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Date: April 5, 2023

Project Number: 19-009

Subject: 301 Mission Retrofit Monitoring Report 100: Results as of April 4, 2023

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## **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. Survey markers were installed on the Mission Street mat extension in January 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**

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 03A presents settlement data since the start of production pile installation (May 12, 2021; baseline readings on May 10, 2021) through April 3, 2023. Figure 03B presents settlement data since January 11, 2021, through April 3, 2023. Figure 04 presents current settlement contours (in inches) on April 3, 2023.

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 April 4, 2023. Figure 06B 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 January 11, 2021, through April 4, 2023.

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 April 4, 2023.



Figure 10 presents extensometer data from within the Tower basement since the start of production pile installation (May 12, 2021) through April 3, 2023. Figure 11 presents extensometer data from Fremont Street since the start of production pile installation (May 12, 2021) through March 28, 2023. Figure 12 presents extensometer data from Mission Street since the start of production pile installation (May 12, 2021) through March 27, 2023.

Figure 13 presents pile load cell data since the start of the First Stage Load Transfer (January 23, 2023) through March 28, 2023.

## **CLOSING**

Note that one of the Mission Street piezometers, PB-2, has been offline since October 3, 2022. One of the Fremont Street piezometers, PB-1, has been offline since February 8, 2023. The Fremont Street extensometers, EB-1, were damaged on February 8, 2023, but are still operational. Repairs are planned to occur after jet grouting operations are completed. An error in the building prism data processing was noticed by the survey team going back to March 11, 2023. That error has been corrected and the updated data is presented herein. Please contact us if you have any comments or questions, or if you would like to discuss the results presented in this memorandum.

## **FIGURES**

- Figure 01A – Instrument Location Map: Settlement Markers, Piezometers, Extensometers
- Figure 01B – Tower Survey Prism Location Schematic
- Figure 02 – Historical Settlement Marker Data
- Figure 03A – Settlement Marker Data since 05/10/2021 through 04/03/2023
- Figure 03B – Settlement Marker Data since 01/11/2021 through 04/03/2023
- Figure 04 – Settlement Contours since 05/10/2021 through 04/03/2023
- Figure 05 – Historical Lateral Roof Deflection Data
- Figure 06A – Lateral Roof Deflection Data since 05/10/2021 through 04/04/2023
- Figure 06B – Lateral Roof Deflection Data since 01/11/2021 through 04/04/2023
- Figure 07 – Historical Groundwater Elevation Measurements at Locations Near 301 Mission
- Figure 08A – Groundwater Elevation Measurements in Marine and Colma Sand since 01/01/2021 through 04/04/2023
- Figure 08B – Groundwater Elevation Measurements in Marine and Colma Sand since 05/10/2021 through 04/04/2023
- Figure 09A – Groundwater Elevation Measurements in Old Bay Clay since 01/01/2021 through 04/04/2023
- Figure 09B – Groundwater Elevation Measurements in Old Bay Clay since 01/01/2021 through 04/04/2023
- Figure 10A – Extensometer Data from within Tower Basement since 01/01/2021 through 04/03/2023
- Figure 10B – Extensometer Data from within Tower Basement since 05/10/2021 through 04/03/2023
- Figure 11A – Extensometer Data from Fremont Street since 01/01/2021 through 04/04/2023
- Figure 11B – Extensometer Data from Fremont Street since 05/10/2021 through 04/04/2023
- Figure 12A – Extensometer Data from Mission Street since 01/01/2021 through 04/04/2023
- Figure 12B – Extensometer Data from Mission Street since 05/10/2021 through 04/04/2023
- Figure 13 – Pile Load Cell Data since 01/23/2023 through 04/04/2023

