



To: Millennium Tower Association

From: Debra Murphy, PE (CA 77748)  
Nathaniel Wagner, PE (CA 88778), GE (CA 3237), PhD  
Tamar Baumer

Date: March 22, 2024

Project Number: 23-018-01

Subject: 301 Mission Retrofit Monitoring Report 132: Results as of March 18, 2024

---

## **REPORTABLE CONDITIONS**

No reportable conditions occurred in the current time period.

## **CONTEXT**

This memorandum summarizes results from the monitoring plan implemented at the 301 Mission property. Instrumentation to monitor the structure prior to, during and after the retrofit was installed in January 2021, including piezometers and extensometers. Settlement markers installed in April 2009 and January 2017, survey prisms mounted on the exterior of the structure in December 2016, and crack gauges installed in April 2009 have also been monitored. Pile load cells were installed on the Mission Street piles in January 2023, and on the Fremont Street piles in June 2023. Survey points were established on the manhole covers around the Tower and a baseline reading was performed on August 8, 2023. This memorandum is for review only. It only contains ongoing monitoring information. This memorandum does not contain recommendations based upon the ongoing monitoring information.

## **PRESENTATION OF DATA**

Table 01 presents the Reportable Conditions as described in the "301 Mission Perimeter Pile Upgrade Post-Construction Monitoring" document developed by Simpson Gumpertz & Heger (dated September 6, 2023). Reportable Conditions that have not occurred since the last monitoring report are denoted with a "No" response and those that have occurred since the last monitoring report are denoted with a "Yes" response.

Figure 01 presents the instrument locations as referenced in later figures.

Figure 02 presents the historical settlement data interpreted from settlement markers installed on the B-1 Level of 301 Mission Tower. In addition, data from surveys performed during the retrofit are included. Figure 03 presents settlement data since the start of production pile installation (May 12, 2021; baseline readings on May 10, 2021) through March 18, 2024. Figure 04 presents current settlement contours (in inches) on March 18, 2024.

Figure 05 presents historical lateral roof deflections in the project north-south and project east-west directions interpreted from survey prisms mounted on the exterior of the Tower, from InSAR data, and from a planar fit of the settlement marker data. In addition, data from surveys performed during the retrofit are included. Figure 06A presents lateral roof deflection data from a planar fit of the settlement marker data and from survey prisms mounted on the exterior of the Tower since the start of production pile installation (May 12, 2021; baseline readings on May 10 and 13, 2021, respectively) through March 18, 2024.

Figure 07 presents the historical groundwater elevation interpreted from piezometer readings at locations near 301 Mission. In addition, data from piezometers installed to monitor groundwater elevation during the retrofit are included. Figures 08 and 09 present groundwater elevation interpreted from piezometer readings



in the Marine/Colma Sand and the Old Bay Clay, respectively, for the time period prior to the start of production pile installation (January 1, 2021) through March 18, 2024.

Figure 10 presents extensometer data from within the Tower basement since the start of production pile installation (May 12, 2021) through March 18, 2024. Figure 11 presents extensometer data from Fremont Street since the start of production pile installation (May 12, 2021) through May 16, 2023, and from the restart after fixing the extensometer (May 30, 2023) through March 18, 2024. Figure 12 presents extensometer data from Mission Street since the start of production pile installation (May 12, 2021) through March 18, 2024.

Figure 13A presents pile load cell data since the start of the First Stage Load Transfer (January 23, 2023) through March 18, 2024. Figure 13B presents the total pile load cell data since July 15, 2023, through March 18, 2024.

Figure 14 presents settlement data interpreted from survey points located on manholes around the Tower since August 8, 2023, through March 18, 2024.

## **CLOSING**

Note that the survey crew found anomalies on settlement marker SM23 and manhole MH2. No indications of disturbance were found on SM23 or the rim of MH2. The vault at MH2 was reported to have work being done. Please contact us if you have any comments or questions, or if you would like to discuss the results presented in this memorandum.

## **DATES**

2021/05/12:	Construction Start
2023/01/23:	First Stage Load Transfer Start
2023/01/27:	First Stage Load Transfer End
2023/06/10:	Second Stage Load Transfer Start
2023/06/14:	Second Stage Load Transfer End
2023/06/15:	Third Stage Load Transfer Start
2023/06/19:	Third Stage Load Transfer End
2023/08/03:	Substantial Construction Completion





## **TABLES**

Table 01 – Reportable Conditions

## **FIGURES**

Figure 01A – Instrument Location Map: Settlement Markers, Piezometers, Extensometers

Figure 01B – Tower Survey Prism Location Schematic

Figure 02 – Historical Settlement Marker Data

Figure 03 – Settlement Marker Data since 05/10/2021 through 03/18/2024

Figure 04 – Settlement Contours since 05/10/2021 through 03/18/2024

Figure 05 – Historical Lateral Roof Deflection Data

Figure 06 – Lateral Roof Deflection Data since 05/10/2021 through 03/18/2024

Figure 07 – Historical Groundwater Elevation Measurements at Locations Near 301 Mission

Figure 08 – Groundwater Elevation Measurements in Marine and Colma Sand since 01/01/2021 through 03/18/2024

Figure 09 – Groundwater Elevation Measurements in Old Bay Clay since 01/01/2021 through 03/18/2024

Figure 10 – Extensometer Data from within Tower Basement since 01/01/2021 through 03/18/2024

Figure 11 – Extensometer Data from Fremont Street since 01/01/2021 through 05/16/2023, since 05/30/2023 through 03/18/2024

Figure 12 – Extensometer Data from Mission Street since 01/01/2021 through 03/18/2024

Figure 13A – Pile Load Cell Data since 01/23/2023 through 03/18/2024

Figure 13B – Total Pile Load Cell Data since 07/15/2023 through 03/18/2024

Figure 14 – Manhole Settlement Data since 08/08/2023 through 03/18/2024

## **ATTACHMENTS**

Attachment 01 – Crack Gauge Report since 01/06/2021 through 03/18/2024



**Table 01 – Reportable Conditions Checklist**  
*from SGH (dated September 6, 2023)*

Reportable Condition	Occurrence
Occurrence of an earthquake producing peak ground acceleration exceeding 0.25g; 5% damped spectral response acceleration at a period of 4 seconds exceeding 0.04g; or 5% damped spectral response acceleration at a period of 5 seconds exceeding 0.035g <sup>1</sup>	No
Occurrence of a windstorm producing estimated sustained gusts with velocity more than 93 miles per hour at a height of 30 feet above ground at the 301 Mission site <sup>2</sup>	No
A sustained decrease (i.e., more than 3 months) of piezometric head exceeding 25 feet below ground surface in soils at the building site	No
A reduction in sustained pile load (i.e., more than 2 weeks) on any pile below 750 kips <sup>3</sup>	No
A reduction in the sustained total load (i.e., more than 2 weeks) in all piles below 16,200 kips	No
An indicated sustained load (i.e., more than 2 weeks) in any pile that exceeds 1,300 kips <sup>4</sup>	No
Average building settlement, as measured by the planar average of settlement markers on the existing mat, exceeds 0.25 inches in a year <sup>5</sup>	No
Sustained horizontal displacement (i.e., more than 3 months) of the roof to the west that exceeds 29 inches, or to the north that exceeds 12 inches <sup>6</sup>	No
Sustained horizontal displacement (i.e., more than 3 months) of the roof to the west that is less than 14 inches, or the north that is less than 6 inches <sup>6</sup>	No
Growth in the width across or horizontal movement along any crack, as measured at the crack gauges relative to the value as of 8/7/2023, that exceeds 1 mm	No
Any instrument malfunction or inability to collect and report data for (1) more than one bi-weekly report (through 2/5/2024), and (2) any scheduled report thereafter.	No

<sup>1</sup> These acceleration parameters are approximately 50% of the parameters for the site-specific design earthquake ground motions used as a basis for design of the PPU. Actual values produced by an earthquake shall be based on spectra derived from instrument CSMIP 58411 located at the building base. In the event data from this instrument is unavailable, spectra shall be derived from available instruments in buildings at sites similar to and within 1 kilometer of the 301 Mission site.

