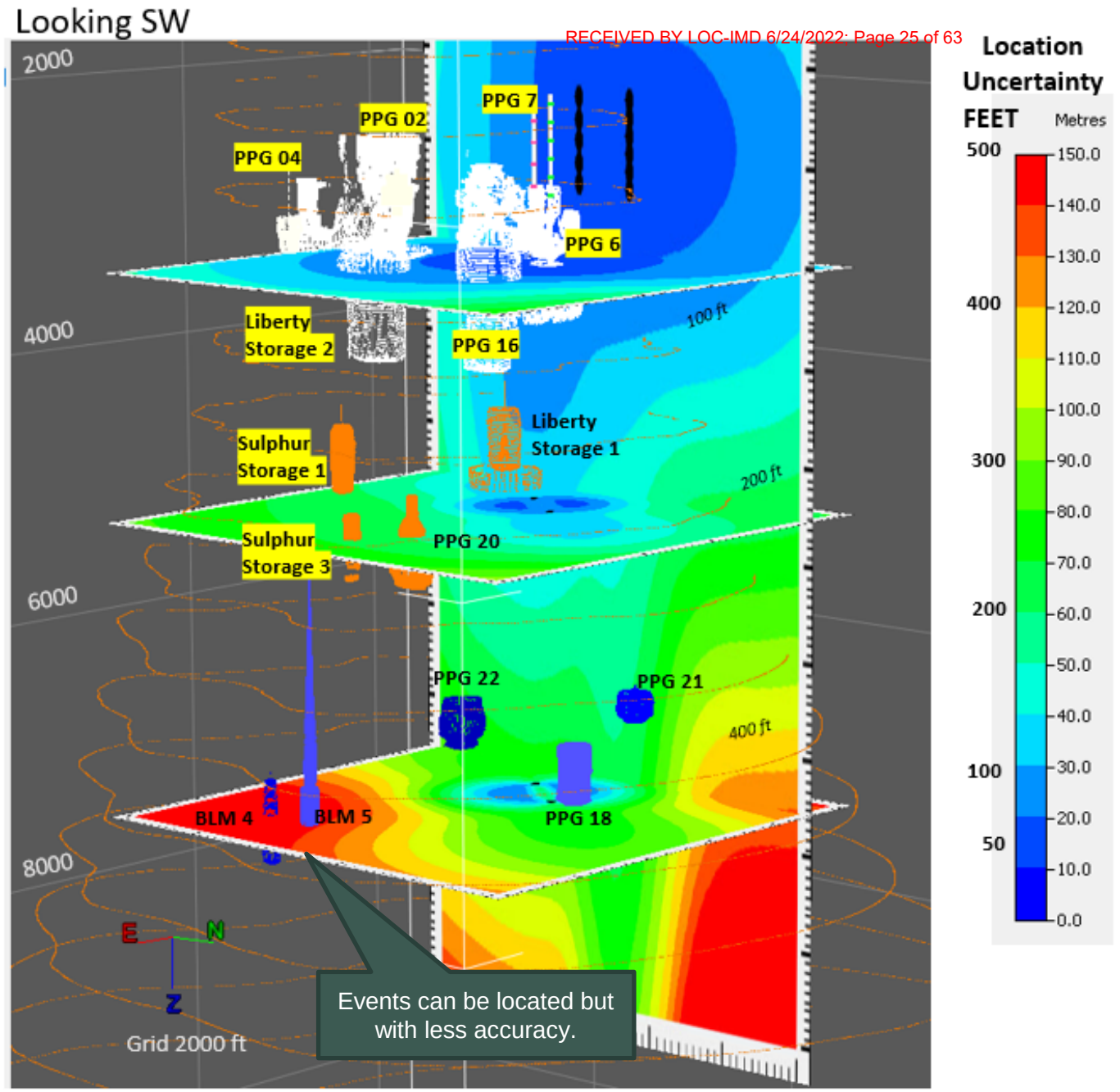
Location Uncertainty Modeling Results

Modeling Assumptions

- Uncertainty contours for a **Magnitude -0.75**
- Background Noise level 20 nm/sec
  - about 2x nearby operator
- Picking uncertainty P wave ± 4 ms
- Picking uncertainty S wave ± 5 ms
- Ave azimuth and inclination uncertainty ±15º





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Location Uncertainty Modeling Results

Modeling Assumptions

- Uncertainty contours for a Magnitude -0.75

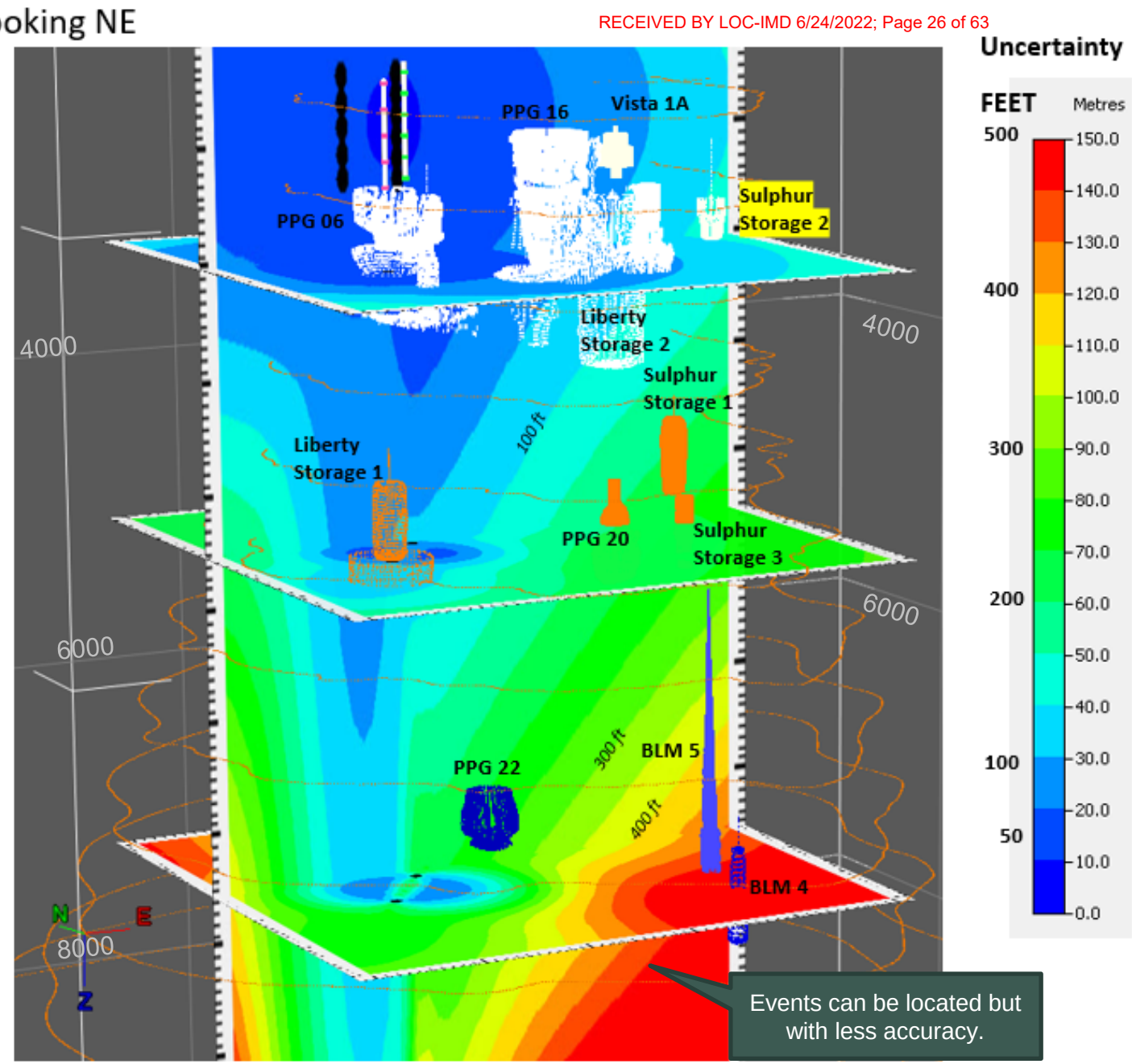
– Background Noise level 20 nm/sec

- (about 2x nearby operator)

– Picking uncertainty P wave ± 4 ms

– Picking uncertainty S wave ± 5 ms

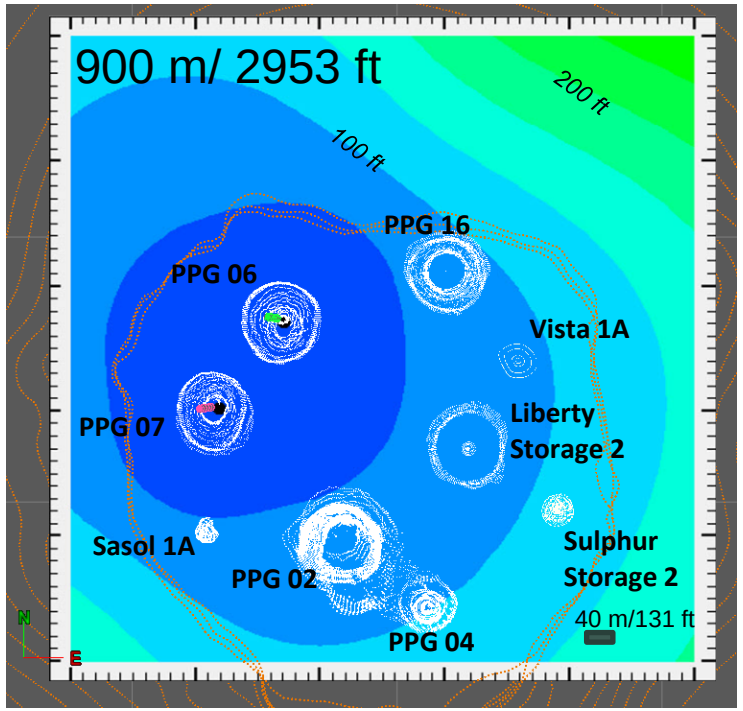
– Ave azimuth and inclination uncertainty ±15º



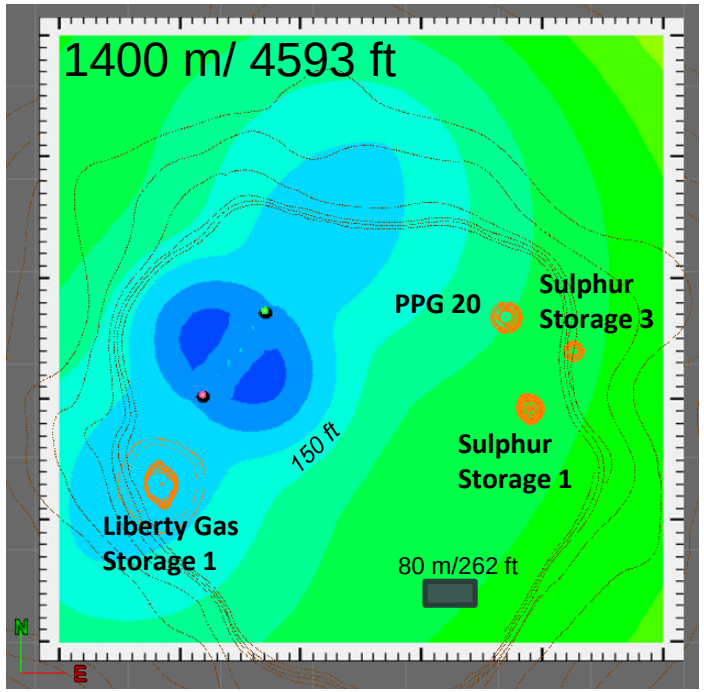
Location Uncertainty Modeling Results

Map view (est. location accuracy at shallow, mid and deep caverns near the depth ranges)

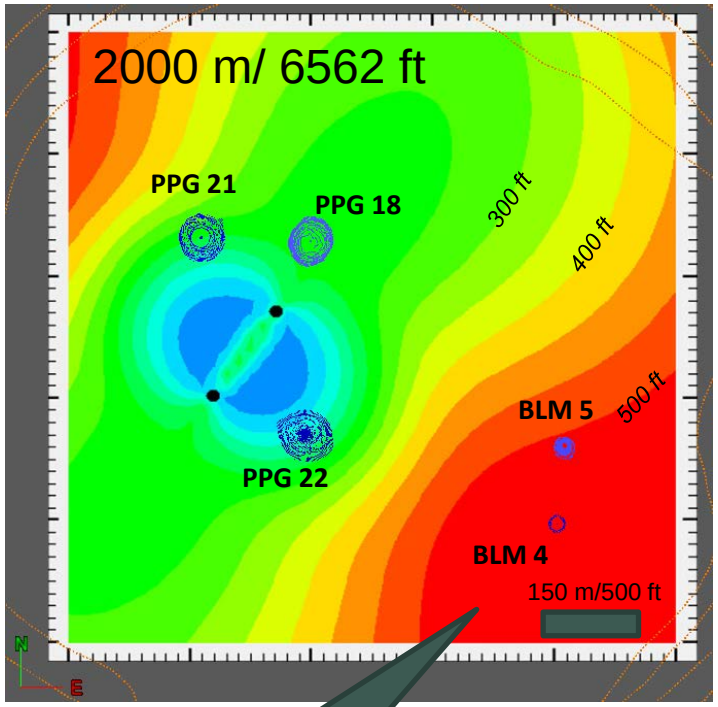
Shallow (~3000 ft)



Mid (~4600 ft)

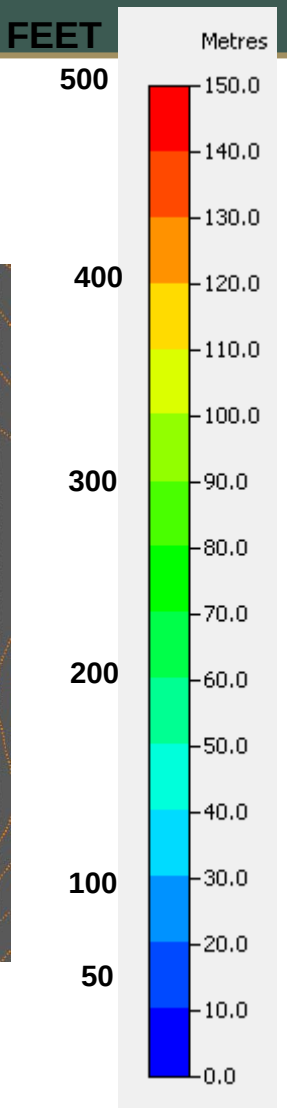


Deep (~6500 ft)



Colored contours of expected location accuracy

Events can be located but with less accuracy.



