July 17, 2024

From:

Nathaniel Byars, Lonquist & Co. LLC

Julie Shemeta, MEQ Geo Inc.

Re: Combined Monthly Surface Deformation Report – June 2024
Sulphur Mines Salt Dome, Louisiana

Please find attached the initial combined monthly deformation report for Sulphur Mines dome with the cumulative InSAR monitoring to the end of June 2024. The tiltmeter and GNSS data is still under review for June 2024 and will be sent as soon as the processing and review is completed. We anticipate this will be completed in another 1-2 weeks.

Additional Notes:

- TREA performed an evaluation of the signal amplitude from the InSAR corner reflectors, and has requested that reflector orientations be adjusted. These adjustments are being performed. The first reflector InSAR data is anticipated to be available in late September, after two months of baseline data is collected from the adjusted reflectors.

- Due to an unsuccessful acquisition of the scheduled June 24, 2024 SNT satellite image, the report for the most recent June SNT dataset from (6/12) has been included for this report

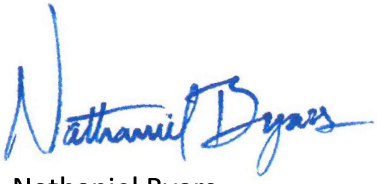
- Future monthly reports will also include calculated 2D InSAR results (vertical and east-west) in a similar format to the current LOS (line of sight) reports

- **Please note, the new monthly combined deformation report will replace the current InSAR reporting schedule, unless otherwise informed.**

Status of a deformation alert plan. As discussed in the "Update on the status of the Tiltmeter and GNSS ground deformation monitoring at Sulphur Mines Salt Dome, Louisiana" dated July 1, 2024, additional time is needed to create a deformation alert system with specific deformation readings from the tiltmeters, GNSS and InSAR monitoring effort. The deformation alert levels will include specific actions and updated

reporting schedules as the alert levels progress in severity. In the meantime, while background ground motion values are established, any clearly anomalous deformation readings in any of the monitoring systems shall be promptly reported to the various stakeholders.

Sincerely,



Nathaniel Byars
Principal Engineer
Lonquist & Co. LLC

Julie Shemeta
MEQ Geo Inc.

Attachment List

A. June 12, 2024 SNT InSAR report
B. June 28, 2024 TSX/PAZ InSAR report

ATTACHMENT A

June 12, 2024 SNT InSAR report

SNT Satellite Update

Continuous InSAR Monitoring of Ground Displacement At Westlake Caverns and Western Dome Flank

Sulphur Mines Salt Dome

Prepared for:
Westlake Chemical

Prepared by:
Lonquist & Co., LLC
8591 United Plaza Blvd., Suite 280
Baton Rouge, LA 70809

Dataset
Satellite Source
Sentinel-1 (SNT)
Most Recent Image Date
Wednesday, June 12, 2024

Analysis Report Date:

June 17, 2024

Dataset Information

Satellite Source	Sentinel-1 (SNT)
Revisit Frequency	12 days
Most Recent Image Date	Wednesday, June 12, 2024
Dataset Image Count	203
Dataset Time Range	October 4, 2016 - June 12, 2024
Dataset Length	7.69 Years
Satellite Line-of-Sight (LOS)	43° West of Vertical (Viewing site from the West)

Analysis Methodology

Time Series Charts

Trend lines were calculated for the averaged displacement values within each AOI. Quadratic regression was used to determine Velocity and Acceleration of LOS displacement. Trends calculated for the AOI point groups are depicted for each AOI in the Time Series section of this report.

Contour Maps

A quadratic trend was also calculated for each individual measurement point across the analysis region. Trend values for each point were used to generate Velocity and Acceleration contour maps to depict the spatial distribution of the movement trends. Negative velocity values indicate subsidence or eastward movement. Negative acceleration values indicate increasing rates of subsidence or eastward movement and positive acceleration values indicate slowing rates of subsidence or eastward movement.

Recent vs. Historical Data

The multi-year SNT dataset timeframe allows for Recent data to be evaluated separately from Historical data and for trends from the two timeframes to be compared. The change in the velocities and accelerations from the two timeframes are provided in the Time Series and Contour Map sections. Velocity values are calculated for the final date in either the Recent or Historical datasets.

Observations

To-date there have been no acute deviations from established subsidence trends in the areas investigated.

The comparison of Recent to Historical trends in the SNT data does imply a minor increase (≥ -0.10) in the negative velocity and/or negative acceleration of LOS displacement in 2 of the 15 AOI point groups. This suggests that marginal increases in subsidence rates may be occuring in these areas in recent years with the greatest velocity increases (in descending order) occuring in AOI 13 (PPG 18) and AOI 8 (PPG 22).

The mapped contours of the change in recent vs. historical subsidence velocity and acceleration mostly display minor fluctuations around 0, intermittently distributed within the AOIs. This observation suggests that statistically relevant areas of change are not currently evident within the rate change maps.

Date Signed: June 17, 2024
Austin, Texas

Nathaniel L. Byars, P.E.
Principal Engineer
Louisiana License No. 40697

InSAR Data Sources

InSAR Data

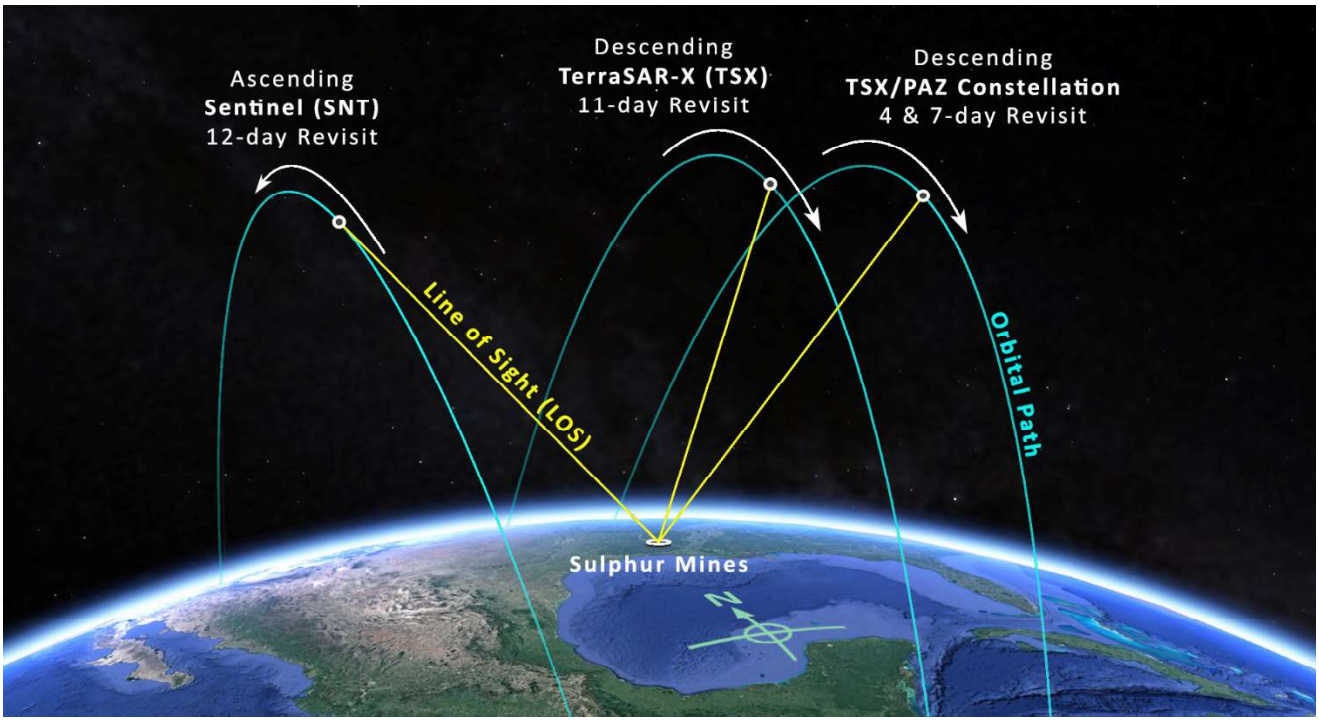
Interferometric Synthetic Aperture Radar (InSAR) is the most well established method to continually evaluate small, normally undetectable, ground movement over a large area. Radar imagery collected via satellites over successive orbital passes is used to identify and define measurement points on the ground. Objects or ground features providing a stable reflection of radar energy such as buildings, roads, and infrastructure produce the highest quality measurement points. InSAR analysis identifies the change in distance between the satellite and each measurement point over time relative to a stable reference point within the imaged area.

Satellite Sources

Two InSAR datasets are being used to evaluate subsidence over the Sulphur Mines Salt Dome. These datasets provide Line-of-Sight (LOS) displacment measurements from both ascending and descending orbits. An ascending orbit denotes the satellite's longitudinal course from south to north as it passes over the site, while a desceding orbit denotes the satellite is moving from north to south.

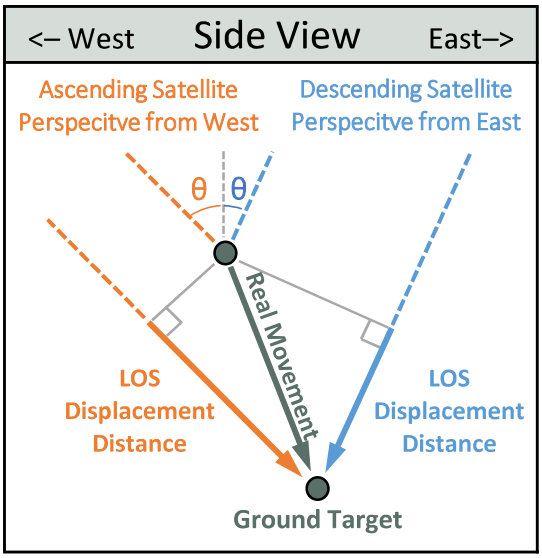
The first dataset comes from a low-resolution Sentinel-1 (SNT) satellite on an ascending orbit that captures data from the west of the site on a 12-day frequency. The second comes from a pair of high resolution satellites that share the same descending orbit and capture data from east of the site. These are a TSX satellite and the PAZ satellite (TSX/PAZ constellation), both with an 11-day revisit frequency. Their orbits are offset with the PAZ satellite passing over the site 4 days after the TSX satellite. Prior to May 2023, data was captured from a different high-resolution TerraSAR-X (TSX) satellite on a descending orbit that captured data from the east of the site on an 11-day frequency. The transition was made for the increased data frequency that resulted from a 4 and 7-day revisit period. The image below depicts the orbital paths of the satellites in relation to the Sulphur Mines Salt Dome.

Satellite Orbital Diagram



InSAR Line-of-Site (LOS) Data

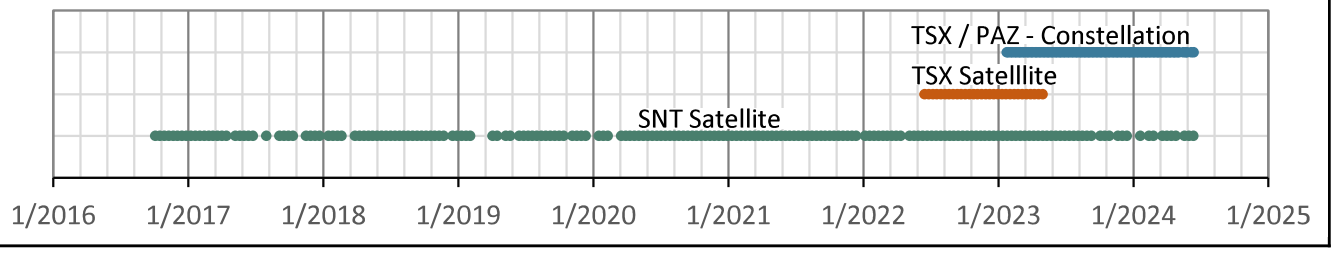
LOS displacement measurements refer to a change in distance between the satellite sensor and the ground target. Measurement positions on the west side of the Sulphur Dome are are known to be experiencing some eastward movement toward the dome center due to the geometry of the subsidence basin. The InSAR satellites view the site from eastward and westward positions so LOS measurements are understood to convey a movement distance that is not purely vertical. The diagram to the right illustrates the geometric relationship between the theoretical Real movement of a ground target and LOS displacement measurements from two different satellite viewing directions.



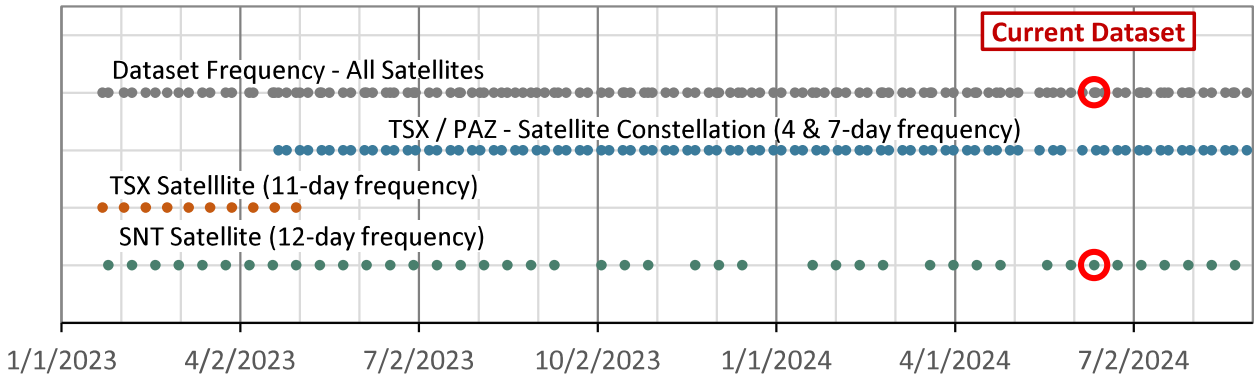
Satellite Properties & Image Frequency

Satellite and Data Properties	SNT	TSX	TSX/PAZ Constellation
Band (Wavelength)	C-band (2.20 in)	X-band (1.22 in)	X-band (1.22 in)
Track	T136	T29	T67 & T120
Pixel resolution	65 x 16 ft	3 x 3 ft	3 x 3 ft
Revisit frequency	12 days	11 days	4 & 7 days
Orbit (LOS Angle, θ)	Ascending (43°)	Descending (17°)	Descending (37°)
Data Start Date	10/4/2016	6/16/2022	1/24/2023
Measurement error range	± 0.20 in	± 0.03 in	± 0.03 in

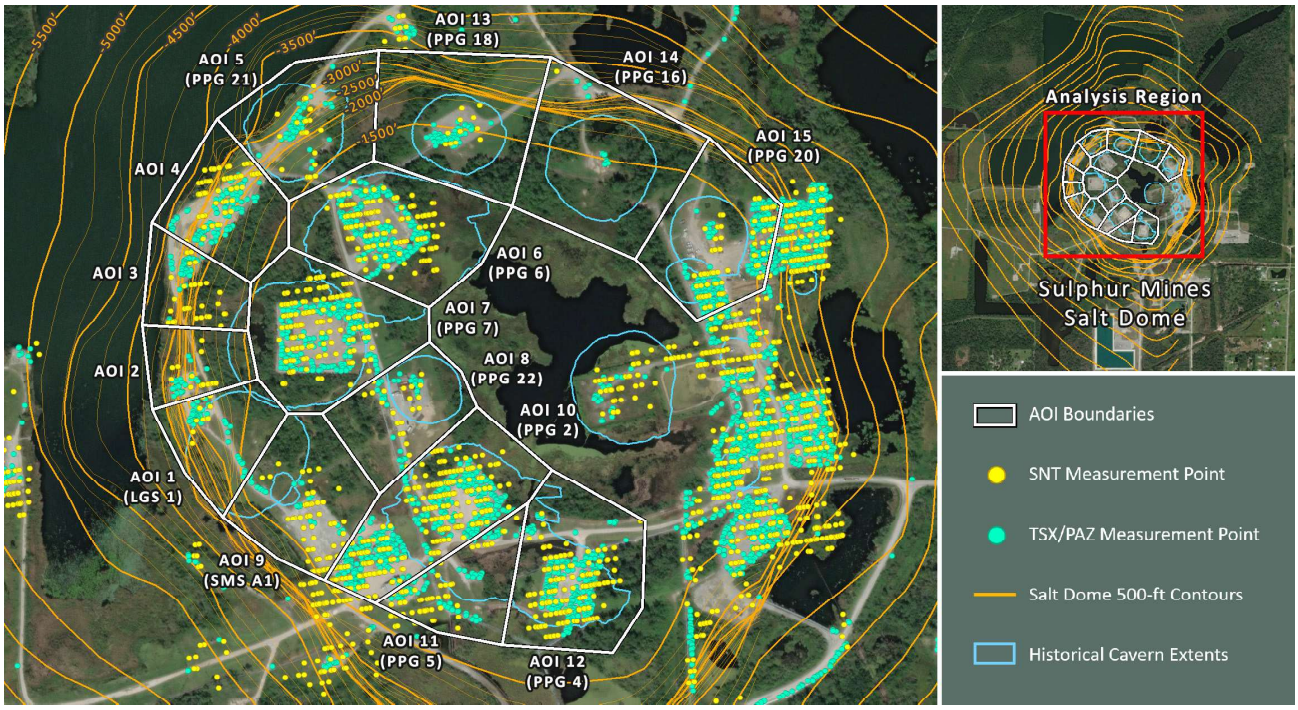
Dataset Measurement History



Dataset Update Frequency



AOI Boundaries & InSAR Measurement Points

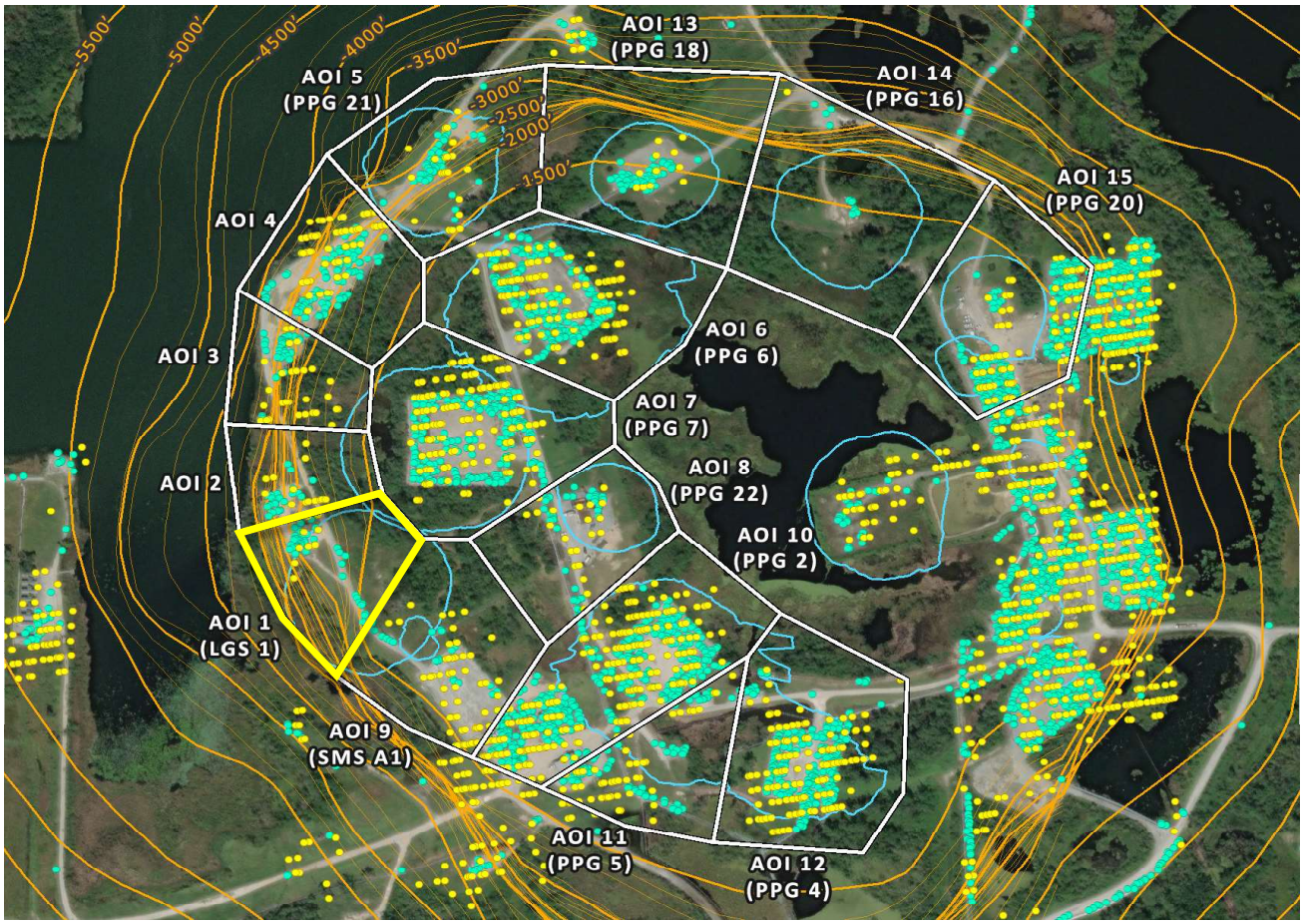


Subsidence Monitoring Areas of Interest (AOIs)

To visually convey and evaluate trend consistency for the displacement time series of each ground target, measurment points were grouped and their displacement values were averaged. The point groups are referred to as Areas of Interest (AOIs) in this analysis and their boundaries are depicted on the above map. The below table lists the trend values calculated in each AOI for the dataset evaluated in this report.

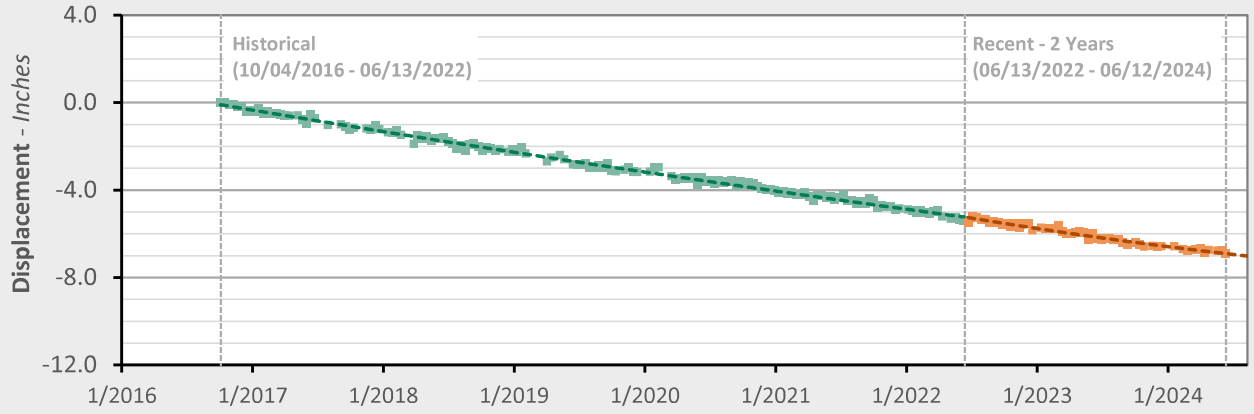
AOI Name	SNT (6/12/2024)	LOS Velocity *(in/yr)*			LOS Acceleration *(in/yr^2)*		
	Point Count	Historical	Recent	Change	Historical	Recent	Change
AOI 1 *(LGS 1)*	13	-0.79	-0.64	+0.16	+0.04	+0.22	+0.18
AOI 2	15	-0.73	-0.72	+0.02	+0.07	+0.14	+0.06
AOI 3	29	-0.67	-0.64	+0.03	+0.03	+0.06	+0.03
AOI 4	61	-0.77	-0.70	+0.07	+0.00	+0.00	-0.00
AOI 5 *(PPG 21)*	26	-0.69	-0.55	+0.13	+0.01	+0.04	+0.03
AOI 6 *(PPG 6)*	134	-0.87	-0.82	+0.05	+0.05	+0.05	-0.01
AOI 7 *(PPG 7)*	140	-1.00	-1.01	-0.01	+0.07	+0.08	+0.01
AOI 8 *(PPG 22)*	20	-1.07	-1.16	-0.09	+0.11	+0.12	+0.02
AOI 9 *(SMS A1)*	59	-0.85	-0.84	+0.01	+0.08	+0.04	-0.04
AOI 10 *(PPG 2)*	230	-0.90	-0.97	-0.07	+0.09	+0.04	-0.06
AOI 11 *(PPG 5)*	52	-0.91	-0.91	+0.00	+0.07	+0.03	-0.04
AOI 12 *(PPG 4)*	121	-0.73	-0.61	+0.11	+0.06	+0.18	+0.12
AOI 13 *(PPG 18)*	12	-0.58	-0.71	-0.13	+0.05	-0.13	-0.18
AOI 14 *(PPG 16)*	1	-0.17	+0.26	+0.43	+0.08	+0.57	+0.49
AOI 15 *(PPG 20)*	72	-0.30	-0.25	+0.05	+0.05	+0.05	+0.01

AOI 1 *(LGS 1)* - Location Map



AOI 1 *(LGS 1)* - Displacement Time Series

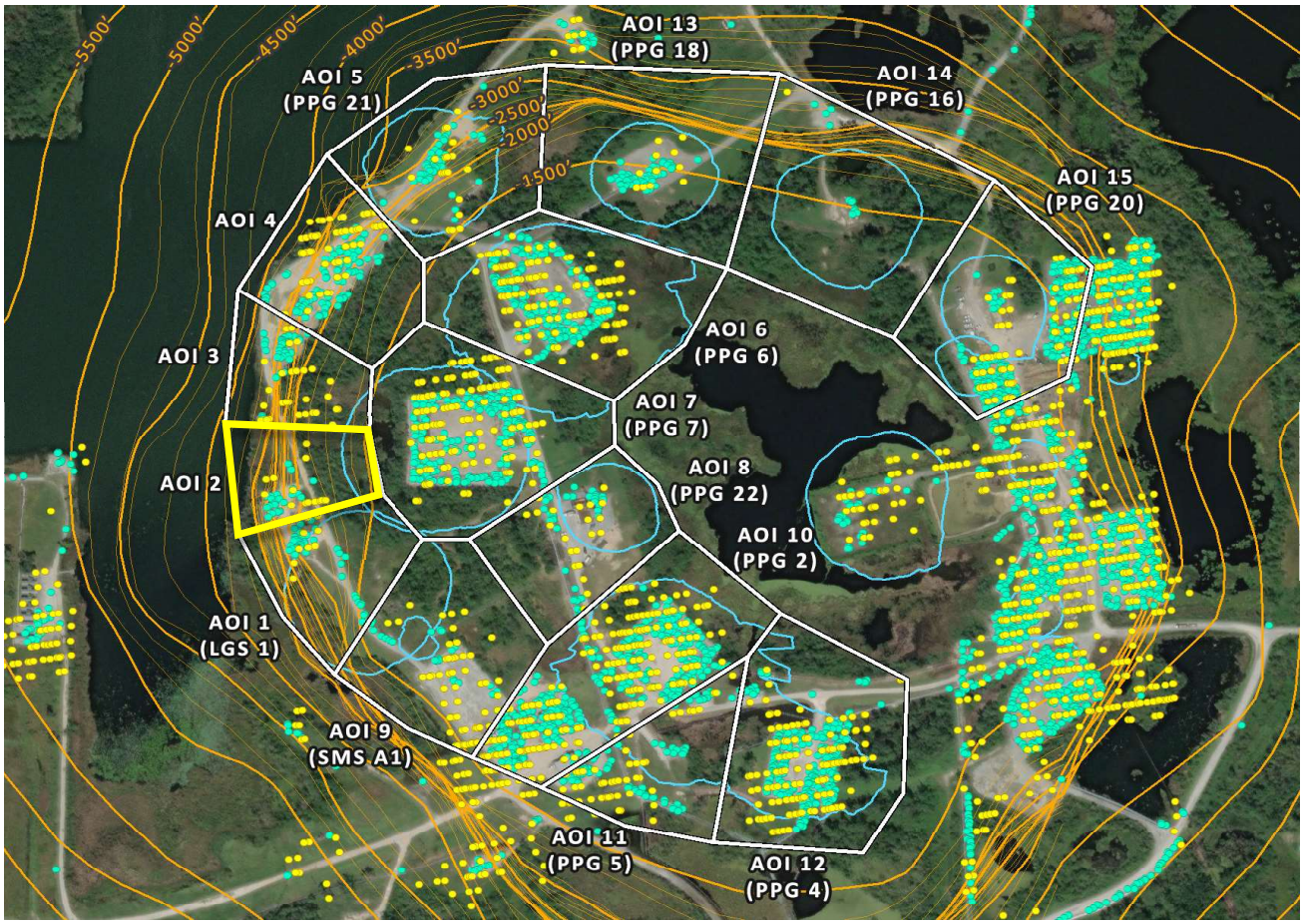
SNT (6/12/2024) Point Count: **13**



	Historical Trend Values	Recent Trend Values	Trend Change
Velocity:	-0.79 in/yr	-0.64 in/yr	+0.16 in/yr
Acceleration:	+0.04 in/yr^2	+0.22 in/yr^2	+0.18 in/yr^2

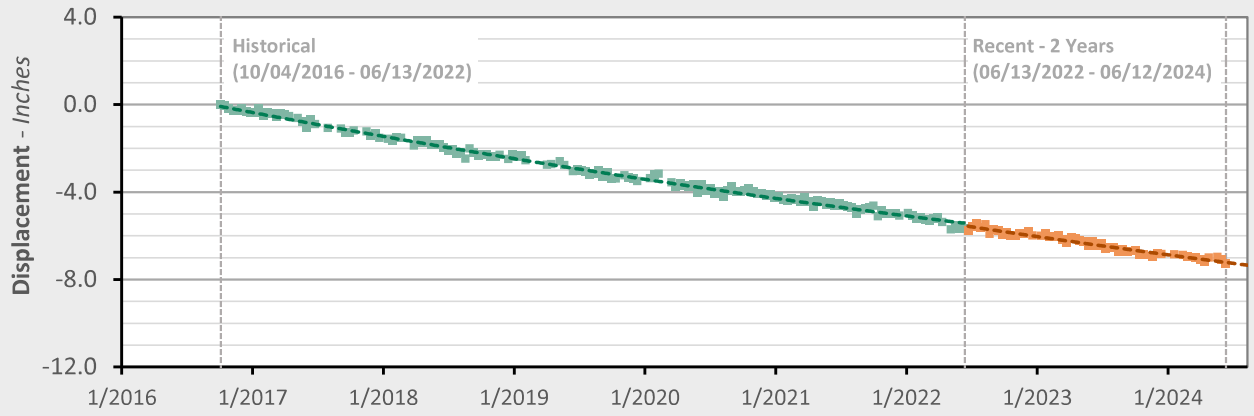
Historical LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)
Recent LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)