## **ATTACHMENTS**

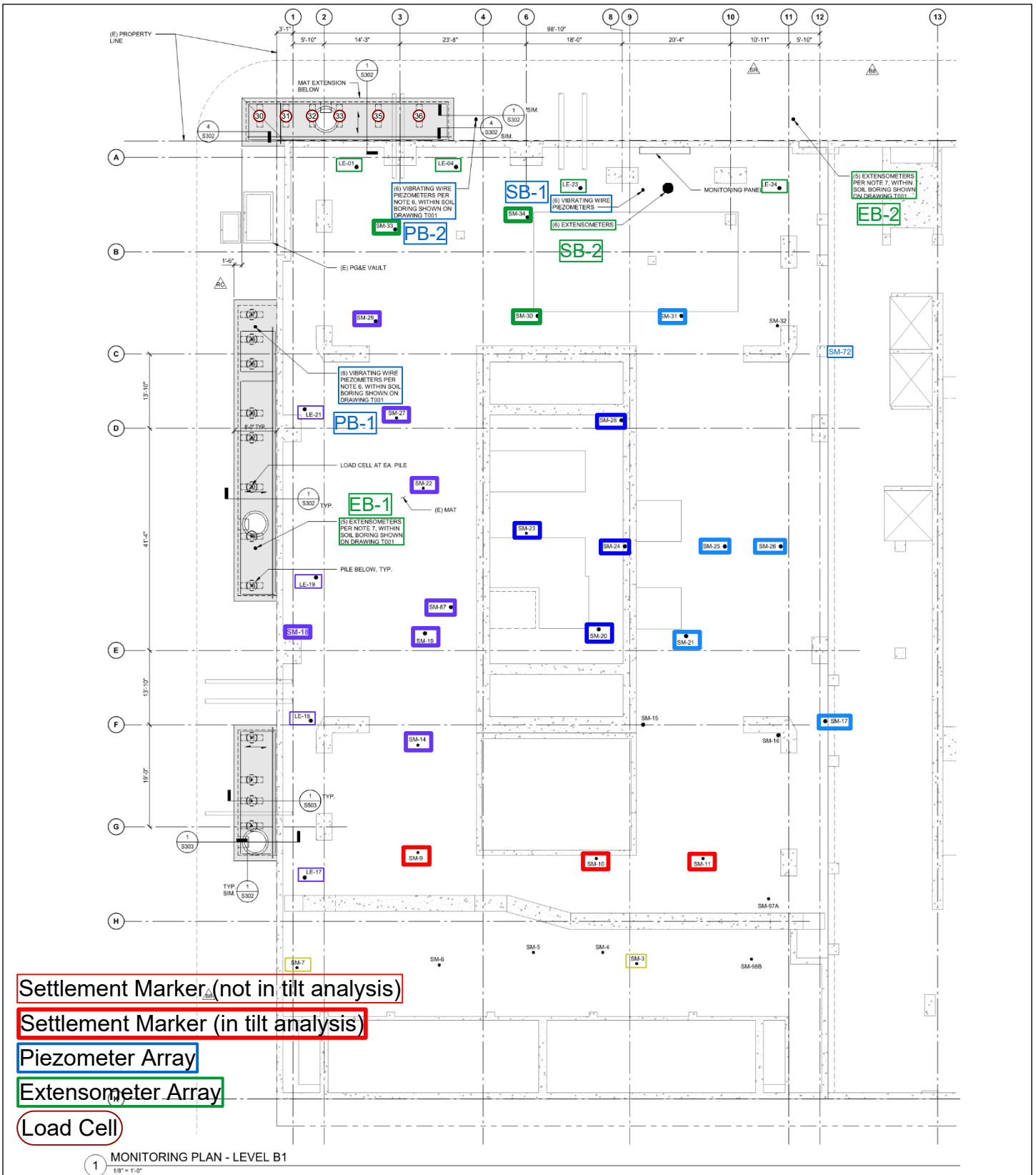
- Attachment 01 – Crack Gauge Report since 01/06/2021 through 04/03/2023