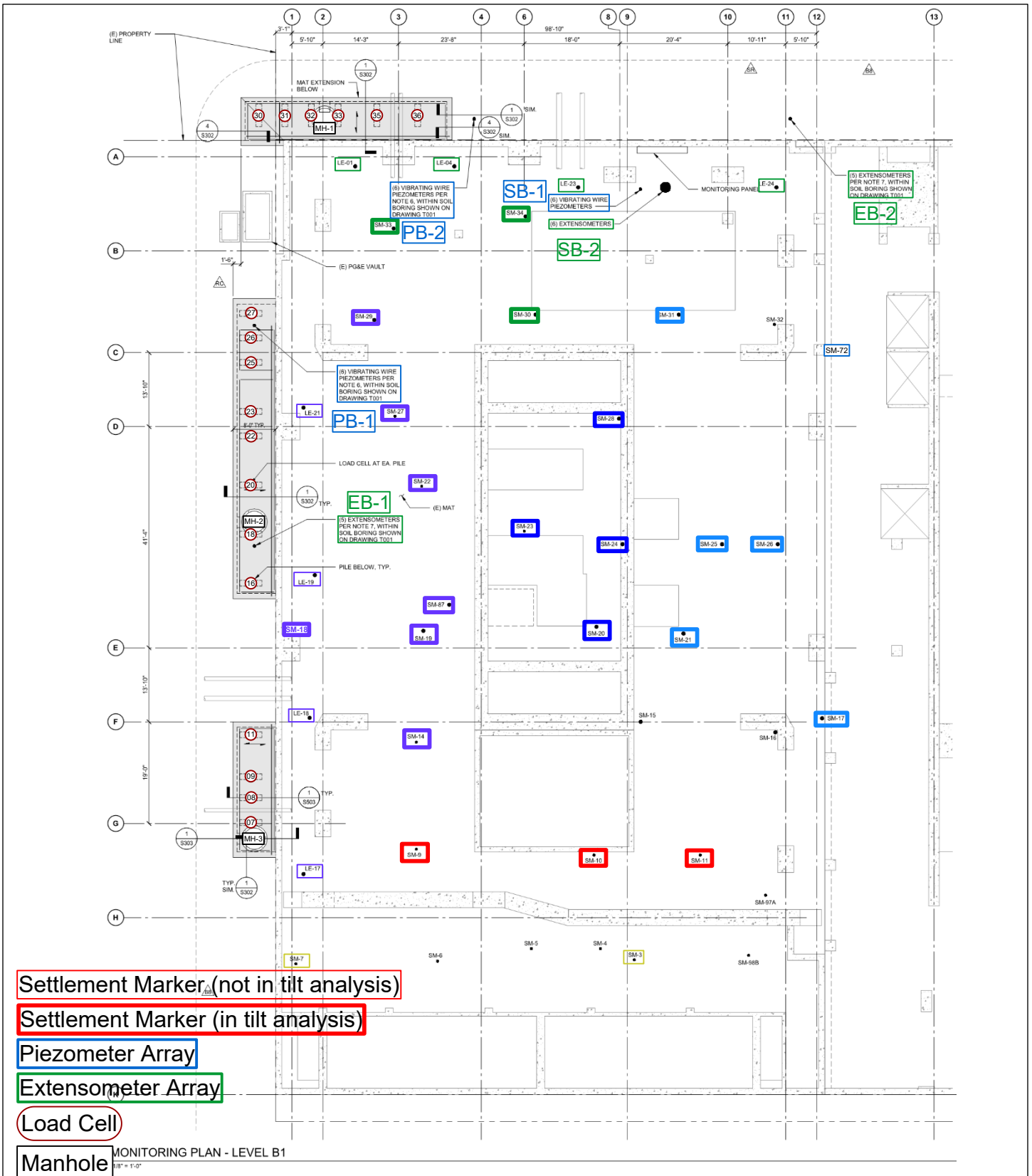
<sup>2</sup> Wind speeds may be as determined at San Francisco International Airport.

<sup>3</sup> This corresponds to conditions included in the negative declaration on the EIR for the project.

<sup>4</sup> The load transfer rods have a maximum safe loading of 375 kips per rod, or 1,500 kips per pile. The 1,300-kip threshold is set to allow sufficient time to evaluate building behavior, should excessive load develop in one or more piles.

<sup>5</sup> As plotted on Figure 03. The annual rate is calculated starting on the settlement monitoring date closest to one year prior to the current date or on June 19, 2023 (the settlement monitoring date corresponding to the last day of jacking load application), whichever is later, and ending on the current date.

<sup>6</sup> As plotted on Figure 05, relative to a plumb condition.



- Settlement Marker (not in tilt analysis)
- Settlement Marker (in tilt analysis)
- Piezometer Array
- Extensometer Array
- Load Cell
- Manhole

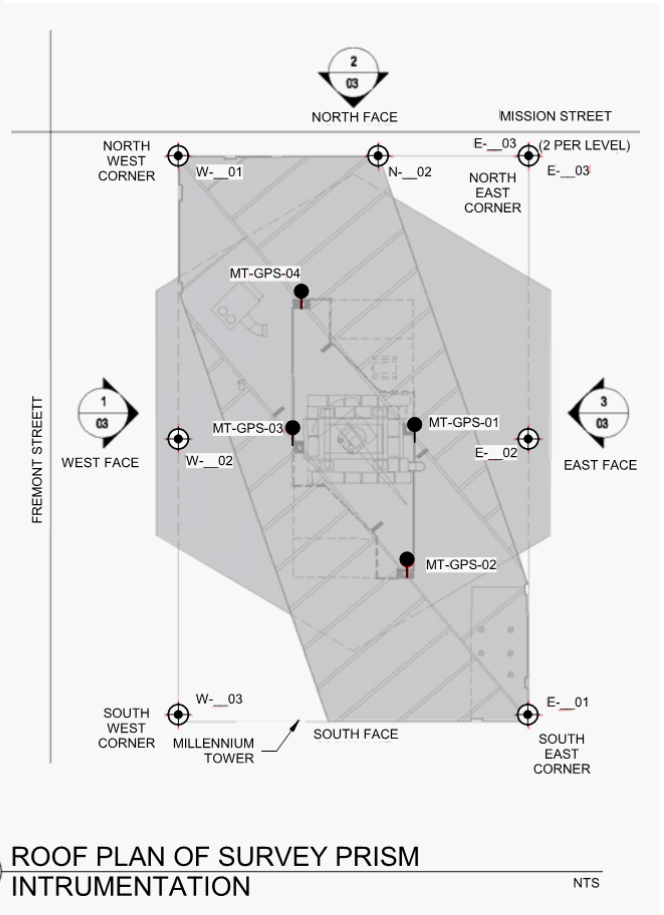
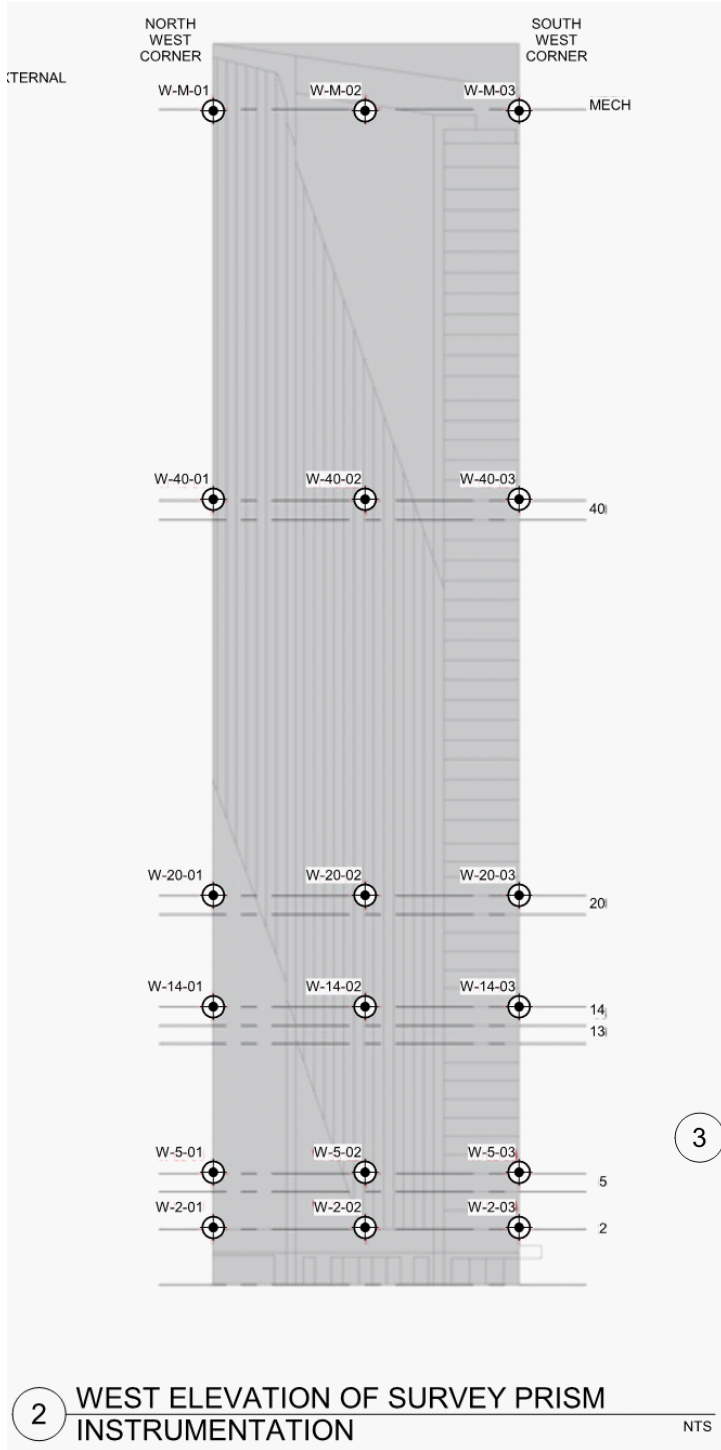
From 301 Mission Perimeter Pile Upgrade Sheet S 207 2022-06-06

Project No: 23-018-01	Date: 8/22/2023	Created By: NBW	Checked By: DGM	Figure No: 132-01A
-----------------------	-----------------	-----------------	-----------------	--------------------



**INSTRUMENT LOCATION MAP  
SETTLEMENT MARKERS, PIEZOMETERS, EXTENSOMETERS, LOAD CELLS**

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data  
City and County of San Francisco, California