AOI 2 - Location Map



AOI 2 - Displacement Time Series

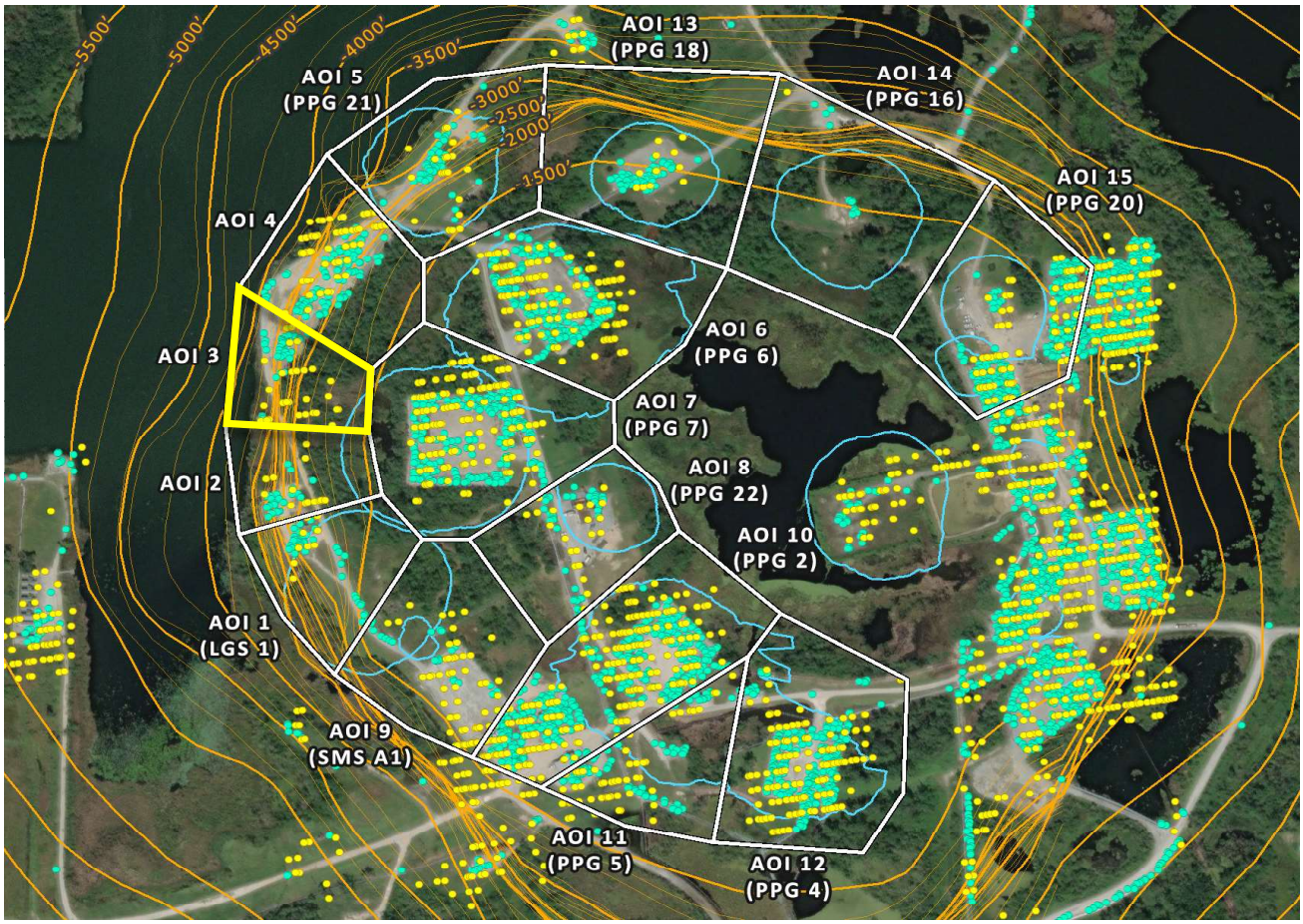
SNT (6/12/2024) Point Count: **15**



	Historical Trend Values	Recent Trend Values	Trend Change
Velocity:	-0.73 in/yr	-0.72 in/yr	+0.02 in/yr
Acceleration:	+0.07 in/yr^2	+0.14 in/yr^2	+0.06 in/yr^2

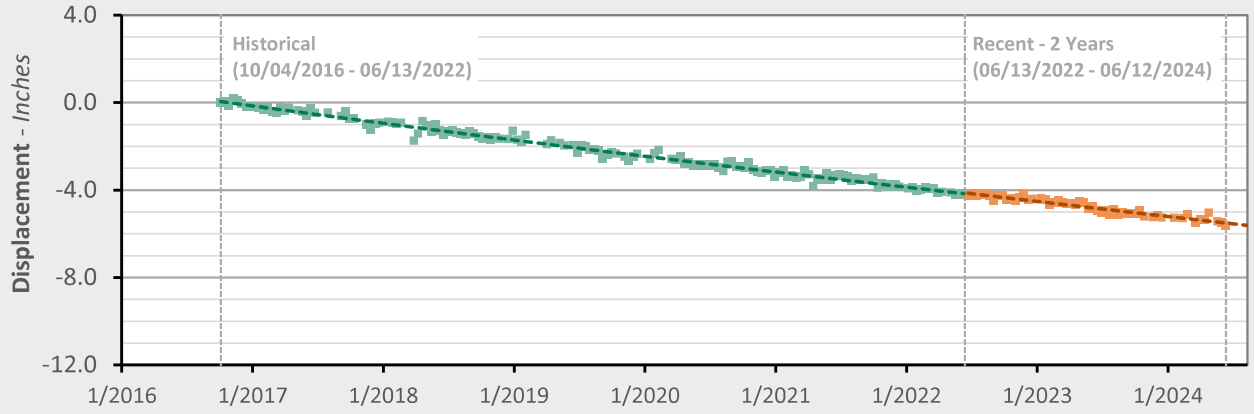
Historical LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)
Recent LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)

AOI 3 - Location Map



AOI 3 - Displacement Time Series

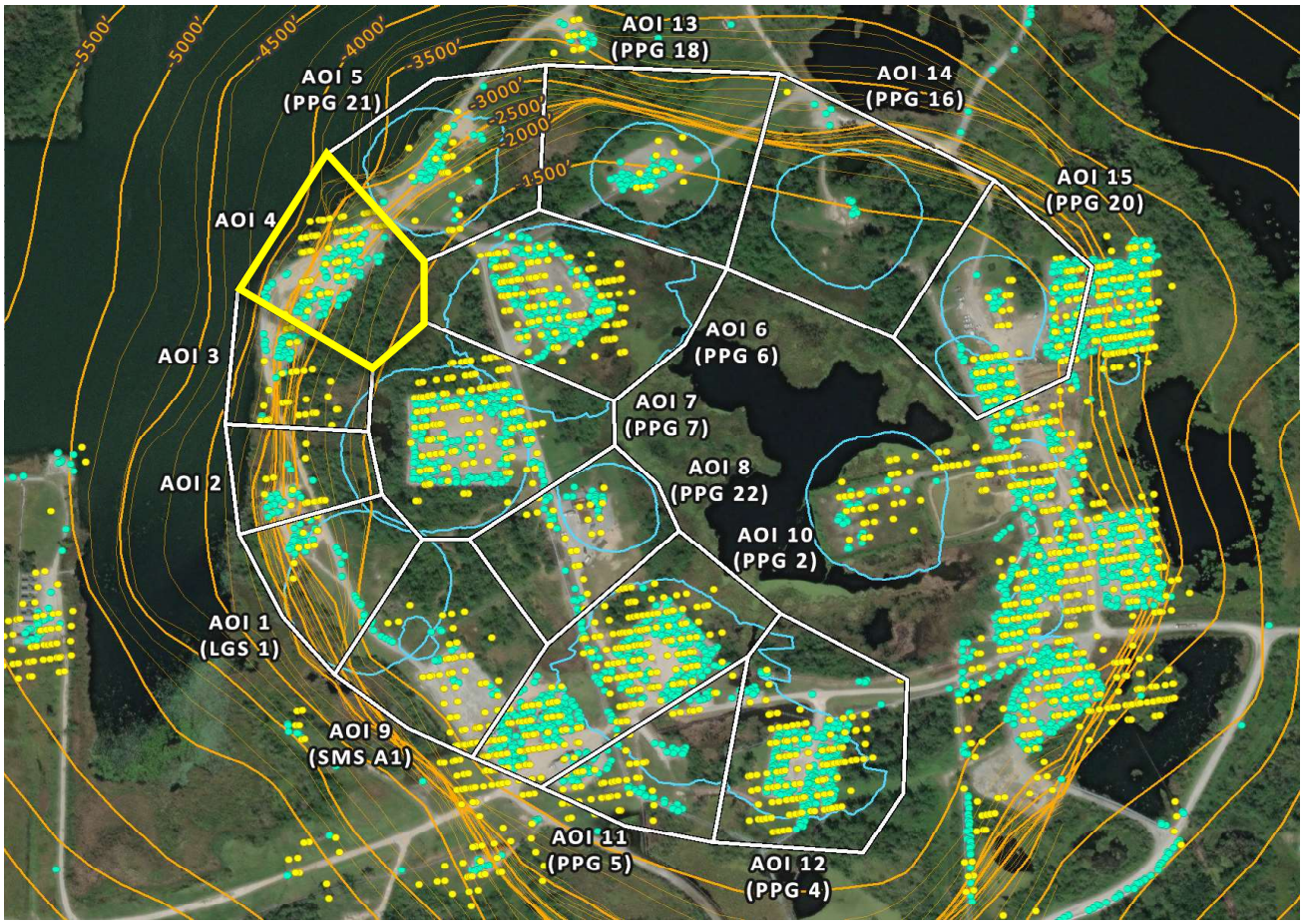
SNT (6/12/2024) Point Count: **29**



	Historical Trend Values	Recent Trend Values	Trend Change
Velocity:	-0.67 in/yr	-0.64 in/yr	+0.03 in/yr
Acceleration:	+0.03 in/yr^2	+0.06 in/yr^2	+0.03 in/yr^2

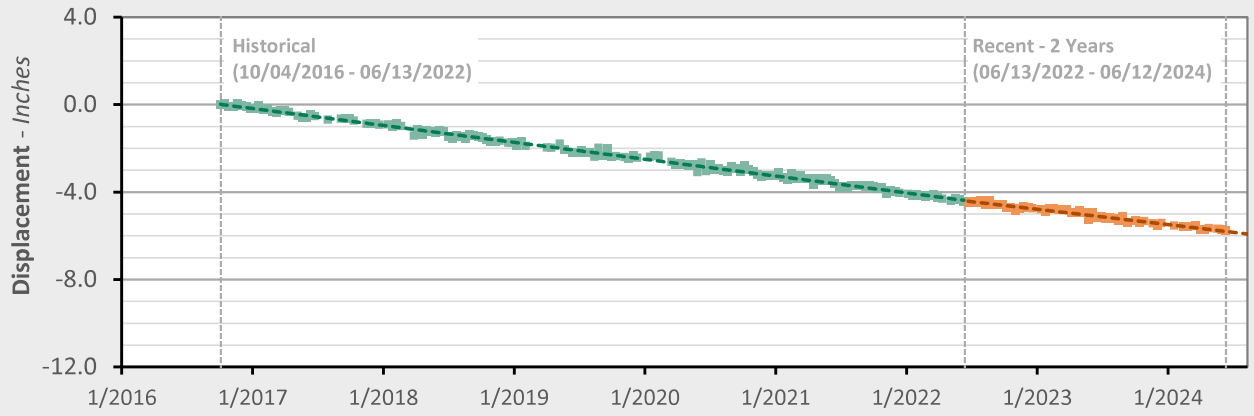
Historical LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)
Recent LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)

AOI 4 - Location Map



AOI 4 - Displacement Time Series

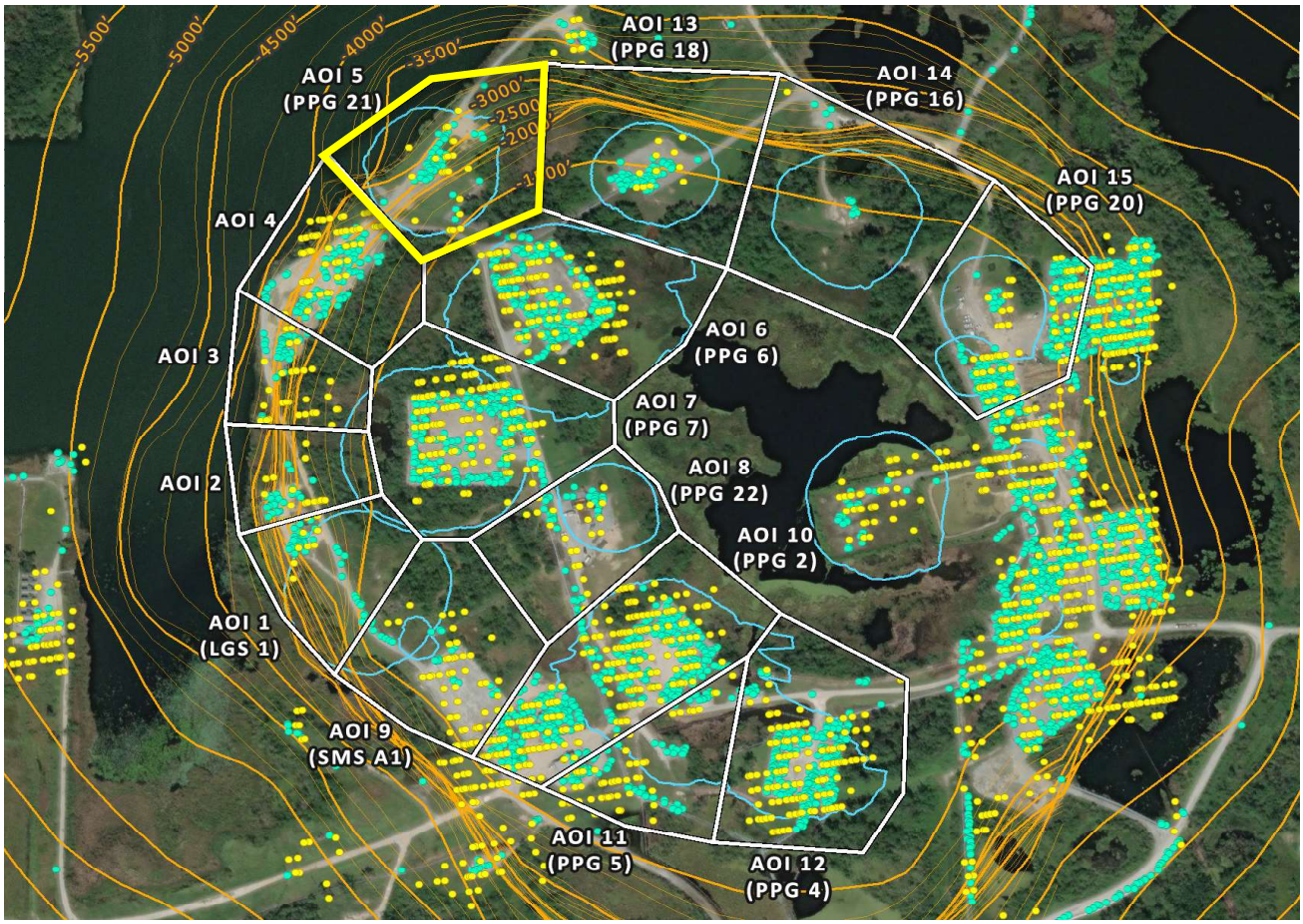
SNT (6/12/2024) Point Count: **61**



	Historical Trend Values	Recent Trend Values	Trend Change
Velocity:	-0.77 in/yr	-0.70 in/yr	+0.07 in/yr
Acceleration:	+0.00 in/yr^2	+0.00 in/yr^2	-0.00 in/yr^2

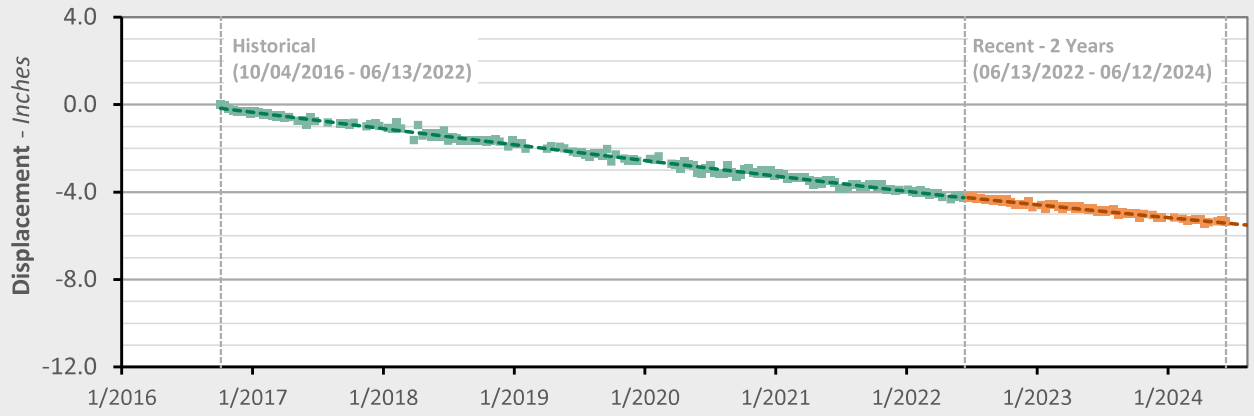
Historical LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)
Recent LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)

AOI 5 *(PPG 21)* - Location Map



AOI 5 *(PPG 21)* - Displacement Time Series

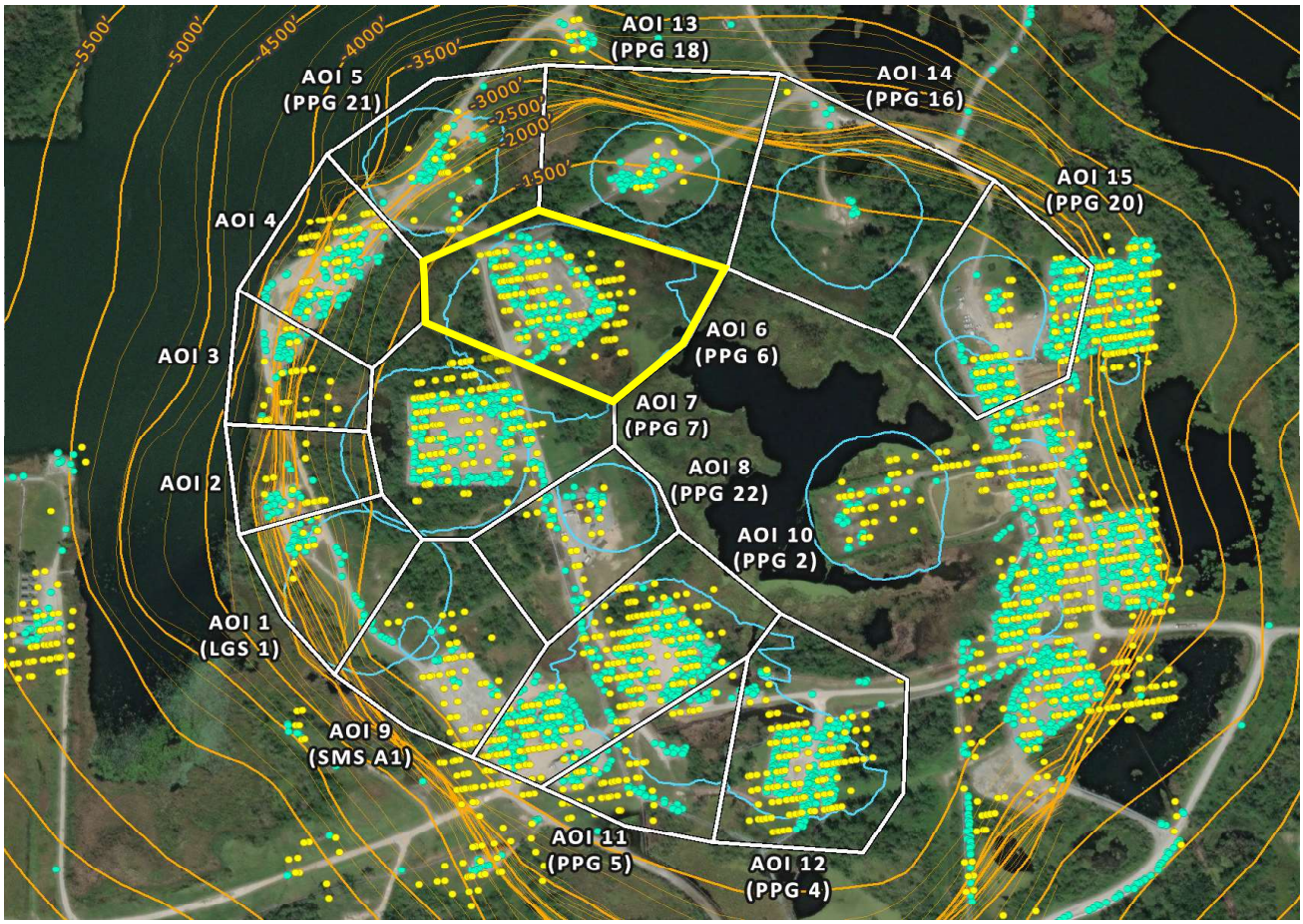
SNT (6/12/2024) Point Count: **26**



	Historical Trend Values	Recent Trend Values	Trend Change
Velocity:	-0.69 in/yr	-0.55 in/yr	+0.13 in/yr
Acceleration:	+0.01 in/yr^2	+0.04 in/yr^2	+0.03 in/yr^2

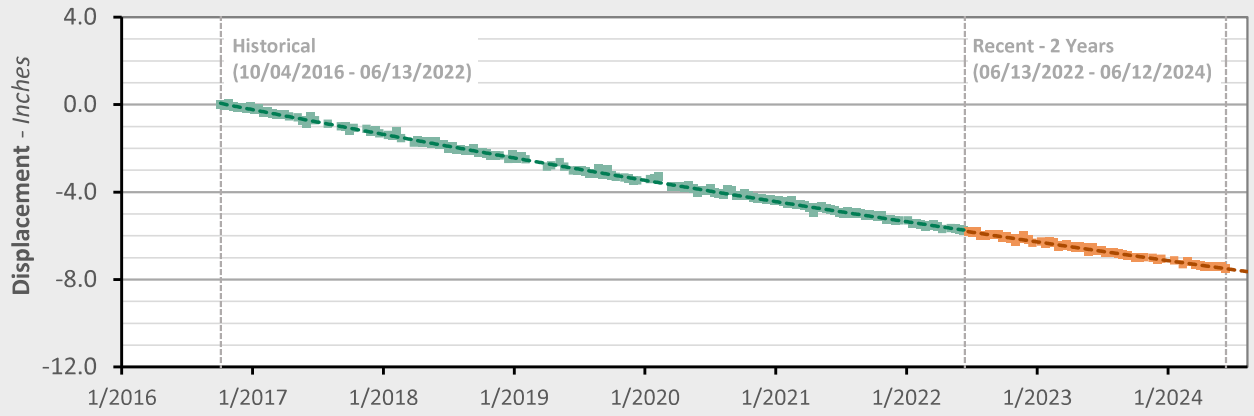
Historical LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)
Recent LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)

AOI 6 *(PPG 6)* - Location Map



AOI 6 *(PPG 6)* - Displacement Time Series

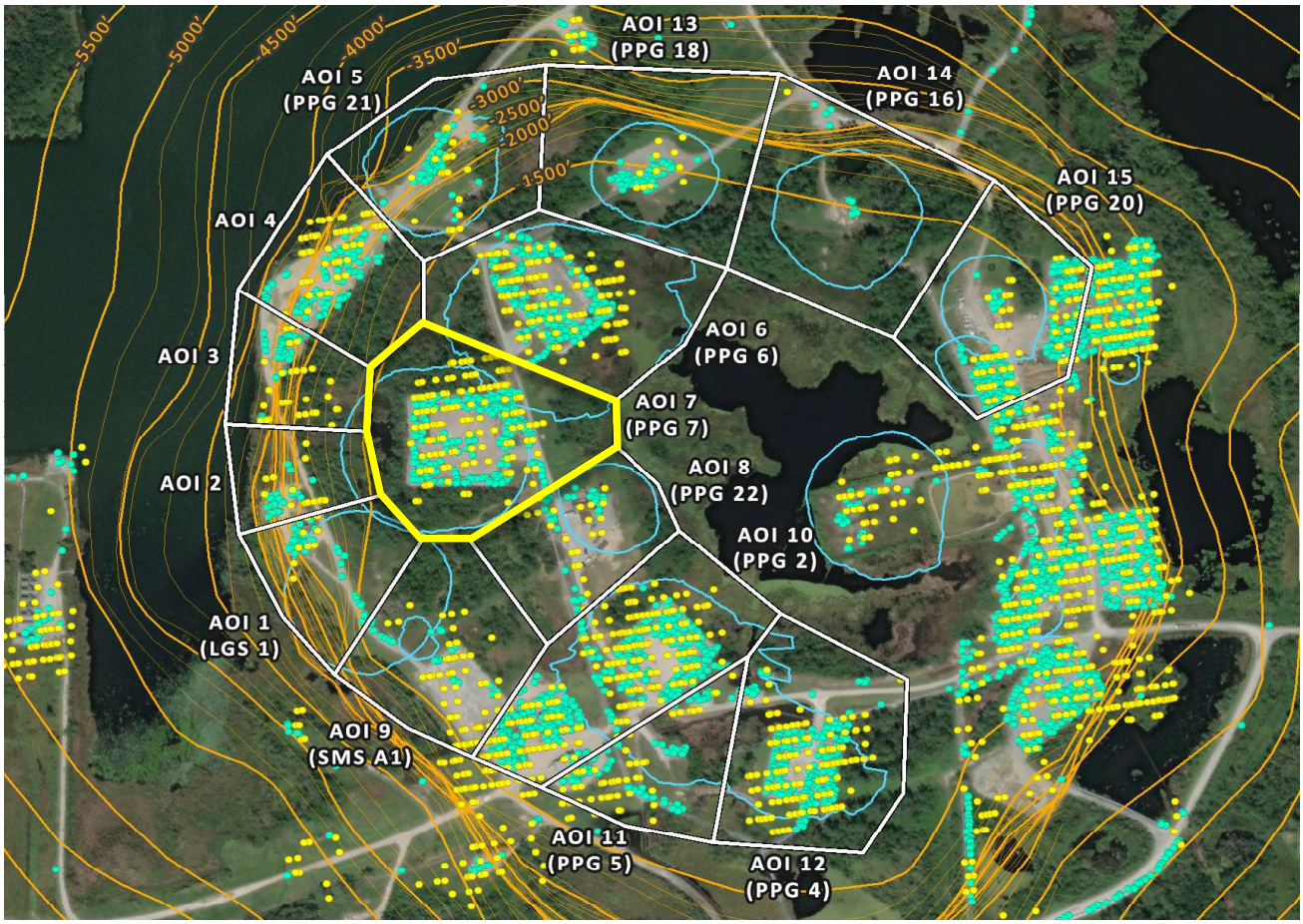
SNT (6/12/2024) Point Count: **134**



	Historical Trend Values	Recent Trend Values	Trend Change
Velocity:	-0.87 in/yr	-0.82 in/yr	+0.05 in/yr
Acceleration:	+0.05 in/yr^2	+0.05 in/yr^2	-0.01 in/yr^2

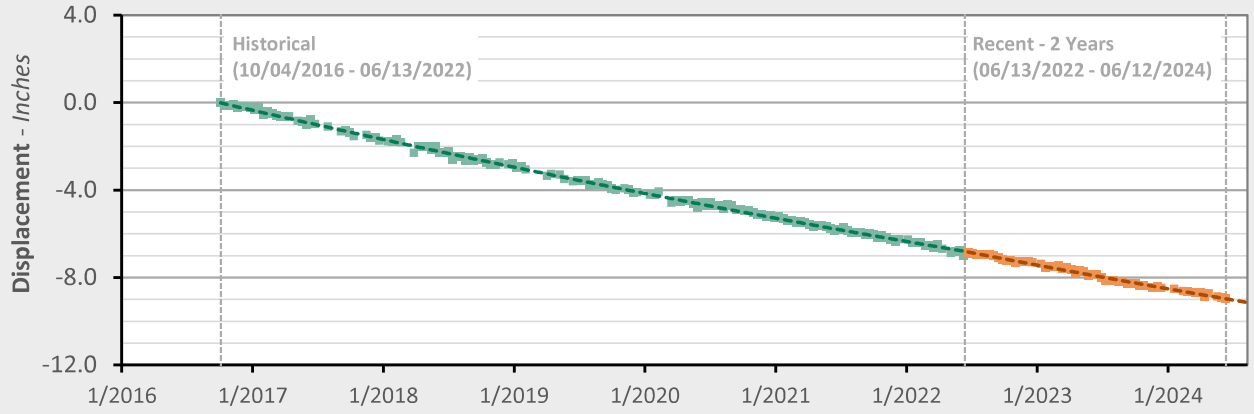
Historical LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)
Recent LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)