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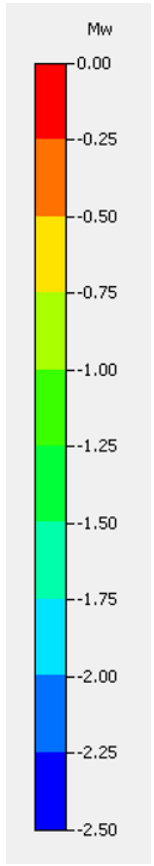
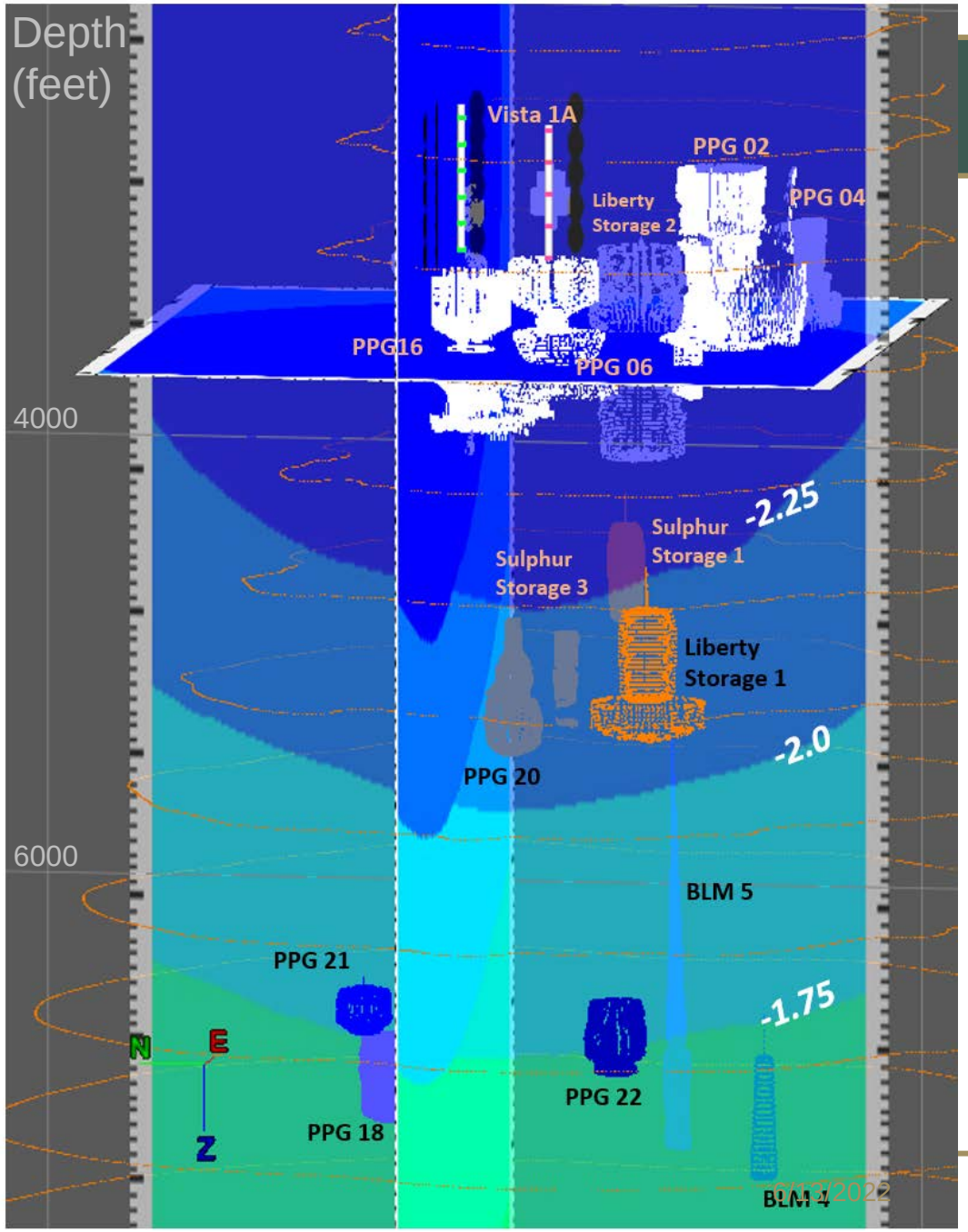
Magnitude Sensitivity Modeling Results

- Modeling suggests sensor geometry can detect events magnitude > -1 throughout the dome area and m <-2 near the geophone arrays.
- Median magnitude at nearby seismic salt some monitoring ~magnitude -1.2

~nearby salt monitoring median -1.2





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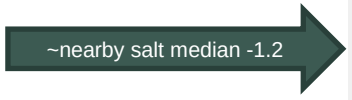
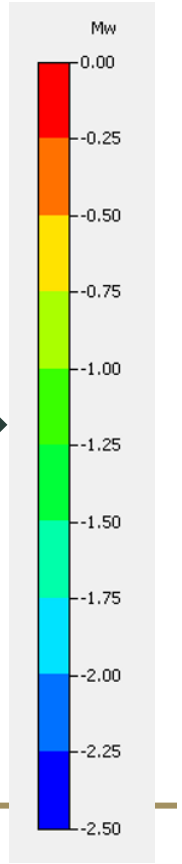
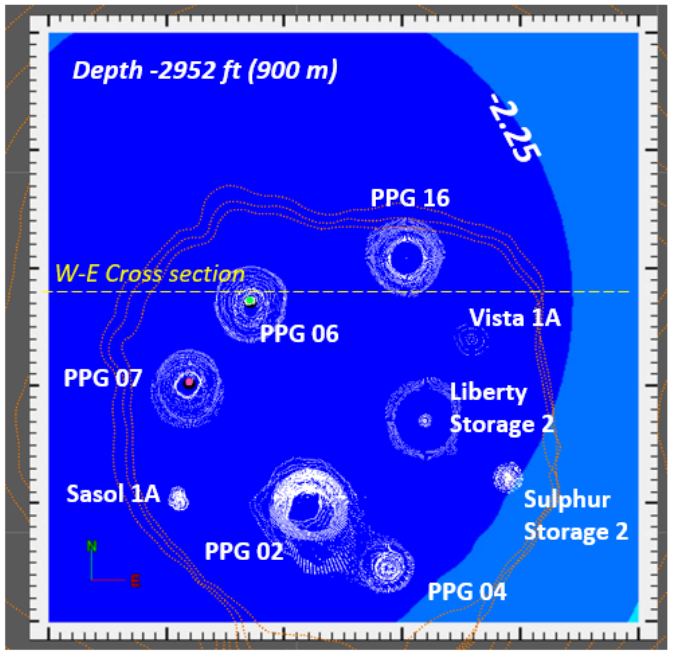
Feasibility Study Results

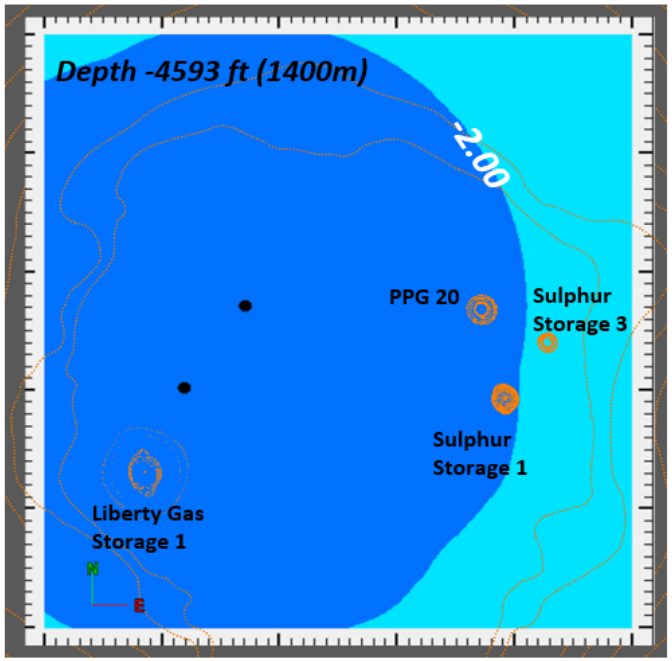
Magnitude Sensitivity Modeling Results

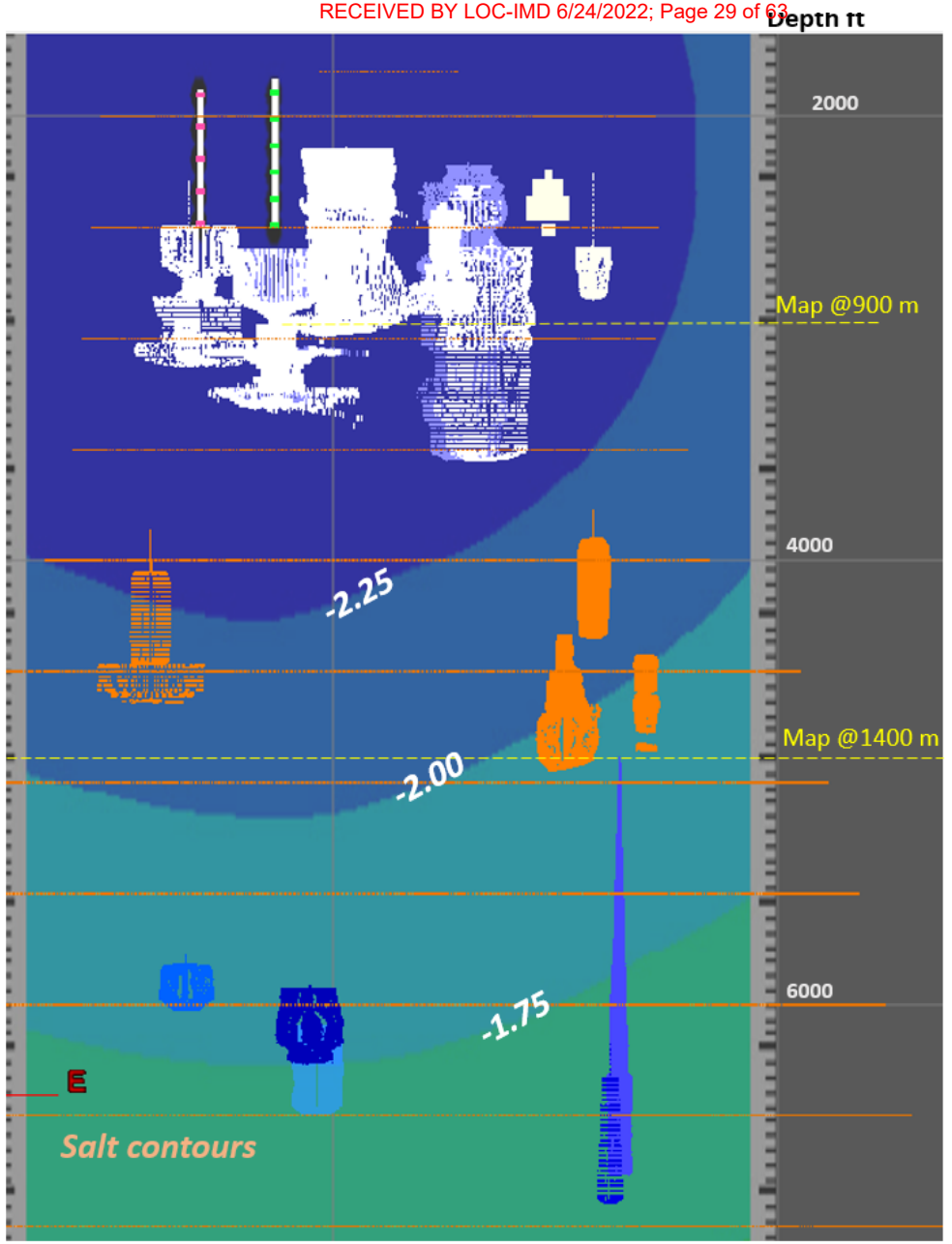
- Modeling suggests network can detect magnitude > -1.5 throughout the dome and magnitude <-2.0 near the arrays.







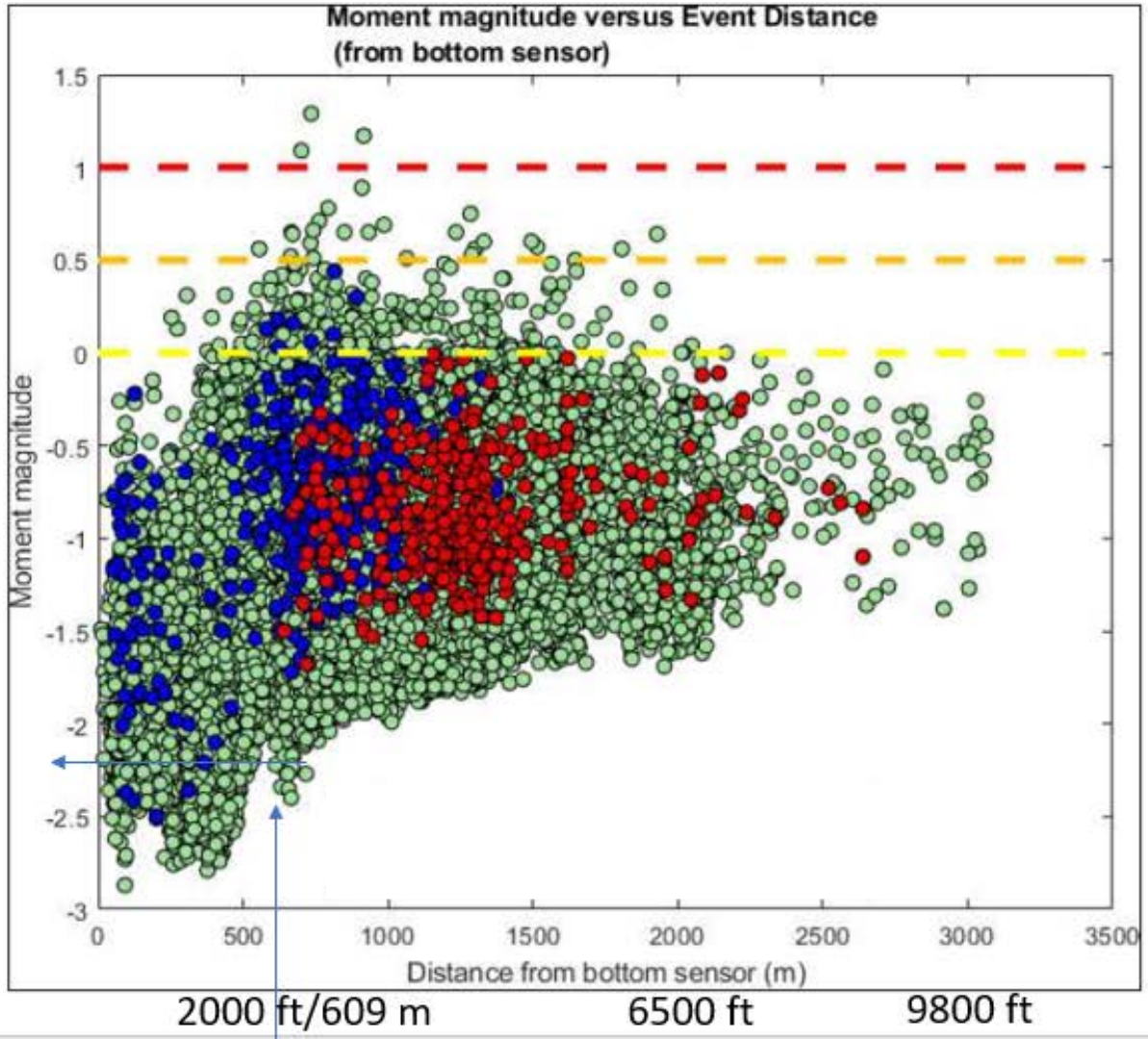


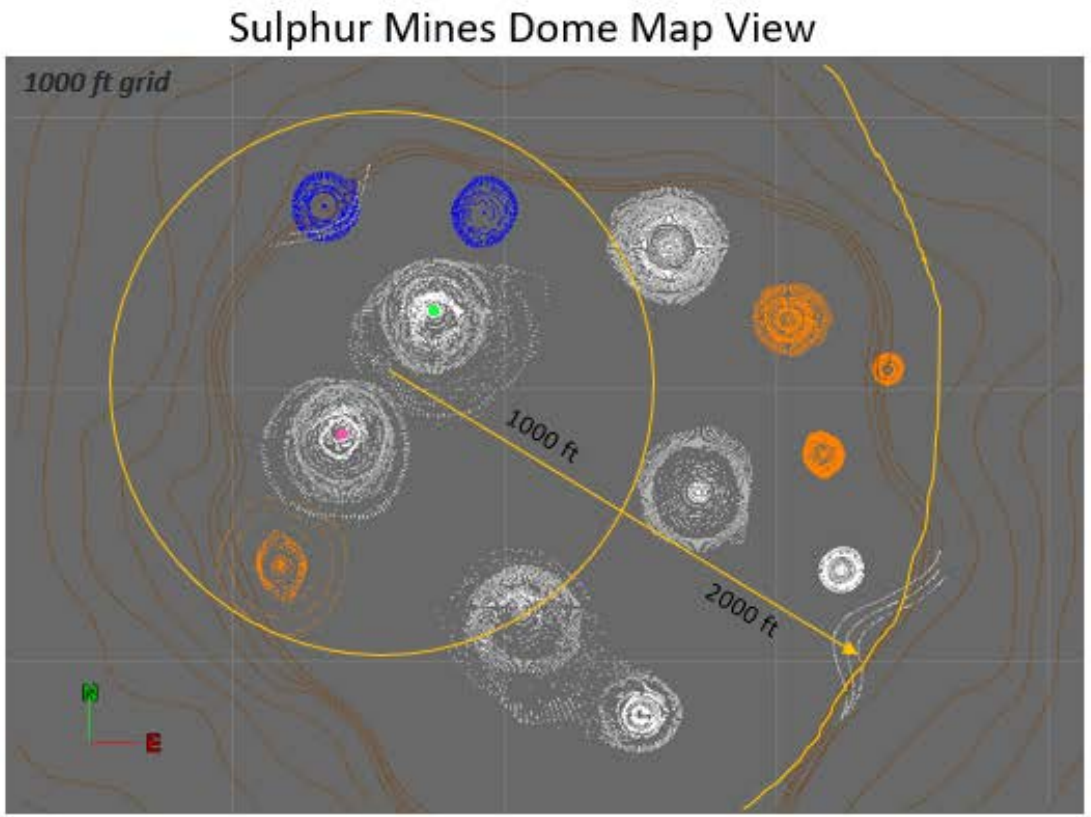


West-East Cross Section

Magnitude "Detectability" observed in a nearby salt dome

- Magnitude vs Distance from Sensors (Gulf Coast Salt Dome)





Based on results form Salt Dome monitoring in Louisiana, Events are located to magnitude <-2 at ~2000 ft distance from sensors.