## **DATES**

2021/05/12: Fremont St. 36" Casing Installation Start  
2021/06/22: Fremont St. 36" Casing Installation End  
2021/07/07: Mission St. 36" Casing Installation Start  
2021/07/09: Fremont St. 24" Casing / Rock Socket Installation Start  
2021/08/02: Mission St. 36" Casing Installation on Hold  
2021/08/22: Fremont St. 24" Casing / Rock Socket Installation on Hold  
2021/10/12-13: 36" Pile Installation / Vibration Test  
2021/10/28: Mission St. 36" Casing Installation Restart  
2021/11/15-19: 24" Pile Installation / Vibration Test  
2021/12/01-05: 24" Pile Installation  
2021/12/13-17: 24" Pile Installation  
2022/01/10: 24" Pile Installation Restart  
2022/02/23: 24" Pile Installation Restart  
2022/03/12: 24" Pile Installation Completion  
2022/04/26-28: Fremont St. Secant Pile Test Installation  
2022/05/03: Fremont St. Shoring Pile Installation Start  
2022/05/26: Fremont St. Shoring Pile Installation on Hold  
2022/06/13: Mission St. Shoring Pile Installation Start  
2022/08/05: Mission St. Shoring Pile Installation End  
2022/09/08: Mission St. Jet Grouting Start  
2022/10/05: Mission St. Jet Grouting End  
2022/10/08: Fremont St. Shoring Pile Installation Resumed  
2022/10/17: Mission St. Excavation Start  
2022/11/12: Fremont St. Shoring Pile Installation End  
2022/11/16: Mission St. Excavation to Mat Extension Depth  
2022/12/07: Fremont St. Jet Grouting Start  
2023/01/23-27: Mission St. First Stage Load Transfer  
2023/02/03: Fremont St. Excavation Start  
2023/03/30: Fremont St. Jet Grouting End

Filepath: S:\StateDrive - Documents\Projects\_2019\19-009.00\_Millennium Tower Retrofit\10\_Construction\01\_Monitoring Reports\TowerSoilWater\100-Figures\Fig\_100-01A\_Instrument\_Map.grf