AOI 7 *(PPG 7)* - Location Map



AOI 7 *(PPG 7)* - Displacement Time Series

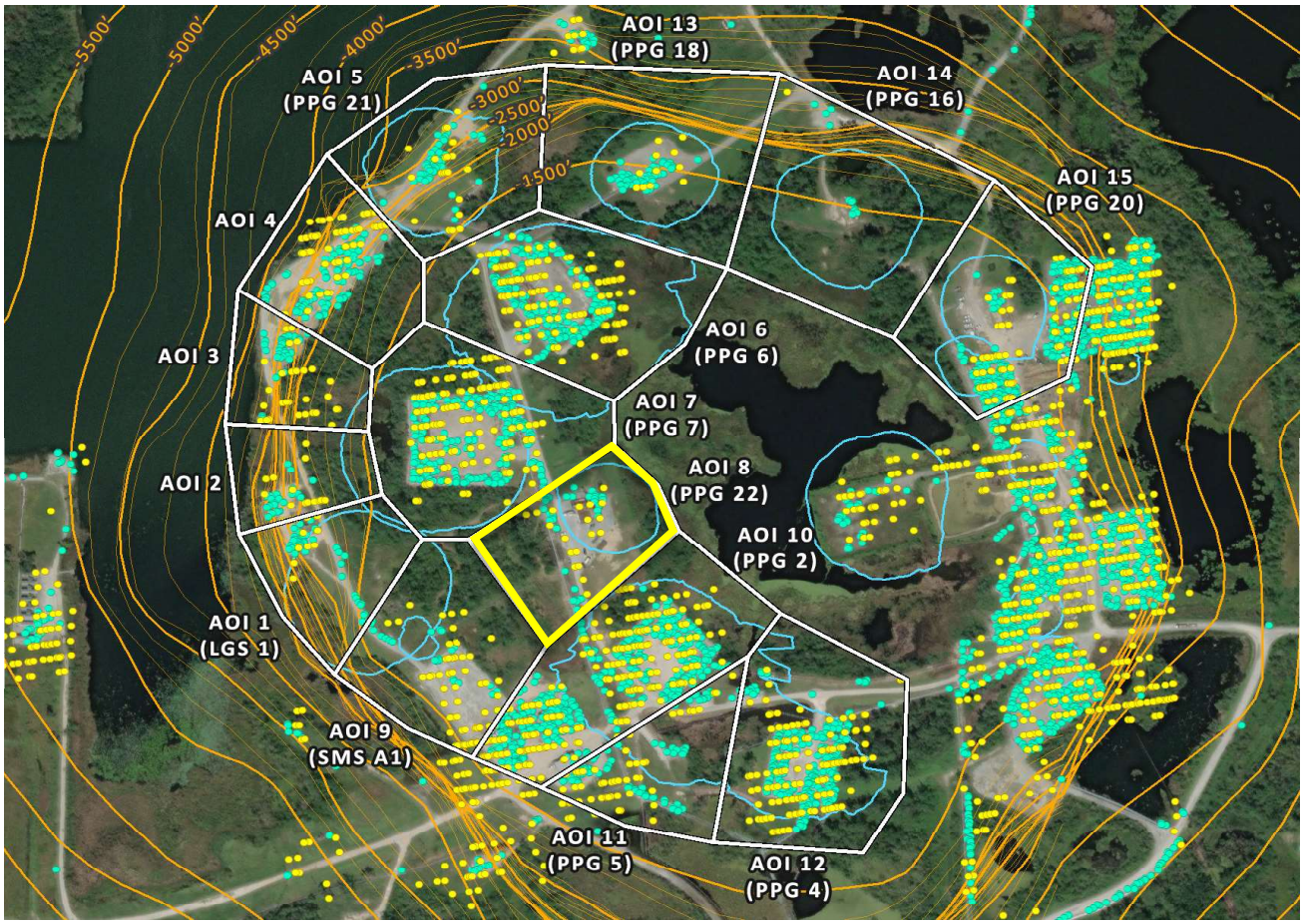
SNT (6/12/2024) Point Count: **140**



	Historical Trend Values	Recent Trend Values	Trend Change
Velocity:	-1.00 in/yr	-1.01 in/yr	-0.01 in/yr
Acceleration:	+0.07 in/yr^2	+0.08 in/yr^2	+0.01 in/yr^2

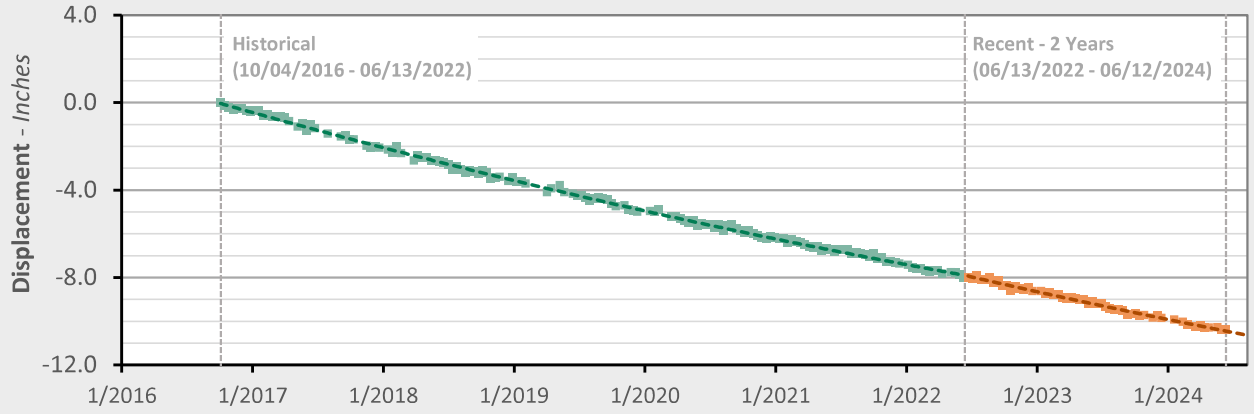
Historical LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)
Recent LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)

AOI 8 *(PPG 22)* - Location Map



AOI 8 *(PPG 22)* - Displacement Time Series

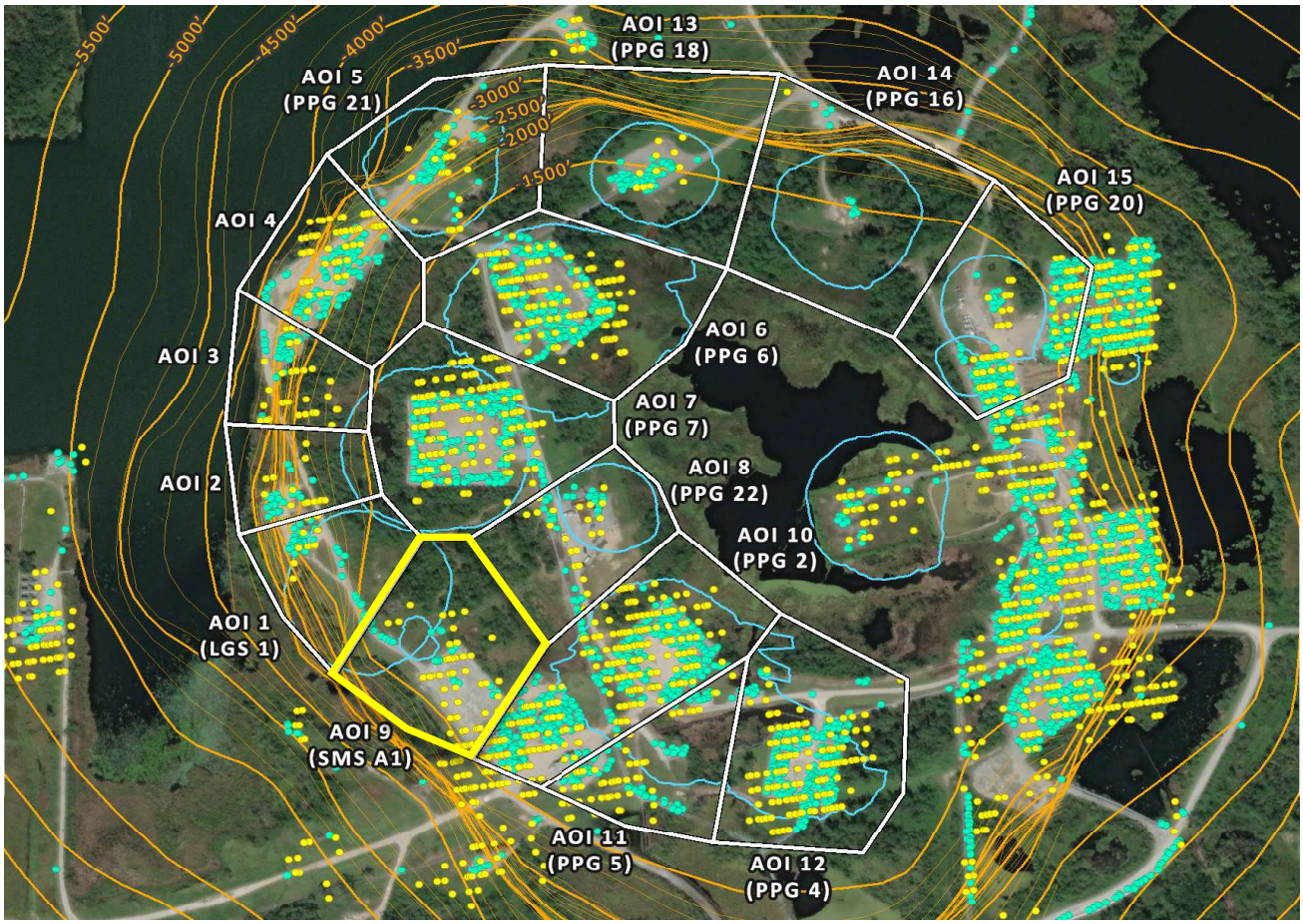
SNT (6/12/2024) Point Count: **20**



	Historical Trend Values	Recent Trend Values	Trend Change
Velocity:	-1.07 in/yr	-1.16 in/yr	-0.09 in/yr
Acceleration:	+0.11 in/yr^2	+0.12 in/yr^2	+0.02 in/yr^2

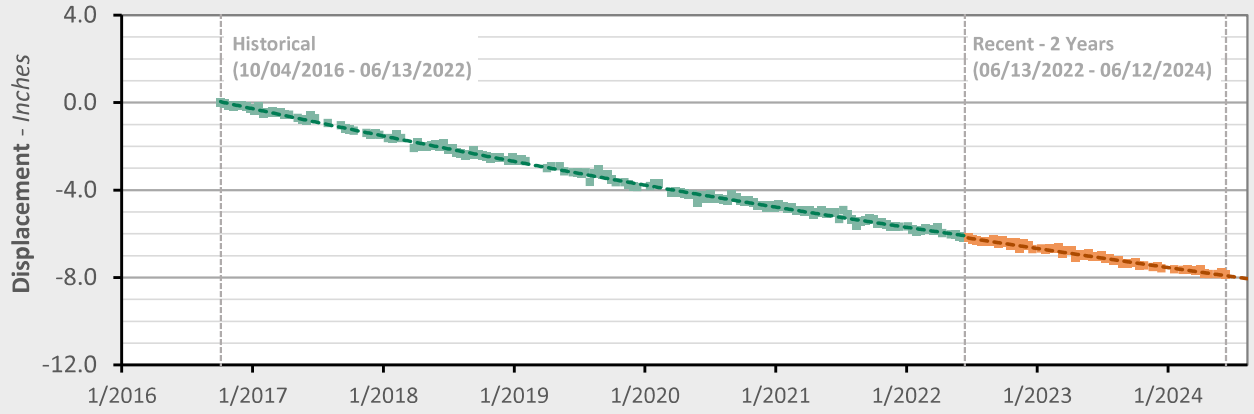
Historical LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)
Recent LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)

AOI 9 *(PPG A1)* - Location Map



AOI 9 *(SMS A1)* - Displacement Time Series

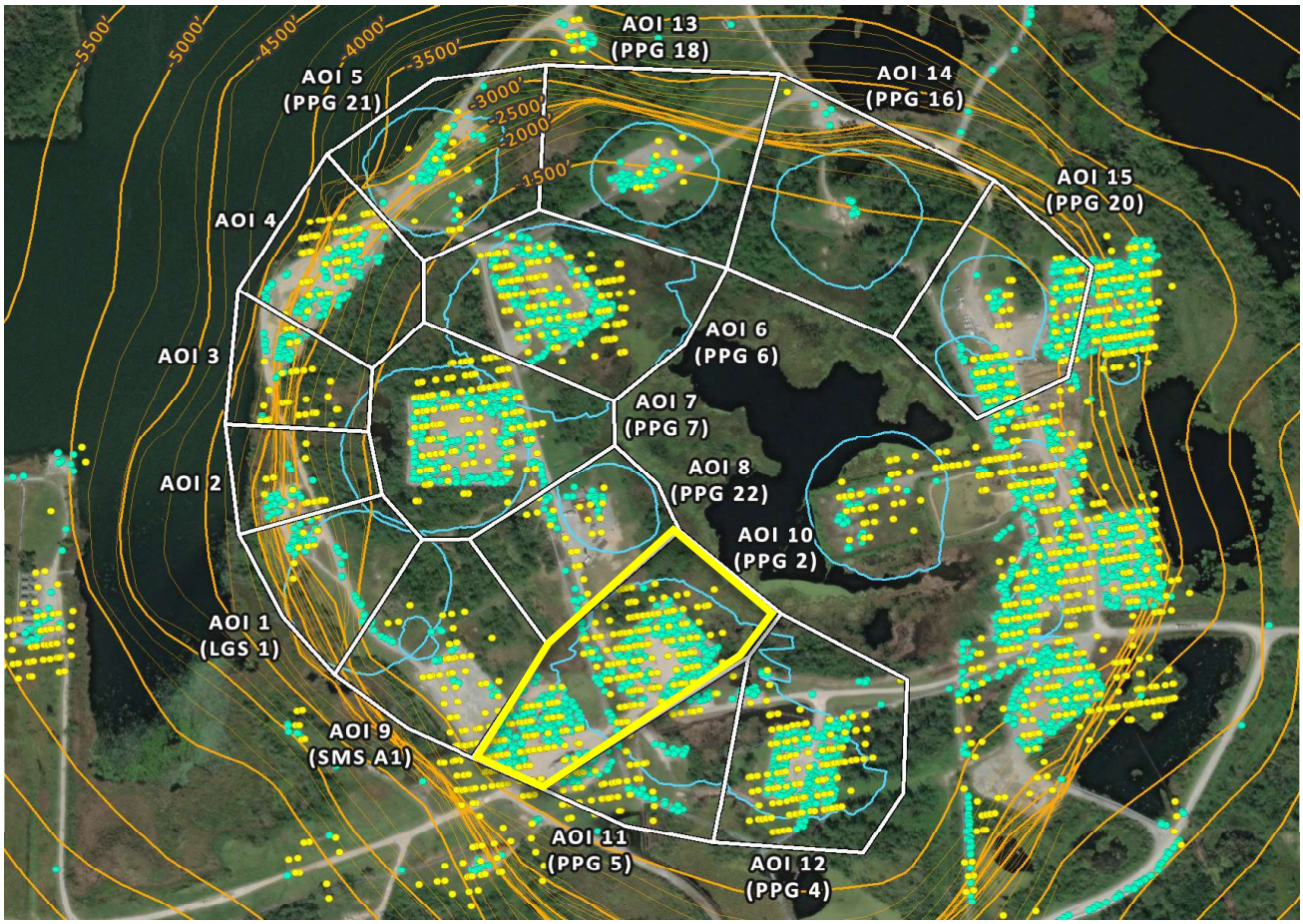
SNT (6/12/2024) Point Count: **59**



	Historical Trend Values	Recent Trend Values	Trend Change
Velocity:	-0.85 in/yr	-0.84 in/yr	+0.01 in/yr
Acceleration:	+0.08 in/yr^2	+0.04 in/yr^2	-0.04 in/yr^2

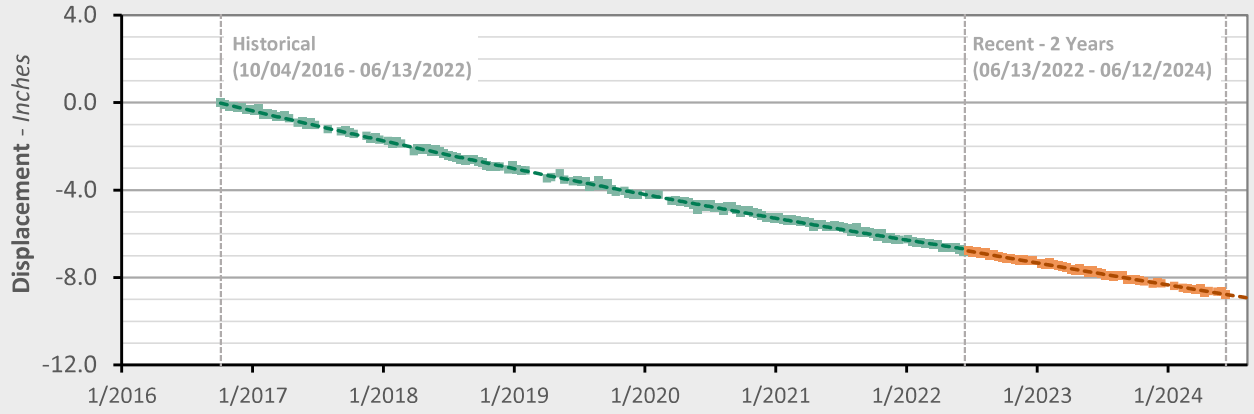
Historical LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)
Recent LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)

AOI 10 *(PPG 2)* - Location Map



AOI 10 *(PPG 2)* - Displacement Time Series

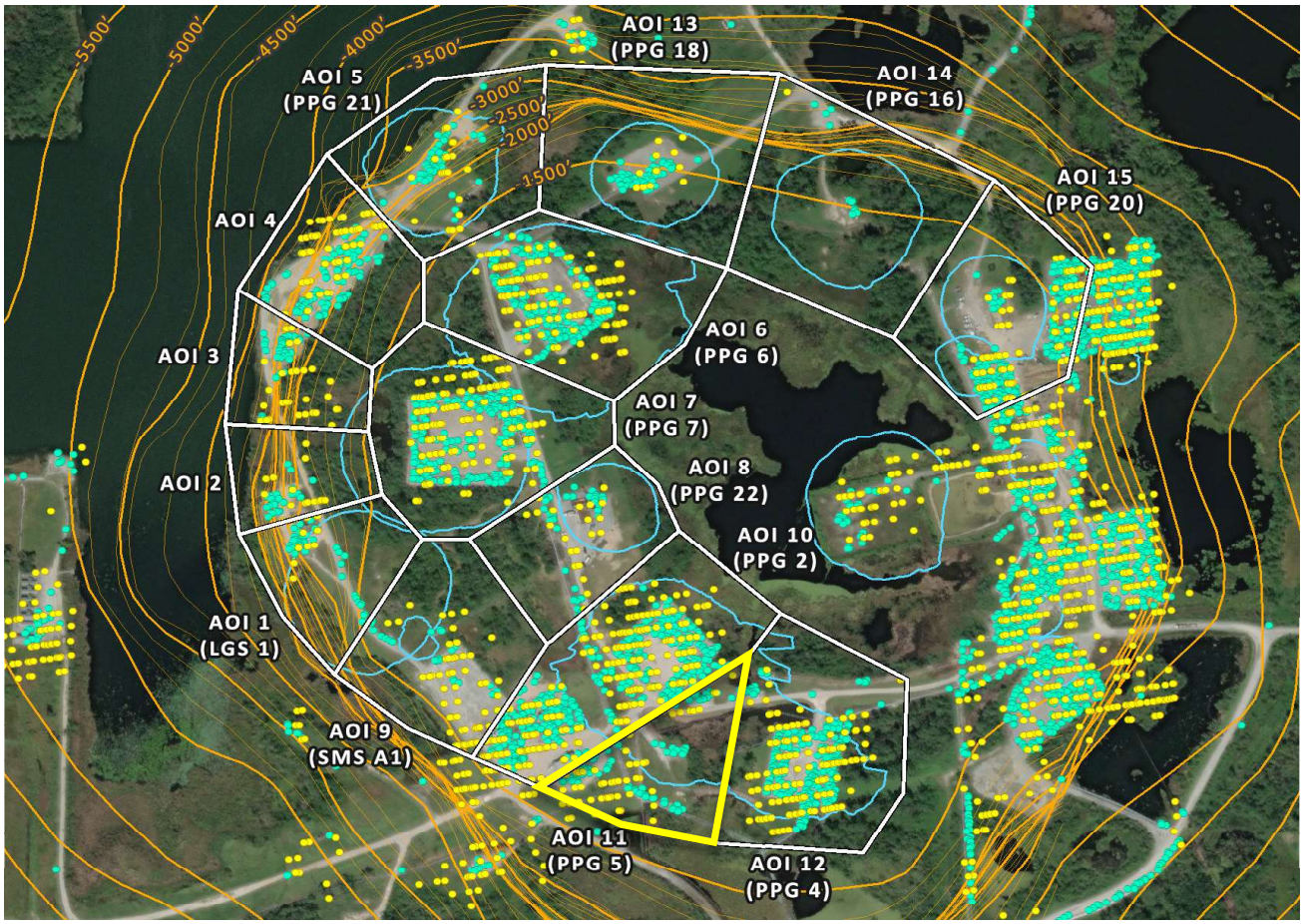
SNT (6/12/2024) Point Count: **230**



	Historical Trend Values	Recent Trend Values	Trend Change
Velocity:	-0.90 in/yr	-0.97 in/yr	-0.07 in/yr
Acceleration:	+0.09 in/yr^2	+0.04 in/yr^2	-0.06 in/yr^2

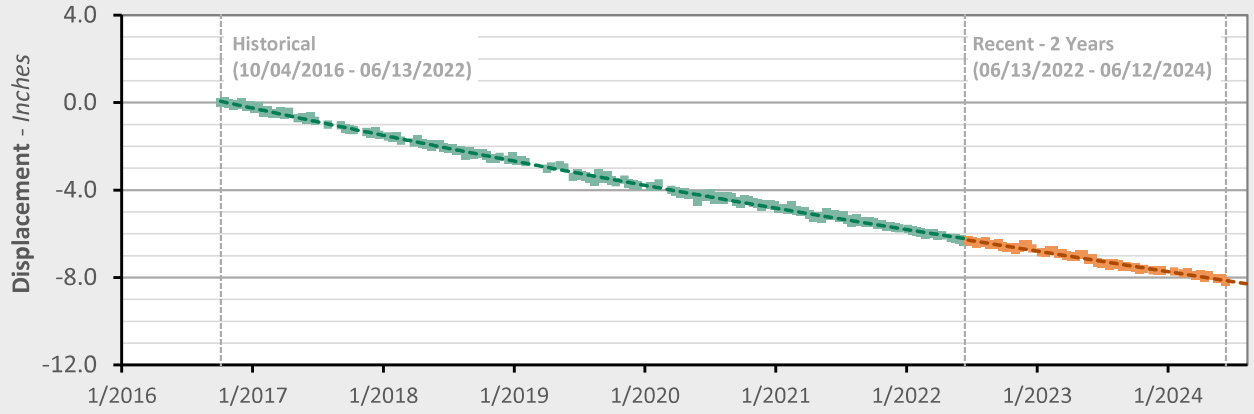
Historical LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)
Recent LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)

AOI 11 *(PPG 5)* - Location Map



AOI 11 *(PPG 5)* - Displacement Time Series

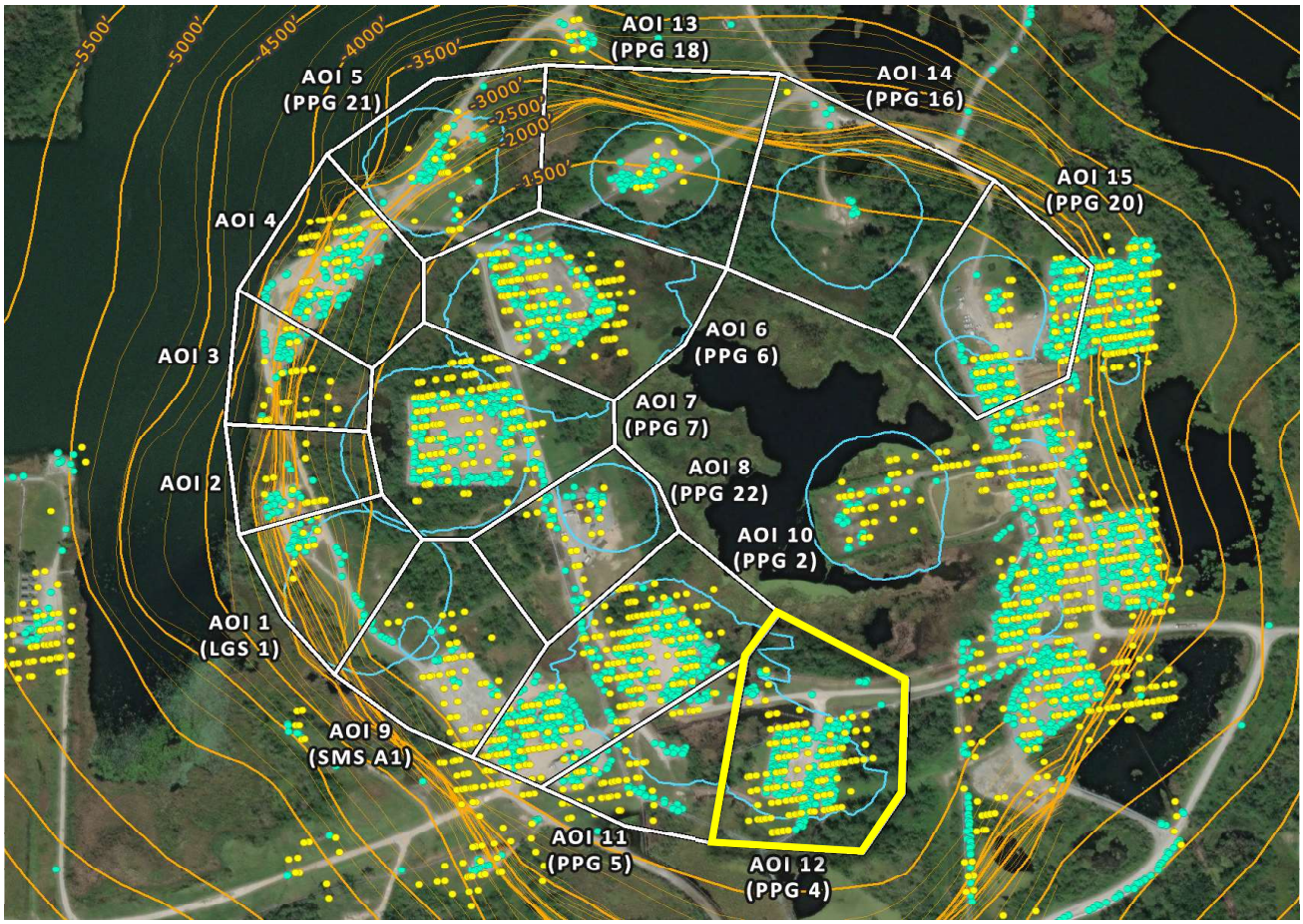
SNT (6/12/2024) Point Count: **52**



	Historical Trend Values	Recent Trend Values	Trend Change
Velocity:	-0.91 in/yr	-0.91 in/yr	+0.00 in/yr
Acceleration:	+0.07 in/yr^2	+0.03 in/yr^2	-0.04 in/yr^2

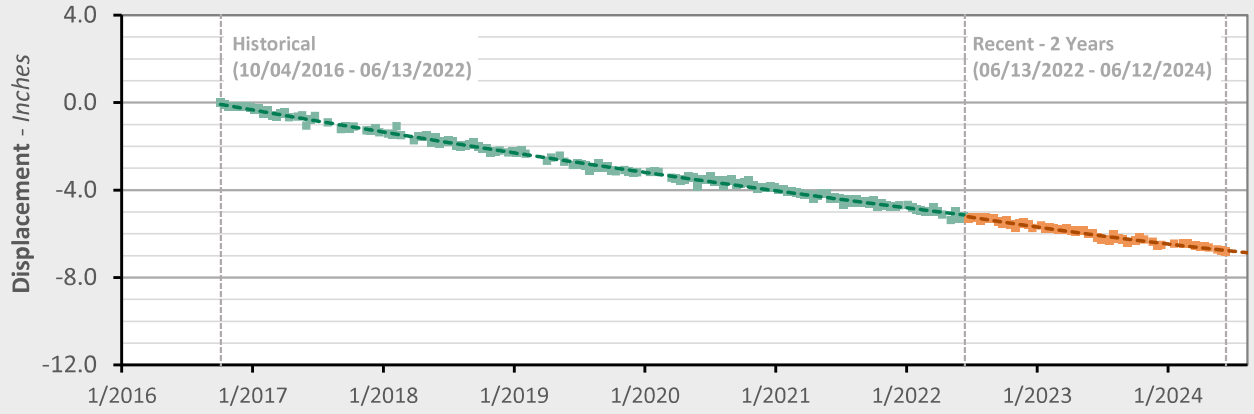
Historical LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)
Recent LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)