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Draft Plan for Microseismic Monitoring:

Place Two Geophone Arrays: use PPG 6X and PPG 7B wellbores

Location Uncertainty Modeling Results:

- Upper 1500 ft of Sulphur Mines dome- <±100 to 150 ft location uncertainty.
- Mid cavern levels ~4000 to 5000 ft depth, uncertainty about ±200 to 300 feet.
- Deep 5000-6000 ft, caverns below array ±200-300 ft uncertainty, location resolution drops off at deep >6000 ft near salt flanks.
  - The deep eastern area of dome has larger location uncertainties (> ±500 ft) but events can be detected and located.

Magnitude Detection Modeling:

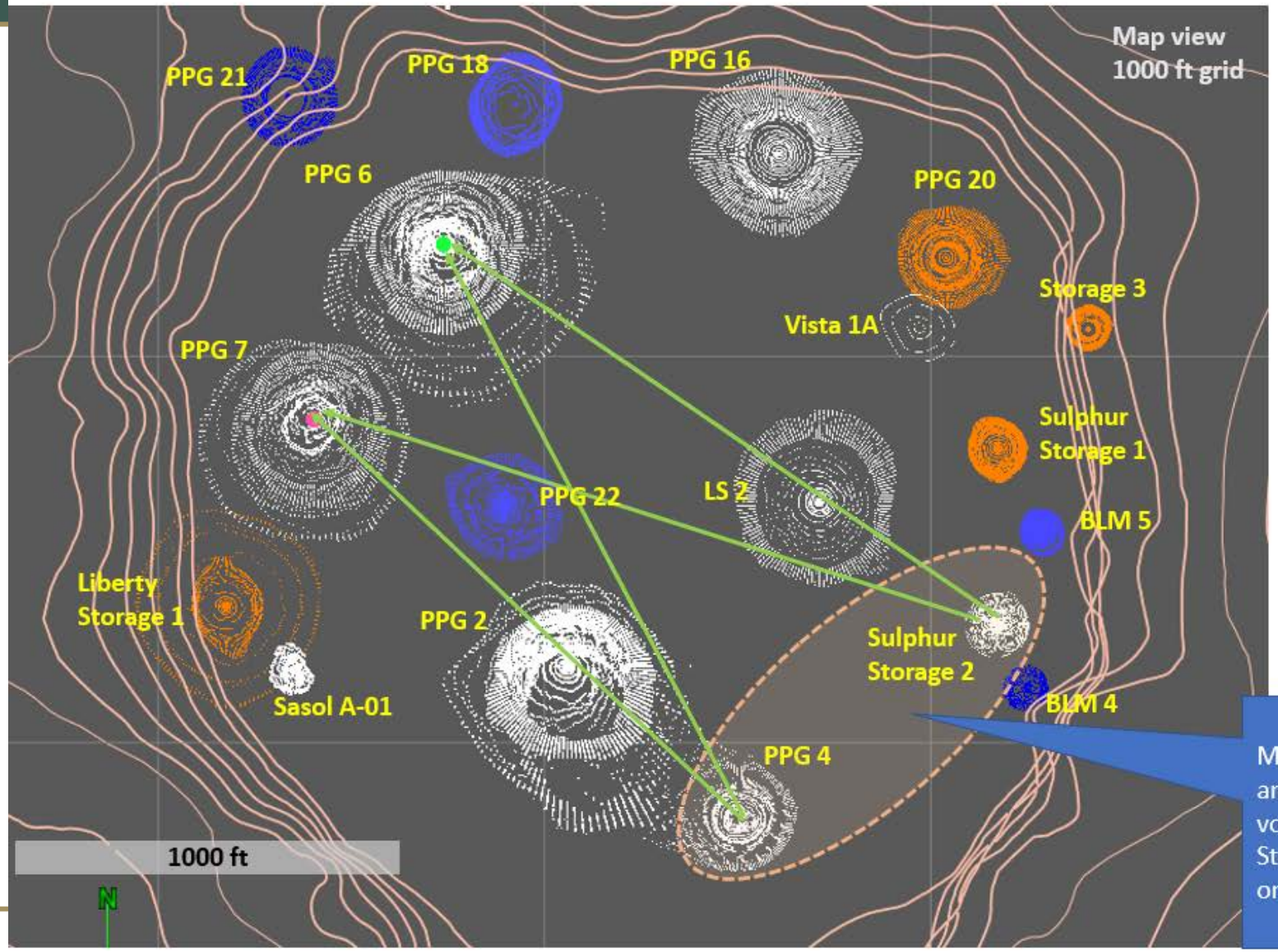
- Excellent magnitude detectability near the arrays (to magnitude -2.5) and expected to fall off with depth to about magnitude -1.25 below 6000 ft depth.

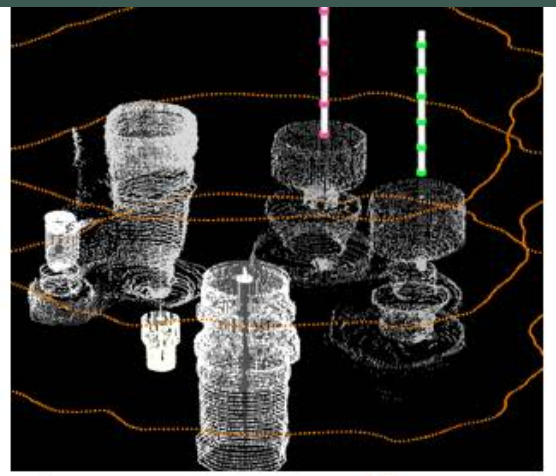
Modeling suggests geophones placed in 6X and 7B should provide microseismic monitoring coverage over the Sulphur Mines salt dome area.

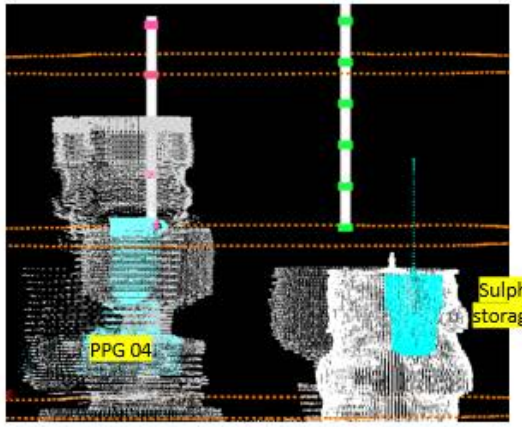
Comments regarding Sulphur Mines microseismic monitoring proposal/modeling, etc.

- The modeling focused on microseismic monitoring within the salt in and around the caverns, which are in the control of the operators.
  - Cap rock events are expected to be detectable and we can locate events above the arrays (not modeled).
    - Nearby dome monitoring able to detect and locate cap rock microseismic activity with array below cap rock.
  - The effects of “cavern” and cap rock void spaces on the signal attenuation were not modeled.
- Deformation in the sediments on the flanks of the Sulphur Mines dome may or may not create detectable microseismic events.
  - Rock “fracturing” must occur to emit a signal for microseismic event detection and location.
  - The Sulphur Mine arrays should pick up seismic activity “off dome” if sediment attenuation, noise levels, etc. are acceptable and the flank formations are actively fracturing.
  - Soft sediment deformation and or slow deformation may not produce microseismic events.
  - The Salt Dome flank- Sediment margin may produce microseismicity.
    - Observed in nearby Gulf Coast Salt Dome and is likely related to growth faults off the salt dome.
- **Background noise levels** in the proposed wellbore intervals is unknown at this time.
  - Modeling used ~2x noise level observed at a nearby microseismic observation well in salt.
  - High background noise can hamper the ability to monitor microseismicity.
    - More difficult to detect small microseismic events.
    - Noise affects quality of the seismic waveforms and the location accuracy worsens.

Cavern "void space" and microseismic monitoring







Microseismic waveform emulating from PPG 04 and Sulphur Storage 2 might be attenuated by void space in caverns PPG 2 and Liberty Gas Storage 2. Each of these cavern likely visible from one of the two arrays, but not both.

Estimated time line for monitoring set up and reporting

- Currently ~6 month build time for custom seismic arrays.
- Monitoring estimated starting ~ Q1 2023
  - 1-2 months “learning phase” for after monitoring system is operational.
  - Q2 2023 initial reports on status on seismic array, event locations, etc.
    - Set up an tiered “seismic alert system” for Sulphur Mines Dome
      - Call down list, example reporting, etc.
      - Set parameters for the notification time based on seismic alert system
      - Considered an “Initial” alert system
        - » The ability to distinguish normal/anomalous microseismicity will continue over time.
  - Q3 2023 initiate monthly report.
    - Continue monthly reporting to ~Q1 2024 (one year)
    - Continued evaluation of Seismic Alert System.
    - Evaluate seismicity/reporting and the appropriate levels of continued seismic monitoring.
  - Q1 2024 – step down in frequency of reporting: start an annual report

Thank you

QUESTIONS?

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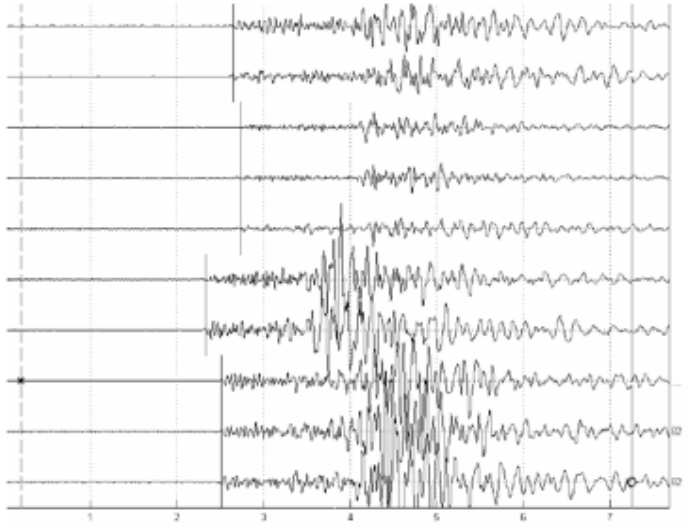
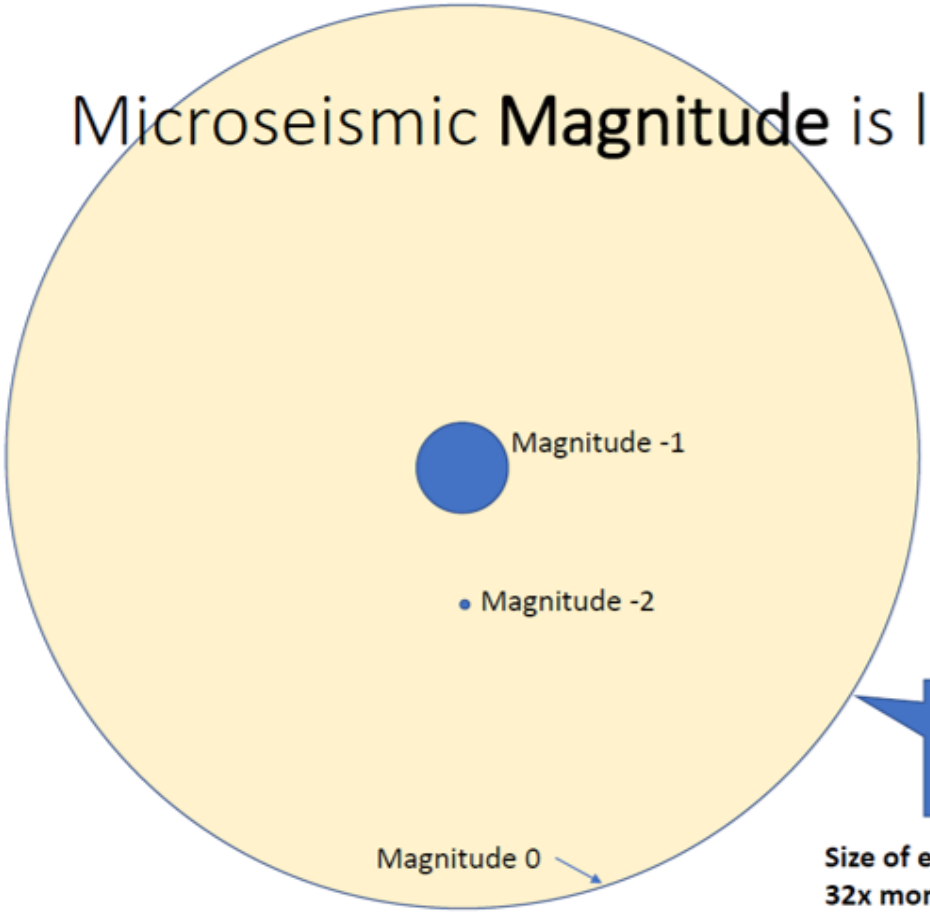
Microseismic "Magnitude"

Magnitude is estimated from seismic waveforms



Microseismic **Magnitude** is logarithmic



"Energy Equivalents"

Magnitude	Potential Energy
0	minivan dropping 3 feet
-1	bbl oil dropping 3 feet
-2	jug of milk 3 feet

Magnitude	Kinetic Energy
0	Rifle
-1	Pistol
-2	Air rifle

Source for Energy table: Microseismic Imaging of Hydraulic Fracturing: Improved Engineering of Unconventional Shale Reservoirs (Distinguished Instructor Series No. 17), SEG, 2014.

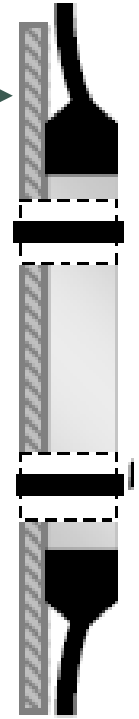
Representative size
0
-1
-2

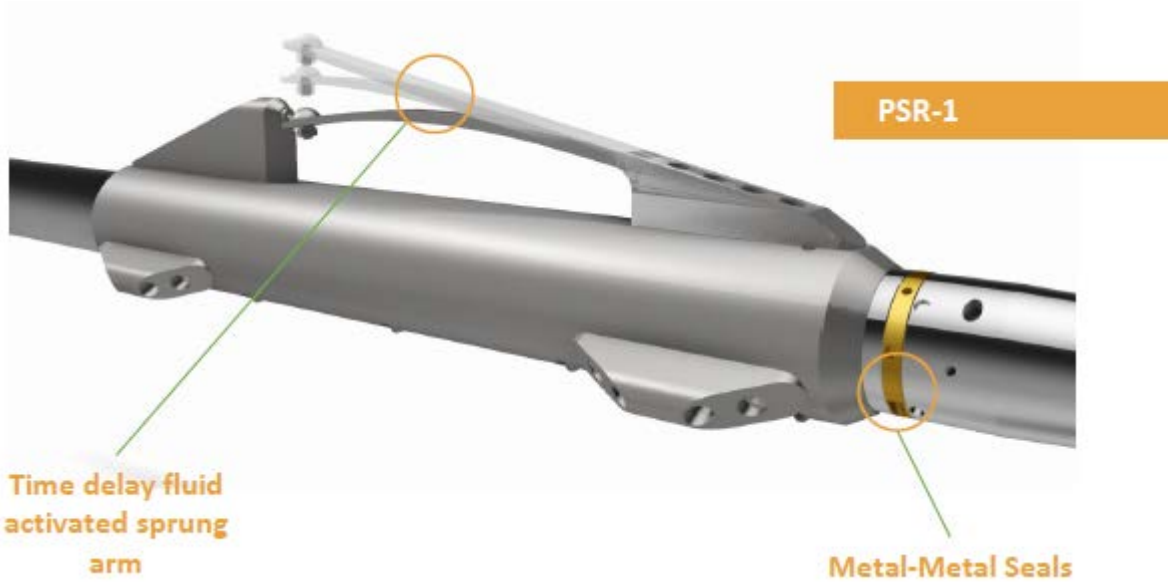
Size of event 10x larger per magnitude level
32x more energy per magnitude level