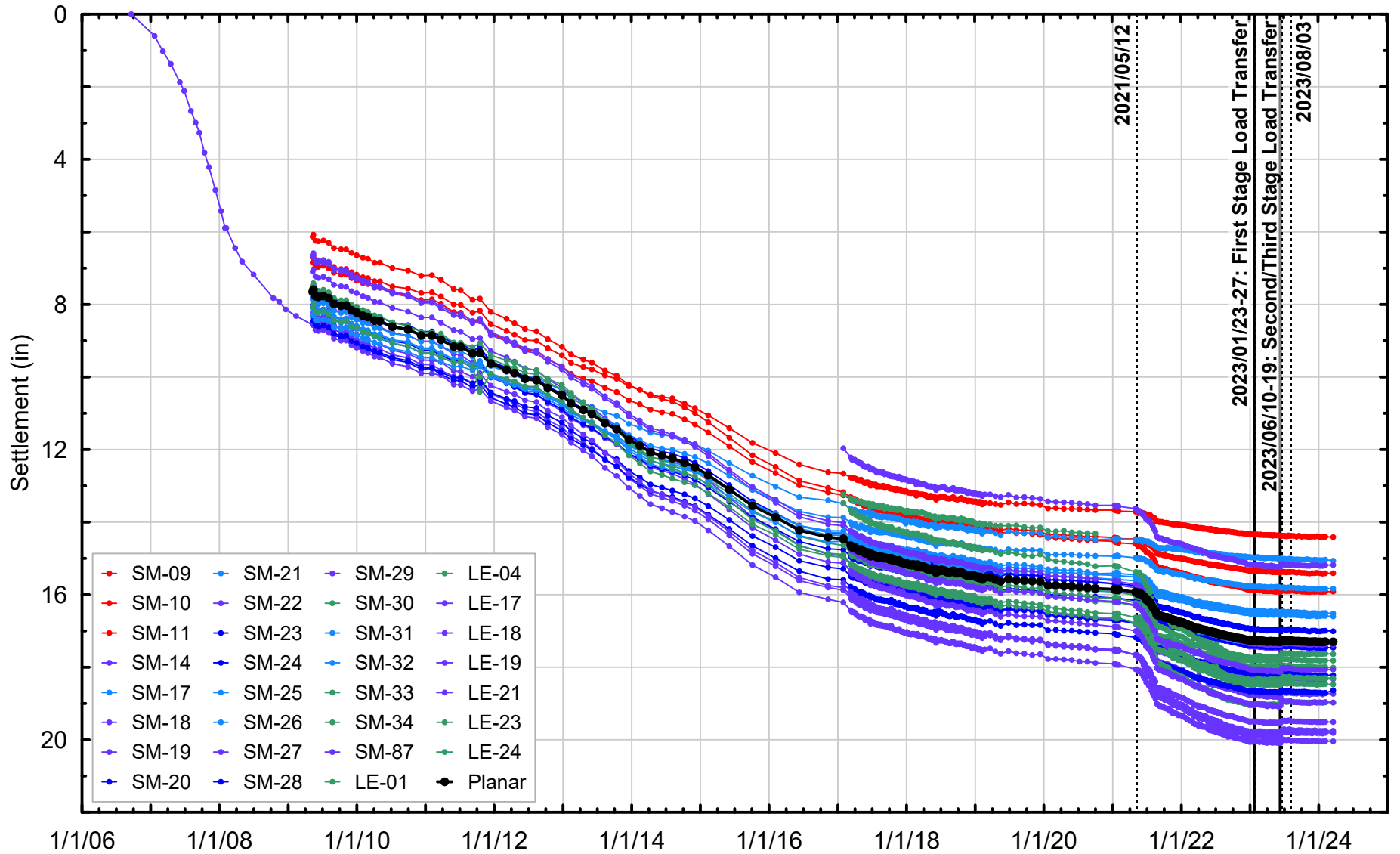
From 301 Mission Perimeter Pile Upgrade Bulletin 8 Set S 207 2021-06-15

Project No: 23-018-01	Date: 7/26/2021	Created By: NBW	Checked By: DGM	Figure No: <b>132-01B</b>
-----------------------	-----------------	-----------------	-----------------	---------------------------



TOWER SURVEY PRISM LOCATION SCHEMATIC

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data  
City and County of San Francisco, California

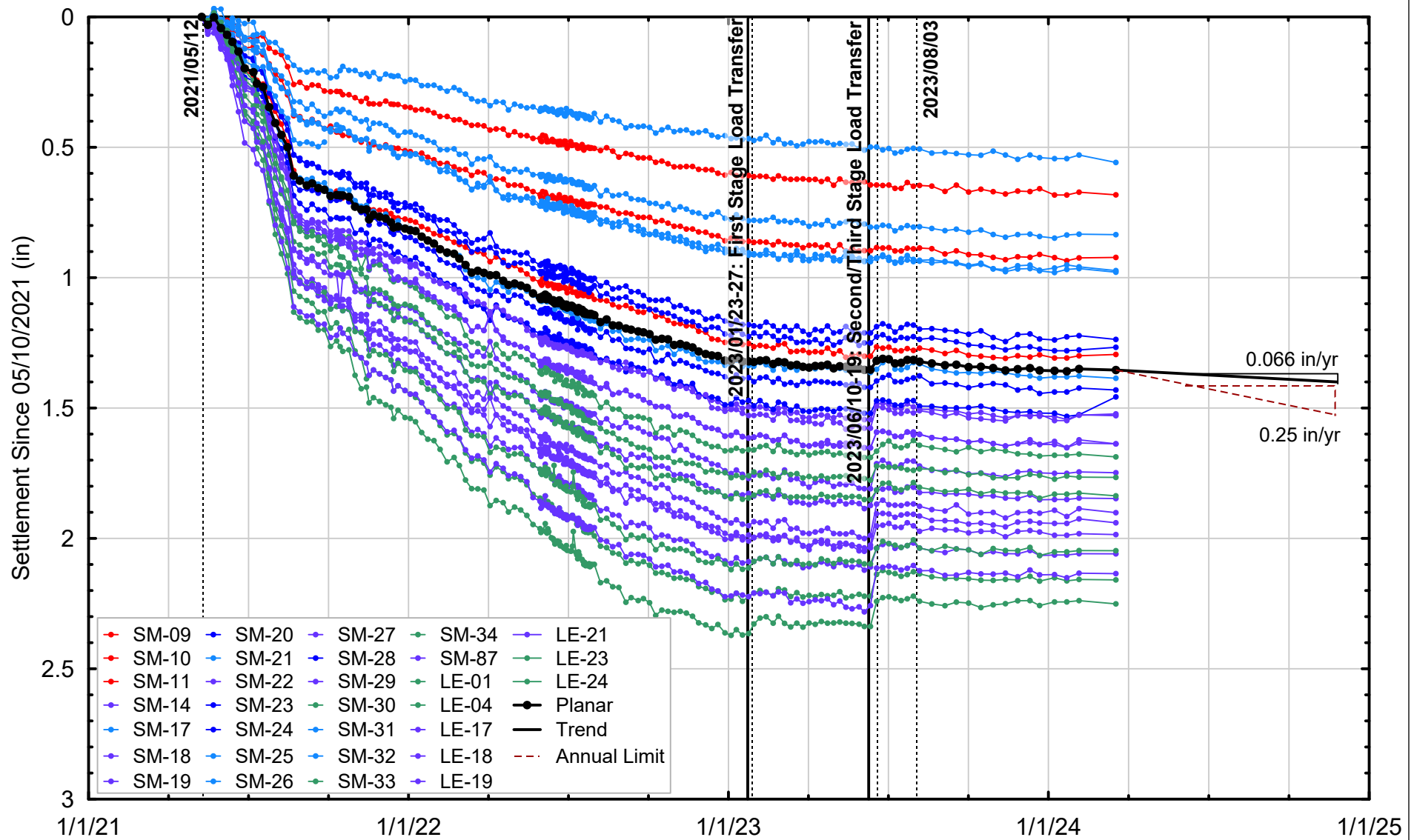



Project No: 23-018-01	Date: 3/22/2024	Created By: TB	Checked By: DGM	Figure No: 132-02
-----------------------	-----------------	----------------	-----------------	-------------------