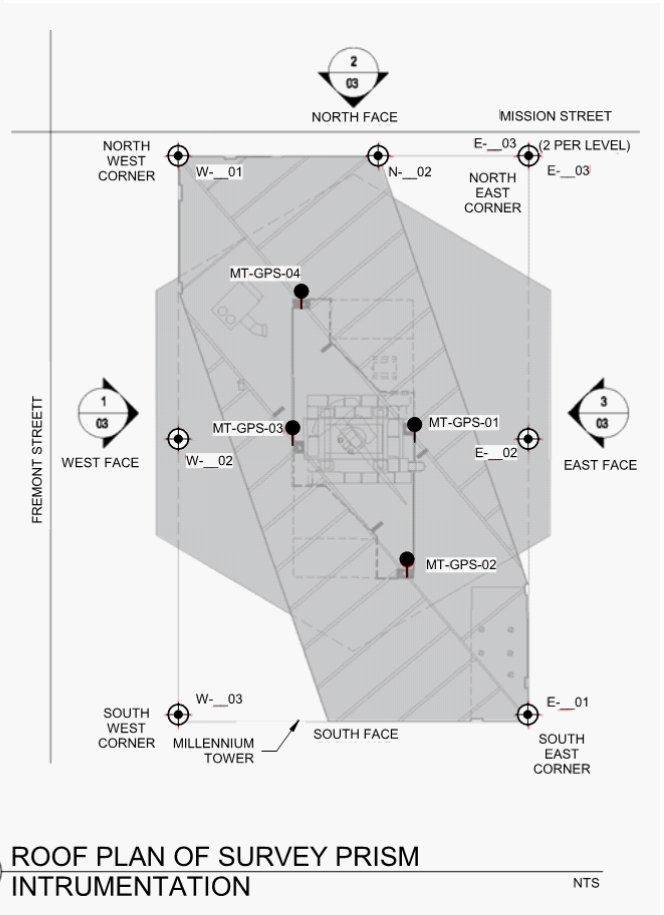
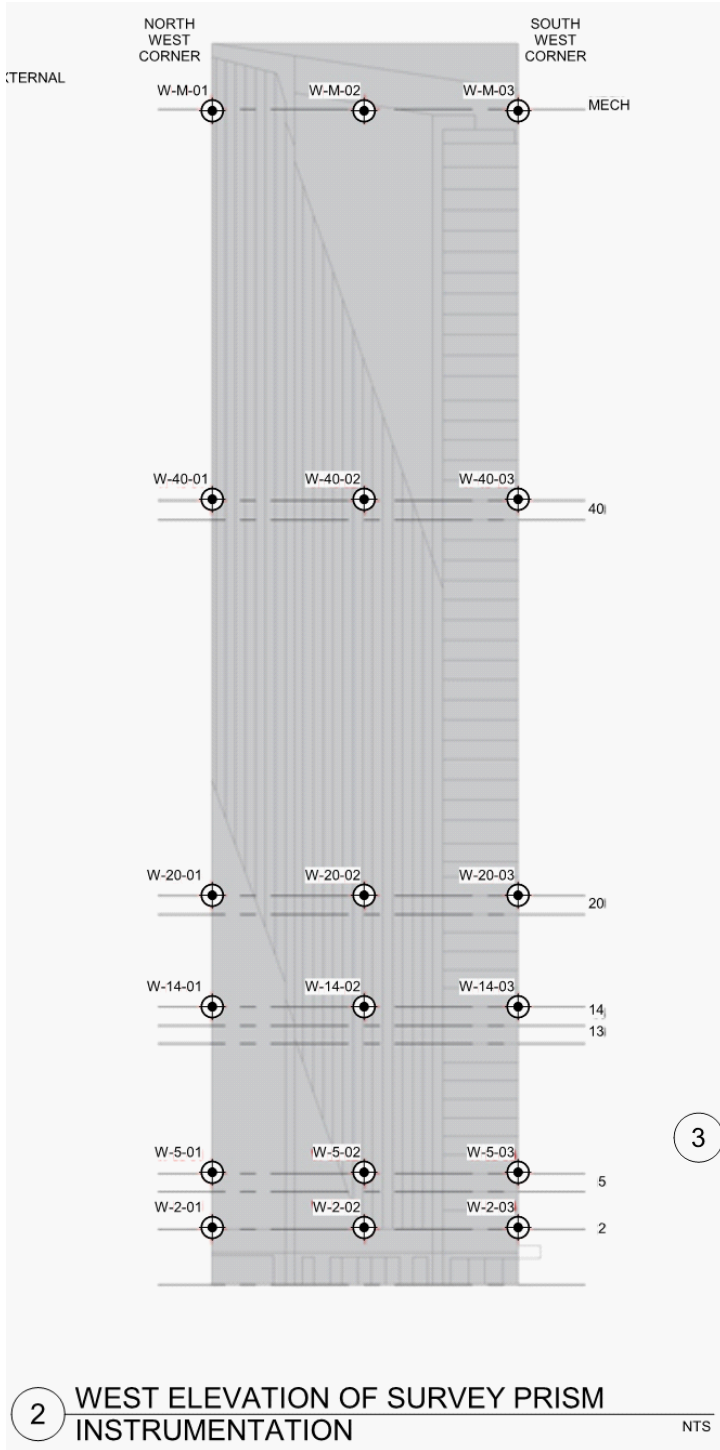
From 301 Mission Perimeter Pile Upgrade Sheet S 207 2022-06-06

Project No: 19-009.00	Date: 2/1/2023	Created By: NBW	Checked By: DGM	Figure No: 100-01A
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INSTRUMENT LOCATION MAP  
SETTLEMENT MARKERS, PIEZOMETERS, EXTENSOMETERS, LOAD CELLS