AOI 12 *(PPG 4)* - Location Map



AOI 12 *(PPG 4)* - Displacement Time Series

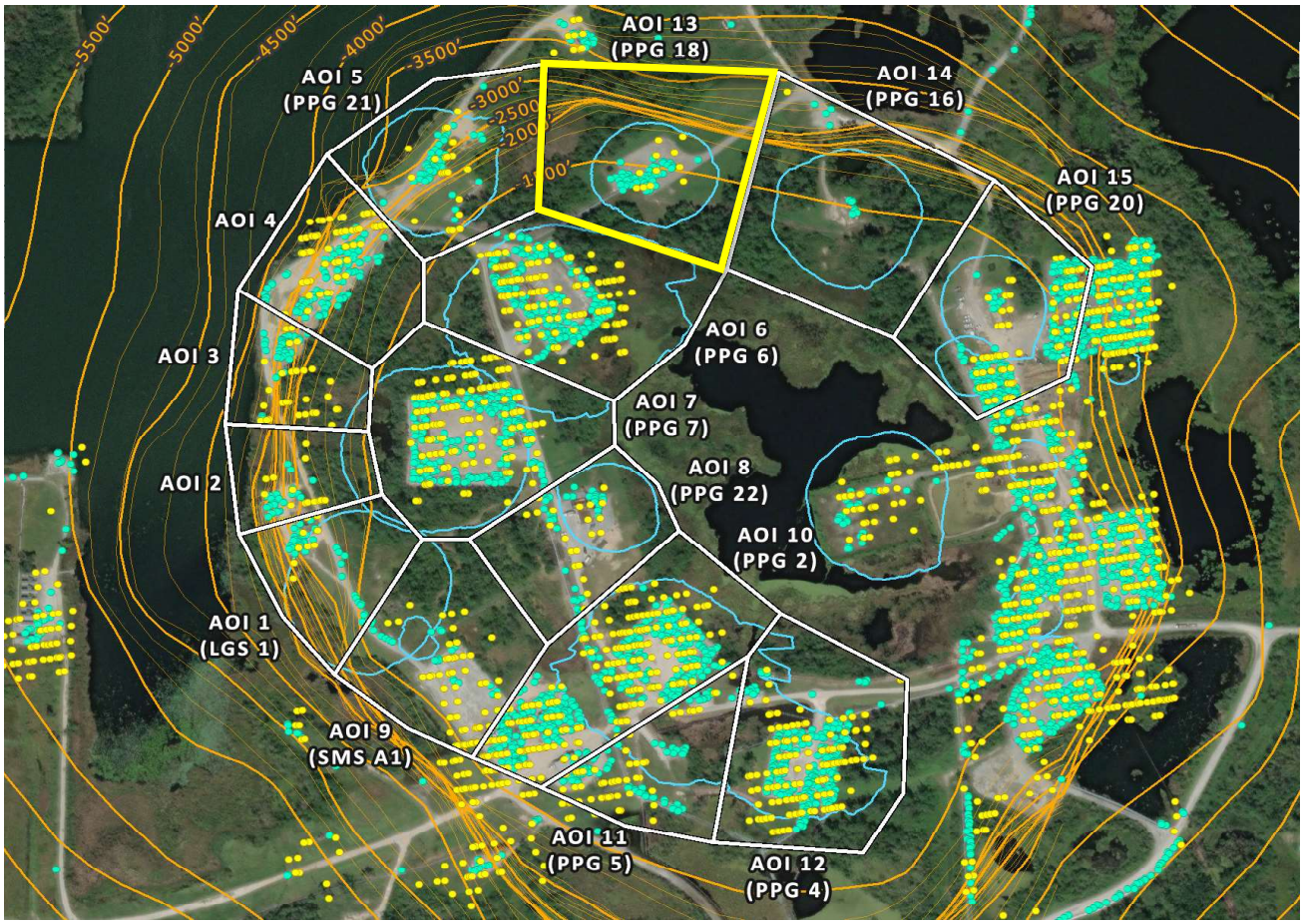
SNT (6/12/2024) Point Count: **121**



	Historical Trend Values	Recent Trend Values	Trend Change
Velocity:	-0.73 in/yr	-0.61 in/yr	+0.11 in/yr
Acceleration:	+0.06 in/yr^2	+0.18 in/yr^2	+0.12 in/yr^2

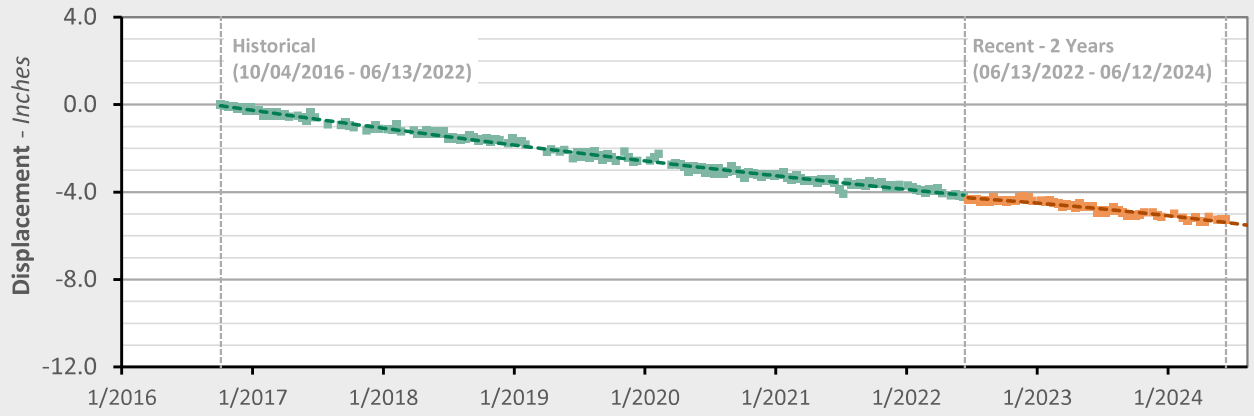
Historical LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)
Recent LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)

AOI 13 *(PPG 18)* - Location Map



AOI 13 *(PPG 18)* - Displacement Time Serie

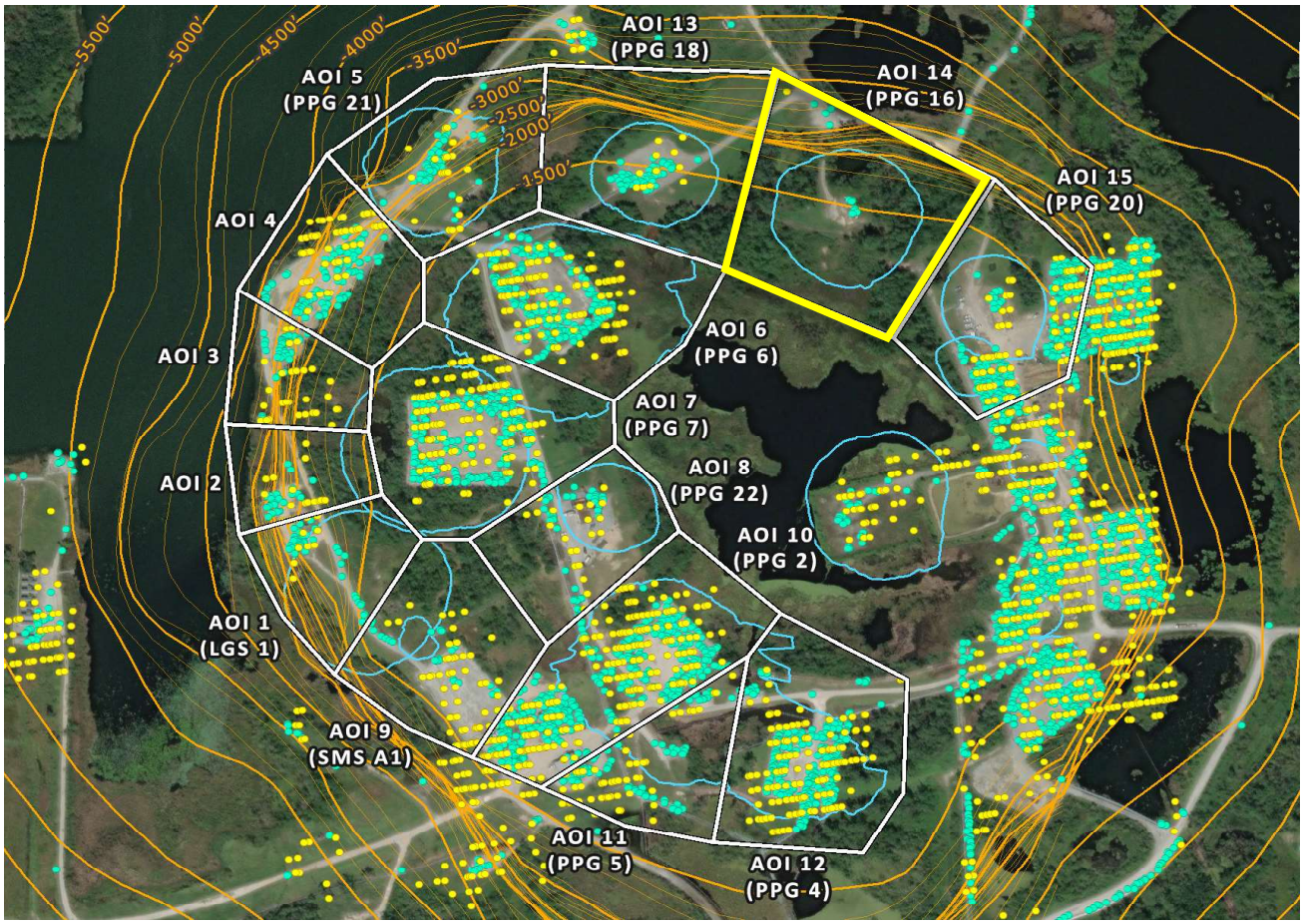
SNT (6/12/2024) Point Count: **12**



	Historical Trend Values	Recent Trend Values	Trend Change
Velocity:	-0.58 in/yr	-0.71 in/yr	-0.13 in/yr
Acceleration:	+0.05 in/yr^2	-0.13 in/yr^2	-0.18 in/yr^2

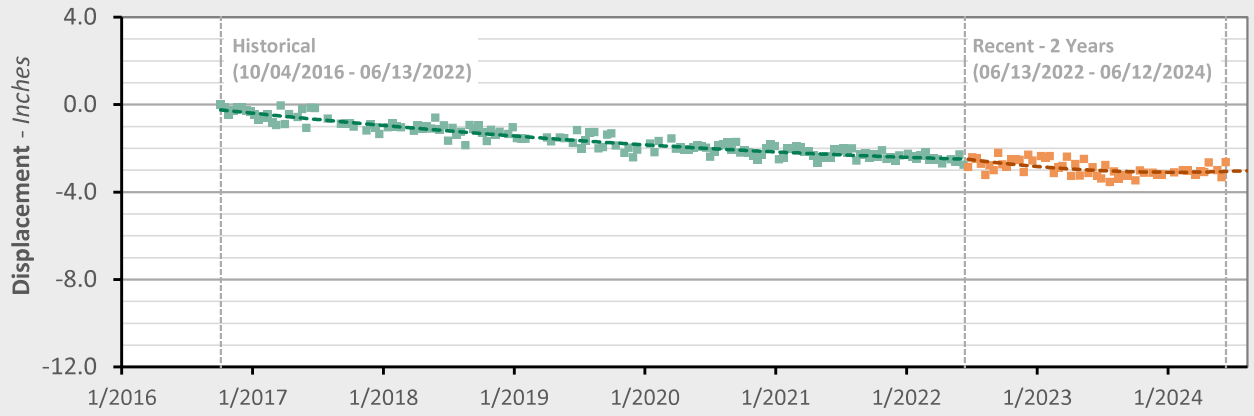
Historical LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)
Recent LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)

AOI 14 *(PPG 16)* - Location Map



AOI 14 *(PPG 16)* - Displacement Time Serie

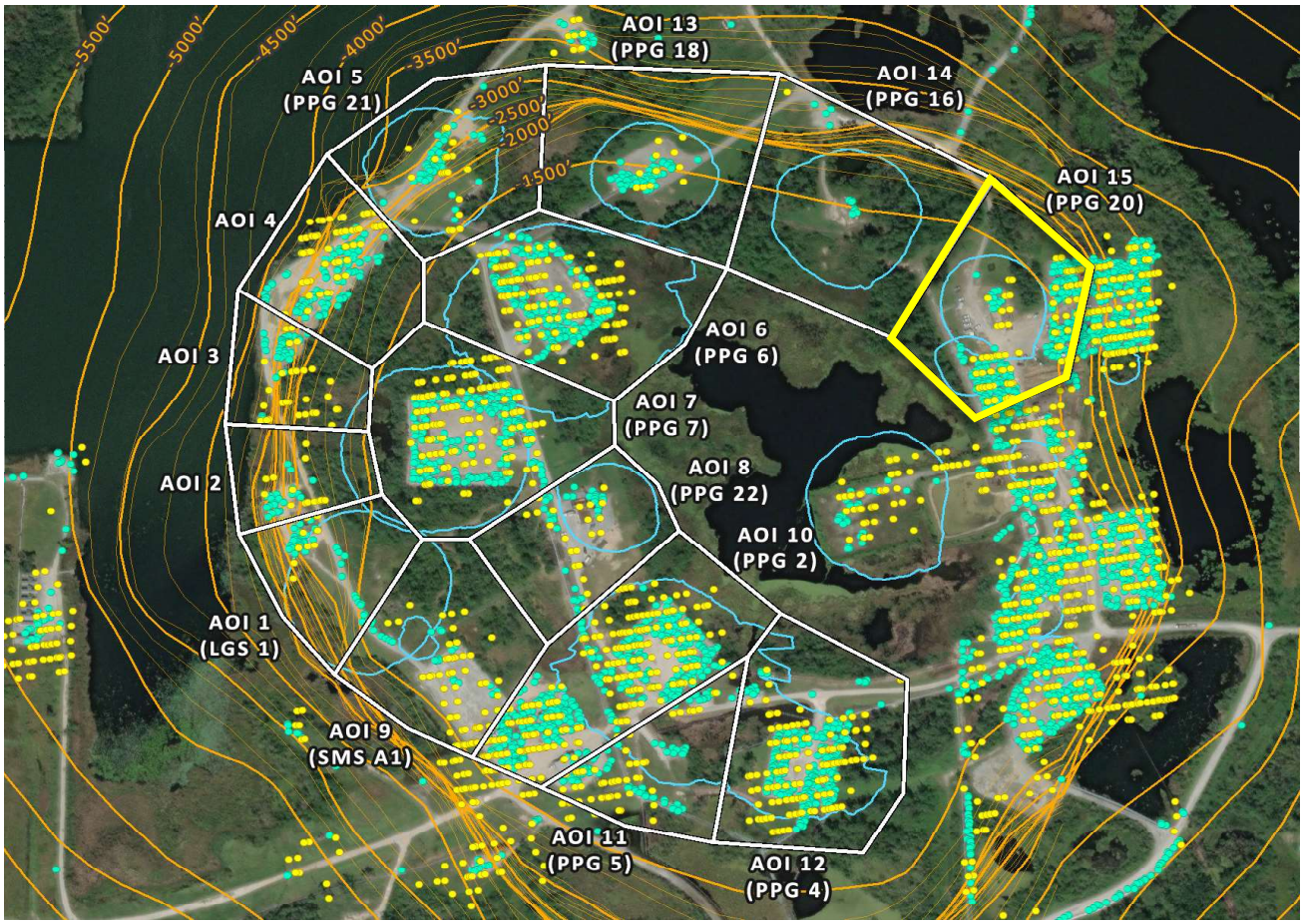
SNT (6/12/2024) Point Count: 1



	Historical Trend Values	Recent Trend Values	Trend Change
Velocity:	-0.17 in/yr	+0.26 in/yr	+0.43 in/yr
Acceleration:	+0.08 in/yr^2	+0.57 in/yr^2	+0.49 in/yr^2

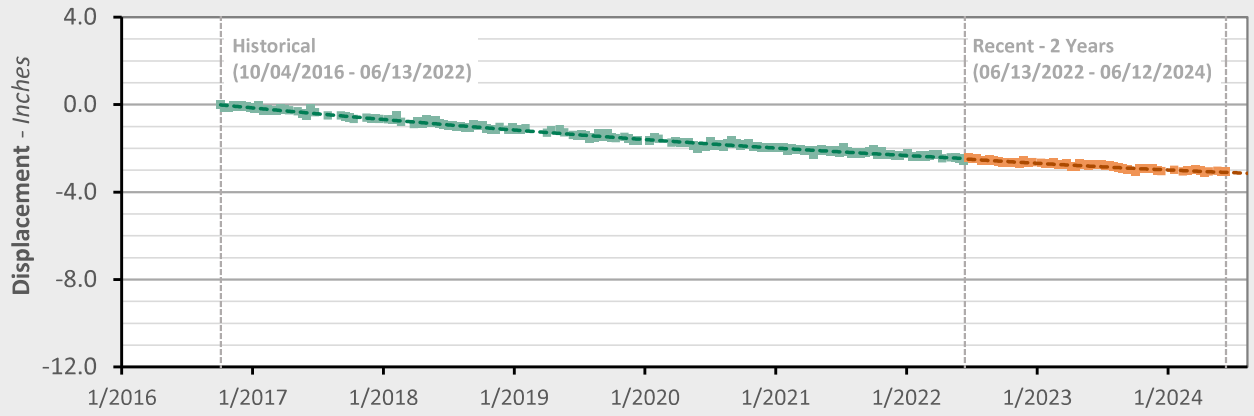
Historical LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)
Recent LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)

AOI 15 *(PPG 20)* - Location Map



AOI 15 *(PPG 20)* - Displacement Time Serie

SNT (6/12/2024) Point Count: **72**



	Historical Trend Values	Recent Trend Values	Trend Change
Velocity:	-0.30 in/yr	-0.25 in/yr	+0.05 in/yr
Acceleration:	+0.05 in/yr^2	+0.05 in/yr^2	+0.01 in/yr^2

Historical LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)
Recent LOS Displacement Measurement
Historical Trend Line (Quadratic Regression)

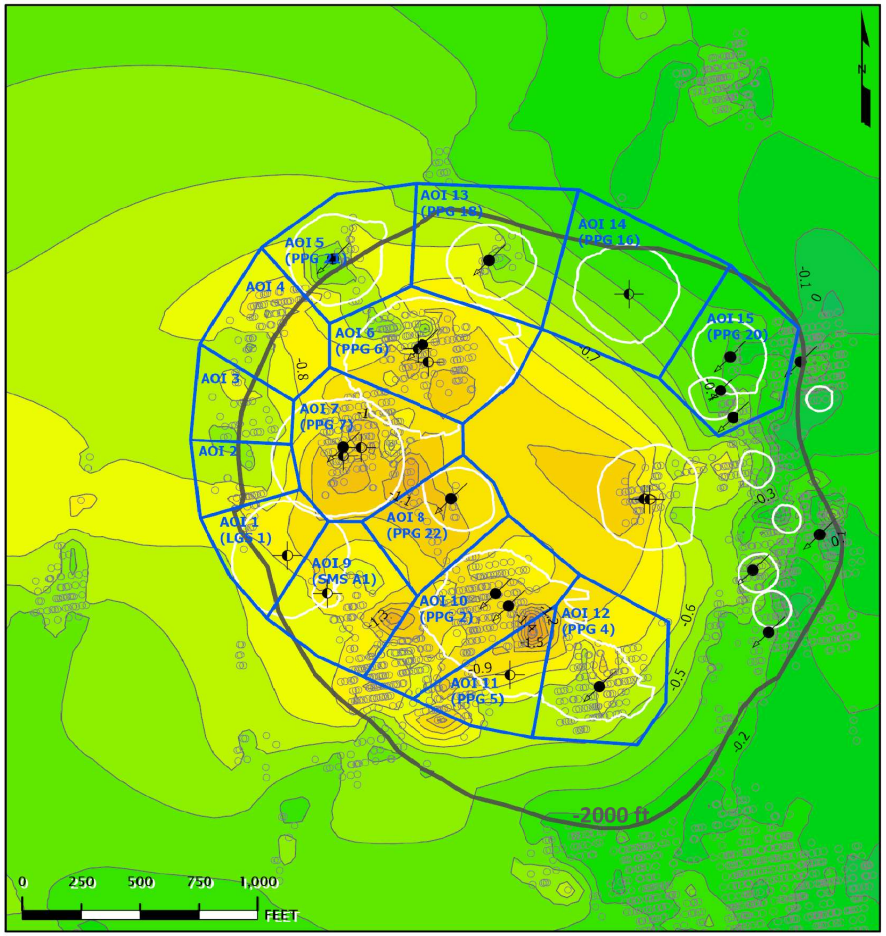
Historical SNT Data (10/04/2016 - 06/13/2022)

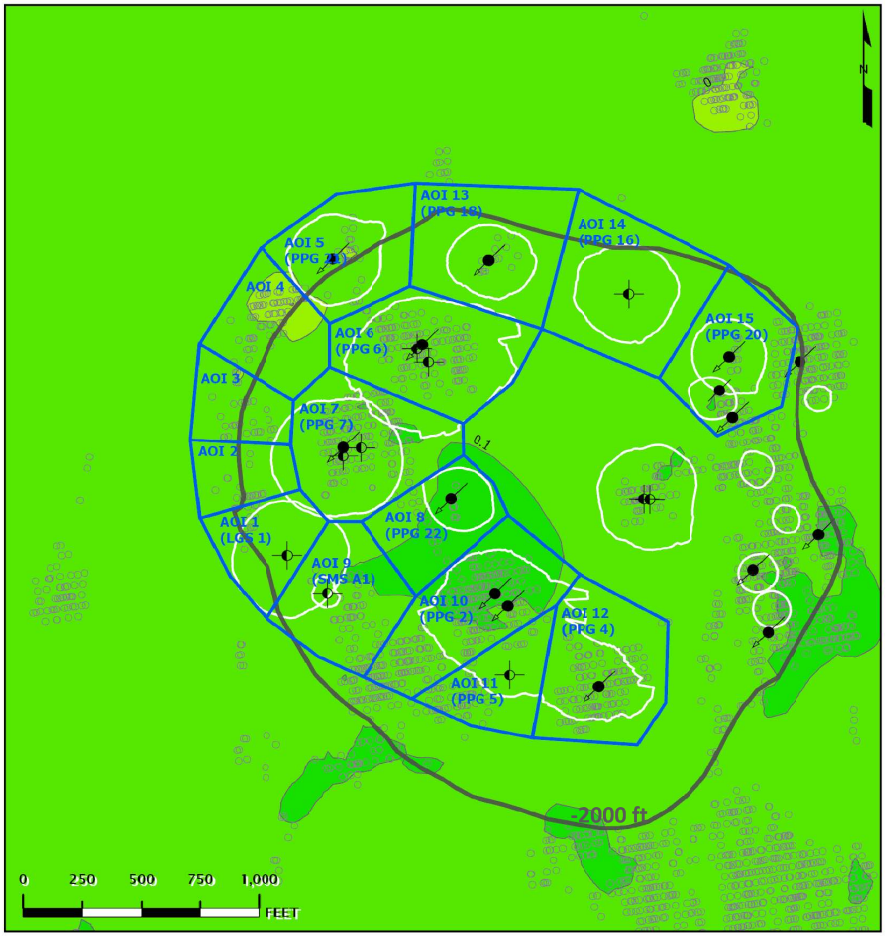
Velocity Contours

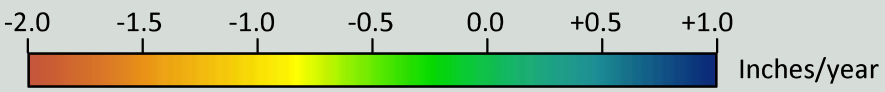
As of date: 06/13/2022

Acceleration Contours

Date range: 10/04/2016 - 06/13/2022







AOI Boundary | InSAR LOS Measurement Point | Contour (0.1) | Cavern Well Surface Locations

Historical Cavern Extent | Top of Dome (-2000 ft Contour) | 09 - Active - Injection | 29 - Dry and Plugged

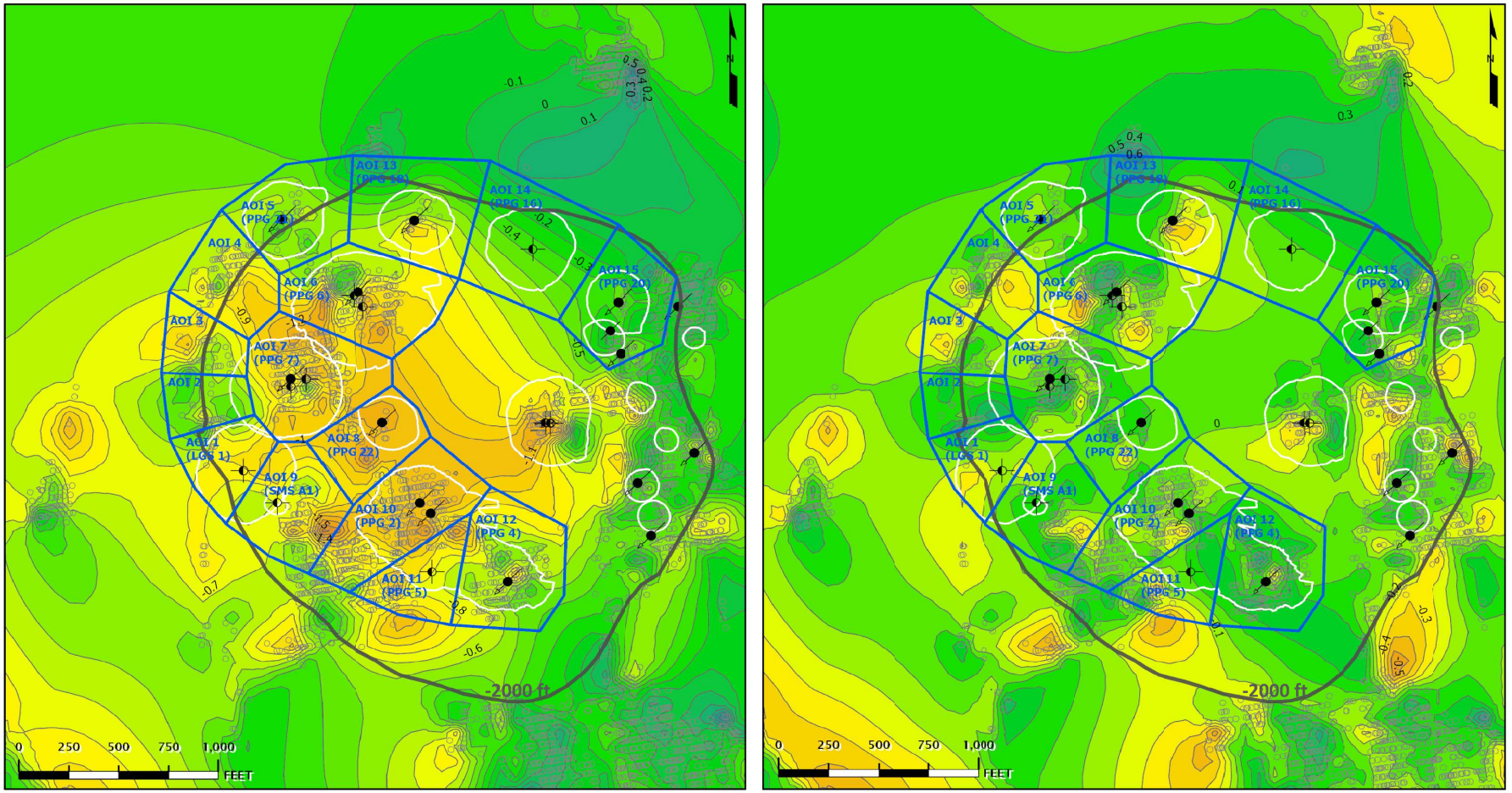
Recent SNT Data - 2 Years (06/13/2022 - 06/12/2024)

Velocity Contours

As of date: 06/12/2024

Acceleration Contours

Date range: 06/13/2022 - 06/12/2024



-2.0 -1.5 -1.0 -0.5 0.0 +0.5 +1.0 Inches/year

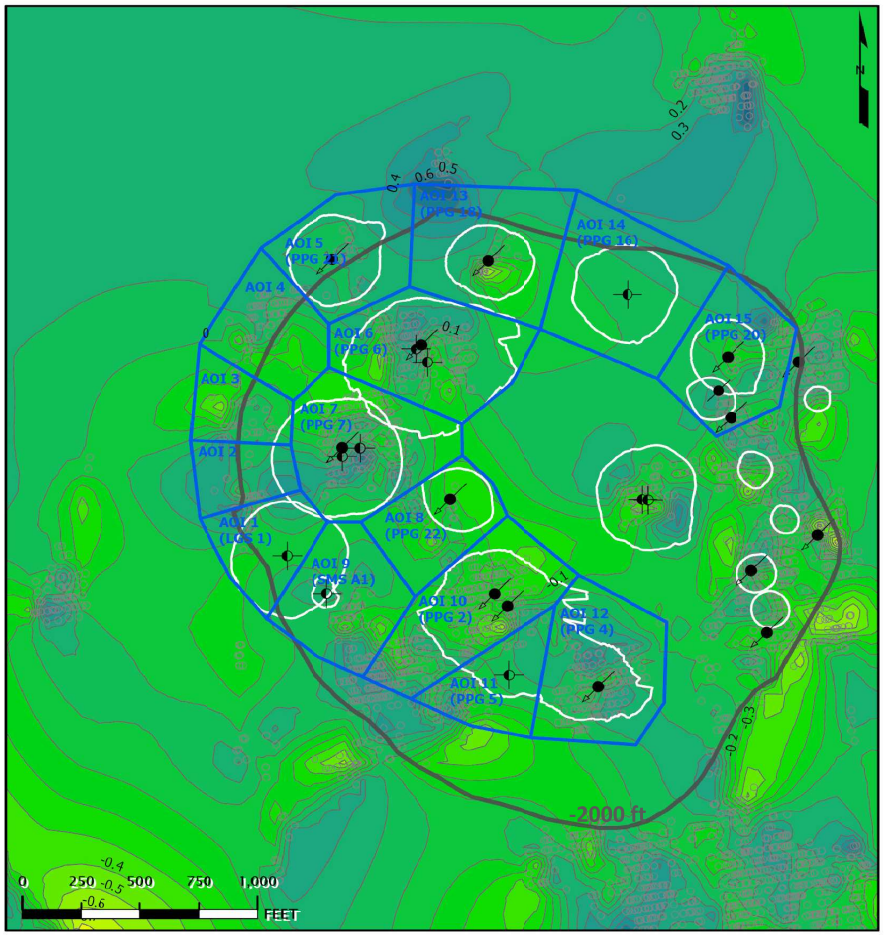
-1.0 -0.5 0.0 +0.5 +1.0 Inches/year^2

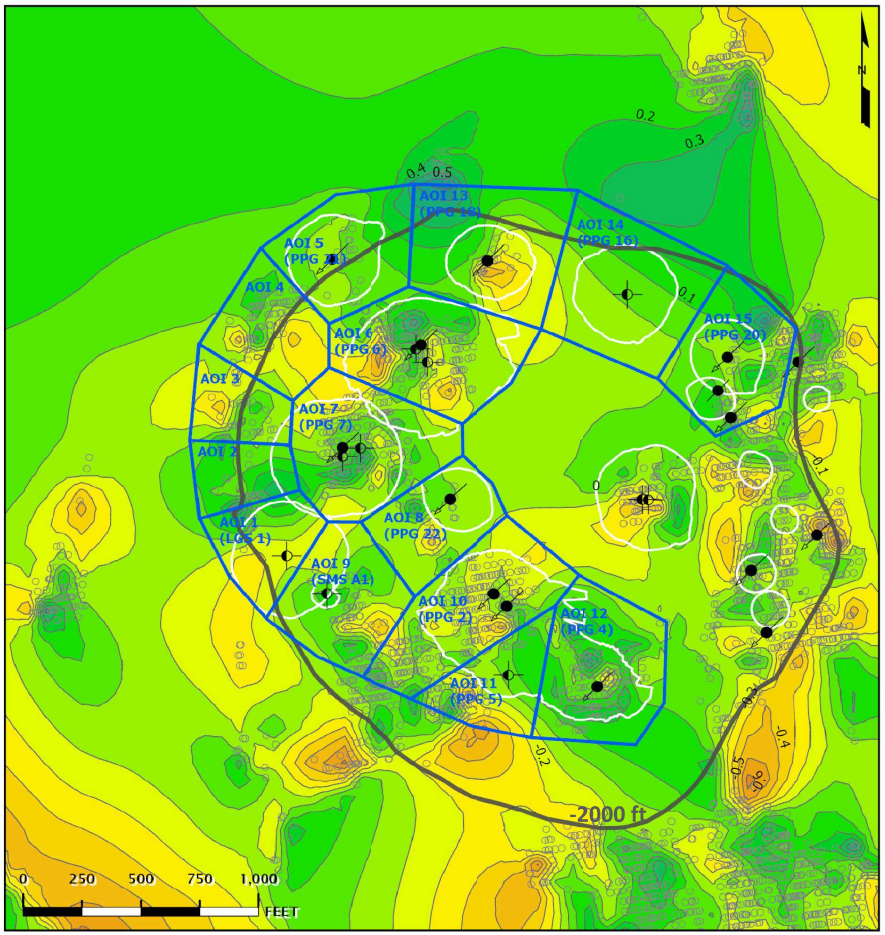
AOI Boundary | InSAR LOS Measurement Point | Contour (0.1) | Cavern Well Surface Locations

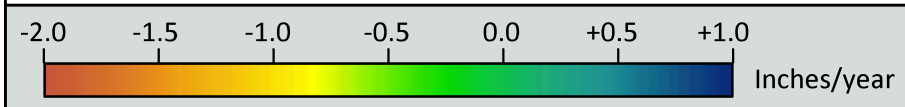
Historical Cavern Extent | Top of Dome (-2000 ft Contour) | 09 - Active - Injection | 29 - Dry and Plugged

Change from Historical to Recent SNT Data

Velocity Contours	Acceleration Contours
Historical Velocity subtracted from Recent Velocity	Historical Acceleration subtracted from Recent Acceleration







AOI Boundary | InSAR LOS Measurement Point | Contour (0.1) | Cavern Well Surface Locations

Historical Cavern Extent | Top of Dome (-2000 ft Contour) | 09 - Active - Injection | 29 - Dry and Plugged

ATTACHMENT B

June 28, 2024 TSX/PAZ InSAR report

TSX/PAZ Satellite Update

Continuous InSAR Monitoring of Ground Displacement At Westlake Caverns and Western Dome Flank

Sulphur Mines Salt Dome

Prepared for:
Westlake Chemical

Prepared by:
Lonquist & Co., LLC
8591 United Plaza Blvd.
Suite 280
Baton Rouge, LA 70809

Dataset
Satellite Source
TerraSAR-X - PAZ Constellation
Most Recent Image Date
Friday, June 28, 2024

Analysis Report Date:

July 3, 2024

Dataset Information

Satellite Source	TerraSAR-X - PAZ Constellation
Revisit Frequency	4 and 7 days
Most Recent Image Date	Friday, June 28, 2024
Dataset Image Count	93
Dataset Time Range	January 24, 2023 - June 28, 2024
Dataset Length	1.43 Years
Satellite Line-of-Sight (LOS)	37° East of Vertical (Viewing site from the East)

Analysis Methodology

Time Series Charts

Trend lines were calculated for the averaged displacement values within each AOI. Both a nonlinear (quadratic) and linear regression were applied to each AOI point group to identify rates of change in LOS displacement. These trends are displayed in the Time Series section of this report.