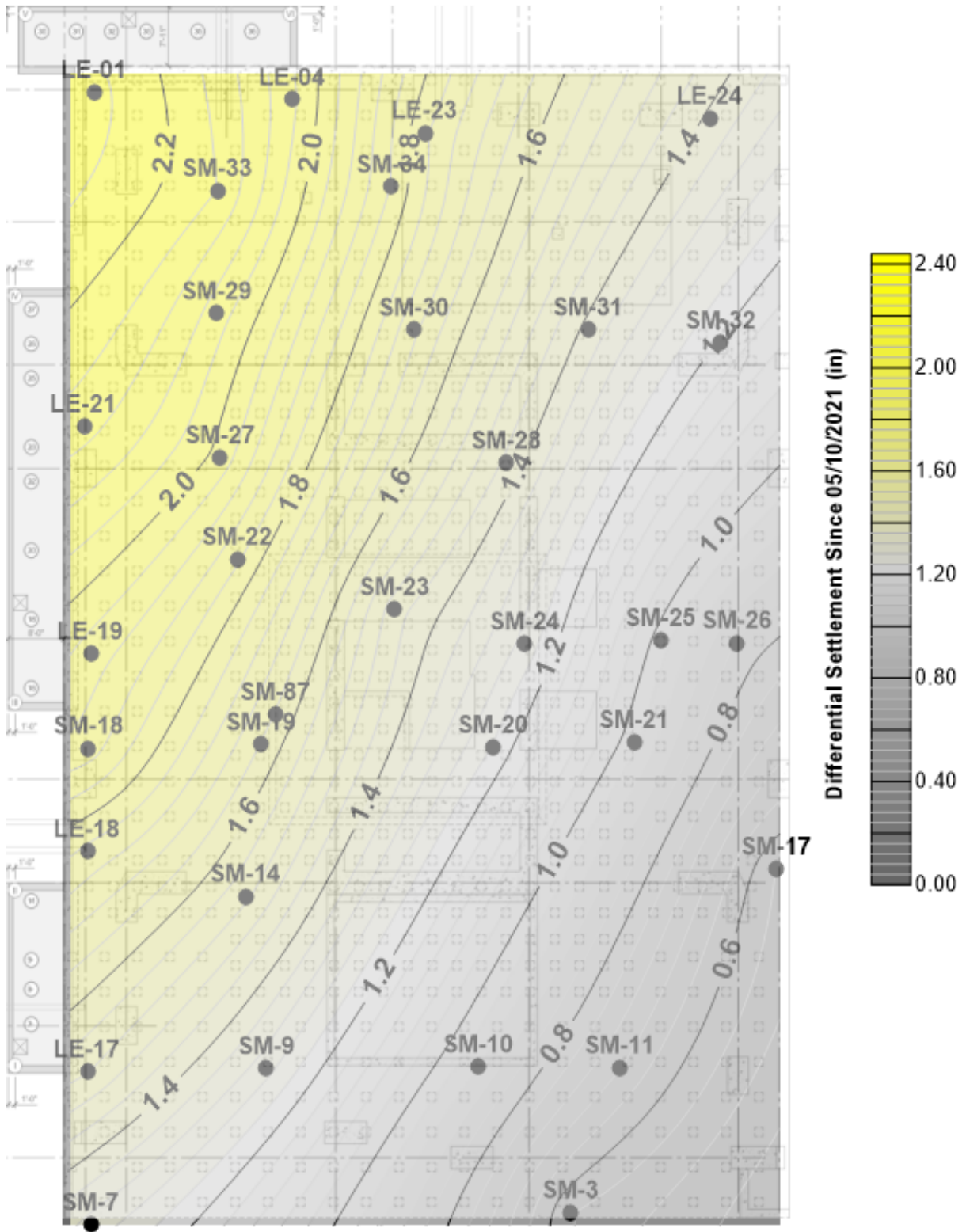
HISTORICAL SETTLEMENT MARKER DATA

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data  
City and County of San Francisco, California



Project No: 23-018-01	Date: 3/22/2024	Created By: TB	Checked By: DGM	Figure No: 132-03
		SETTLEMENT MARKER DATA SINCE 05/10/2021 THROUGH 03/18/2024 Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data City and County of San Francisco, California		





Project No: 23-018-01

Date: 3/22/2024

Created By: TB

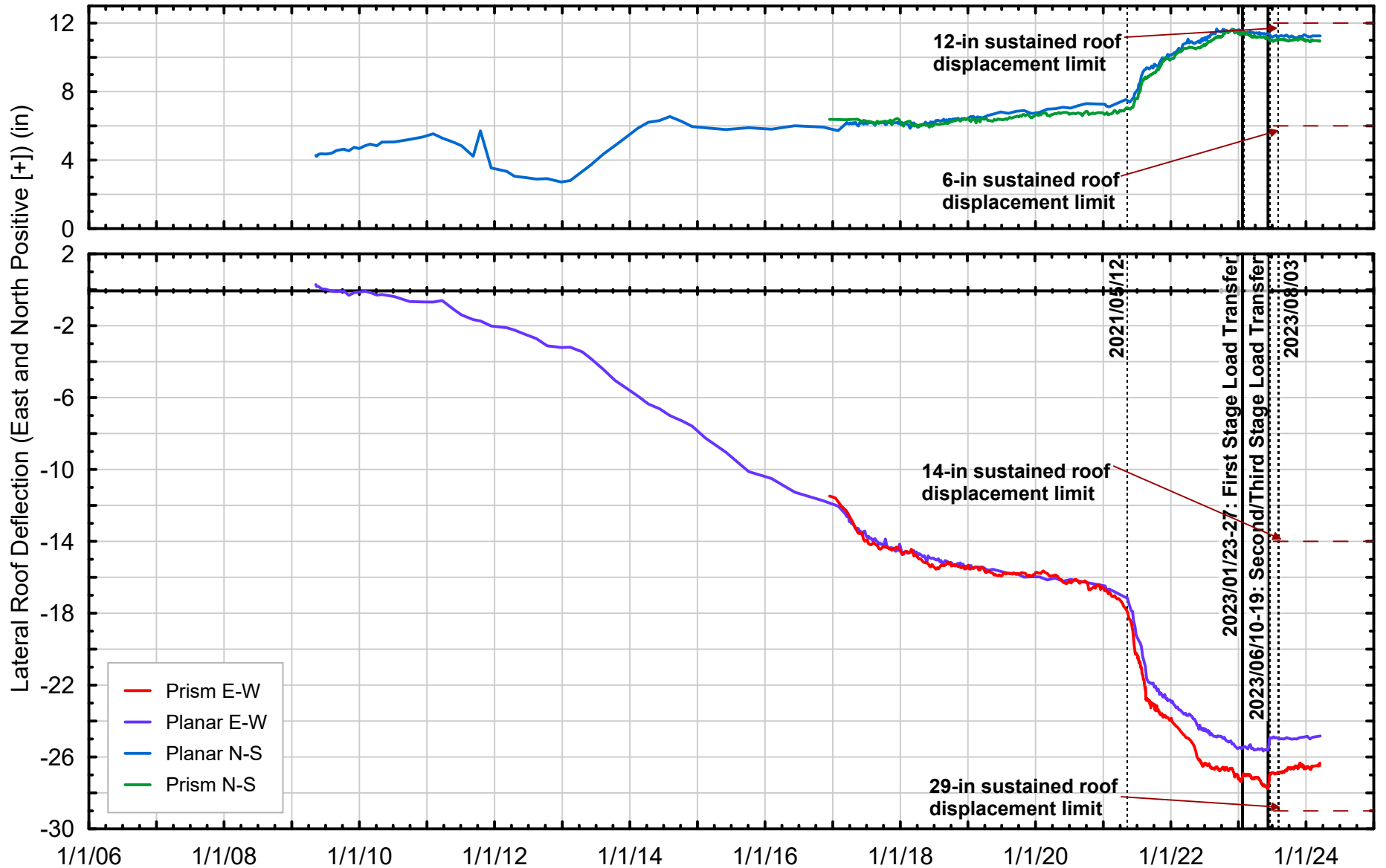
Checked By: DGM

Figure No: **132-04**



SETTLEMENT CONTOURS  
SINCE 05/10/2021 THROUGH 03/18/2024

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data  
City and County of San Francisco, California



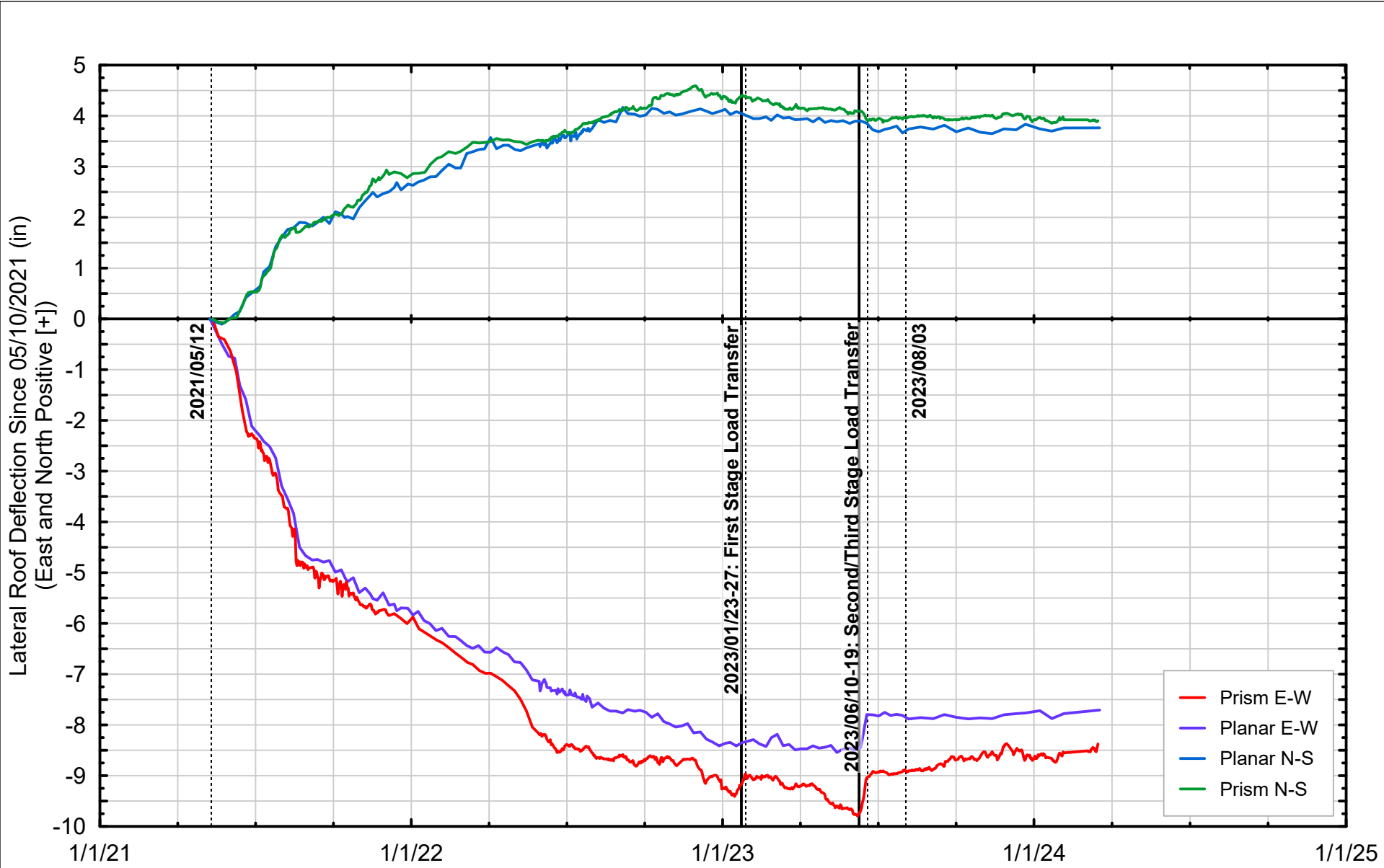
Project No: 23-018-01	Date: 3/22/2024	Created By: TB	Checked By: DGM	Figure No: 132-05
-----------------------	-----------------	----------------	-----------------	-------------------