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



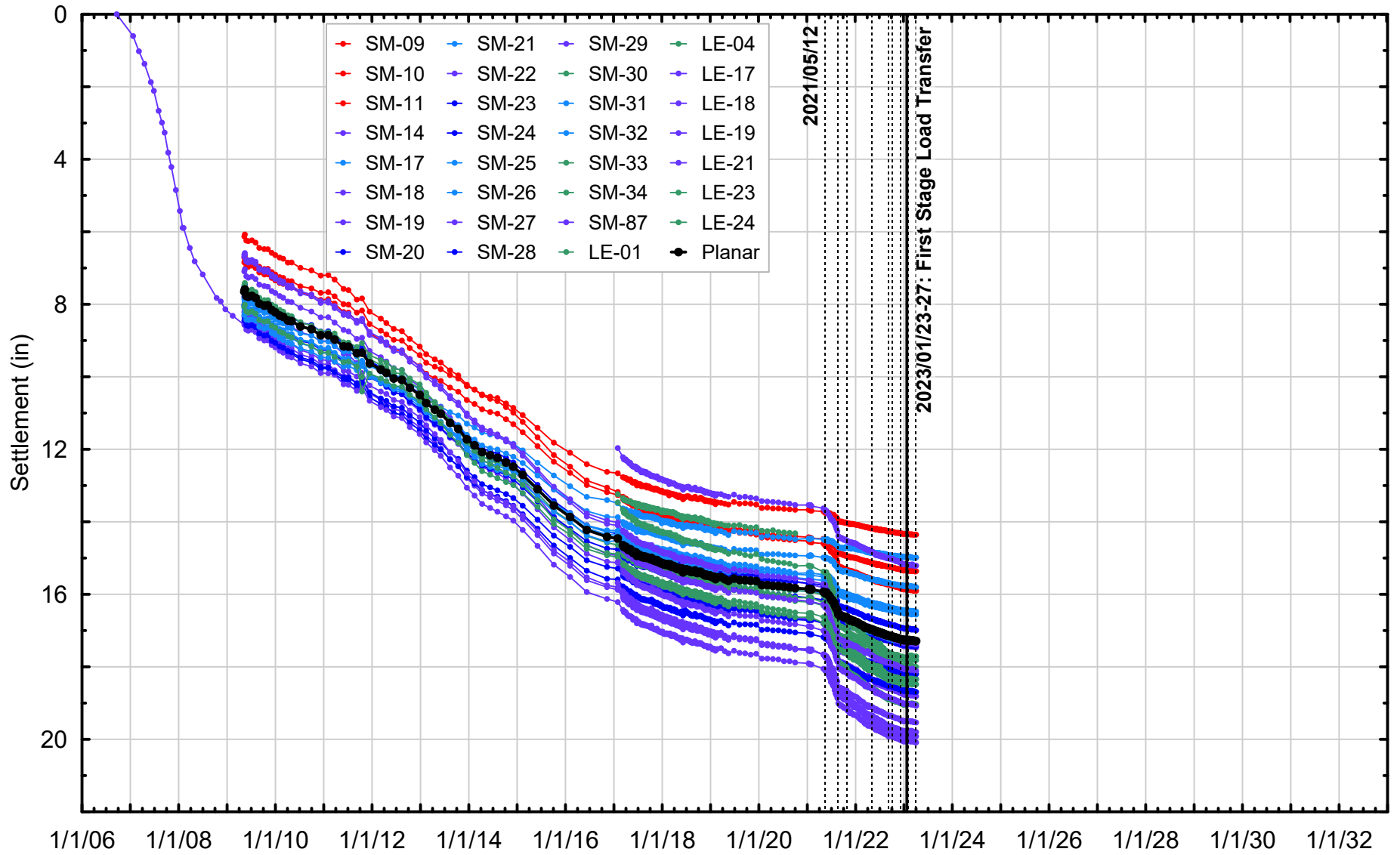
From 301 Mission Perimeter Pile Upgrade Bulletin 8 Set S 207 2021-06-15

Project No: 19-009.00	Date: 7/26/2021	Created By: NBW	Checked By: DGM	Figure No: <b>100-01B</b>
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TOWER SURVEY PRISM LOCATION SCHEMATIC