Contour Maps

A nonlinear (quadratic) and linear trend was also calculated for each individual measurement point across the analysis region. Nonlinear trend values for each point were used to generate Velocity and Acceleration contour maps to convey the spatial distribution of the calculated movement. The linear trend values for each point (which lack an acceleration component) were used to generate an additional Velocity contour map. Negative velocity values indicate subsidence or westward movement and positive velocity indicates uplift or eastward movement. Negative acceleration values indicate increasing rates of subsidence, increasing westward movement, or slowing eastward movement and positive acceleration values indicate slowing rates of subsidence, slowing westward movement, or increasing eastward movement.

Observations

The negative trend deviation observed in the majority of the AOIs in the 6-17-2024 dataset was determined to have been caused by atmospheric influences and is being charaterized as a low-quality outlier. The displacement measurements from the most recent two datasets (6-24 and 6-28-2024) are nearer to the trend in all AOIs.

Recent data has begun to indicate a negative acceleration of varying magnitudes across most of the AOI point groups evaluated. This is most evident in the trend acceleration values in the westernmost AOIs and in the mapped contours on the western side of AOI 2 and AOI 3. This suggests that marginal increases in subsidence rates may be occuring in this area of the dome. Seasonal effects are believed to contribute to fluctuations above and below the trend lines for each AOI and may play a siginficant role in the gradual changes that are being observed.

Date Signed: July 3, 2024
Austin, Texas

Nathaniel L. Byars, P.E.
Principal Engineer
Louisiana License No. 40697

InSAR Data Sources

InSAR Data

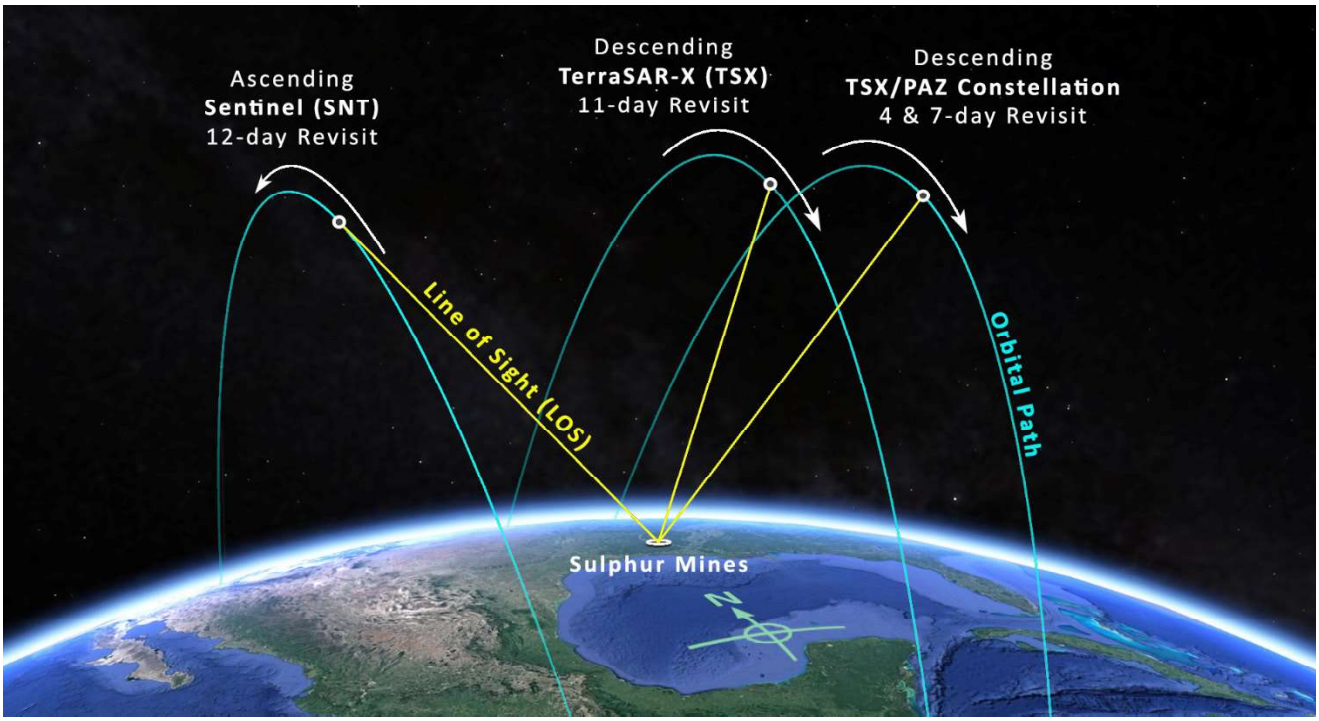
Interferometric Synthetic Aperture Radar (InSAR) is the most well established method to continually evaluate small, normally undetectable, ground movement over a large area. Radar imagery collected via satellites over successive orbital passes is used to identify and define measurement points on the ground. Objects or ground features providing a stable reflection of radar energy such as buildings, roads, and infrastructure produce the highest quality measurement points. InSAR analysis identifies the change in distance between the satellite and each measurement point over time relative to a stable reference point within the imaged area.

Satellite Sources

Two InSAR datasets are being used to evaluate subsidence over the Sulphur Mines Salt Dome. These datasets provide Line-of-Sight (LOS) displacment measurements from both ascending and descending orbits. An ascending orbit denotes the satellite's longitudinal course from south to north as it passes over the site, while a desceding orbit denotes the satellite is moving from north to south.

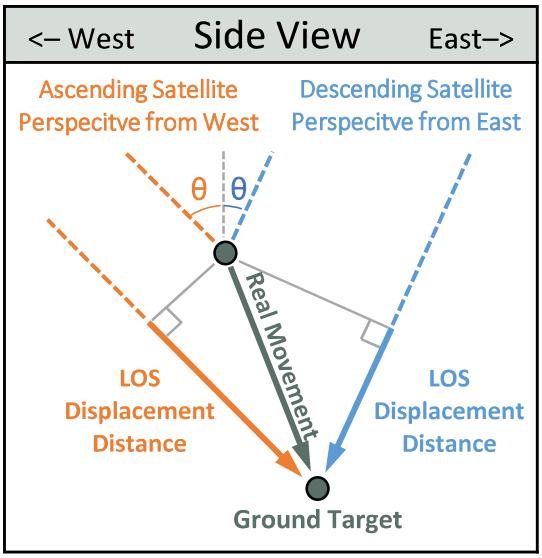
The first dataset comes from a low-resolution Sentinel-1 (SNT) satellite on an ascending orbit that captures data from the west of the site on a 12-day frequency. The second comes from a pair of high resolution satellites that share the same descending orbit and capture data from east of the site. These are a TSX satellite and the PAZ satellite (TSX/PAZ constellation), both with an 11-day revisit frequency. Their orbits are offset with the PAZ satellite passing over the site 4 days after the TSX satellite. Prior to May 2023, data was captured from a different high-resolution TerraSAR-X (TSX) satellite on a descending orbit that captured data from the east of the site on an 11-day frequency. The transition was made for the increased data frequency that resulted from a 4 and 7-day revisit period. The image below depicts the orbital paths of the satellites in relation to the Sulphur Mines Salt Dome.

Satellite Orbital Diagram



InSAR Line-of-Site (LOS) Data

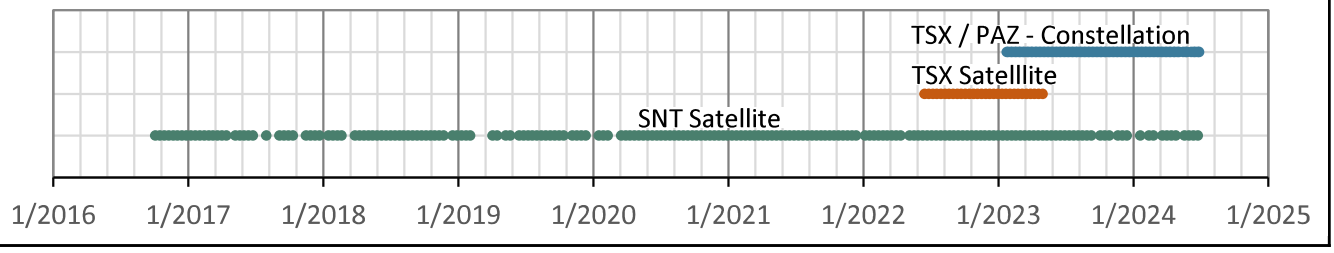
LOS displacement measurements refer to a change in distance between the satellite sensor and the ground target. Measurement positions on the west side of the Sulphur Dome are are known to be experiencing some eastward movement toward the dome center due to the geometry of the subsidence basin. The InSAR satellites view the site from eastward and westward positions so LOS measurements are understood to convey a movement distance that is not purely vertical. The diagram to the right illustrates the geometric relationship between the theoretical Real movement of a ground target and LOS displacement measurements from two different satellite viewing directions.



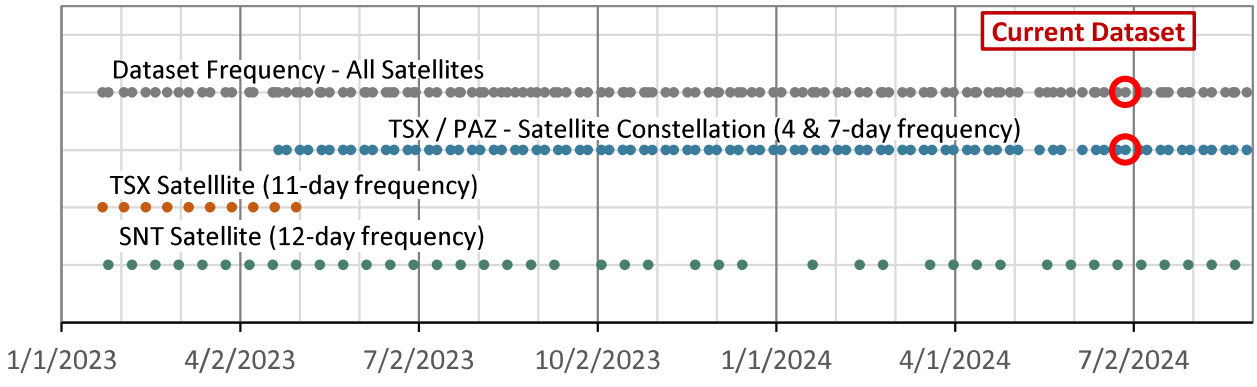
Satellite Properties & Image Frequency

Satellite and Data Properties	SNT	TSX	TSX/PAZ Constellation
Band (Wavelength)	C-band (2.20 in)	X-band (1.22 in)	X-band (1.22 in)
Track	T136	T29	T67 & T120
Pixel resolution	65 x 16 ft	3 x 3 ft	3 x 3 ft
Revisit frequency	12 days	11 days	4 & 7 days
Orbit (LOS Angle, θ)	Ascending (43°)	Descending (17°)	Descending (37°)
Data Start Date	10/4/2016	6/16/2022	1/24/2023
Measurement error range	± 0.20 in	± 0.03 in	± 0.03 in

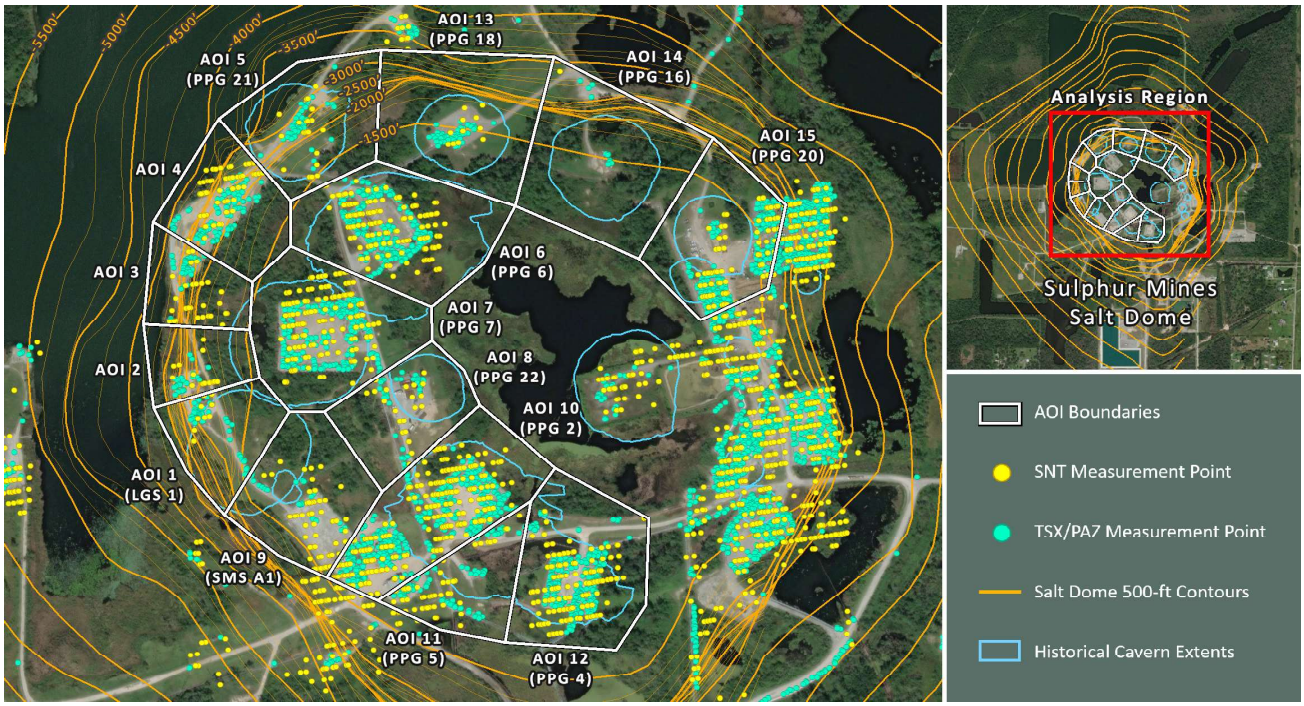
Dataset Measurement History



Dataset Update Frequency



AOI Boundaries & InSAR Measurement Points

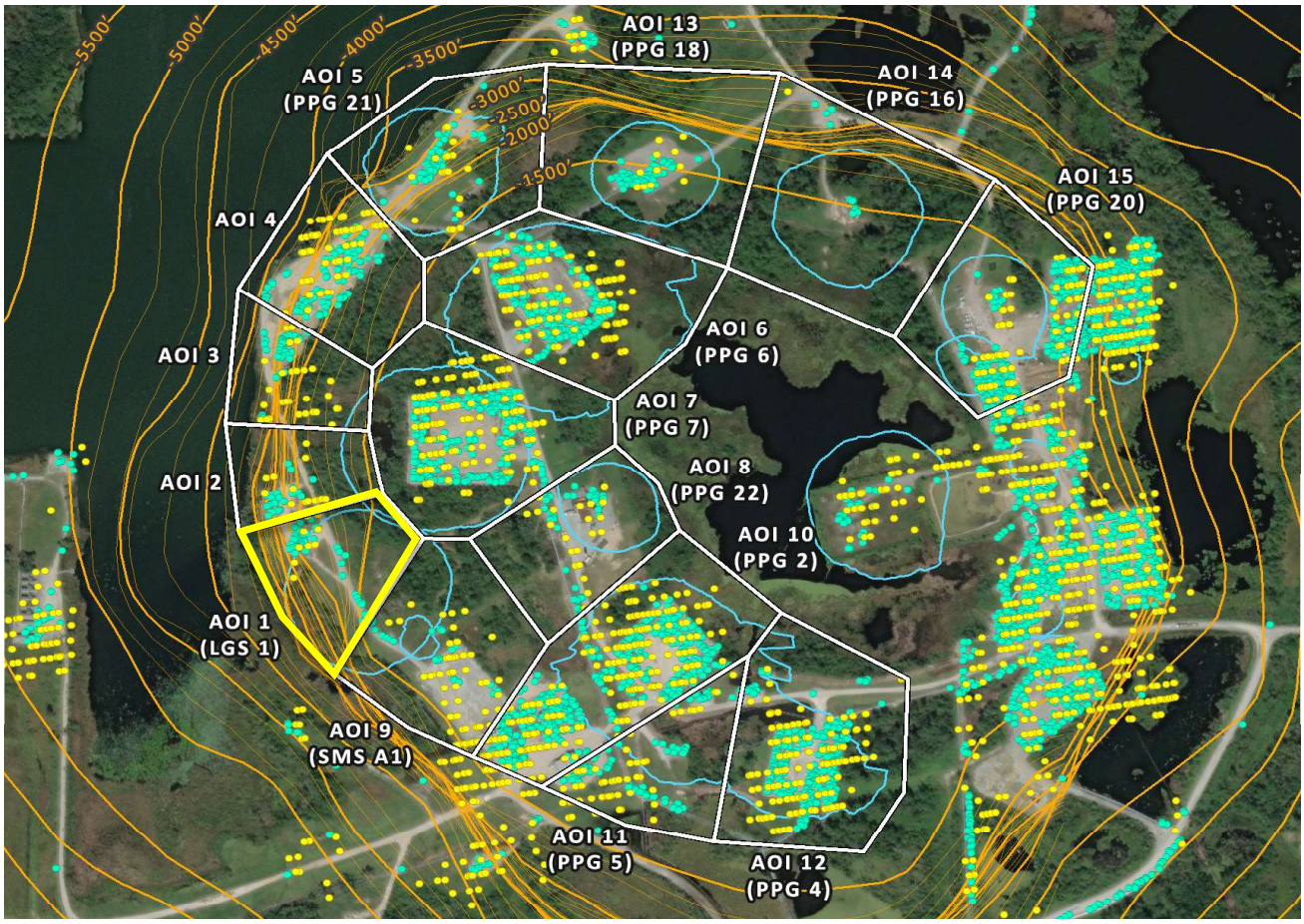


Subsidence Monitoring Areas of Interest (AOIs)

To visually convey and evaluate trend consistency for the displacement time series of each ground target, measurment points were grouped and their displacement values were averaged. The point groups are referred to as Areas of Interest (AOIs) in this analysis and their boundaries are depicted on the above map. The below table lists the trend values calculated in each AOI for the dataset evaluated in this report.

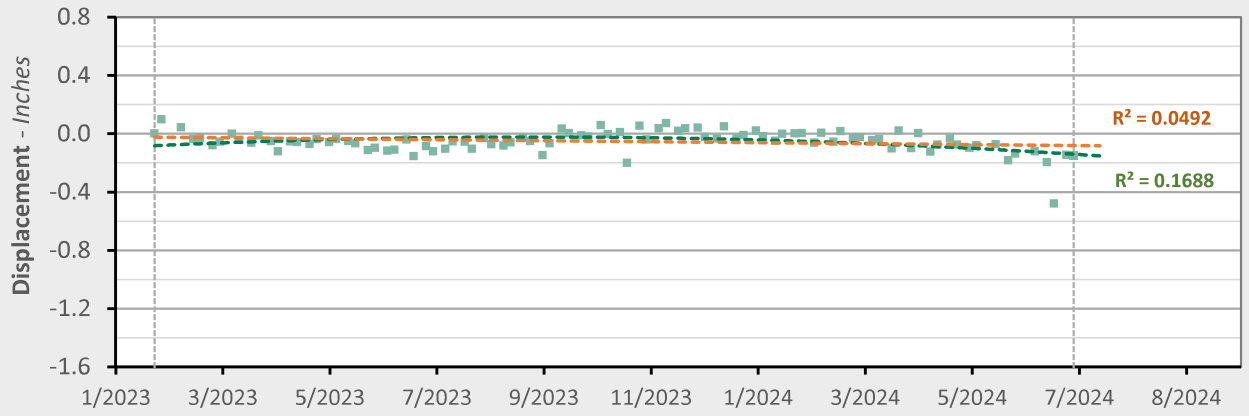
AOI Name	TSX/PAZ (6/28/2024)	LOS Velocity (in/yr)		LOS Acceleration (in/yr²)	
	Point Count	Nonlinear	Linear	Nonlinear	Linear
AOI 1 *(LGS 1)*	42	-0.28	-0.04	-0.34	0.00
AOI 2	24	-0.33	-0.02	-0.43	0.00
AOI 3	40	-0.48	-0.03	-0.63	0.00
AOI 4	102	-0.25	+0.03	-0.39	0.00
AOI 5 *(PPG 21)*	47	-0.30	-0.18	-0.17	0.00
AOI 6 *(PPG 6)*	212	-0.58	-0.40	-0.24	0.00
AOI 7 *(PPG 7)*	216	-0.51	-0.28	-0.33	0.00
AOI 8 *(PPG 22)*	36	-0.62	-0.56	-0.08	0.00
AOI 9 *(SMS A1)*	23	-0.07	-0.23	+0.23	0.00
AOI 10 *(PPG 2)*	404	-0.68	-0.54	-0.19	0.00
AOI 11 *(PPG 5)*	85	-0.48	-0.44	-0.05	0.00
AOI 12 *(PPG 4)*	262	-0.83	-0.80	-0.05	0.00
AOI 13 *(PPG 18)*	52	-0.56	-0.42	-0.19	0.00
AOI 14 *(PPG 16)*	11	-0.28	-0.63	+0.49	0.00
AOI 15 *(PPG 20)*	224	-0.90	-0.94	+0.05	0.00

AOI 1 *(LGS 1)* - Location Map



AOI 1 *(LGS 1)* - Displacement Time Series

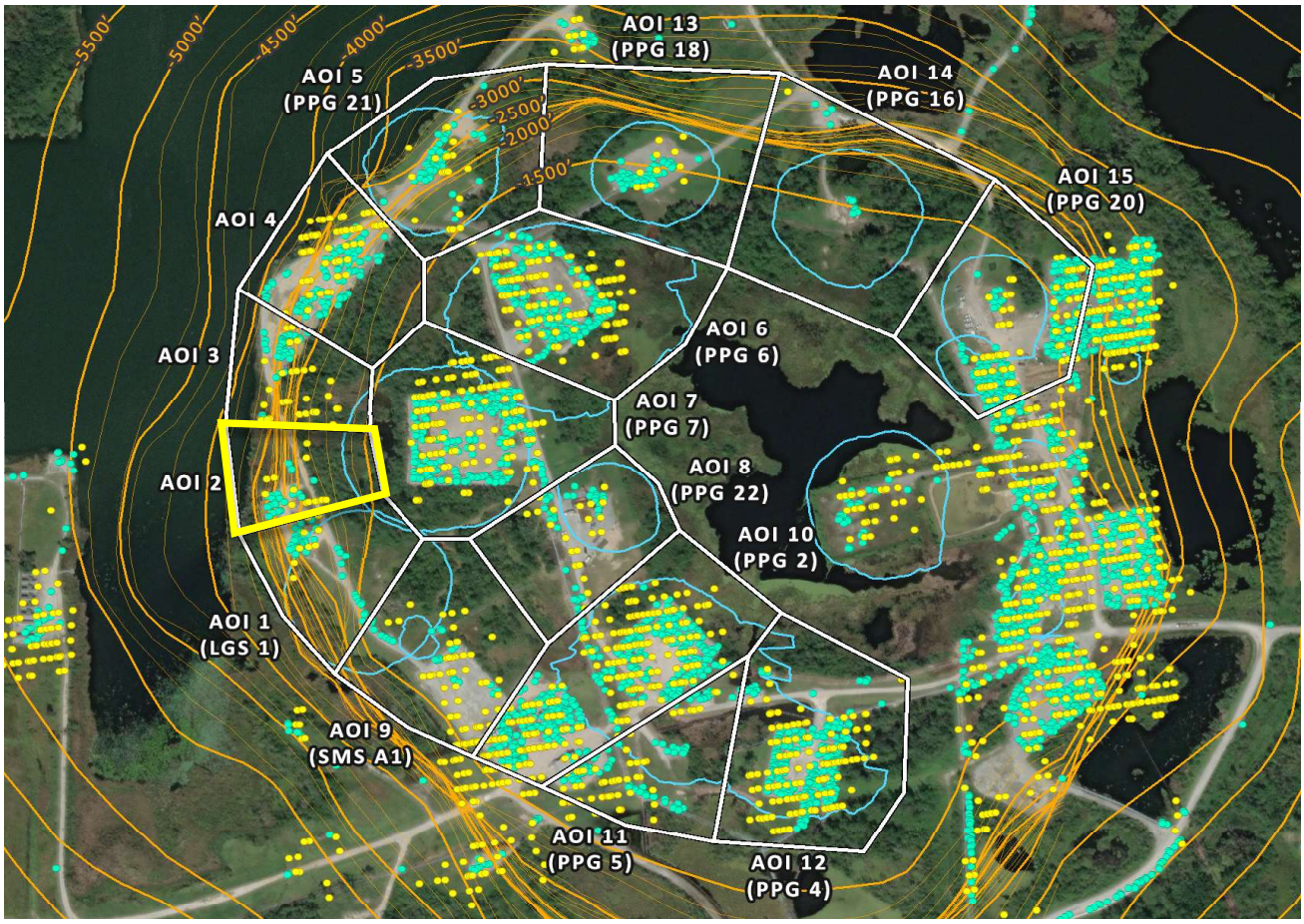
TSX/PAZ (6/28/2024) Point Count: **42**



	Nonlinear Trend	Linear Trend
Velocity:	-0.28 in/yr	-0.04 in/yr
Acceleration:	-0.34 in/yr^2	0.00 in/yr^2

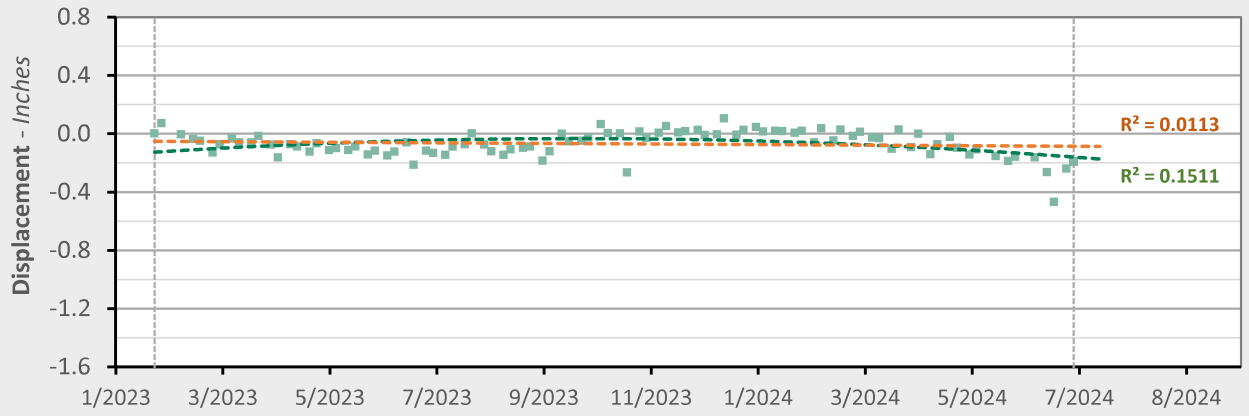
LOS Displacement Measurement
Nonlinear Trend Line (Quadratic Regression)
Linear Trend Line (Linear Regression)