HISTORICAL LATERAL ROOF DEFLECTION DATA

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data  
City and County of San Francisco, California



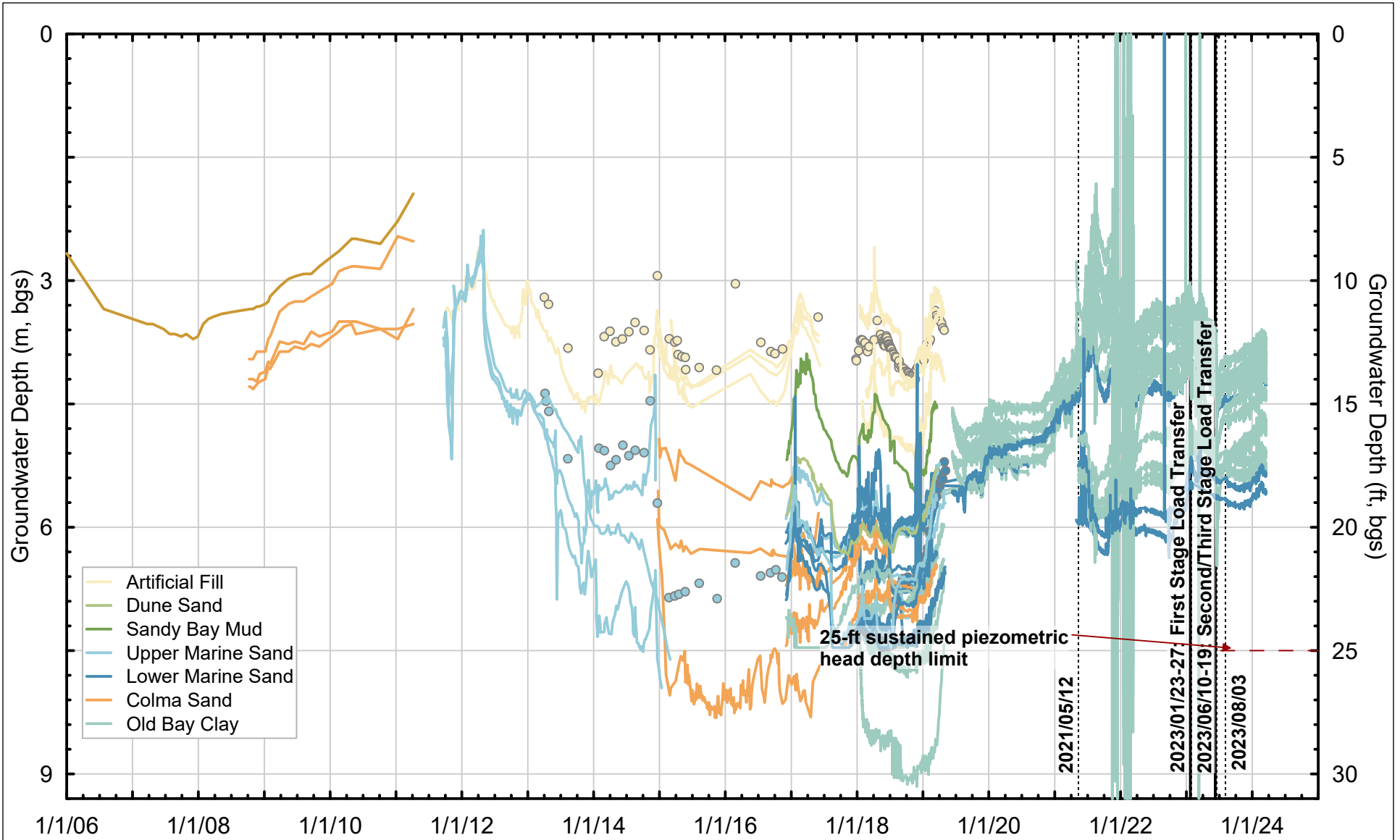


Project No: 23-018-01	Date: 3/22/2024	Created By: TB	Checked By: DGM	Figure No: 132-06
-----------------------	-----------------	----------------	-----------------	-------------------



LATERAL ROOF DEFLECTION DATA  
SINCE 05/10/2021 THROUGH 03/18/2024

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data  
City and County of San Francisco, California

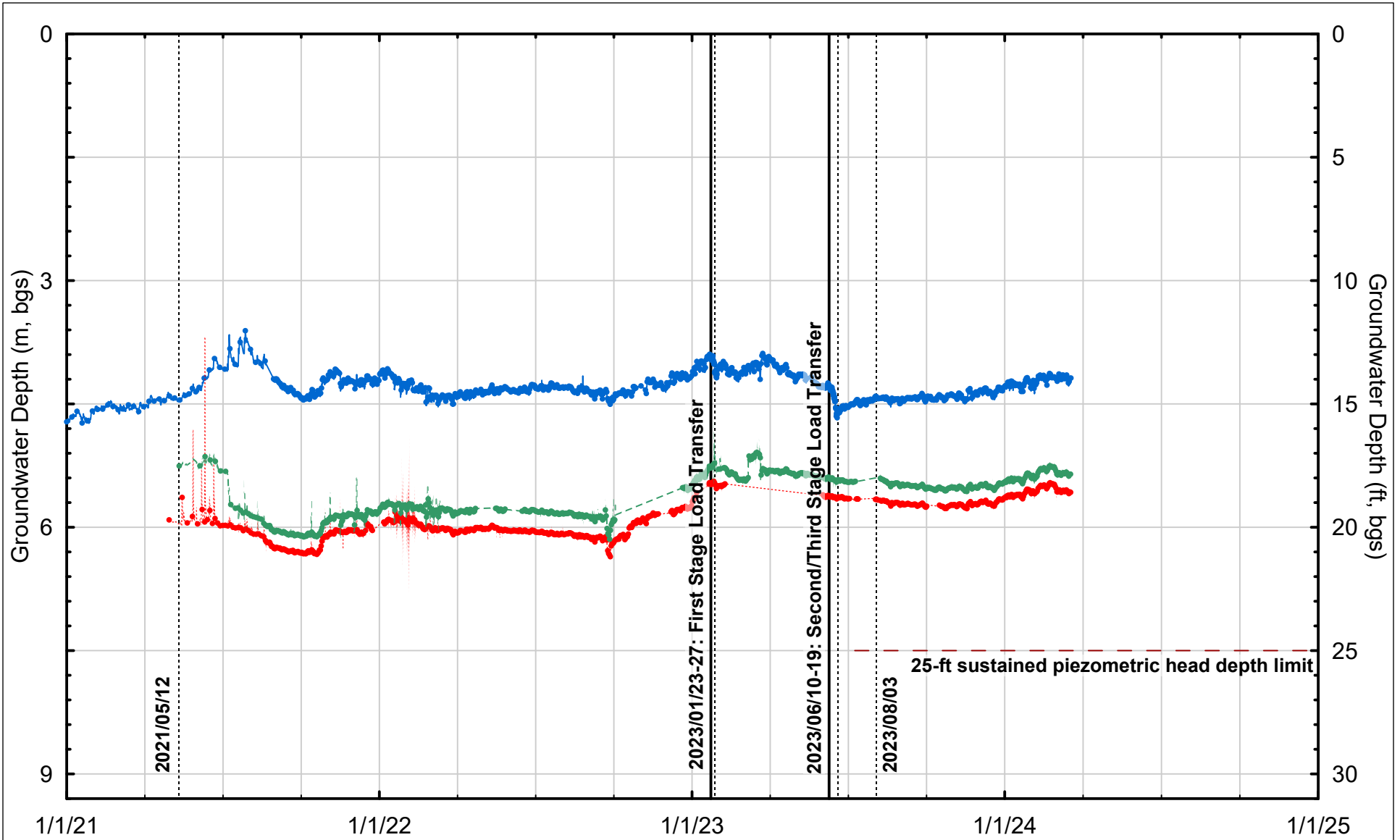


Project No: 23-018-01	Date: 3/22/2024	Created By: TB	Checked By: DGM	Figure No: 132-07
-----------------------	-----------------	----------------	-----------------	-------------------



HISTORICAL GROUNDWATER ELEVATION MEASUREMENTS  
AT LOCATIONS NEAR 301 MISSION

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data  
City and County of San Francisco, California



- SB-1 @ 85'
- PB-1 @ 85'
- PB-2 @ 85'