Geophone & Cable

Comms/Array Cable

Hoisting Cable





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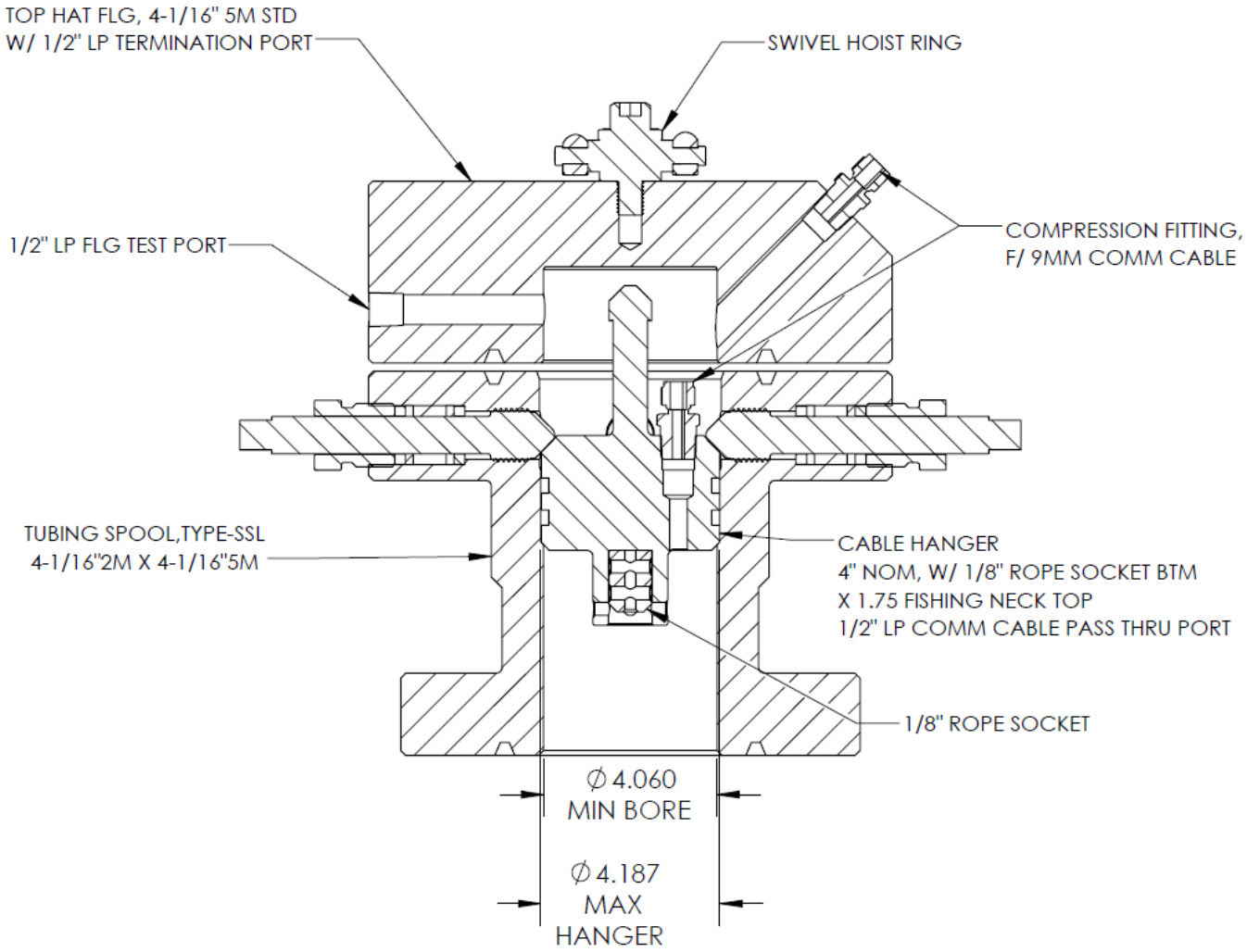
Wellbore Inspection Phase

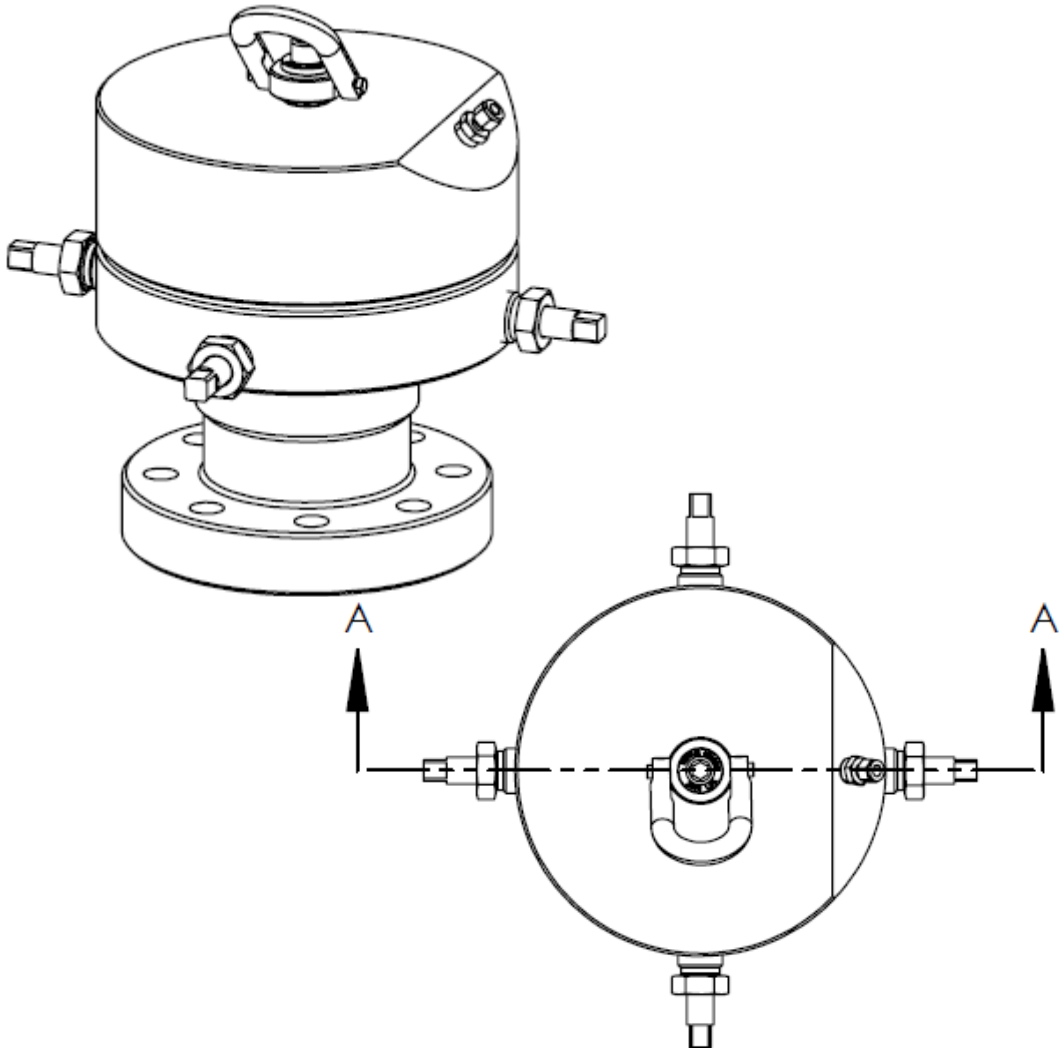
- Move in service rig
- Remove 5-1/2” brine string
- Scraper run on 7 5/8” production casing
- Run casing inspection logs and CBL
  - HiRes Vertilog, 60-Arm Caliper, & SBT
  - Confirm geophone placement depths
    - Sonar Surveys & Nitrogen MIT’s previously performed in March 2022
- Complete the above on both wellbores
- Order geophone equipment (24 week lead time) based upon above results
- Prep surface for equipment installation

Geophone Installation Phase

- Install surface facilities/equipment for data collection and processing
- Run geophones & pressure gauge system to target depth with 1/8” slickline
  - Rigless; via slickline and crane
  - Scaffolding around wellhead to be installed as work floor
- Install new wellhead spool
- Conduct string shot “seismic event” via offset PPG 2 wellbore/cavern
  - Verify orientation of the geophones within 6X & 7B

New Wellhead Spool





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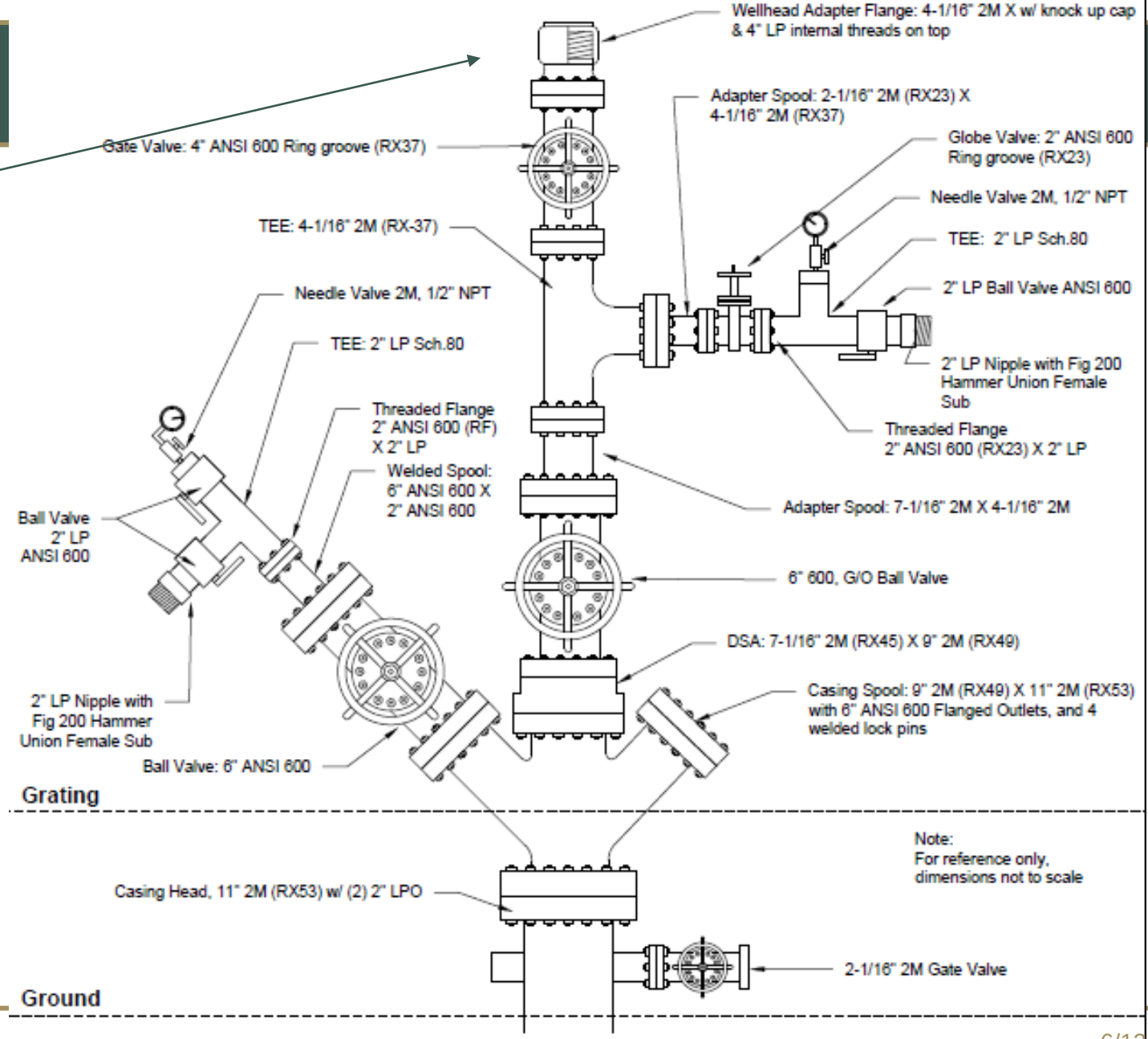
New Wellhead Spool

New Spool will go here.



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PETROLEUM ENGINEERS | ENERGY ADVISORS
AUSTIN · HOUSTON · WICHITA · DENVER · BATON ROUGE · COLLEGE STATION · CALGARY · EDMONTON

ATTACHMENT NO. 3

SONAR SURVEY & GEO-SPATIAL DISPLACEMENT EVALUATION

PPG 6X & 7B
March Sonar and Gyro Surveys
Investigation Update

Sulphur Dome
Westlake Chemical

March 2022

Westlake Chemical

LONQUIST & CO. LLC
PETROLEUM ENGINEERS | ENERGY ADVISORS

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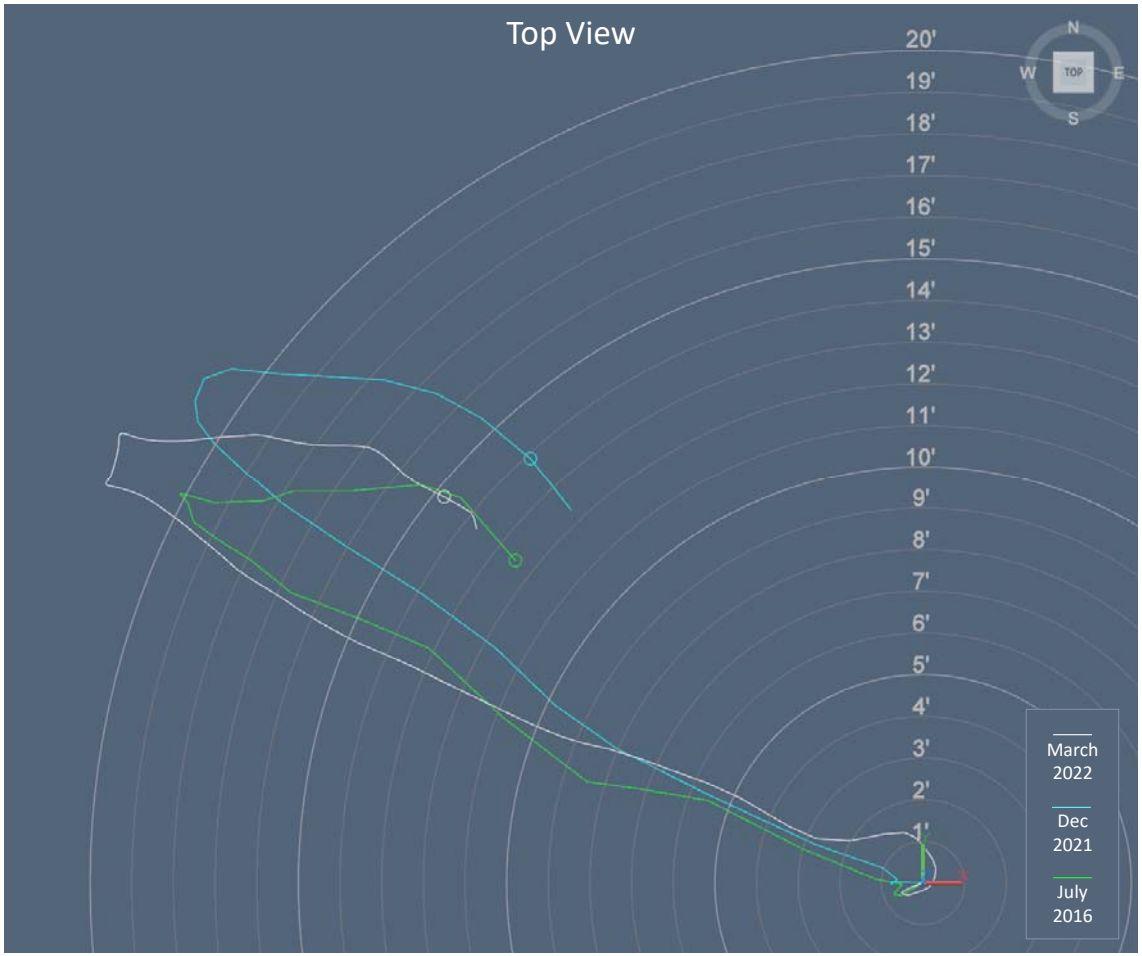
New gyro surveys for PPG 6X and 7B – March 2022

- Similar appearance to past surveys, resulted in small lateral adjustments to cavern positions
- Path detail was improved by 25’ depth increments between vertices
- All sonars, current and past, adjusted for new gyros in model
- PPG 6X sonars shown to right
  - March 2022 – Rusty Clark - White
  - December 2021 – Gyrodata - Cyan
  - July 2016 – Rusty Clark - Green