AOI 2 - Location Map



AOI 2 - Displacement Time Series

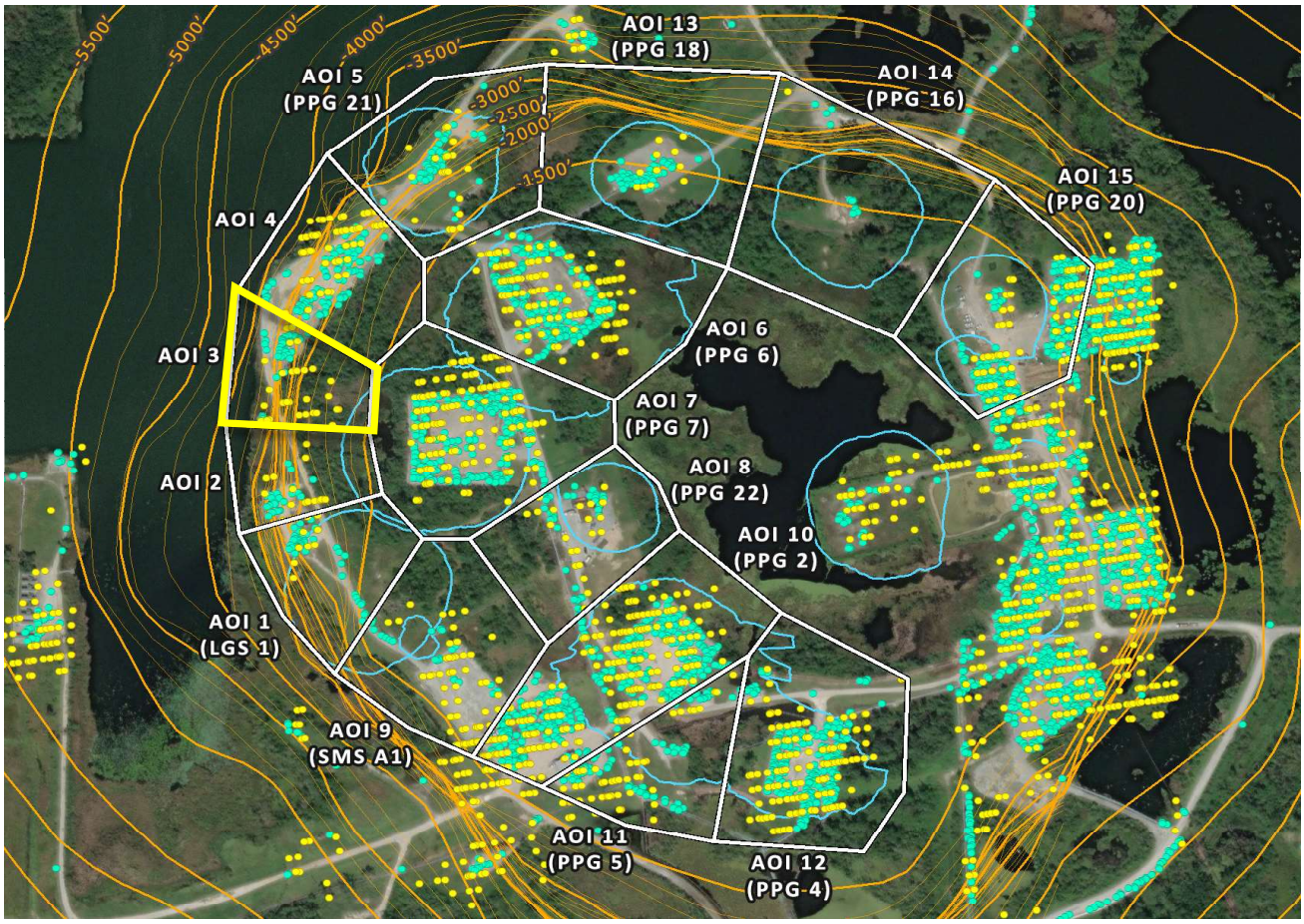
TSX/PAZ (6/28/2024) Point Count: **24**



	Nonlinear Trend	Linear Trend
Velocity:	-0.33 in/yr	-0.02 in/yr
Acceleration:	-0.43 in/yr²	0.00 in/yr²

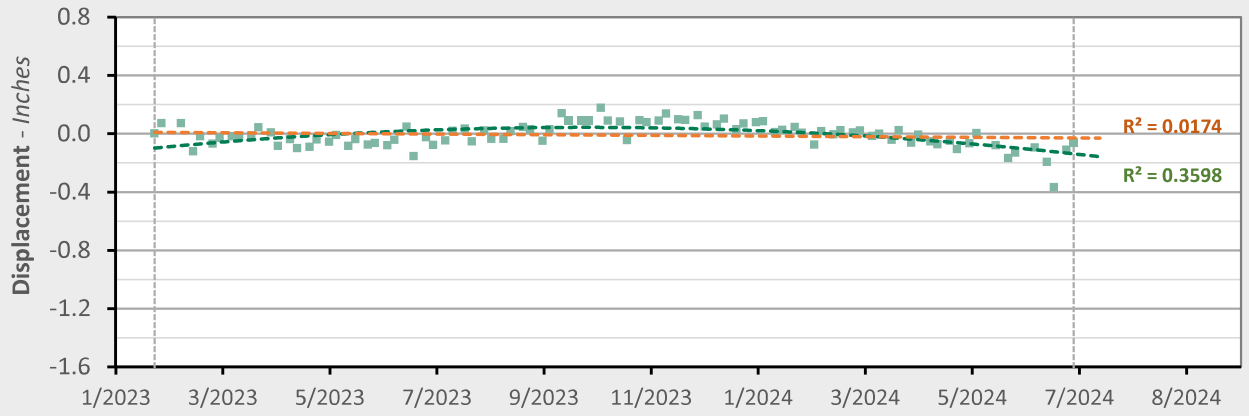
LOS Displacement Measurement | Nonlinear Trend Line (Quadratic Regression) | Linear Trend Line (Linear Regression)

AOI 3 - Location Map



AOI 3 - Displacement Time Series

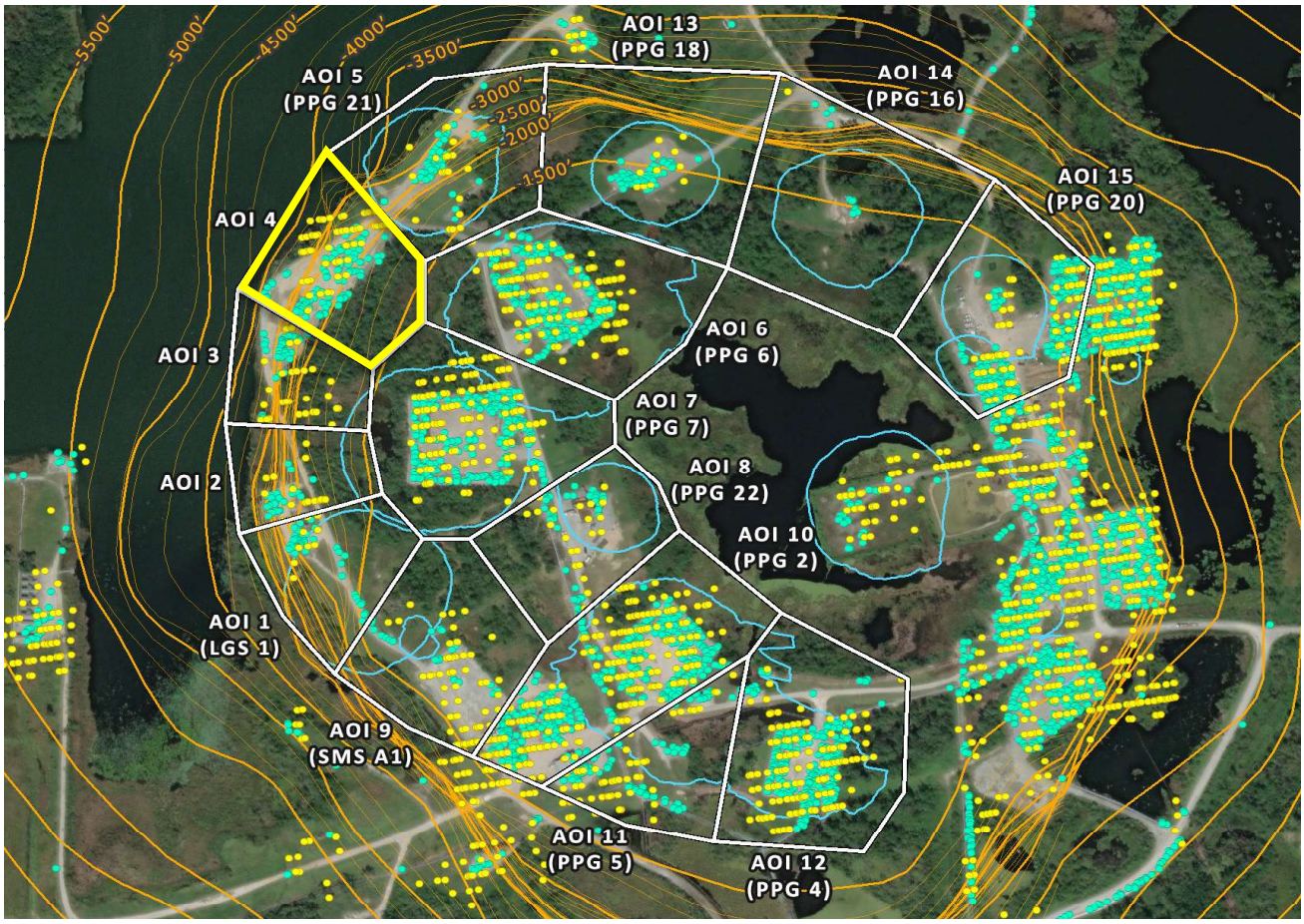
TSX/PAZ (6/28/2024) Point Count: **40**



	Nonlinear Trend	Linear Trend
Velocity:	-0.48 in/yr	-0.03 in/yr
Acceleration:	-0.63 in/yr²	0.00 in/yr²

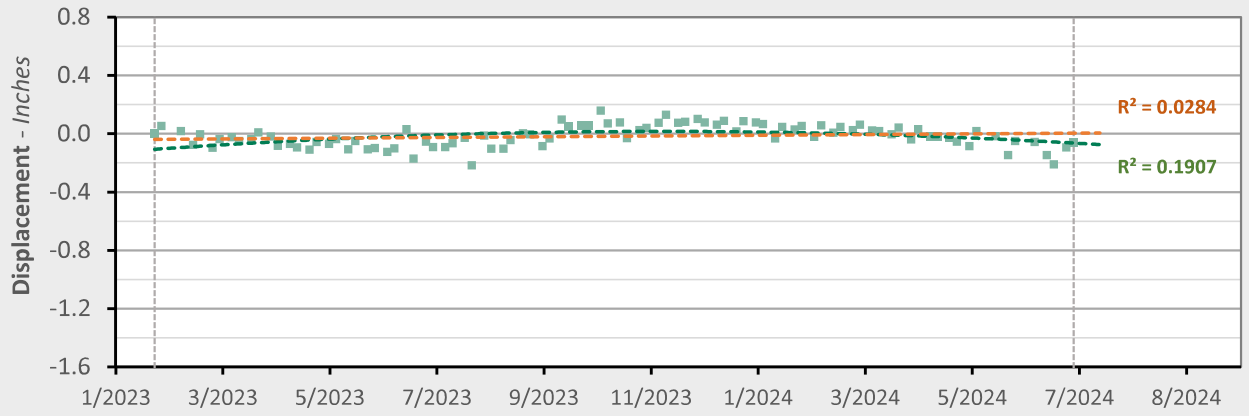
LOS Displacement Measurement
Nonlinear Trend Line (Quadratic Regression)
Linear Trend Line (Linear Regression)

AOI 4 - Location Map



AOI 4 - Displacement Time Series

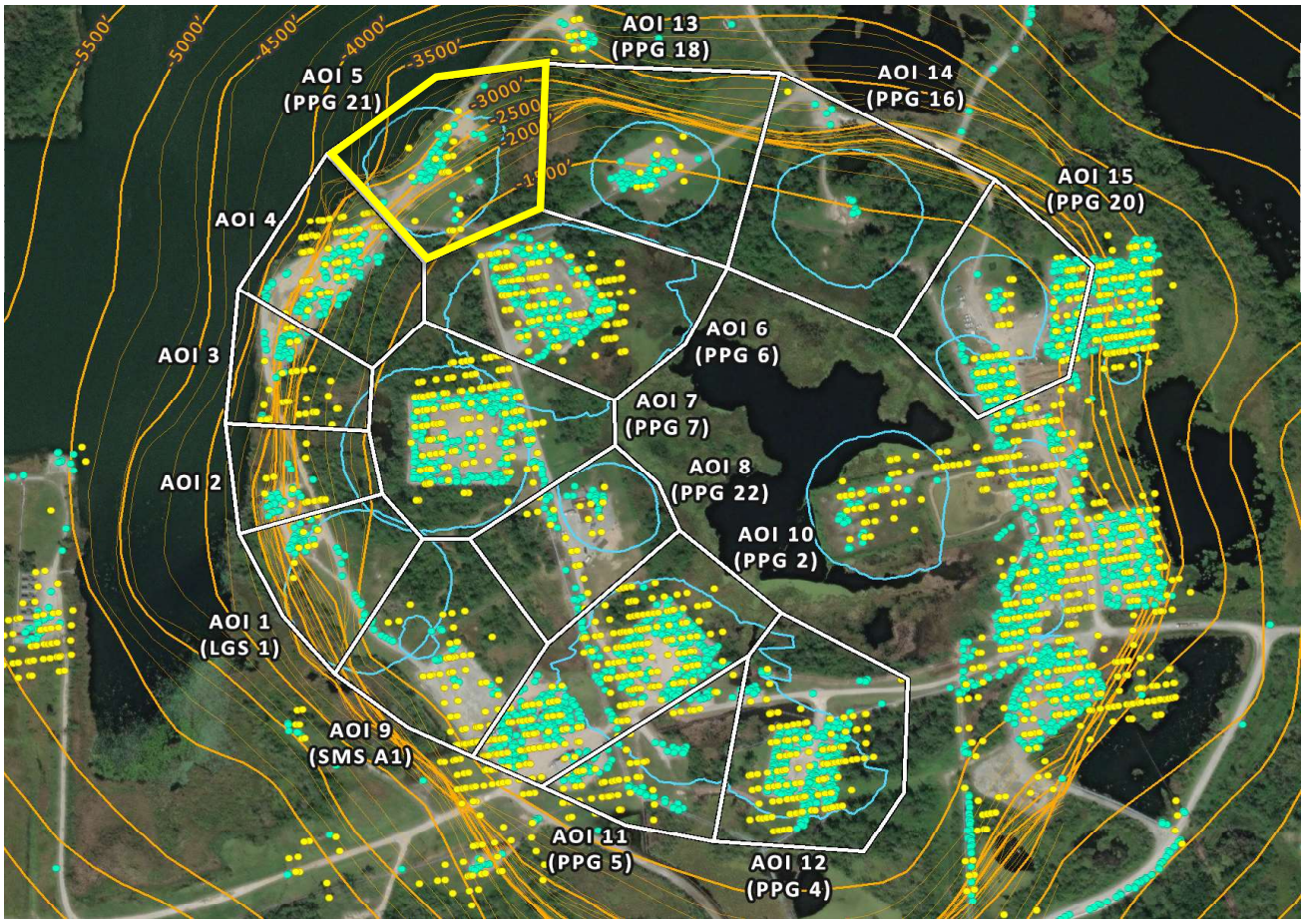
TSX/PAZ (6/28/2024) Point Count: **102**



	Nonlinear Trend	Linear Trend
Velocity:	-0.25 in/yr	+0.03 in/yr
Acceleration:	-0.39 in/yr²	0.00 in/yr²

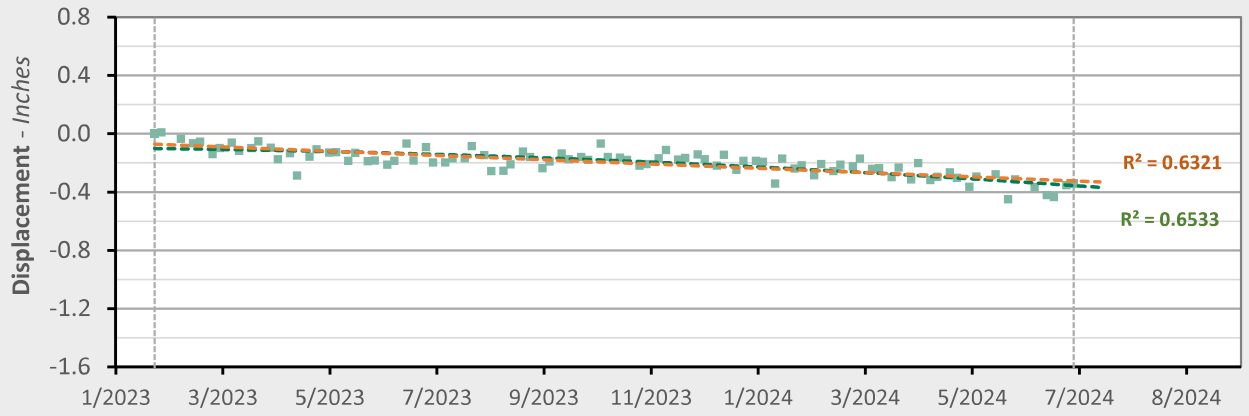
LOS Displacement Measurement
Nonlinear Trend Line (Quadratic Regression)
Linear Trend Line (Linear Regression)

AOI 5 *(PPG 21)* - Location Map



AOI 5 *(PPG 21)* - Displacement Time Series

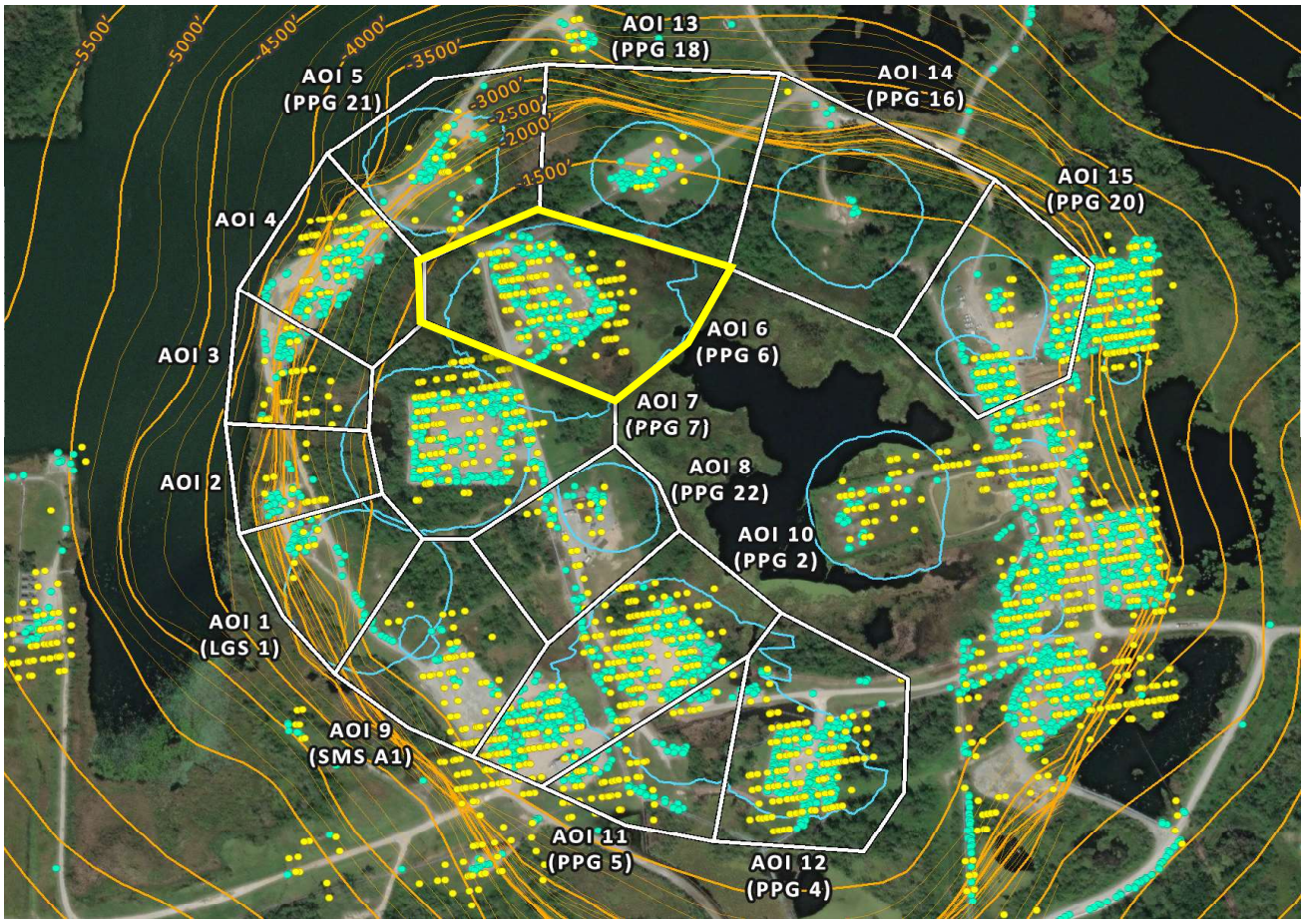
TSX/PAZ (6/28/2024) Point Count: **47**



	Nonlinear Trend	Linear Trend
Velocity:	-0.30 in/yr	-0.18 in/yr
Acceleration:	-0.17 in/yr²	0.00 in/yr²

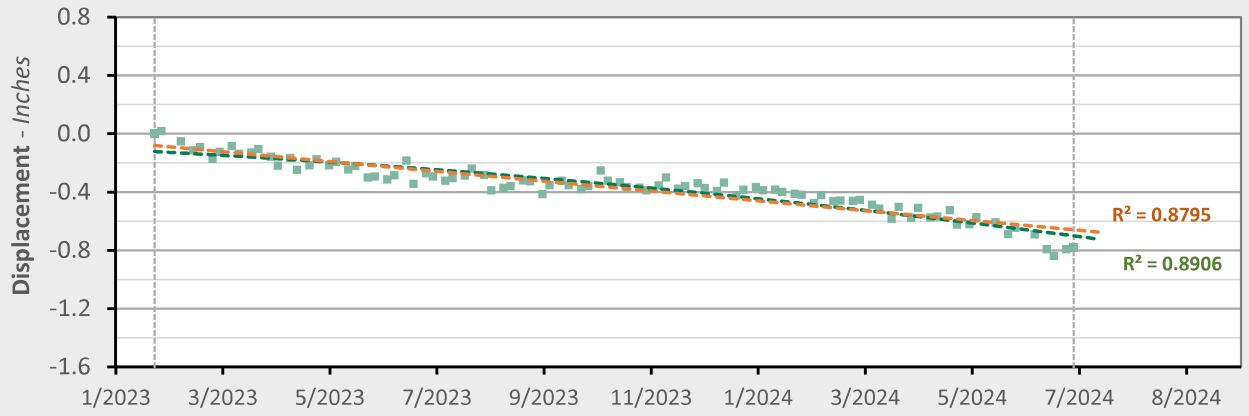
LOS Displacement Measurement | Nonlinear Trend Line (Quadratic Regression) | Linear Trend Line (Linear Regression)

AOI 6 *(PPG 6)* - Location Map



AOI 6 *(PPG 6)* - Displacement Time Series

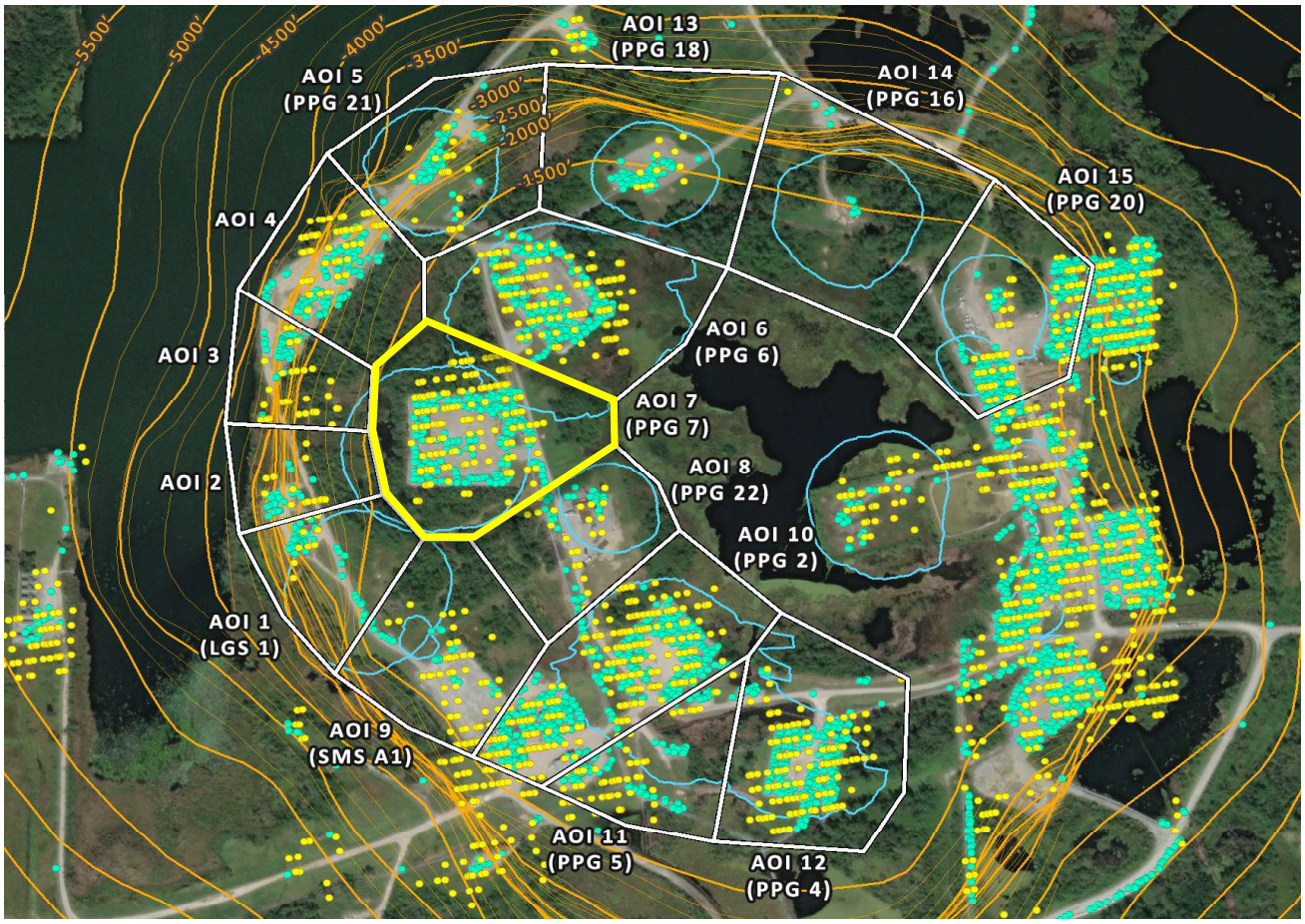
TSX/PAZ (6/28/2024) Point Count: **212**



	Nonlinear Trend	Linear Trend
Velocity:	-0.58 in/yr	-0.40 in/yr
Acceleration:	-0.24 in/yr^2	0.00 in/yr^2

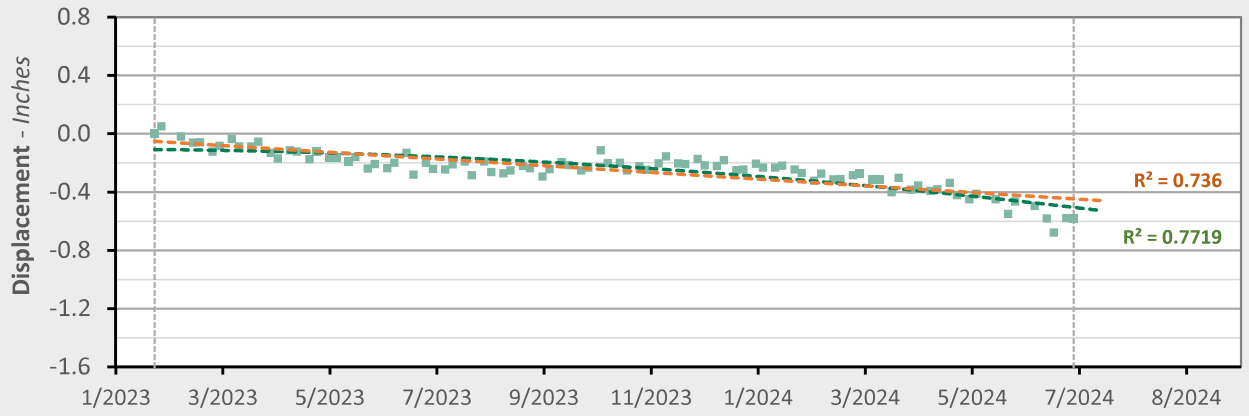
LOS Displacement Measurement
Nonlinear Trend Line (Quadratic Regression)
Linear Trend Line (Linear Regression)