Project No: 23-018-01

Date: 3/22/2024

Created By: TB

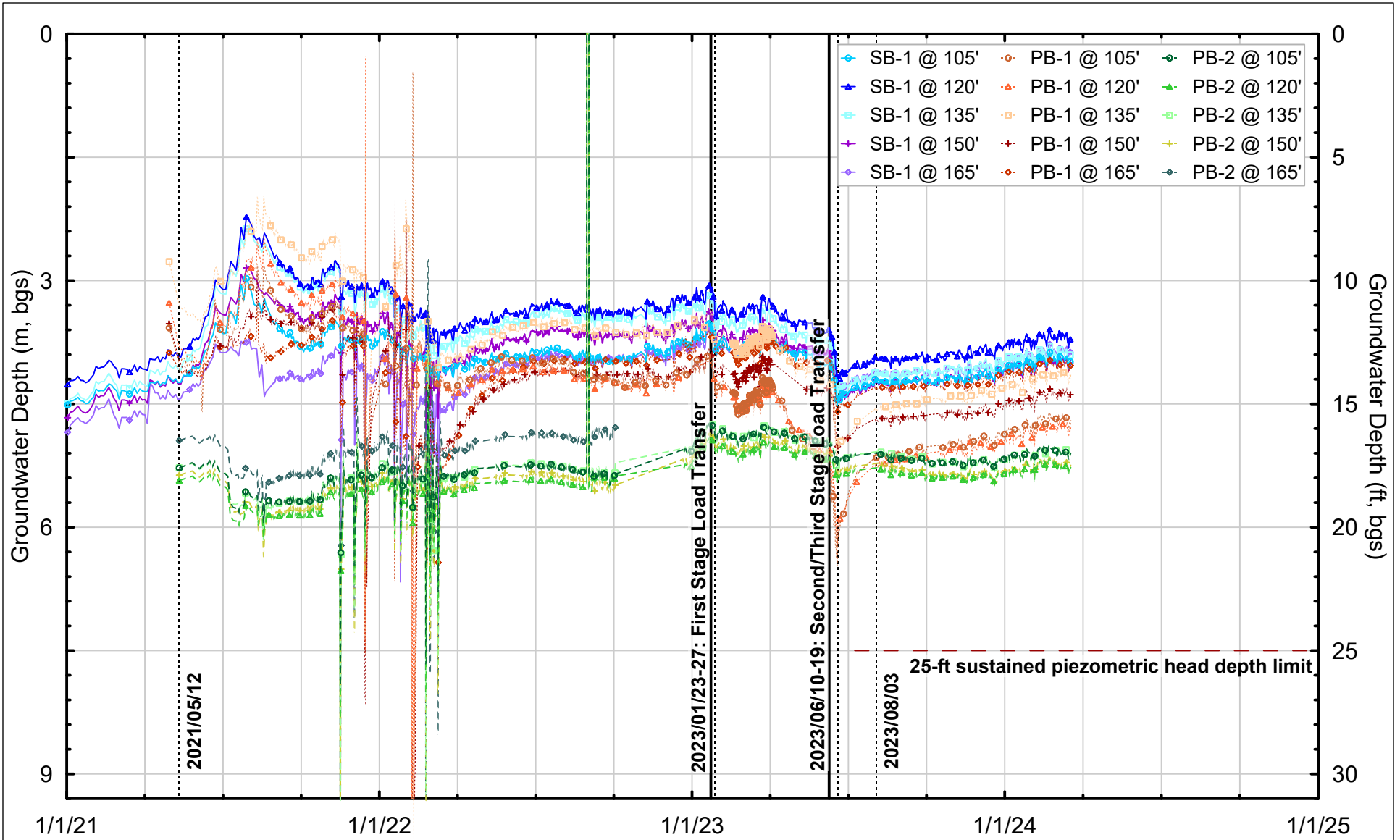
Checked By: DGM

Figure No: 132-08



GROUNDWATER ELEVATION MEASUREMENTS IN MARINE AND COLMA SAND  
SINCE 01/01/2021 THROUGH 03/18/2024

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data  
City and County of San Francisco, California

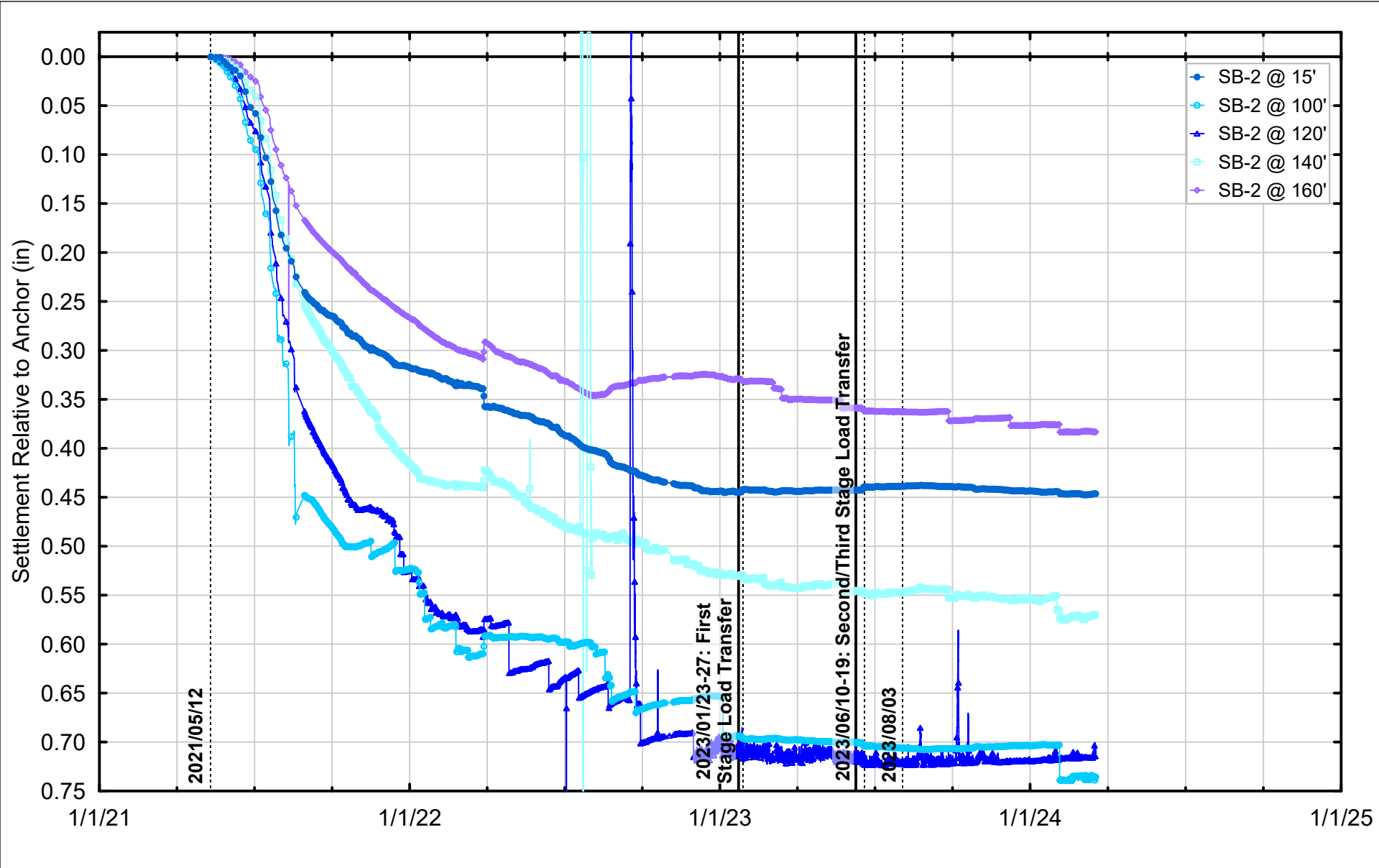


Project No: 23-018-01	Date: 3/22/2024	Created By: TB	Checked By: DGM	Figure No: 132-09
-----------------------	-----------------	----------------	-----------------	-------------------



GROUNDWATER ELEVATION MEASUREMENTS IN OLD BAY CLAY  
SINCE 01/01/2021 THROUGH 03/18/2024

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data  
City and County of San Francisco, California