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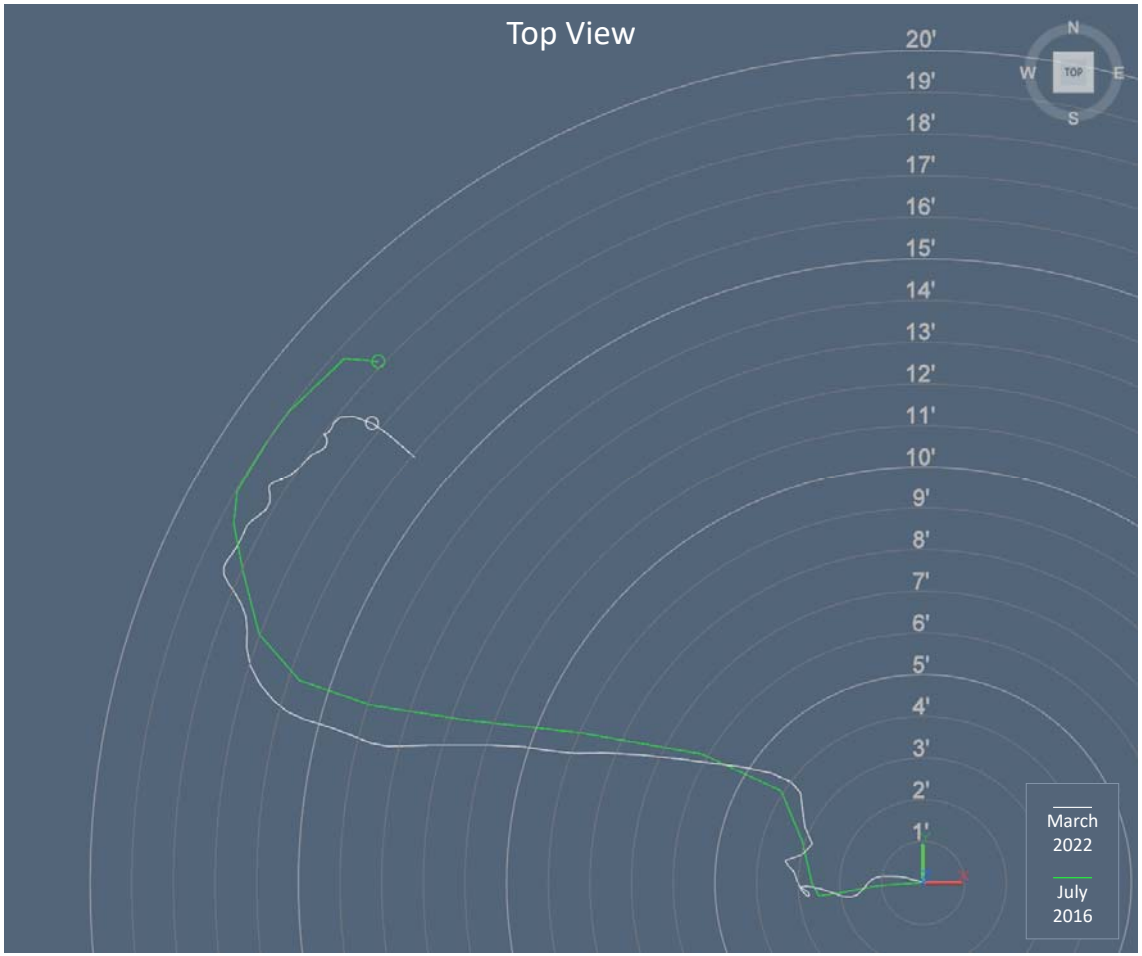
  - May 2018 – Socon – Green



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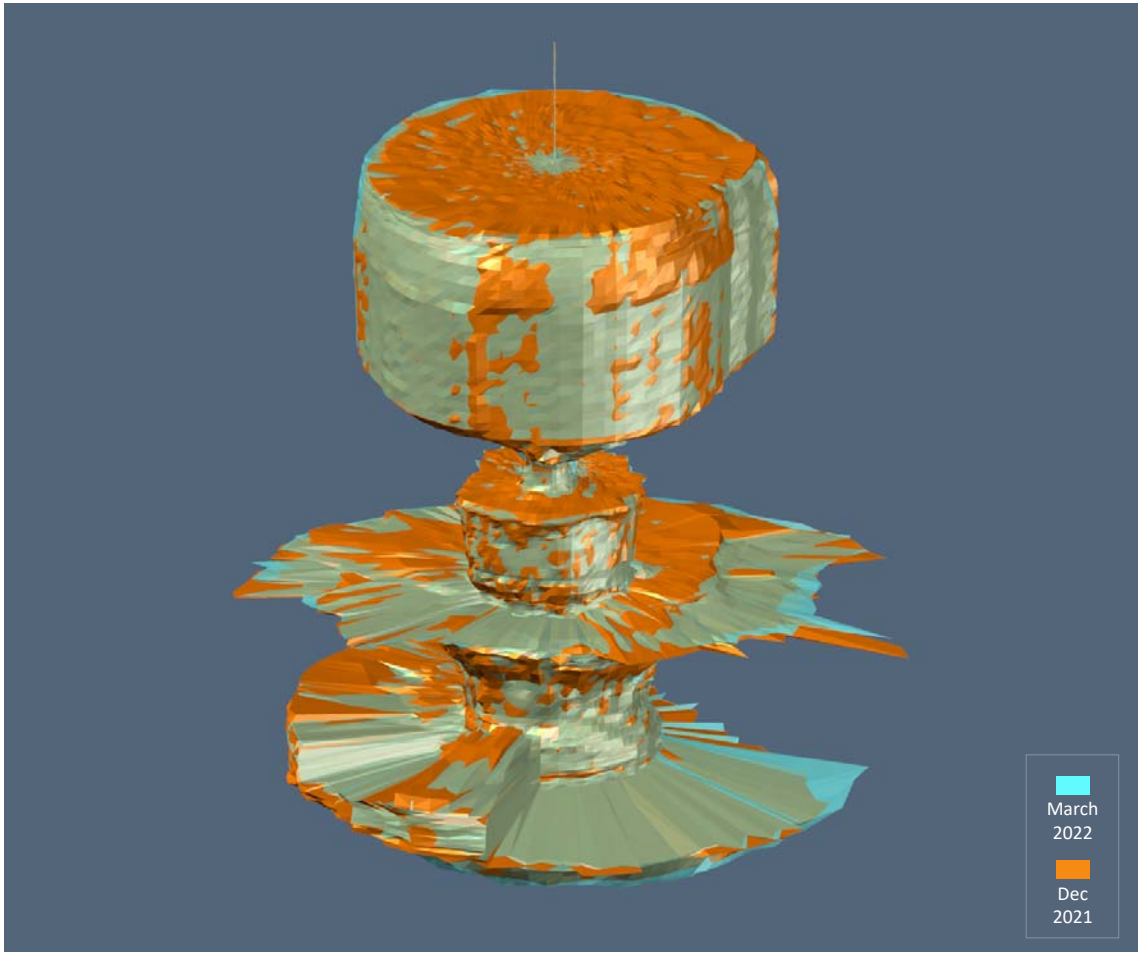
PPG 6X Sonar comparison – March 2022

- Three sonars were evaluated to compare geometry and orientation
  - March 2022 - Sonic Surveys
  - December 2021 - Sonic Surveys
  - July 2016 – Sonarwire
- New sonar shows no notable changes from prior December 2021 sonar following rotational adjustments to align orientation of cavern features



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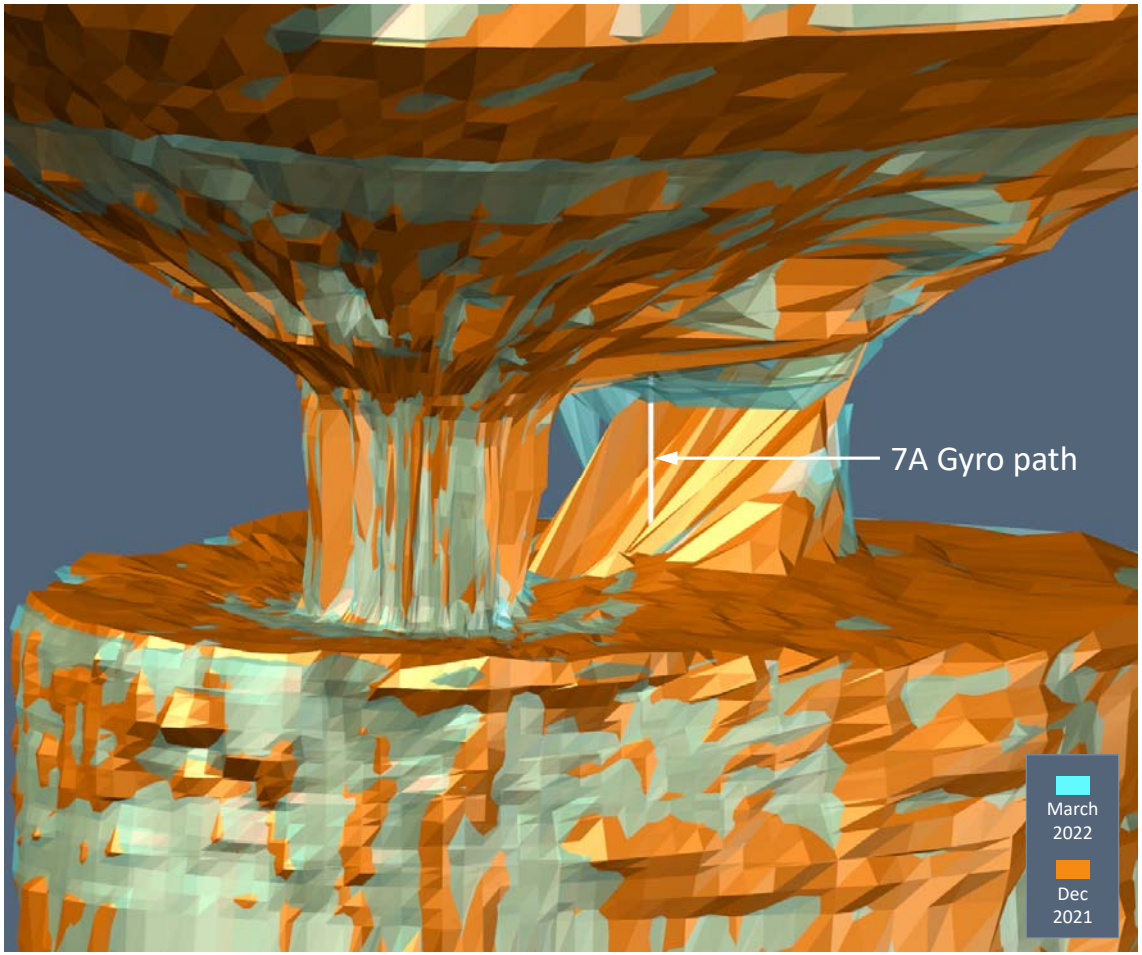
PPG 6X Sonar comparison – March 2022

- New sonar appeared to be rotated roughly 36° CW from prior December 2021 sonar
- Communications with sonar operator indicates that December sonar was not properly oriented to magnetic north during post-processing
  - According to operator's field notes data should have been rotated ~33° CW to reconcile with difference between tool's gyro compass and hand-held compass measurements on the surface
- Correction resulted in an improved agreement between 7A gyro spatial location and cavern neck associated with 7A wellbore – shown to right



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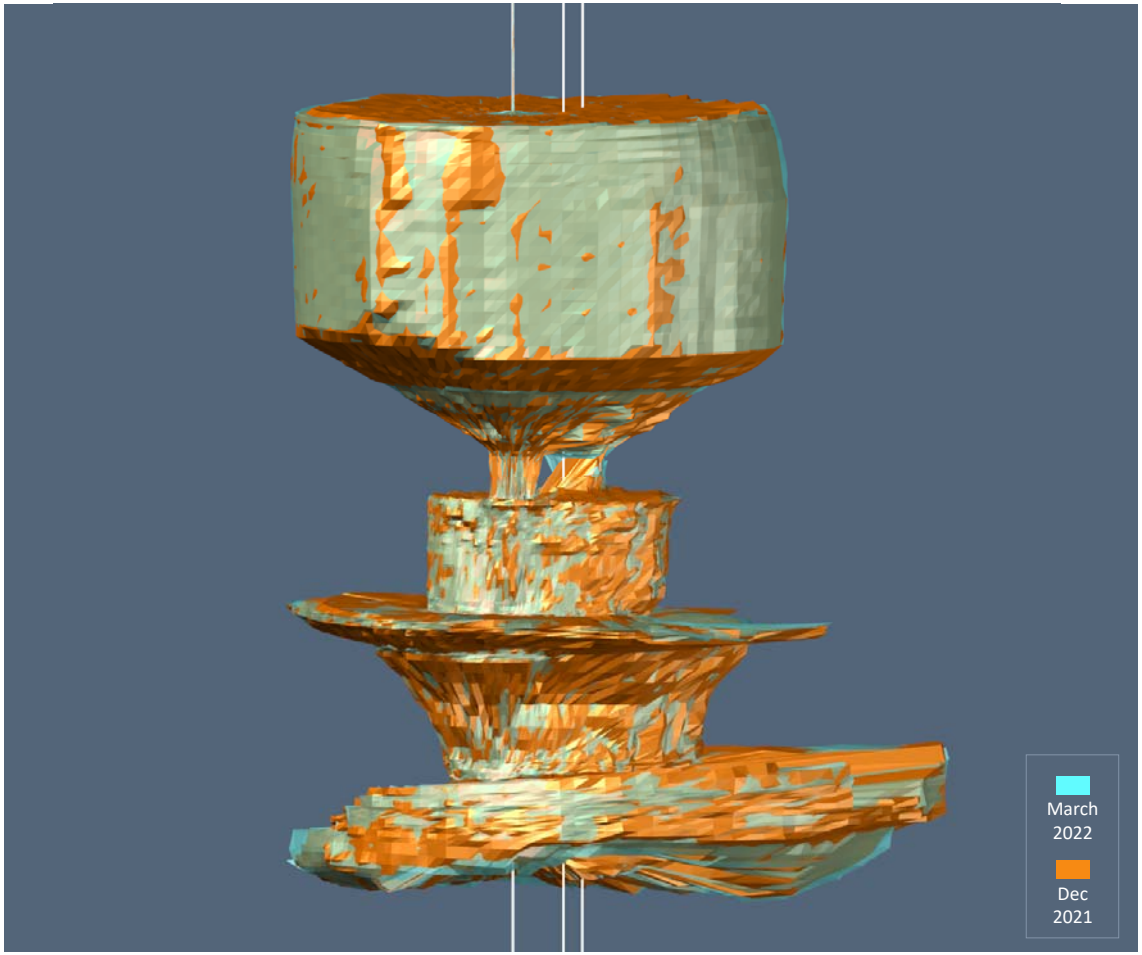
PPG 6X Sonar comparison – March 2022

- December 2021 Sonar was rotated 3° further CW in CAD and was moved downward 2 feet to improve alignment of features with new sonar