AOI 7 *(PPG 7)* - Location Map



AOI 7 *(PPG 7)* - Displacement Time Series

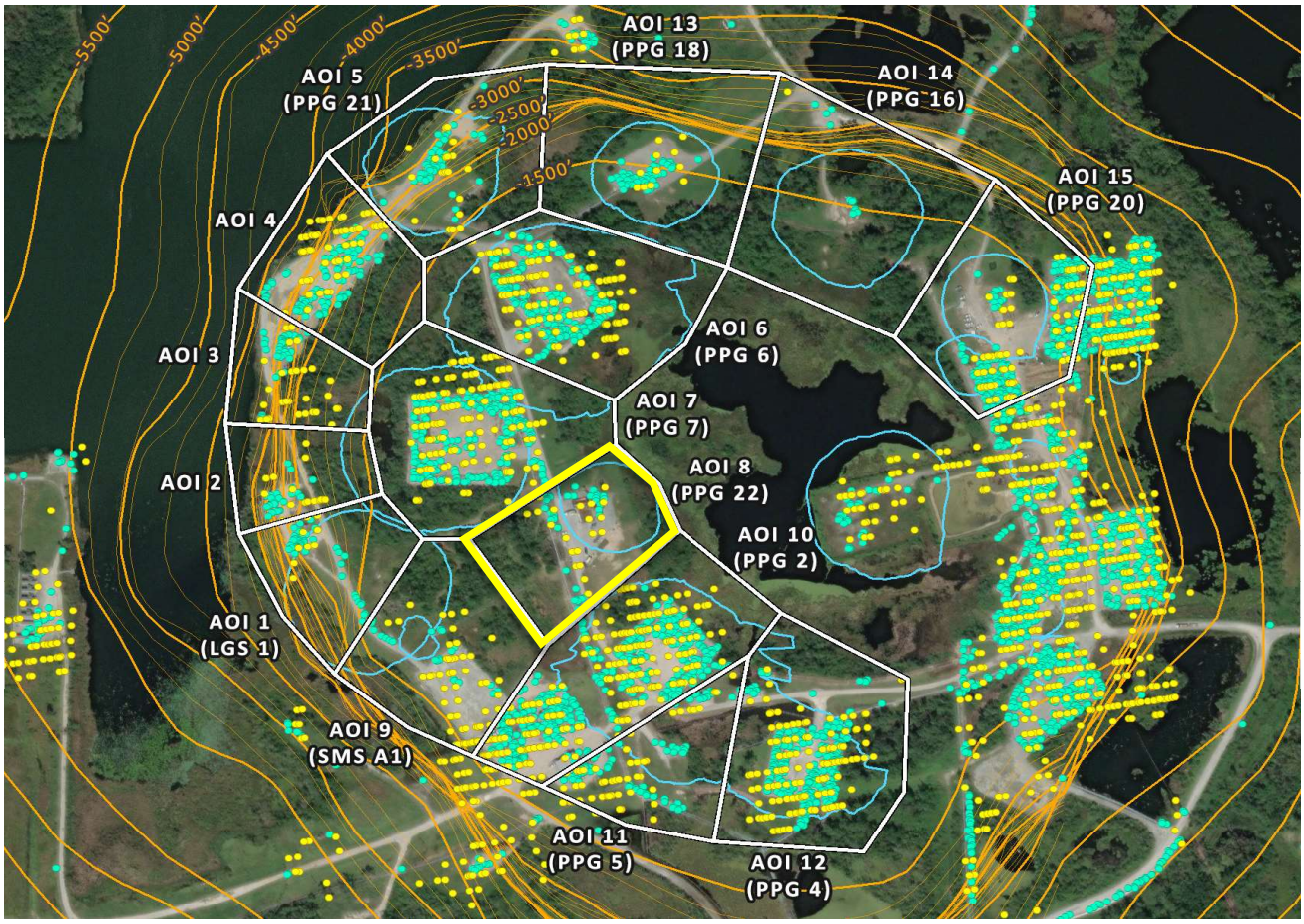
TSX/PAZ (6/28/2024) Point Count: **216**



	Nonlinear Trend	Linear Trend
Velocity:	-0.51 in/yr	-0.28 in/yr
Acceleration:	-0.33 in/yr^2	0.00 in/yr^2

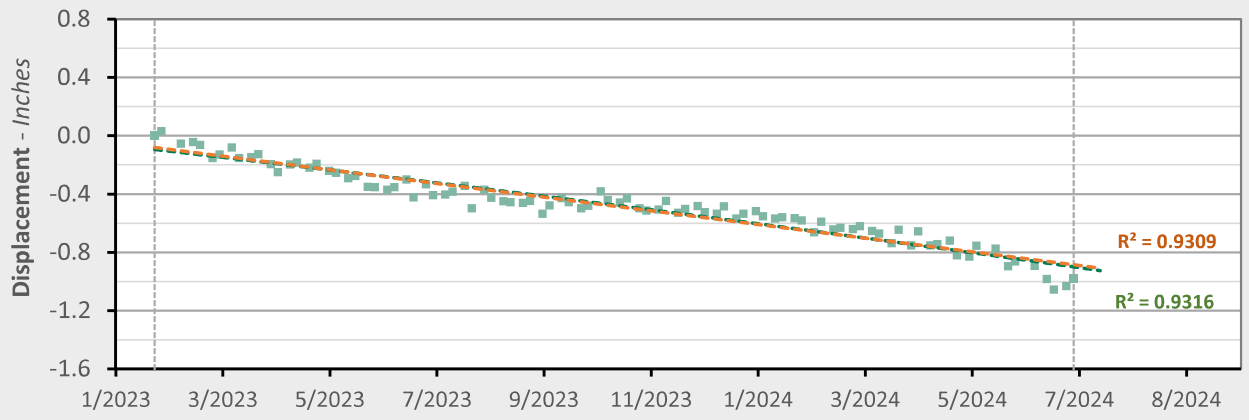
LOS Displacement Measurement
Nonlinear Trend Line (Quadratic Regression)
Linear Trend Line (Linear Regression)

AOI 8 *(PPG 22)* - Location Map



AOI 8 *(PPG 22)* - Displacement Time Series

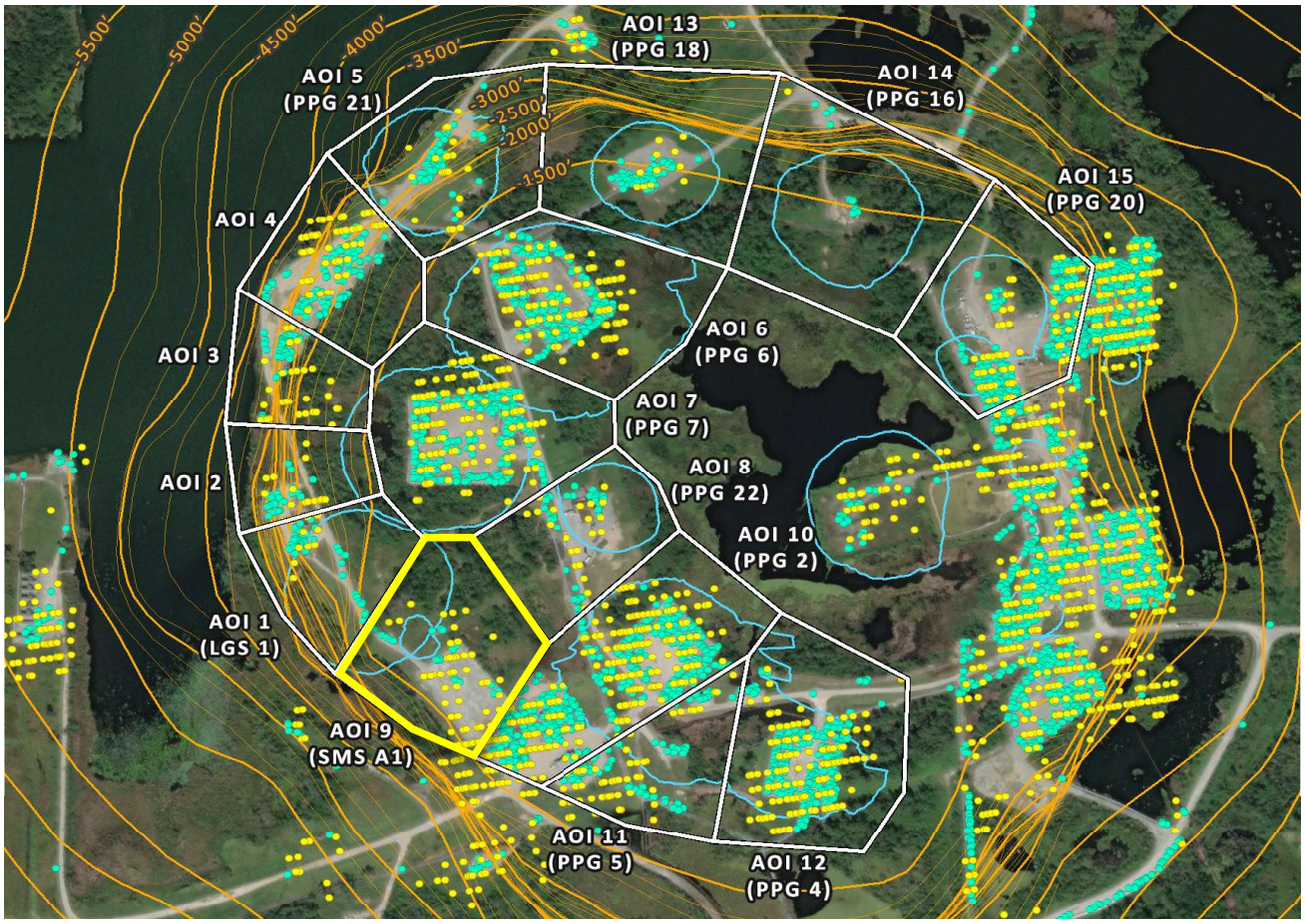
TSX/PAZ (6/28/2024) Point Count: **36**



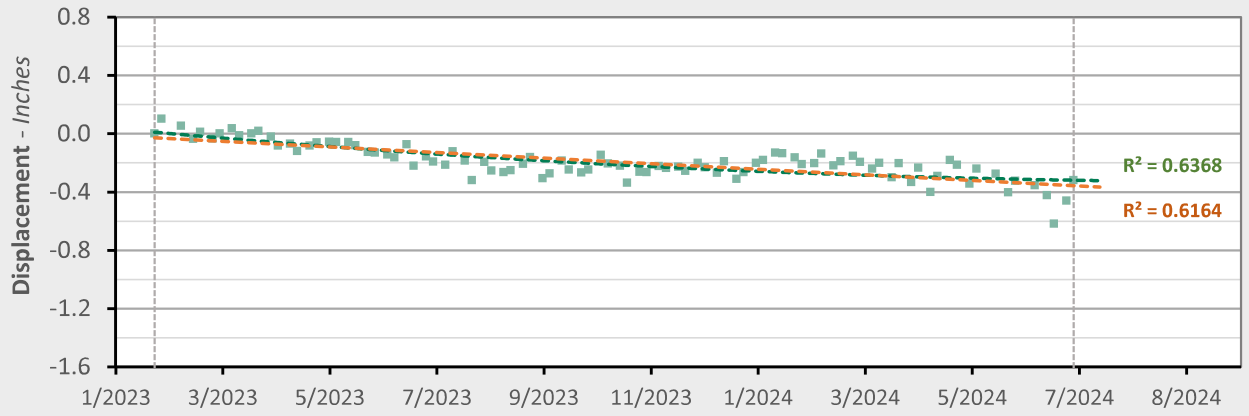
	Nonlinear Trend	Linear Trend
Velocity:	-0.62 in/yr	-0.56 in/yr
Acceleration:	-0.08 in/yr^2	0.00 in/yr^2

LOS Displacement Measurement
Nonlinear Trend Line (Quadratic Regression)
Linear Trend Line (Linear Regression)

AOI 9 *(PPG A1)* - Location Map



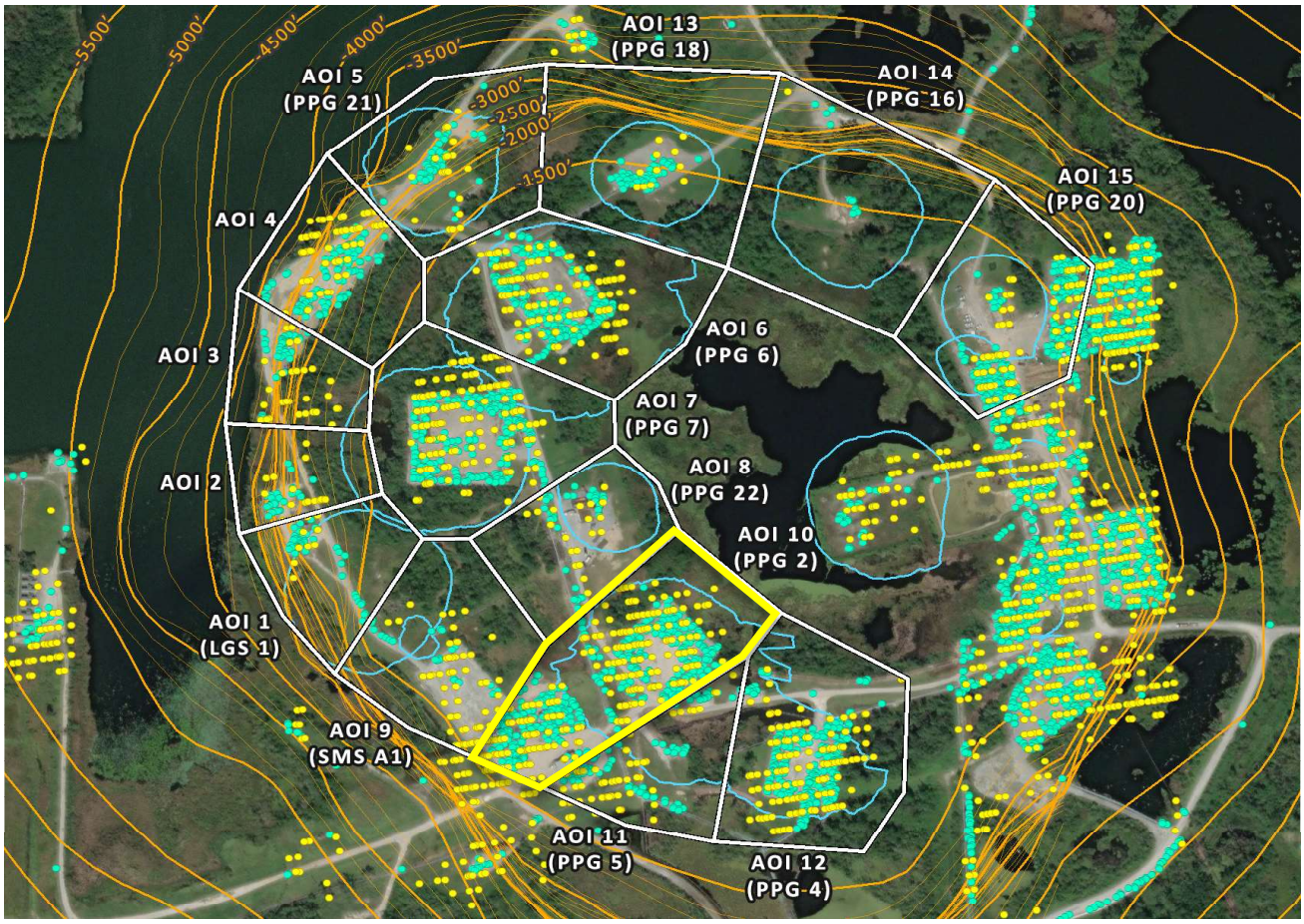
AOI 9 *(SMS A1)* - Displacement Time Series TSX/PAZ (6/28/2024) Point Count: 23



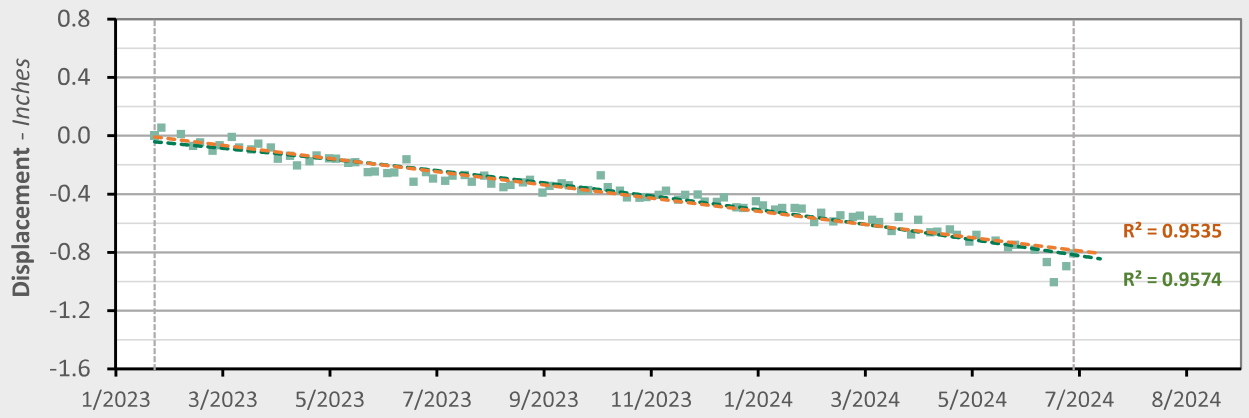
	Nonlinear Trend	Linear Trend
Velocity:	-0.07 in/yr	-0.23 in/yr
Acceleration:	+0.23 in/yr²	0.00 in/yr²

LOS Displacement Measurement
Nonlinear Trend Line (Quadratic Regression)
Linear Trend Line (Linear Regression)

AOI 10 *(PPG 2)* - Location Map



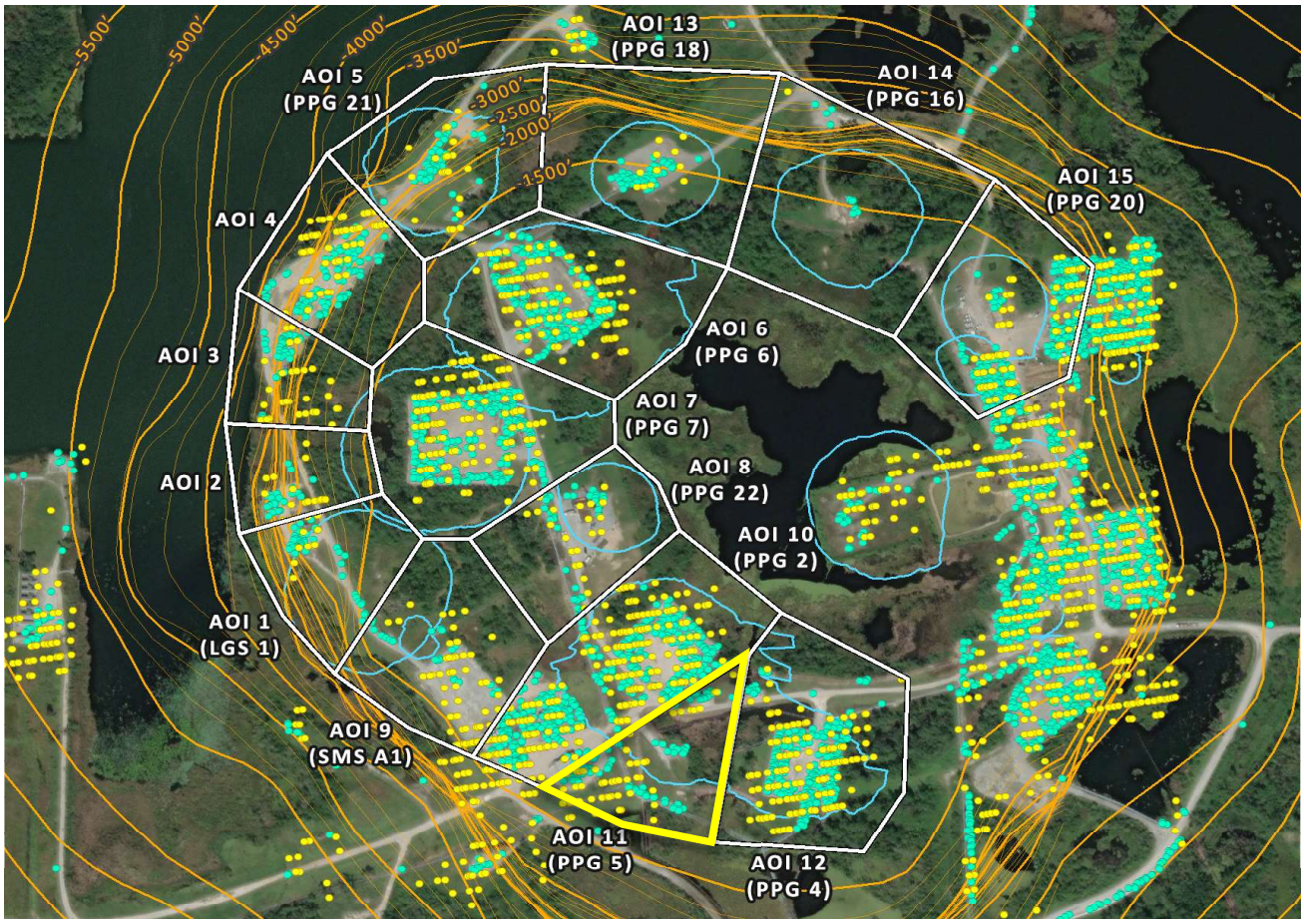
AOI 10 *(PPG 2)* - Displacement Time Series TSX/PAZ (6/28/2024) Point Count: 404



	Nonlinear Trend	Linear Trend
Velocity:	-0.68 in/yr	-0.54 in/yr
Acceleration:	-0.19 in/yr^2	0.00 in/yr^2

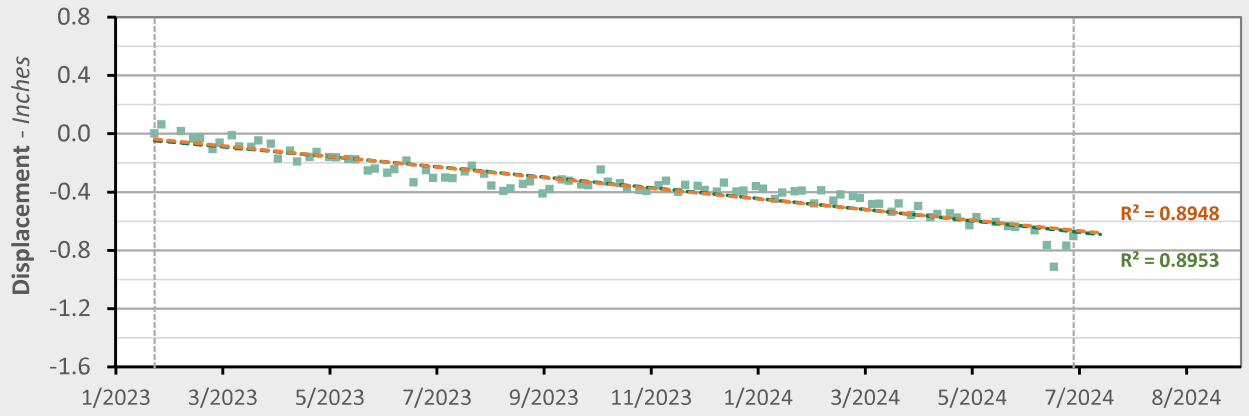
LOS Displacement Measurement
Nonlinear Trend Line (Quadratic Regression)
Linear Trend Line (Linear Regression)

AOI 11 *(PPG 5)* - Location Map



AOI 11 *(PPG 5)* - Displacement Time Series

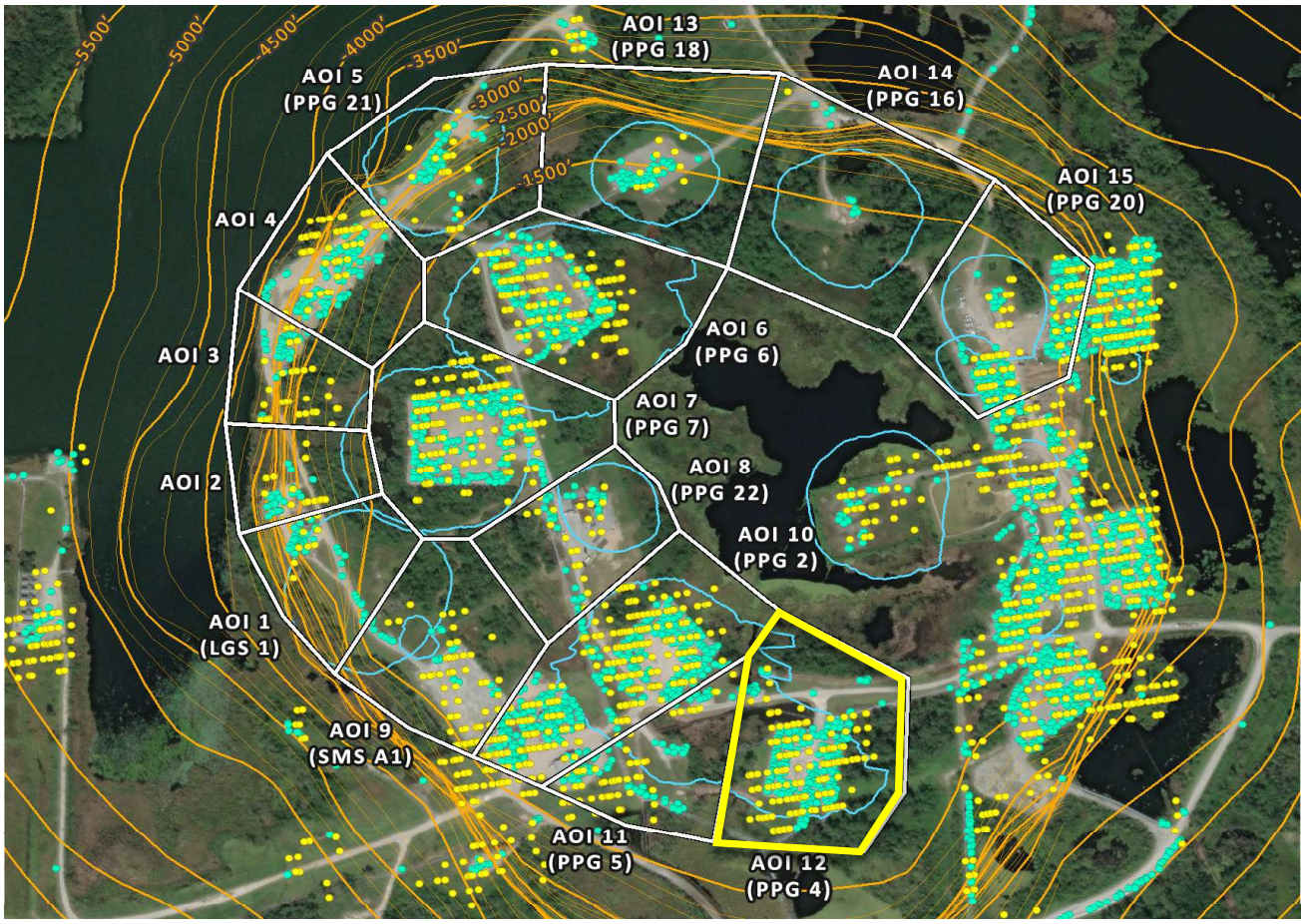
TSX/PAZ (6/28/2024) Point Count: **85**



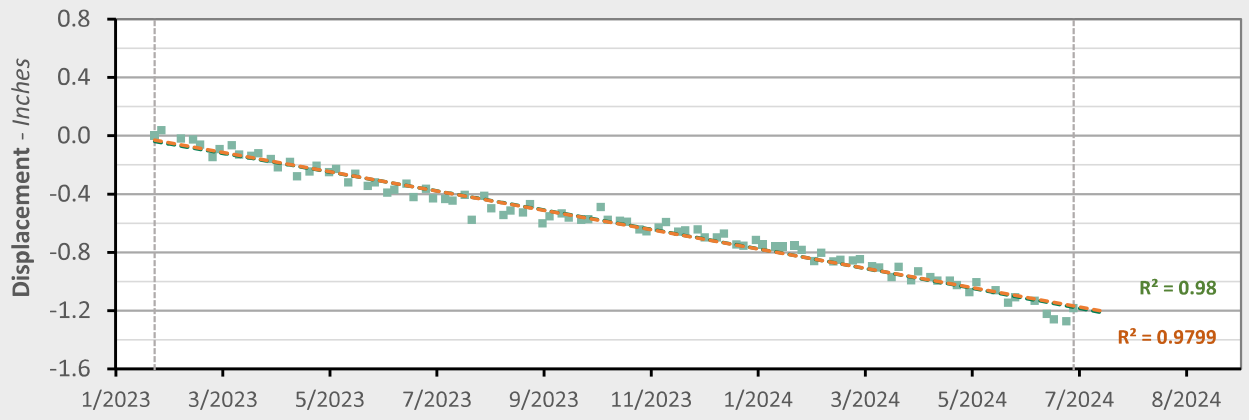
	Nonlinear Trend	Linear Trend
Velocity:	-0.48 in/yr	-0.44 in/yr
Acceleration:	-0.05 in/yr^2	0.00 in/yr^2

LOS Displacement Measurement | Nonlinear Trend Line (Quadratic Regression) | Linear Trend Line (Linear Regression)