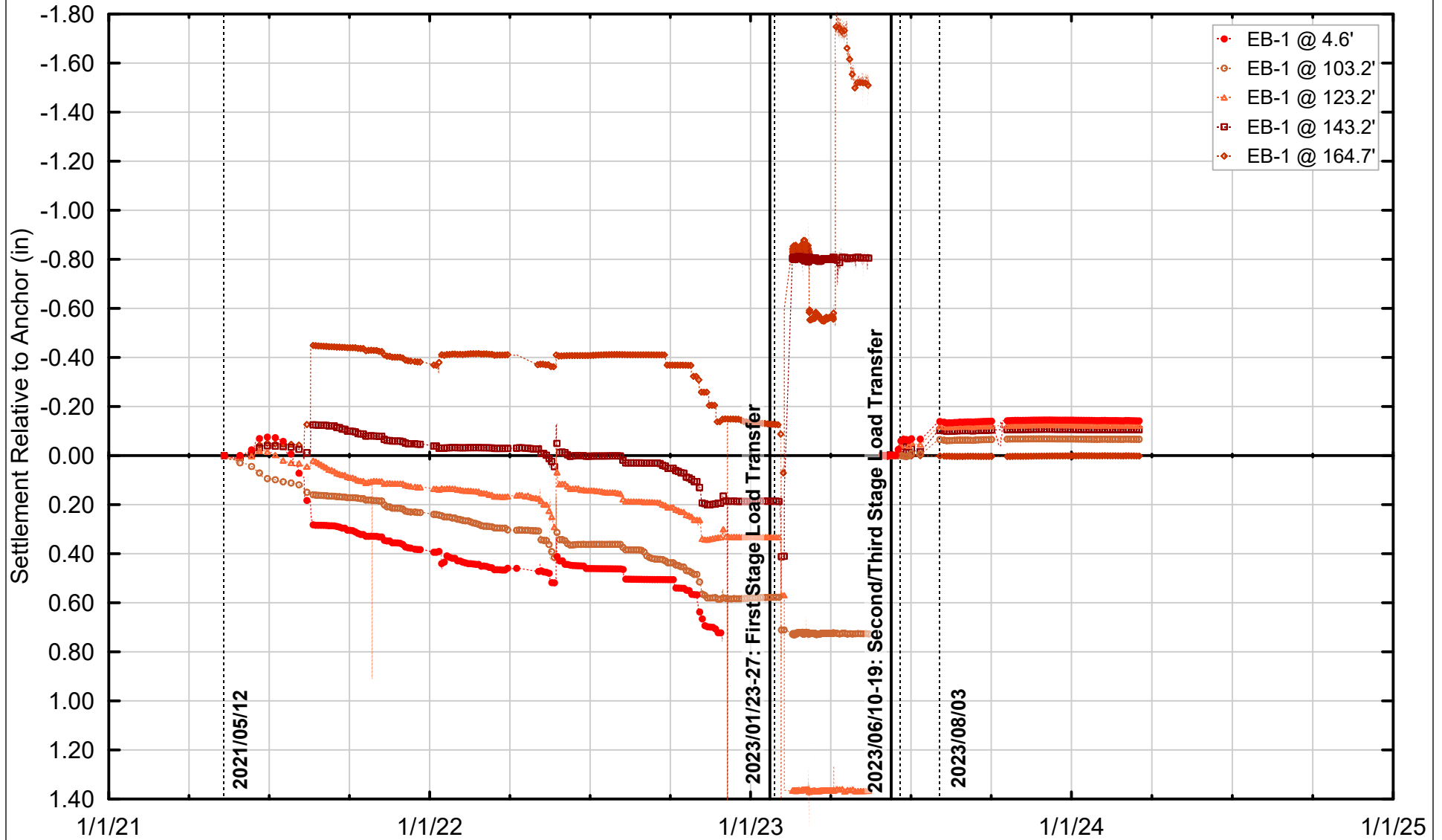


Project No: 23-018-01	Date: 3/22/2024	Created By: TB	Checked By: DGM	Figure No: 132-10
-----------------------	-----------------	----------------	-----------------	-------------------



EXTENSOMETER DATA FROM WITHIN TOWER BASEMENT  
SINCE 01/01/2021 THROUGH 03/18/2024

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data  
City and County of San Francisco, California



Note: EB-1 was repaired and reset on 2023/05/30

Project No: 23-018-01

Date: 3/22/2024

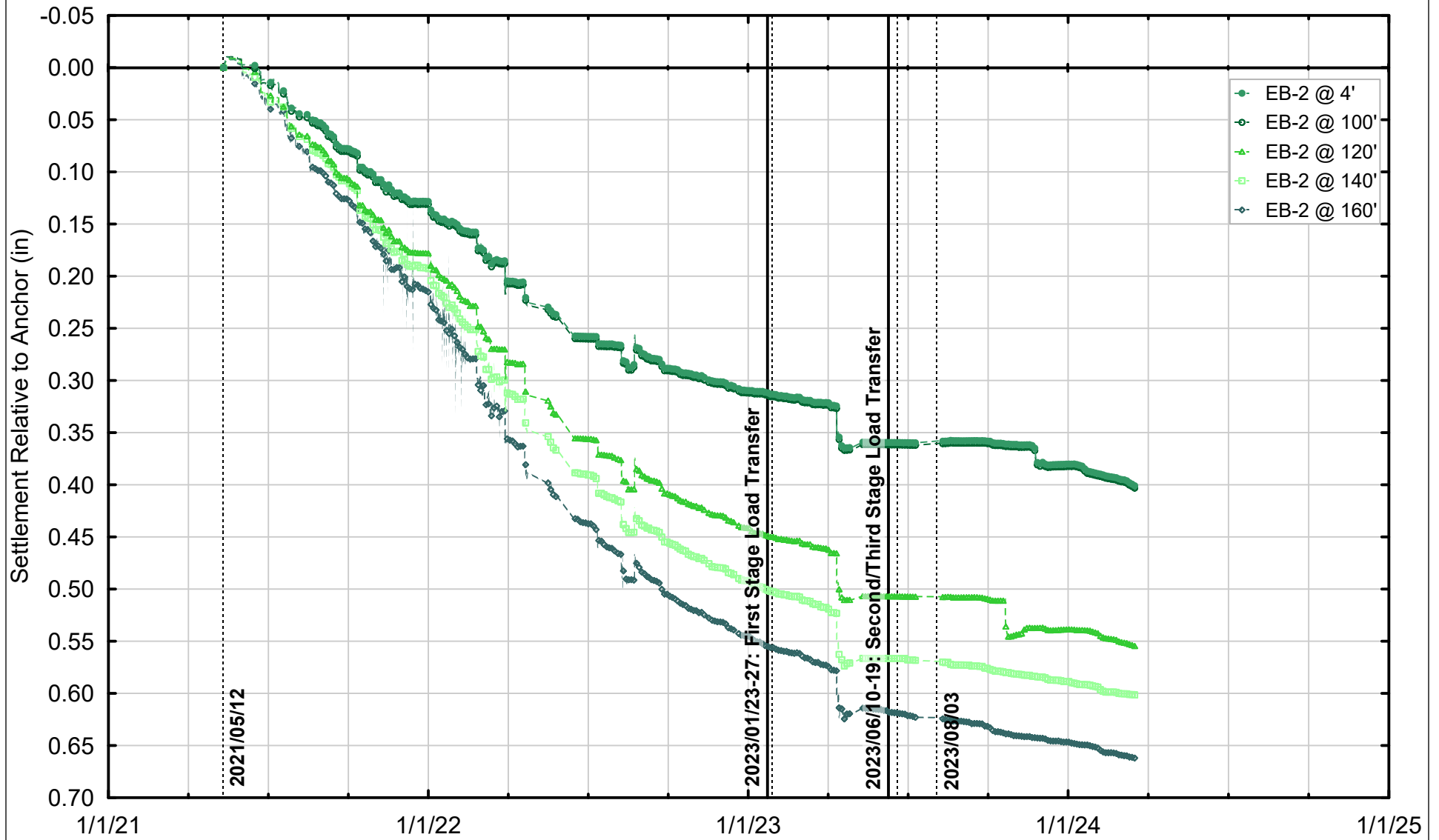
Created By: TB

Checked By: DGM

Figure No: 132-11



EXTENSOMETER DATA FROM FREMONT STREET  
 SINCE 05/10/2021 THROUGH 05/16/2023  
 SINCE 05/30/2023 THROUGH 03/18/2024  
 Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data  
 City and County of San Francisco, California

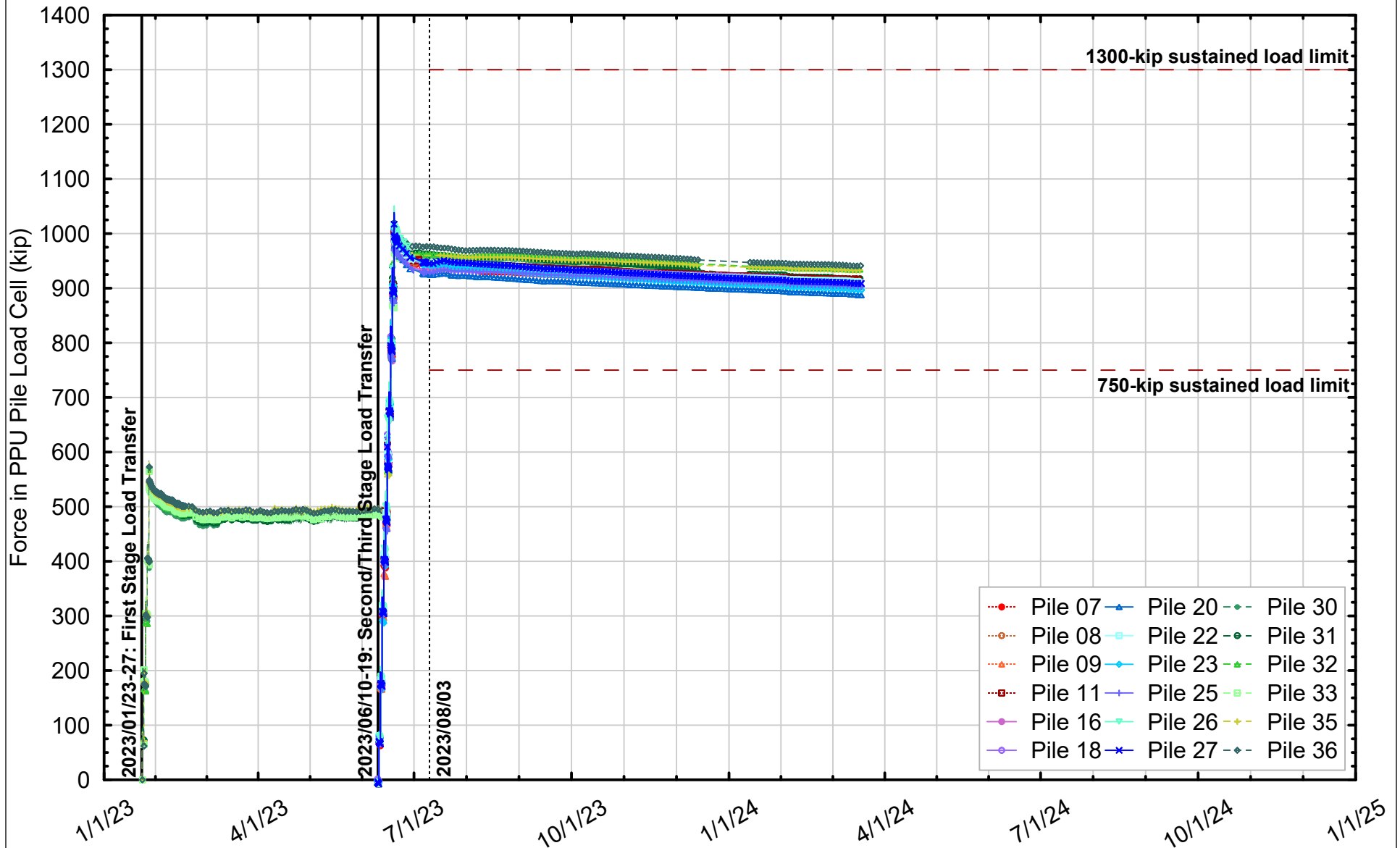


Project No: 23-018-01	Date: 3/22/2024	Created By: TB	Checked By: DGM	Figure No: 132-12
-----------------------	-----------------	----------------	-----------------	-------------------