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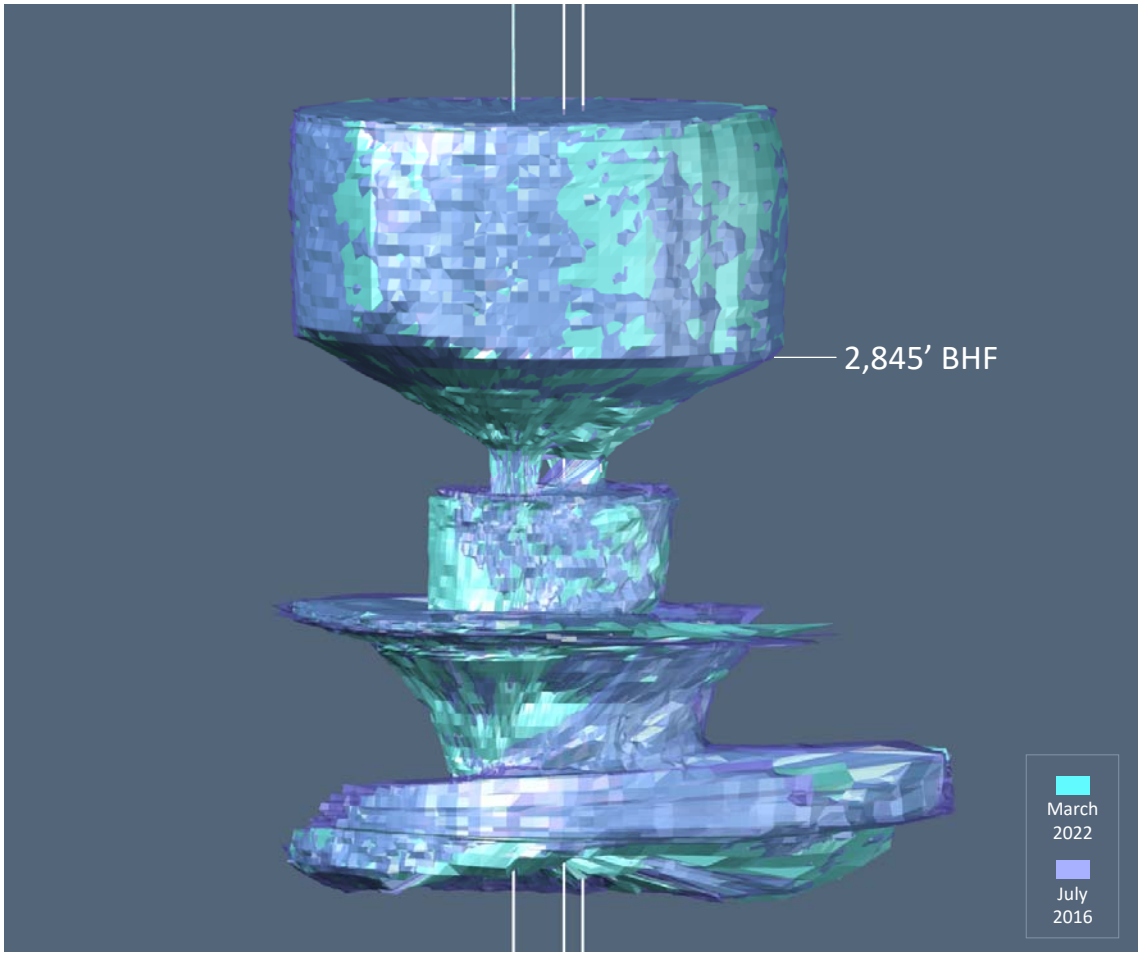
PPG 6X Sonar comparison – March 2022

- July 2016 sonar required a 9° CW rotation below a depth of 2,845’ and a 29° CW rotation above that depth to align with March 2022 sonar
- Sonar was further moved downward 6 feet to improve match



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PPG 6X Sonar comparison – March 2022

- Future spacing measurements and analysis involving these three sonars will rely on orientation indicated by current sonar
- Operator provided the following note in the March 2022 sonar report:

  All Sections are orientated to Magnetic North.

  Gyro Compass was set up using the Magnetic Compass 40 feet below the 5-1/2” tubing. After the survey was completed, the orientation was double checked on surface using a handheld compass to verify direction. The handheld compass showed that the tool direction was within +/- 5 degrees of magnetic north.

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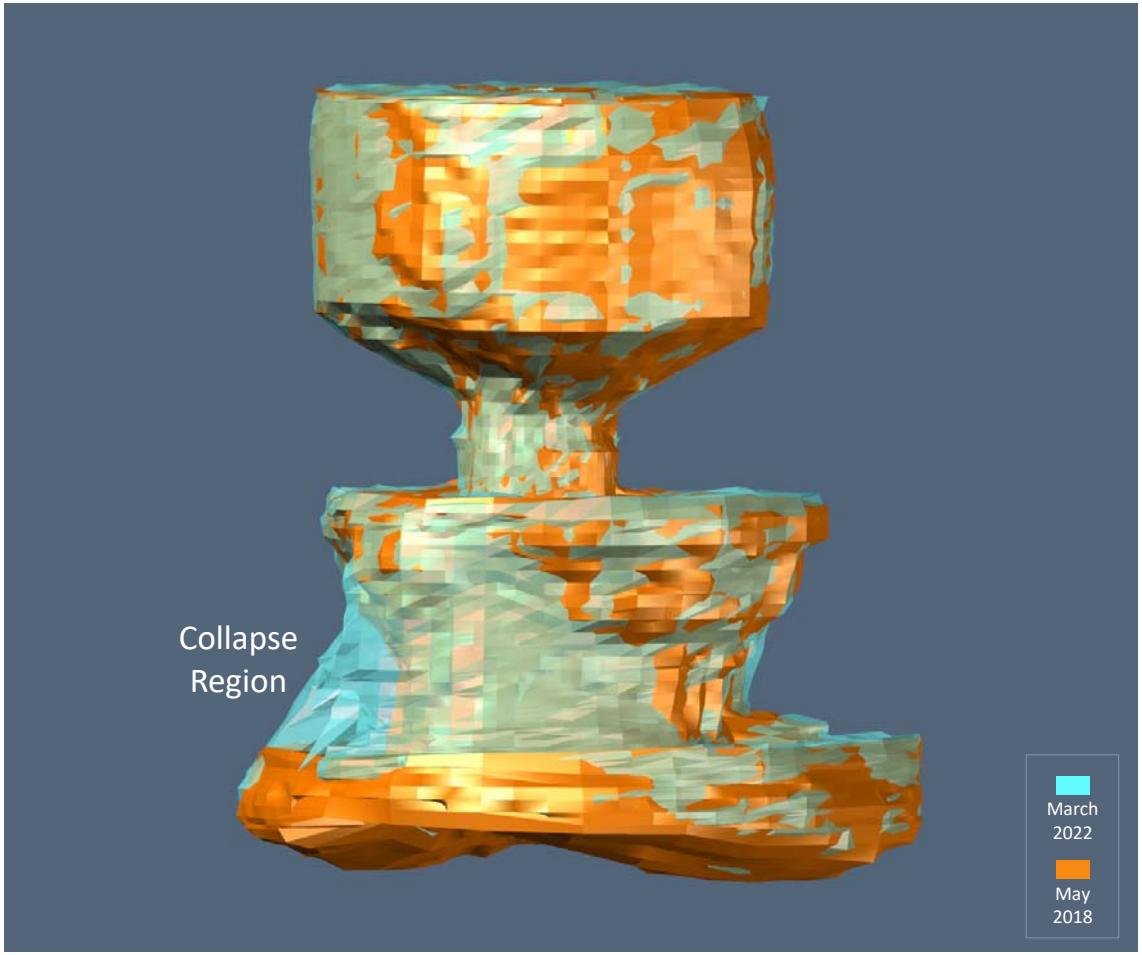
PPG 7B Sonar comparison – March 2022

- Three sonars were evaluated to compare geometry and orientation
  - March 2022 - Sonic Surveys
  - May 2018 - Socon
  - July 2011 – Sonarwire
- New sonar showed material collapse and resulting fill in lower cavern body along the western side



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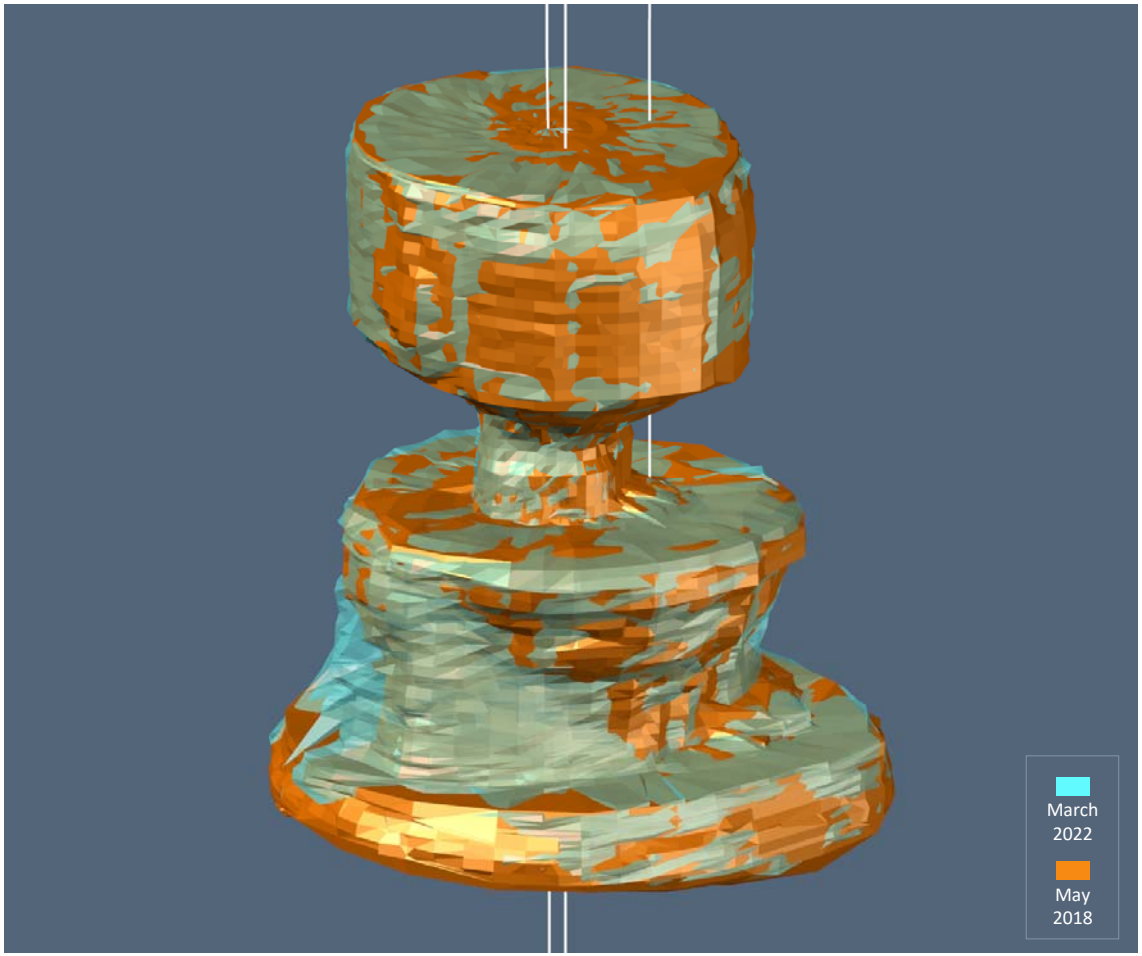
PPG 7B Sonar comparison – March 2022

- Historical sonars were evaluated to properly align orientations before evaluation of geometry changes and material fall
- May 2018 sonar required a 13° CCW rotation to align with March 2022 sonar



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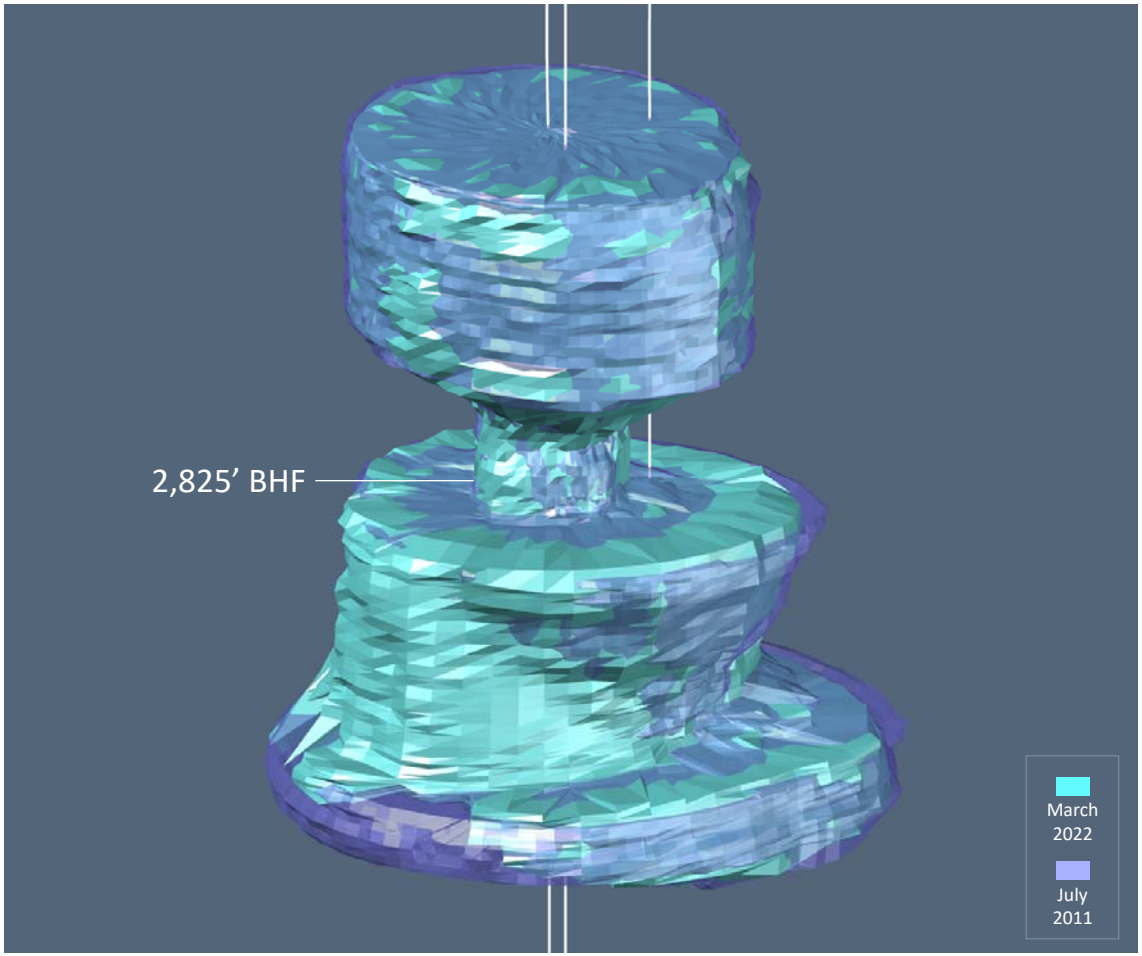
PPG 7B Sonar comparison – March 2022

- July 2011 sonar required a 24° CCW rotation below a depth of 2,825’ and an 8° CCW rotation above that depth to align with March 2022 sonar
- Operator provided the same note as in PPG 6X report regarding QC procedures for 7B March 2022 sonar
- Future spacing measurements and analysis involving these three sonars will rely on orientation indicated by current sonar



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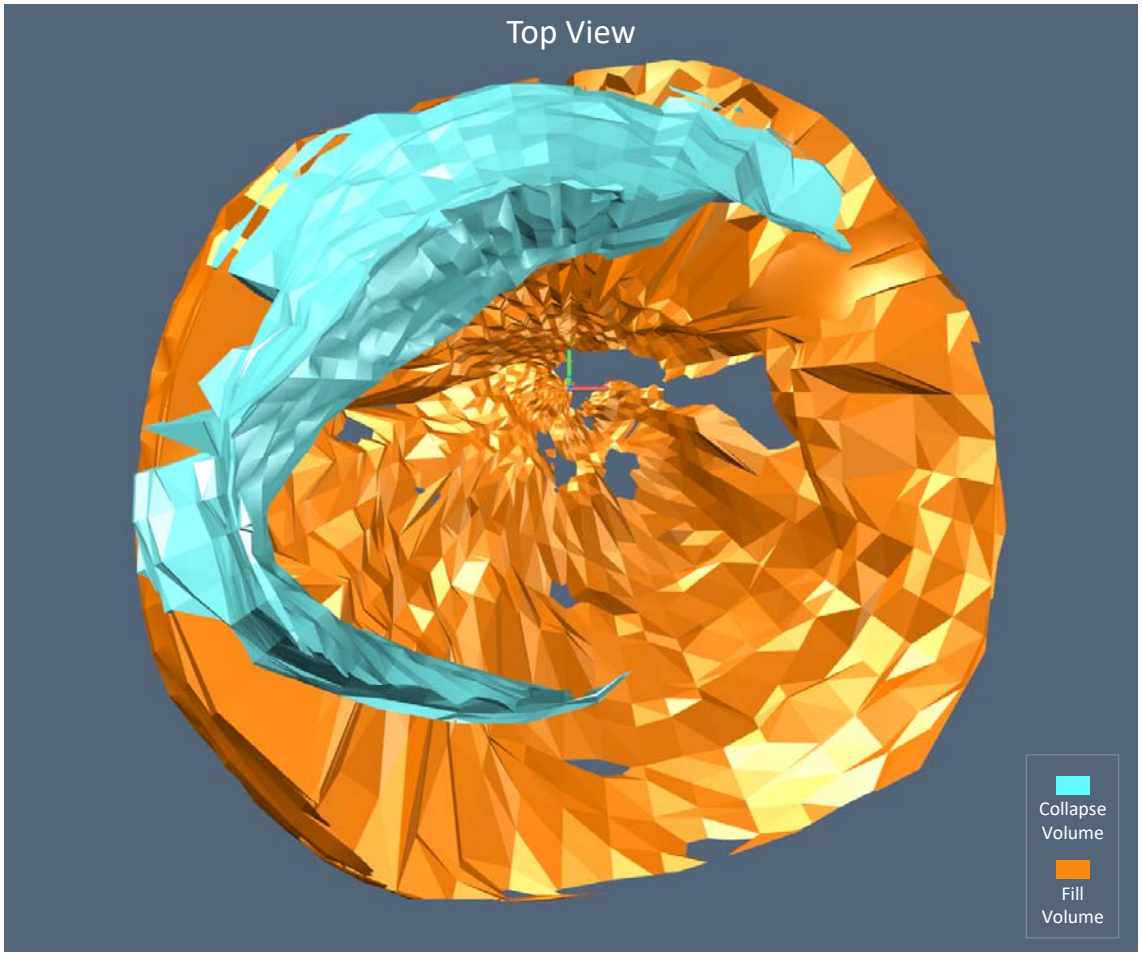
PPG 7B Material collapse evaluation – March 2022