AOI 12 *(PPG 4)* - Location Map



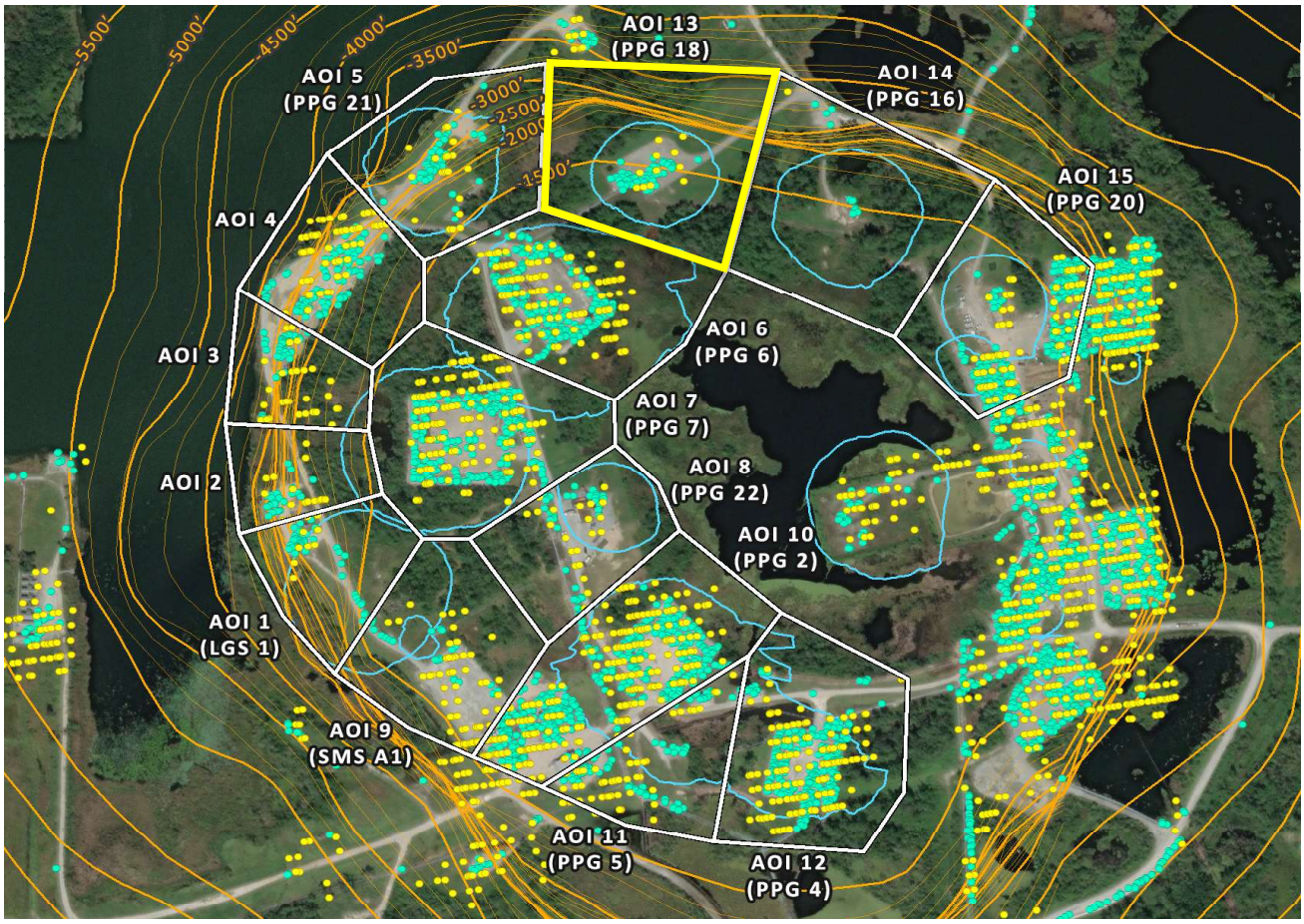
AOI 12 *(PPG 4)* - Displacement Time Series TSX/PAZ (6/28/2024) Point Count: 262



	Nonlinear Trend	Linear Trend
Velocity:	-0.83 in/yr	-0.80 in/yr
Acceleration:	-0.05 in/yr^2	0.00 in/yr^2

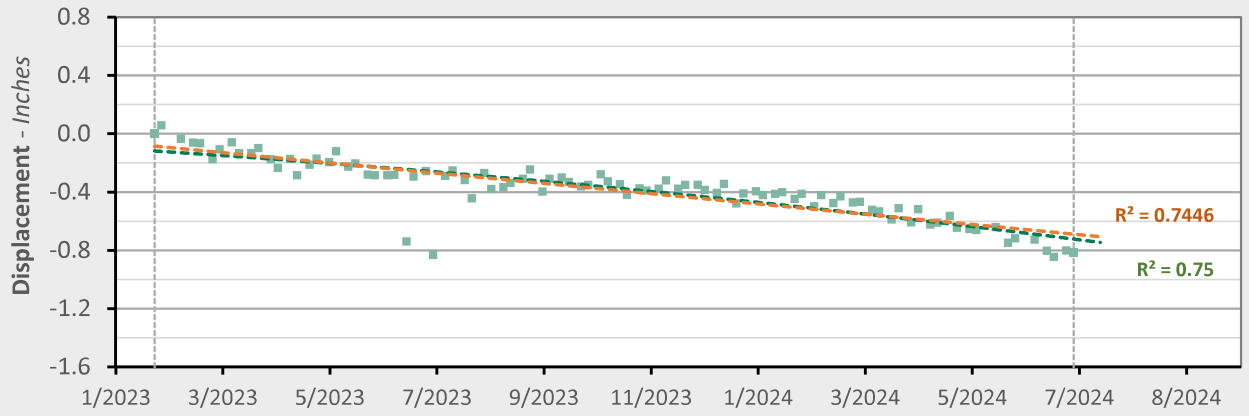
LOS Displacement Measurement
Nonlinear Trend Line (Quadratic Regression)
Linear Trend Line (Linear Regression)

AOI 13 *(PPG 18)* - Location Map



AOI 13 *(PPG 18)* - Displacement Time Series

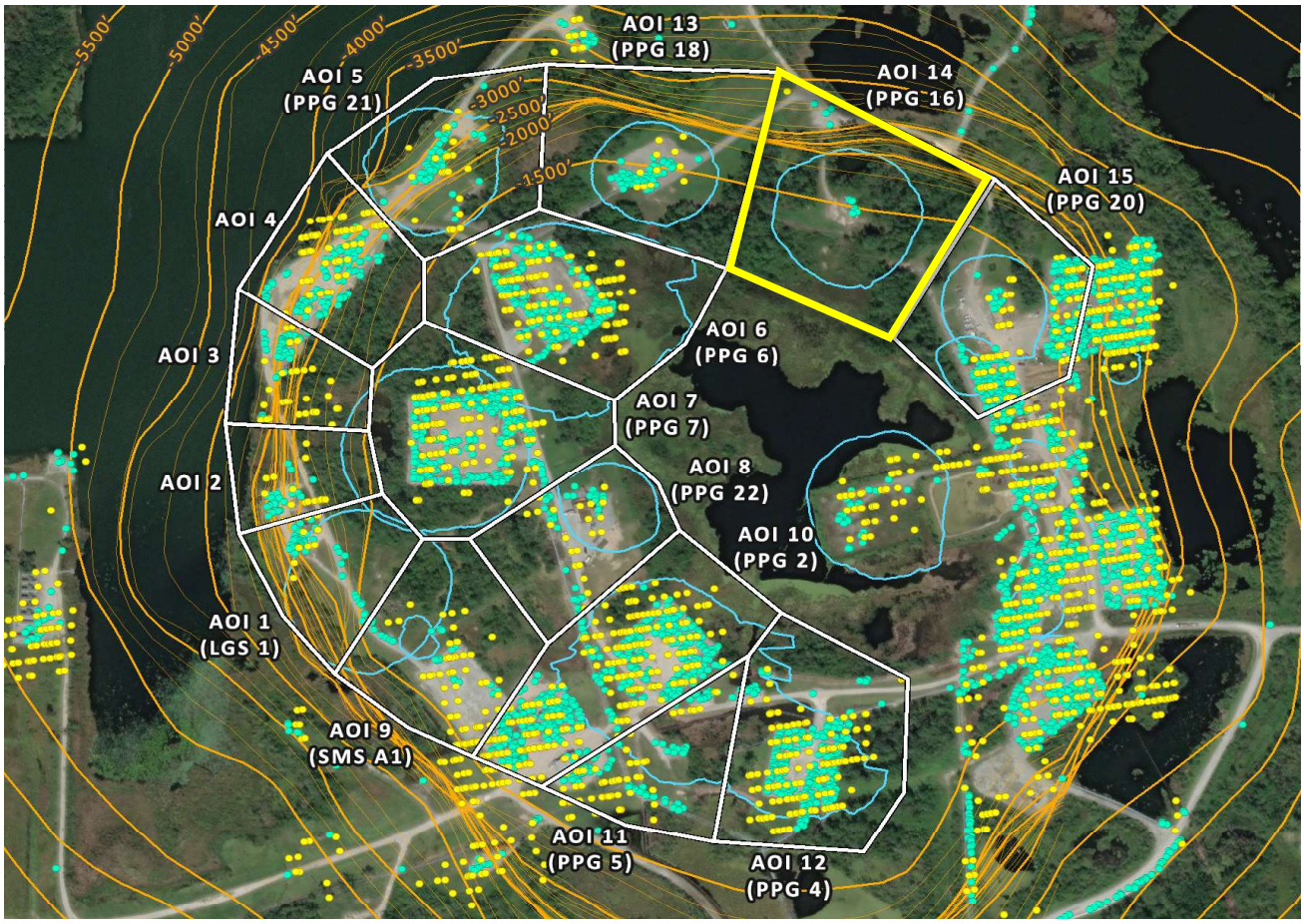
TSX/PAZ (6/28/2024) Point Count: **52**



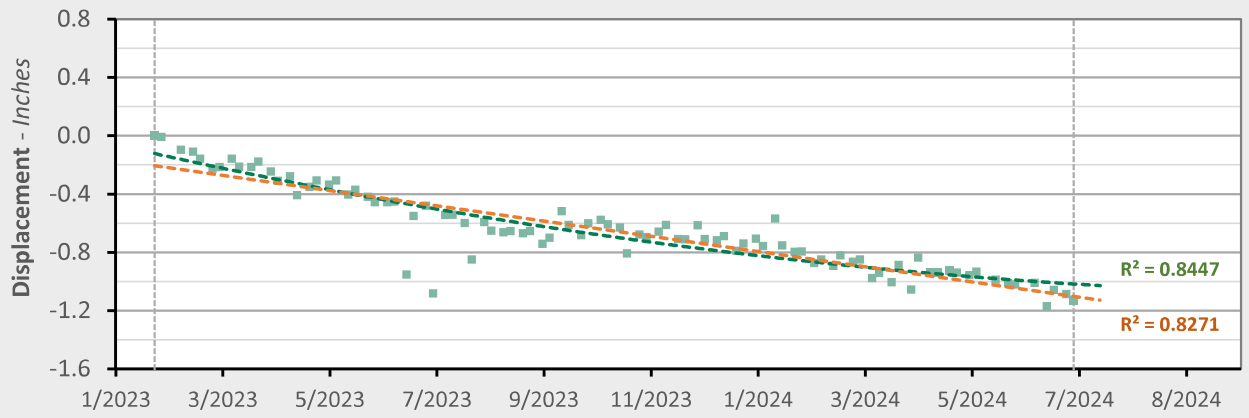
	Nonlinear Trend	Linear Trend
Velocity:	-0.56 in/yr	-0.42 in/yr
Acceleration:	-0.19 in/yr^2	0.00 in/yr^2

LOS Displacement Measurement
Nonlinear Trend Line (Quadratic Regression)
Linear Trend Line (Linear Regression)

AOI 14 *(PPG 16)* - Location Map



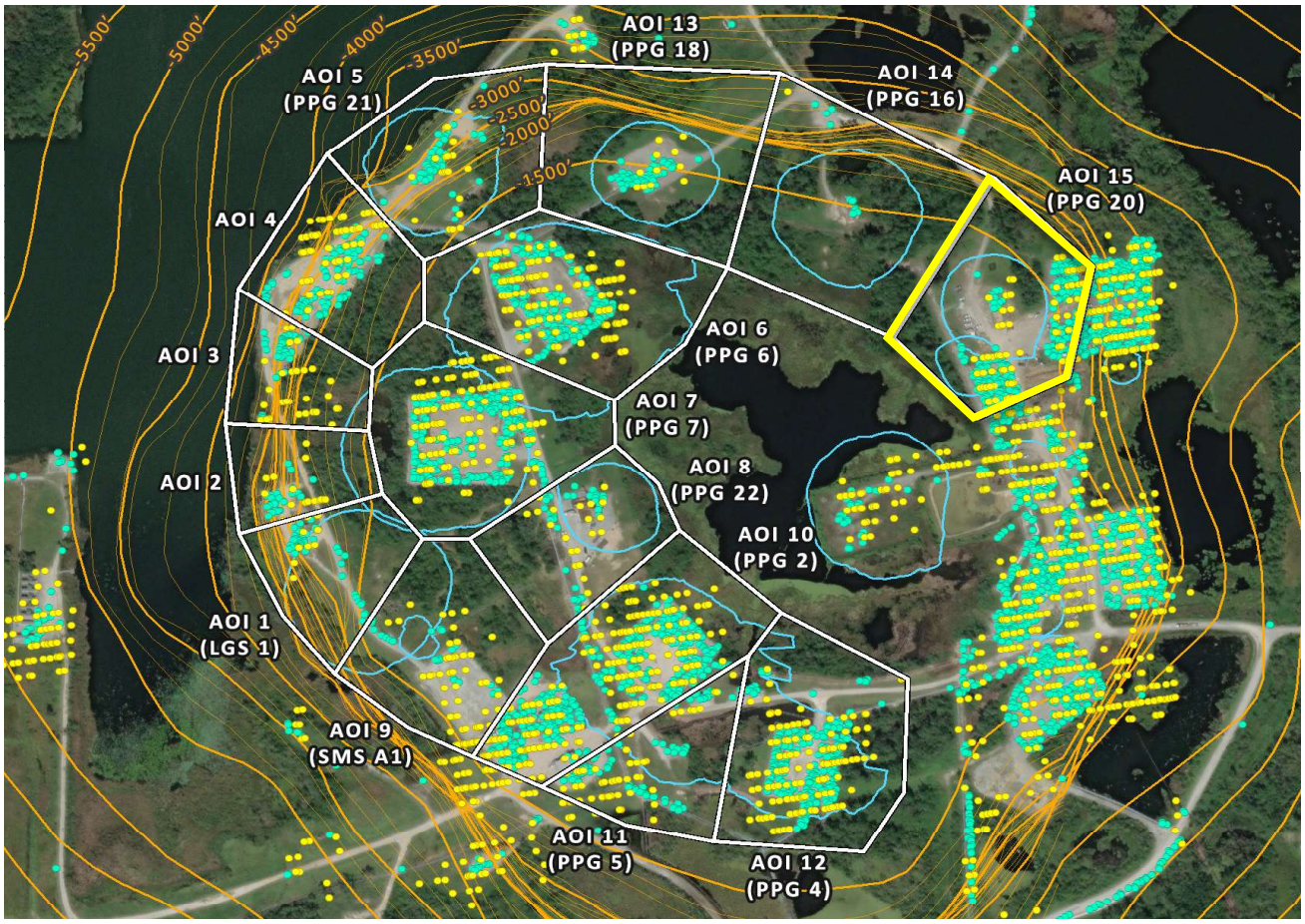
AOI 14 *(PPG 16)* - Displacement Time Series TSX/PAZ (6/28/2024) Point Count: 11



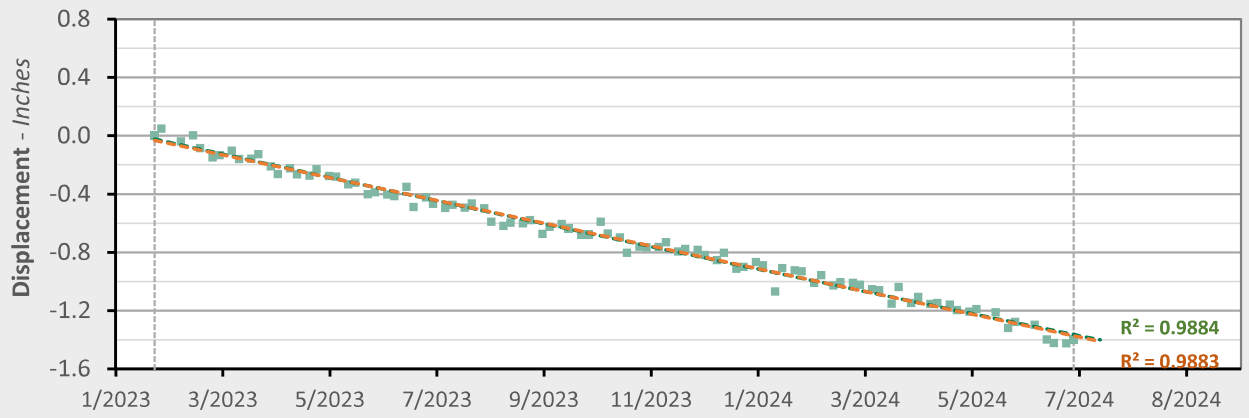
	Nonlinear Trend	Linear Trend
Velocity:	-0.28 in/yr	-0.63 in/yr
Acceleration:	+0.49 in/yr²	0.00 in/yr²

LOS Displacement Measurement
Nonlinear Trend Line (Quadratic Regression)
Linear Trend Line (Linear Regression)

AOI 15 *(PPG 20)* - Location Map



AOI 15 *(PPG 20)* - Displacement Time Series TSX/PAZ (6/28/2024) Point Count: 224



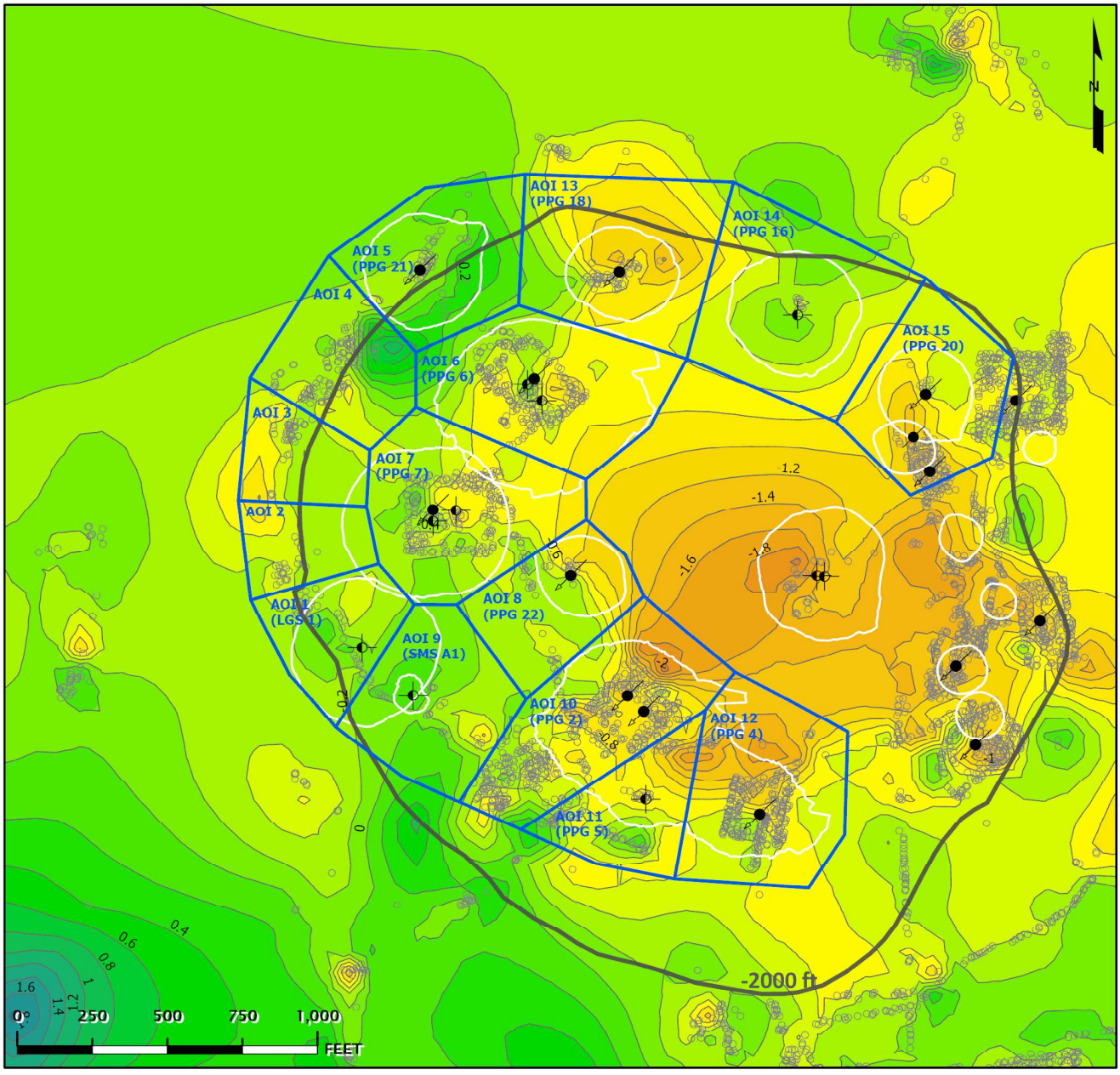
	Nonlinear Trend	Linear Trend
Velocity:	-0.90 in/yr	-0.94 in/yr
Acceleration:	+0.05 in/yr²	0.00 in/yr²

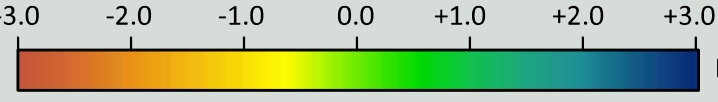
LOS Displacement Measurement
Nonlinear Trend Line (Quadratic Regression)
Linear Trend Line (Linear Regression)

TSX/PAZ Data (01/24/2023 - 06/28/2024)

Nonlinear Velocity Contours

As of date: 06/28/2024





AOI Boundary | InSAR LOS Measurement Point | Contour (0.2)

Historical Cavern Extent | Top of Dome (-2000 ft Contour)

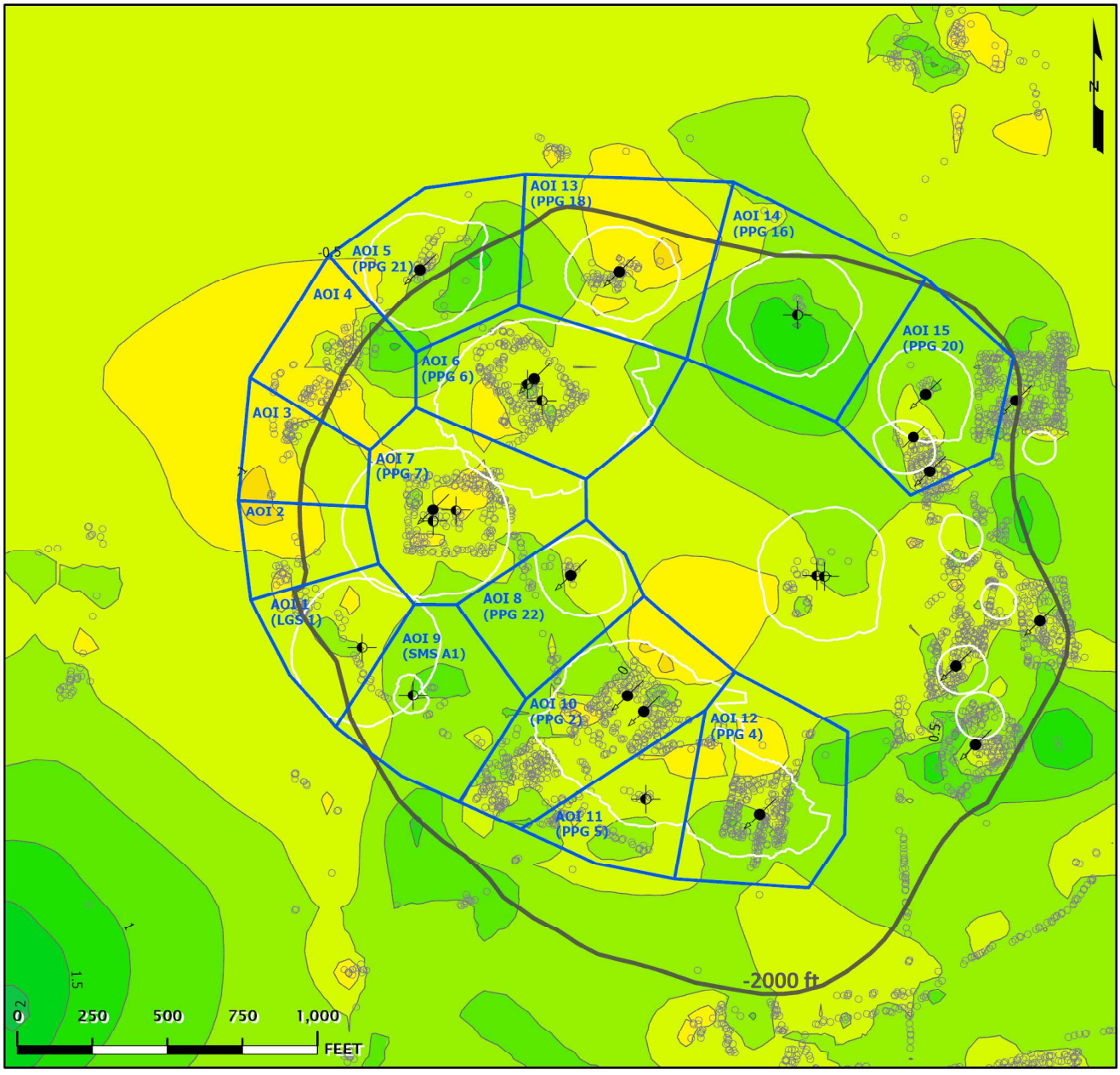
Cavern Well Surface Locations

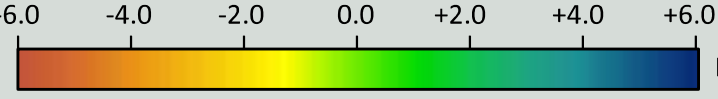
09 - Active - Injection | 29 - Dry and Plugged

TSX/PAZ Data (01/24/2023 - 06/28/2024)

Nonlinear Acceleration Contours

Date range: 01/24/2023 - 06/28/2024





AOI Boundary | InSAR LOS Measurement Point | Contour (0.5)

Historical Cavern Extent | Top of Dome (-2000 ft Contour)

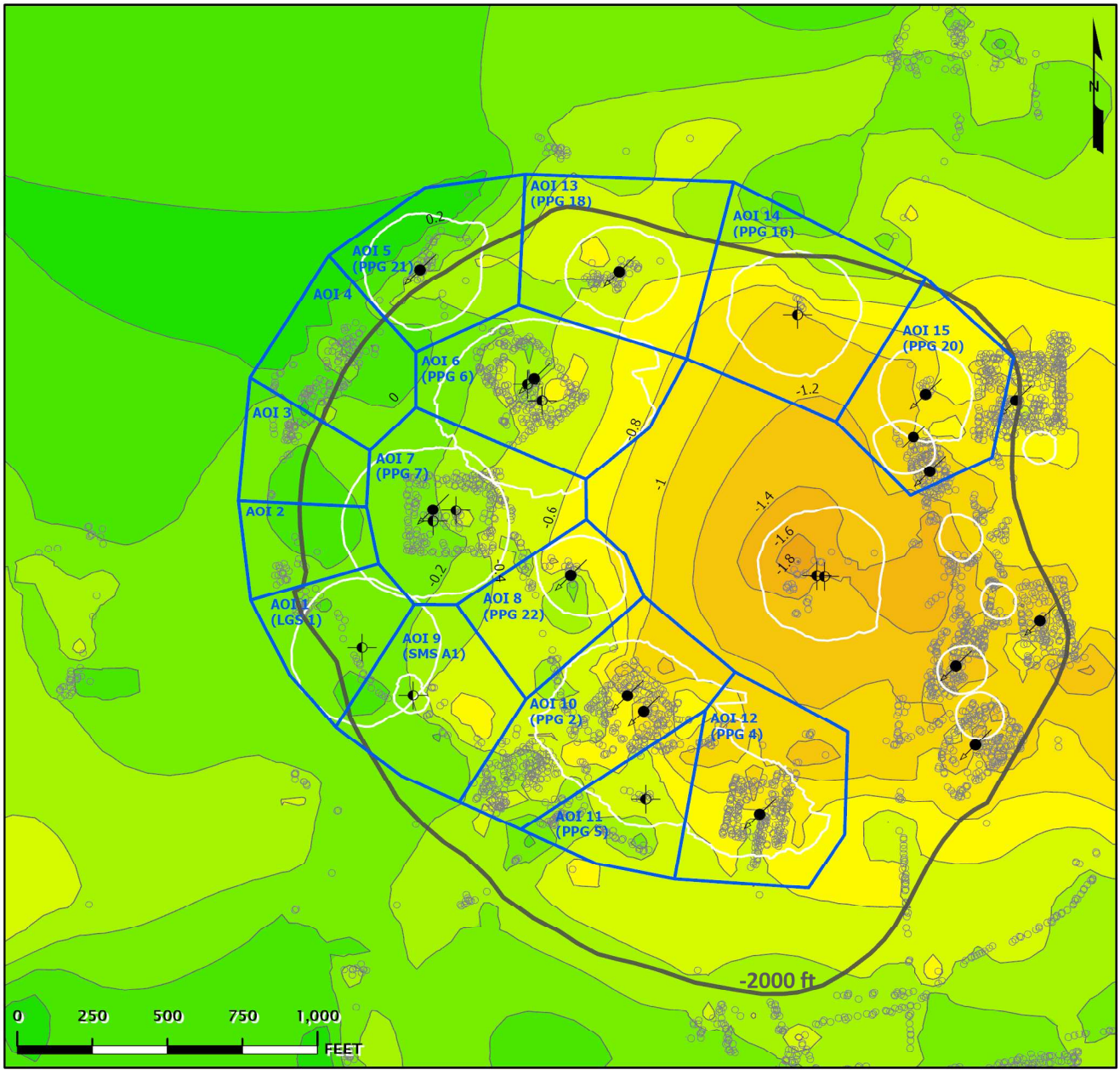
Cavern Well Surface Locations

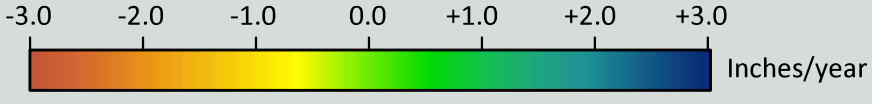
09 - Active - Injection | 29 - Dry and Plugged

TSX/PAZ Data (01/24/2023 - 06/28/2024)

Linear Velocity Contours

Date range: 01/24/2023 - 06/28/2024





AOI Boundary | InSAR LOS Measurement Point | Contour (0.2)

Historical Cavern Extent | Top of Dome (-2000 ft Contour)

Cavern Well Surface Locations

09 - Active - Injection | 29 - Dry and Plugged