EXTENSOMETER DATA FROM MISSION STREET  
SINCE 01/01/2021 THROUGH 03/18/2024

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data  
City and County of San Francisco, California



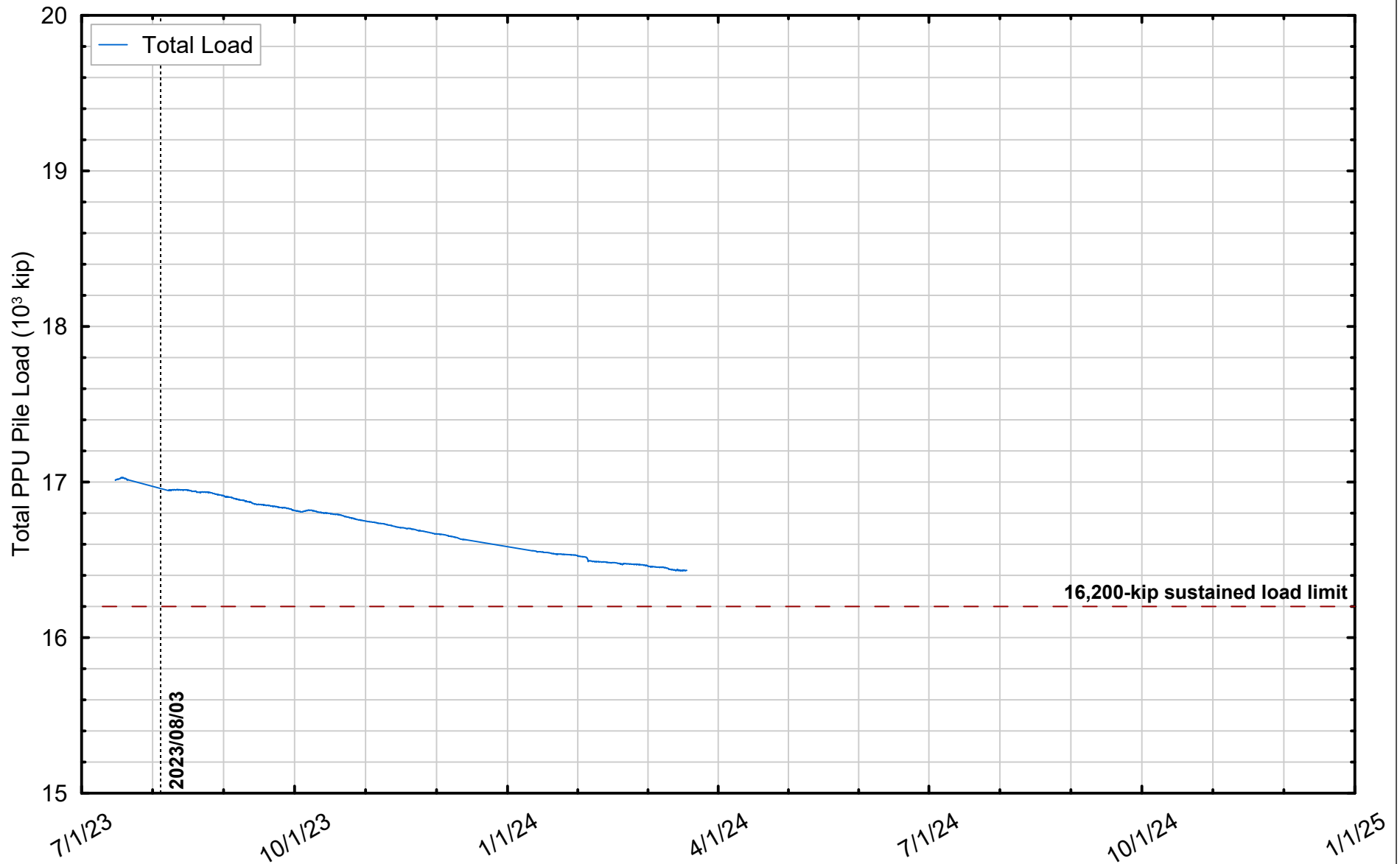
Project No: 23-018-01	Date: 3/22/2024	Created By: TB	Checked By: DGM	Figure No: 132-13A
-----------------------	-----------------	----------------	-----------------	--------------------



PILE LOAD CELL DATA  
SINCE 01/23/2023 THROUGH 03/18/2024

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data  
City and County of San Francisco, California



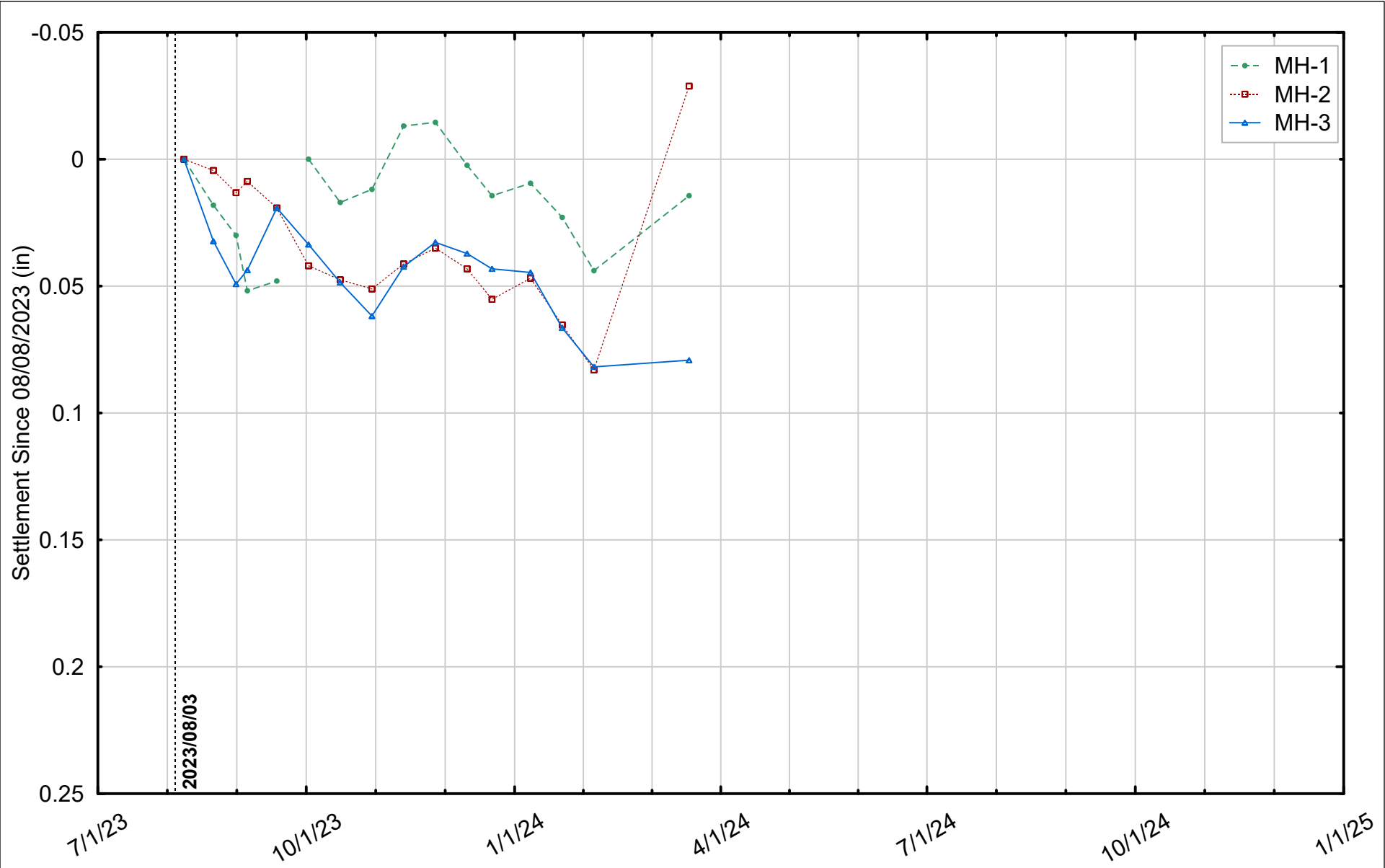


Project No: 23-018-01	Date: 3/22/2024	Created By: TB	Checked By: DGM	Figure No: 132-13B
-----------------------	-----------------	----------------	-----------------	--------------------



TOTAL PILE LOAD CELL DATA  
SINCE 07/15/2023 THROUGH 03/18/2024

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data  
City and County of San Francisco, California



Project No: 23-018-01	Date: 3/22/2024	Created By: TB	Checked By: DGM	Figure No: 132-14
-----------------------	-----------------	----------------	-----------------	-------------------

Note: MH-1 was reset on 10/02/2023



MANHOLE SETTLEMENT DATA  
SINCE 08/08/2023 THROUGH 03/18/2024

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data  
City and County of San Francisco, California