- March 2022 sonar was compared to May 2018 sonar to evaluate collapse areas and geometry changes
- Collapse and Fill volumes were isolated for evaluation
- Material collapse extended around lower portion of cavern from the north to the southwest



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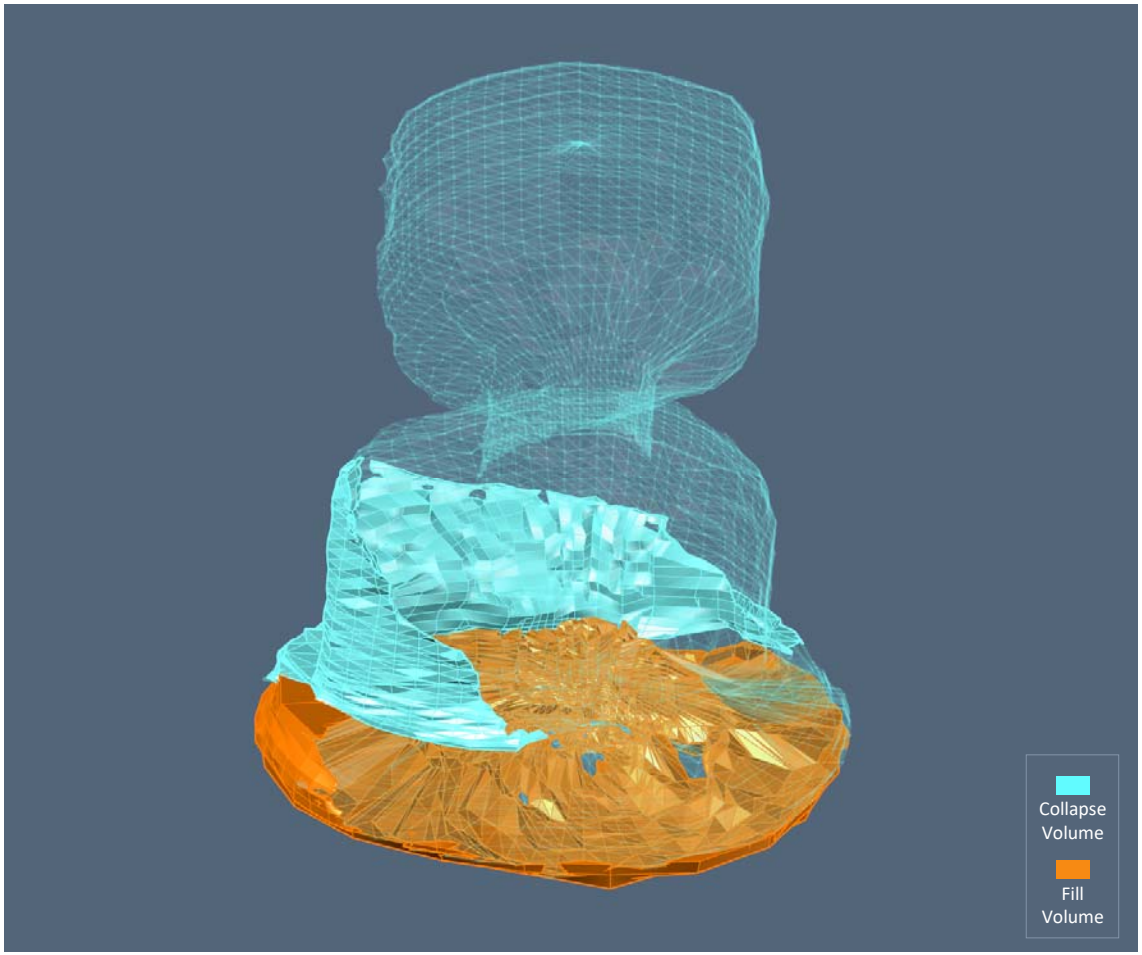
PPG 7B Material collapse evaluation – March 2022

- Collapse and fill volumes were measured in CAD
  - Collapse Volume: 491,300 bbls
  - Fill Volume: 841,101 bbls
  - 71% higher fill volume implies (in addition to typical bulking of rubble) that significant portions of the volume identified in this way remain void but are hidden from sonar view due to "walls" of piled material ("sonar shadows")



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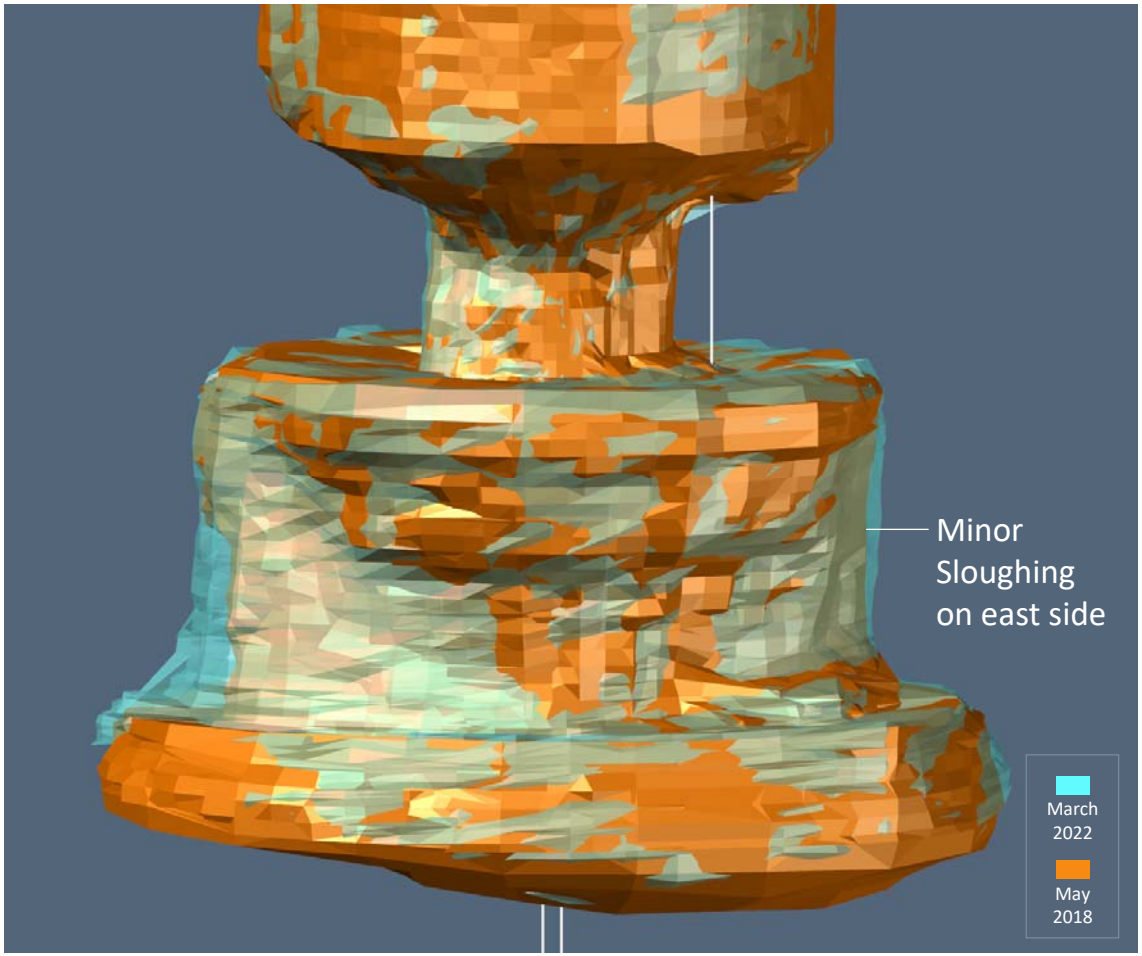
PPG 7B Material collapse evaluation – March 2022

- Aside from main material collapse region, only minor sloughing at similar depths was evident on eastern side of cavern
- No other notable changes in cavern geometry between March 2022 and prior May 2018 sonar



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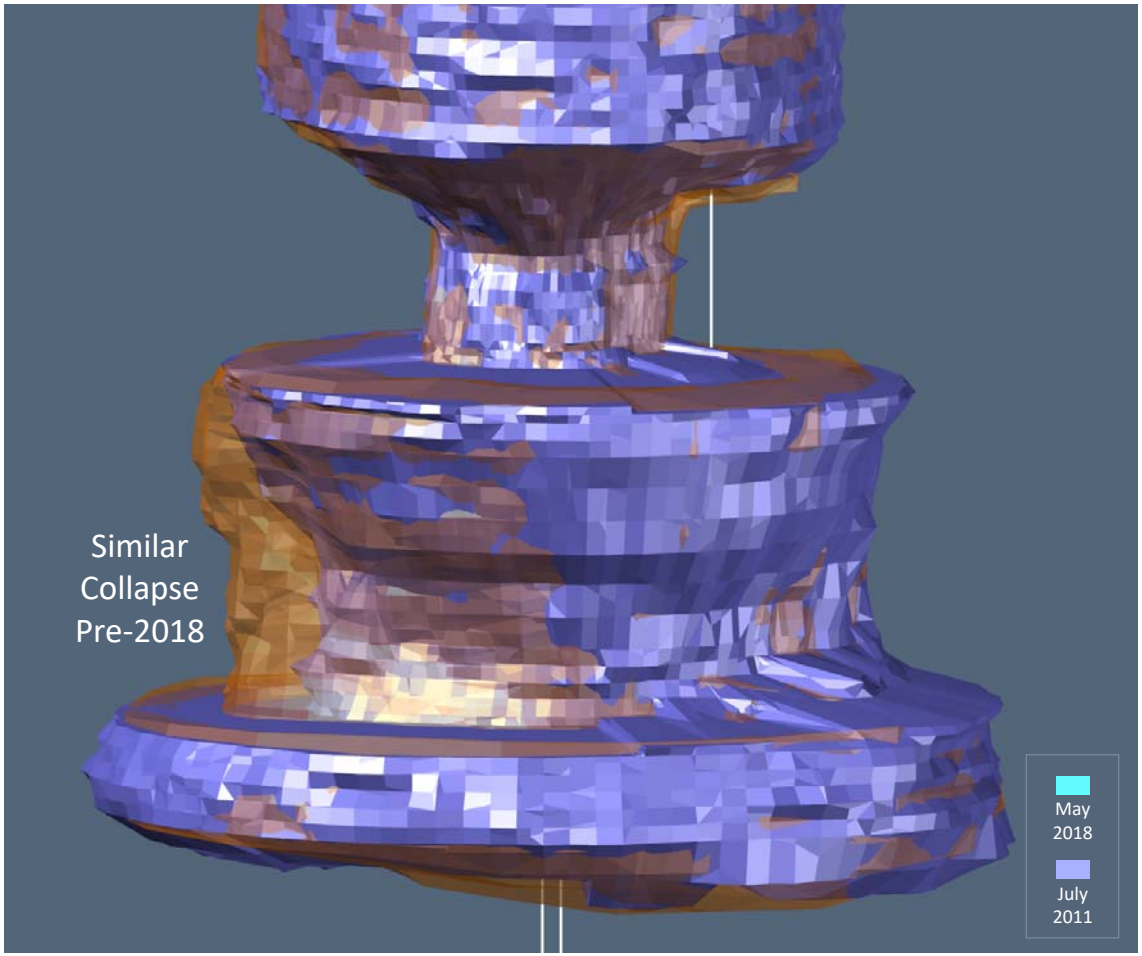
PPG 7B Material collapse evaluation – March 2022

- Comparison of the July 2011 sonar to the May 2018 sonar showed that a similar but less substantial material fall and associated fill had occurred at some point prior to 2018
- The fall was in the same region but affected a narrower azimuth range on the western side of the cavern



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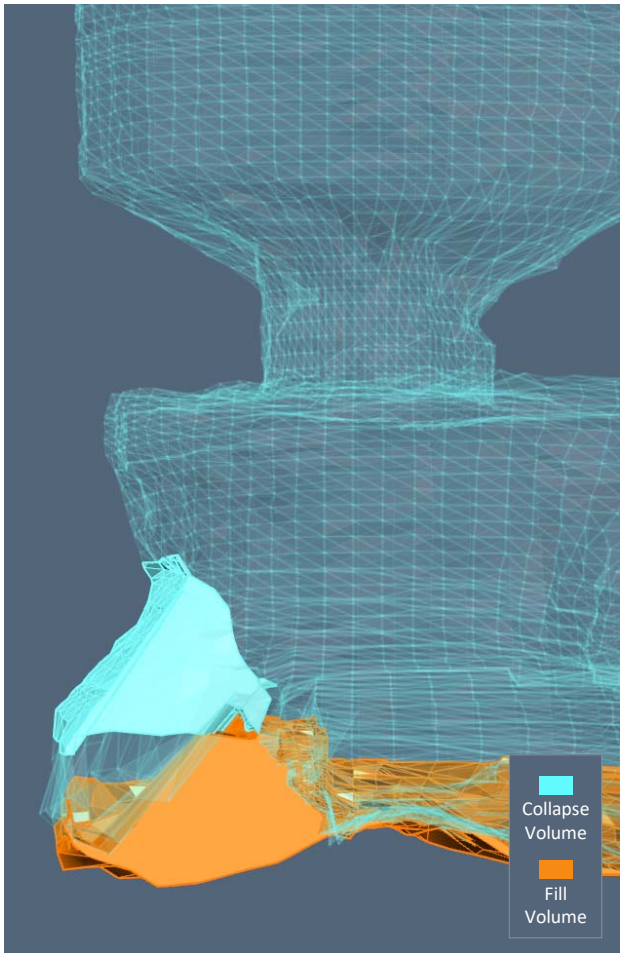
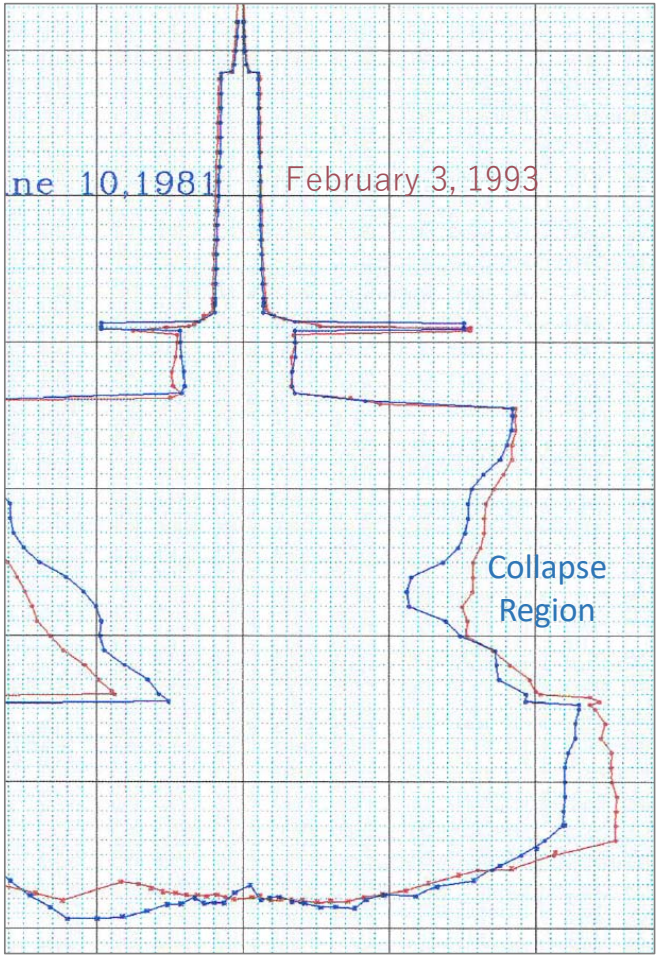
PPG 7B Material collapse evaluation – March 2022

- Review of historical sonars dating back to 1973 indicated that an identical material fall to that witnessed in the 2022 sonar appears to have occurred on the northeast and eastern portions of the cavern in the 1970's
- Shown to right:
  2022 Northwest X-section vs.
  1981 East X-section





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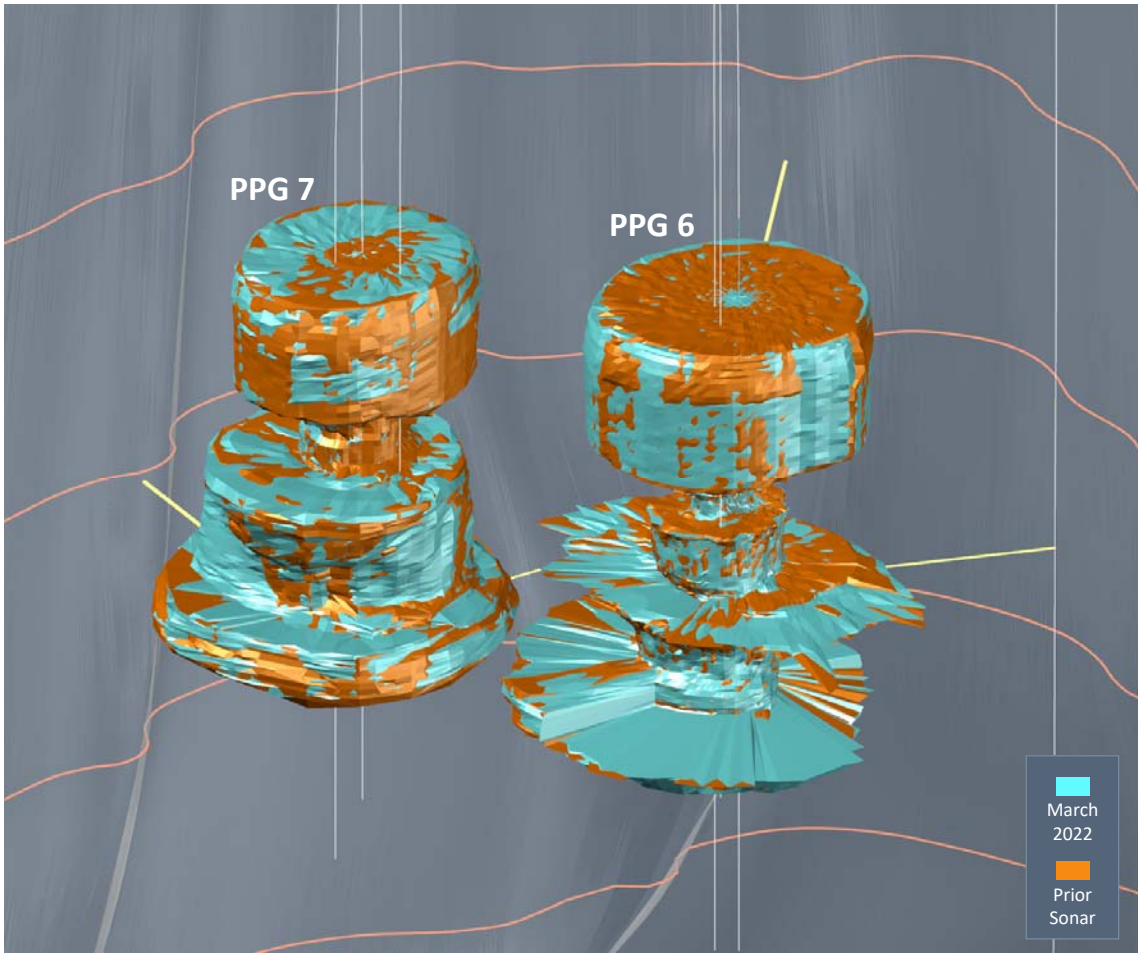
Spacing Measurement Updates – March 2022

- Minimum distances were re-measured for a few key areas as identified in the initial 3D mapping investigation
  - Changes are mostly attributed to new orientation of sonar data
- Most recent sonars shown in cyan, prior sonar in orange



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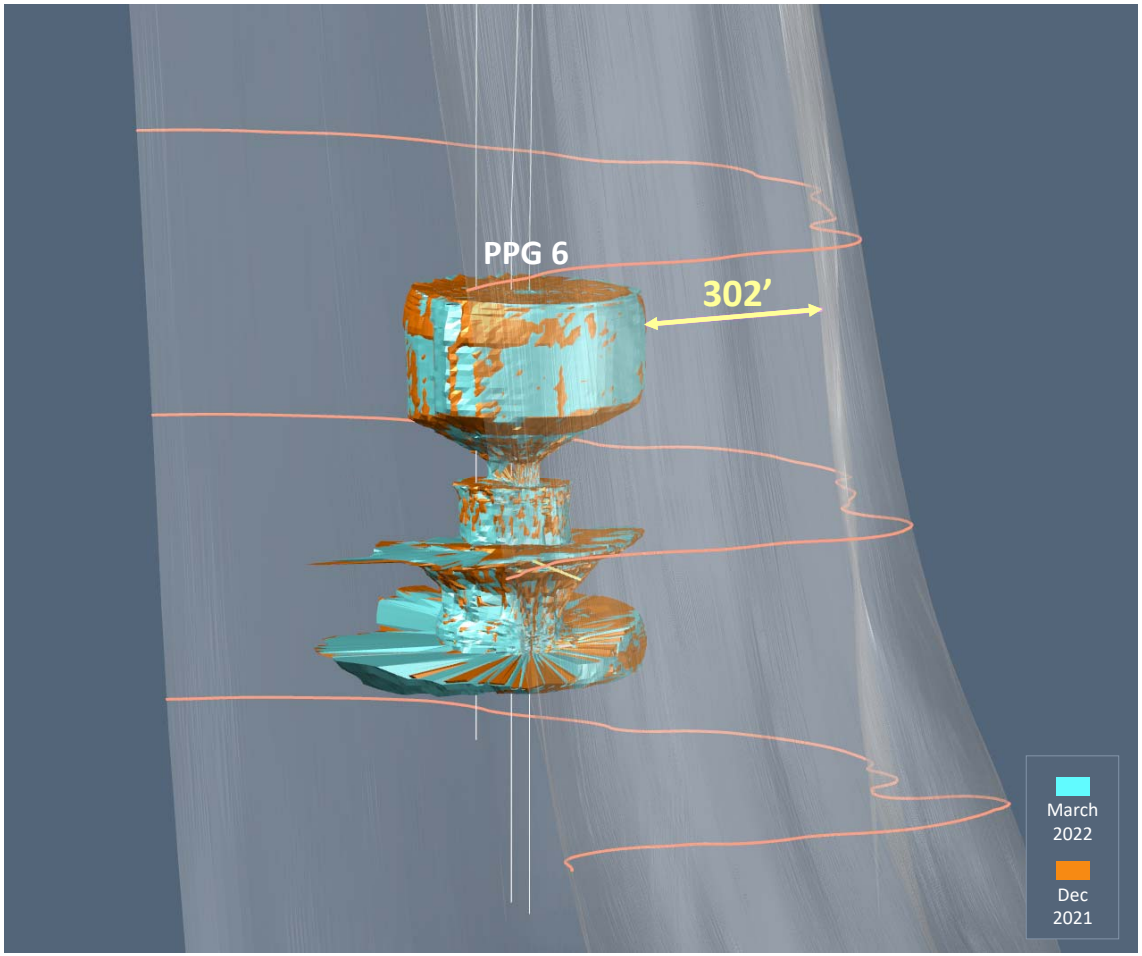
Spacing Measurement Updates – March 2022

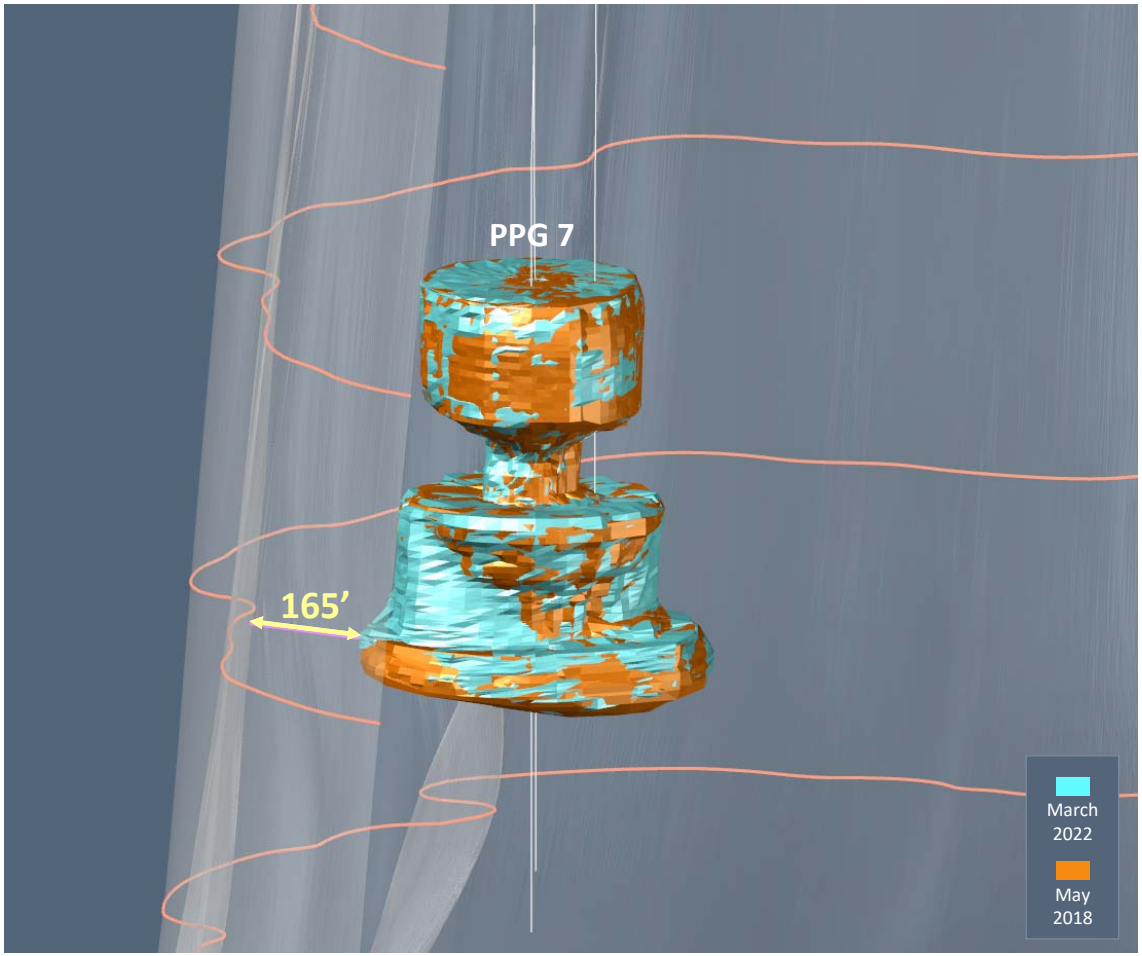
- Minimum distances were re-measured for a few key areas as identified in the initial 3D mapping investigation
  - Changes are mostly attributed to new orientation of sonar data
- Most recent sonars shown in cyan, prior sonar in orange
- PPG 6 Minimum distance to flank: 302’



LONQUIST & CO. LLC

Spacing Measurement Updates – March 2022

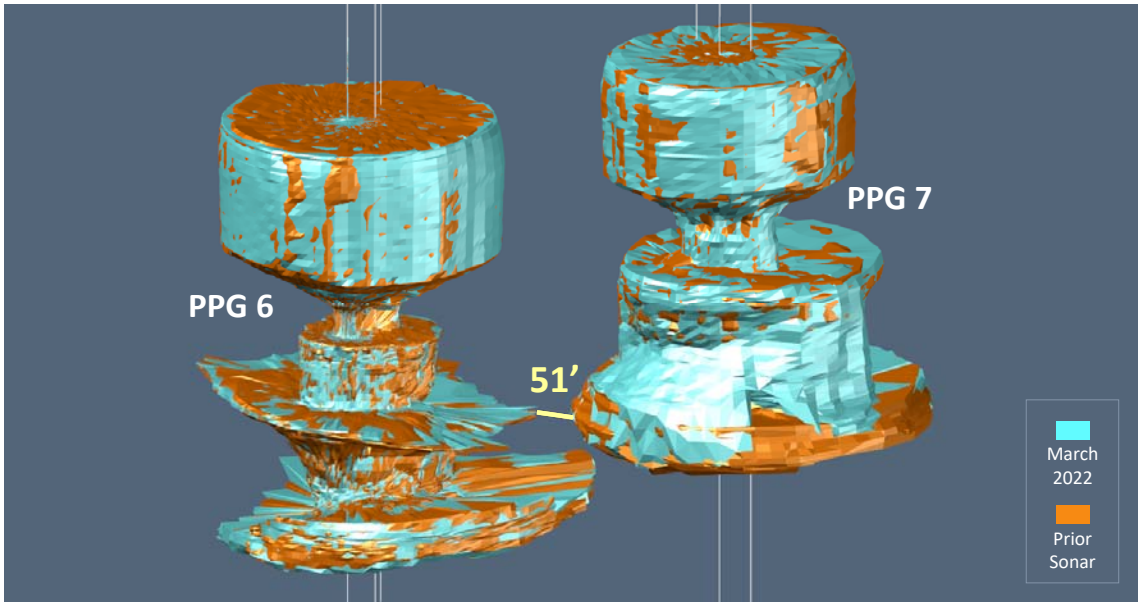
- Minimum distances were re-measured for a few key areas as identified in the initial 3D mapping investigation
  - Changes are mostly attributed to new orientation of sonar data
- Most recent sonars shown in cyan, prior sonar in orange
- PPG 6 Minimum distance to flank: 302’
- PPG 7 Minimum distance to flank: 165’

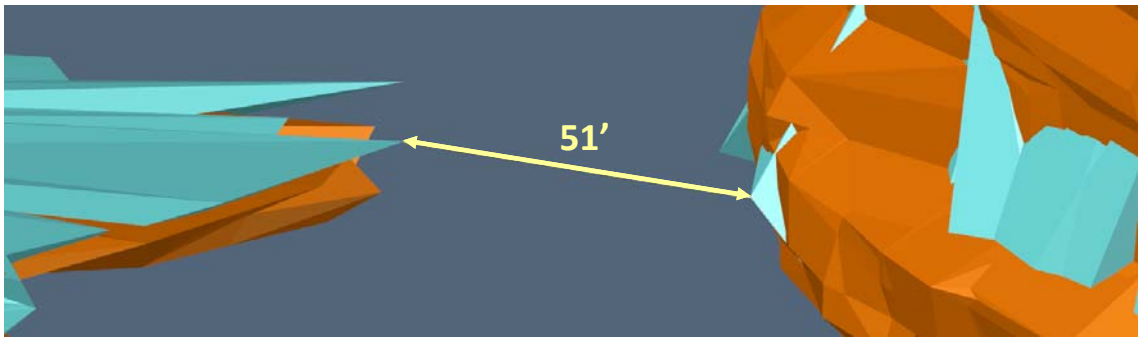


LONQUIST & CO. LLC

Spacing Measurement Updates – March 2022

- Minimum distances were re-measured for a few key areas as identified in the initial 3D mapping investigation
  - Changes are mostly attributed to new orientation of sonar data
- Most recent sonars shown in cyan, prior sonar in orange
- PPG 6 Minimum distance to flank: 302’
- PPG 7 Minimum distance to flank: 165’
- PPG 6 to PPG 7 Minimum distance: 51’





LONQUIST & CO. LLC

Spacing Measurement Updates – March 2022

- Minimum distances were re-measured for a few key areas as identified in the initial 3D mapping investigation
  - Changes are mostly attributed to new orientation of sonar data
- Most recent sonars shown in cyan, prior sonar in orange
- PPG 6 Minimum distance to flank: 302’
- PPG 7 Minimum distance to flank: 165’
- PPG 6 to PPG 7 Minimum distance: 51’
- PPG 6 to PPG 18 wellbore: 260’