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

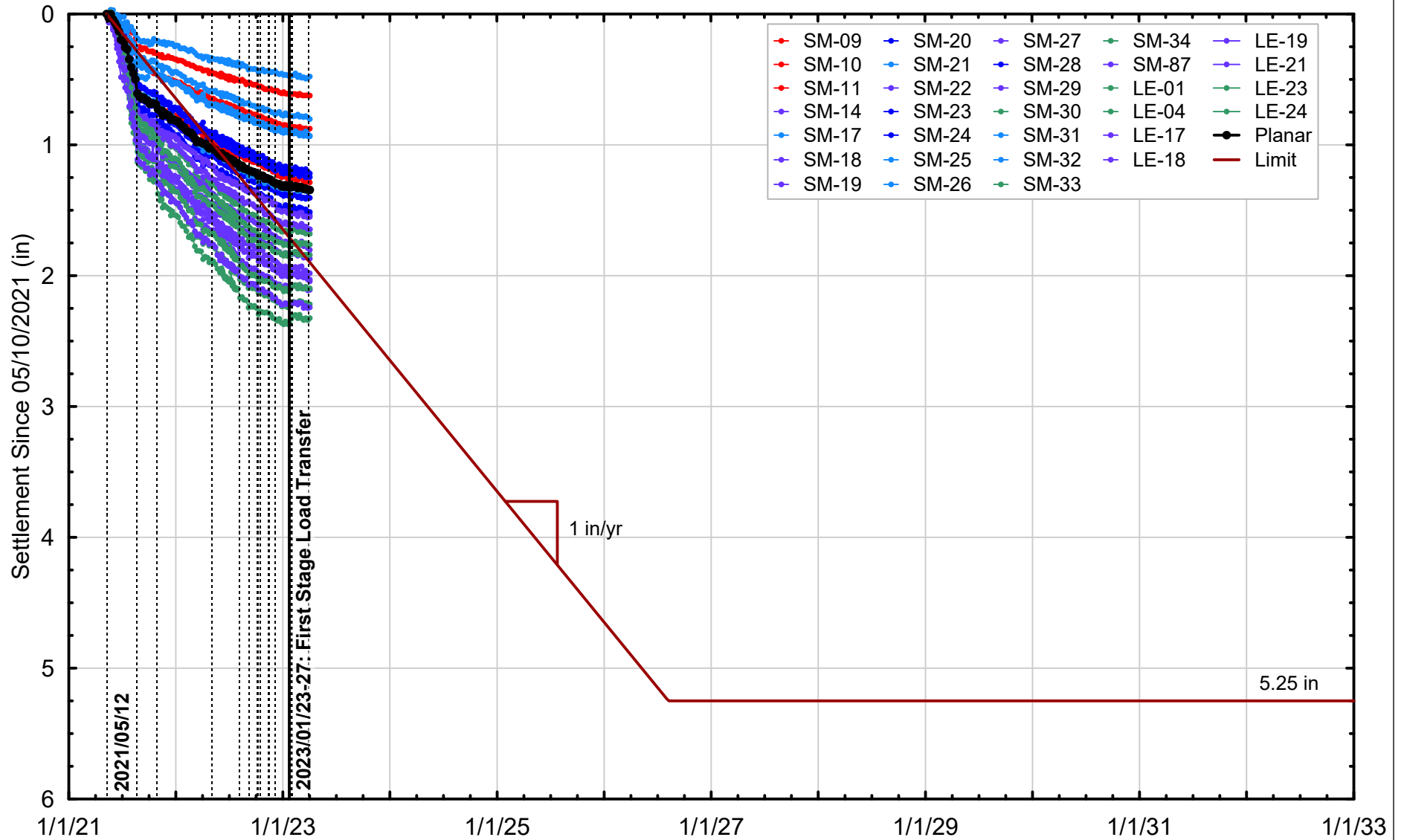


Project No: 19-009.00	Date: 4/5/2023	Created By: NBW	Checked By: DGM	Figure No: <b>100-02</b>
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HISTORICAL SETTLEMENT MARKER DATA

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

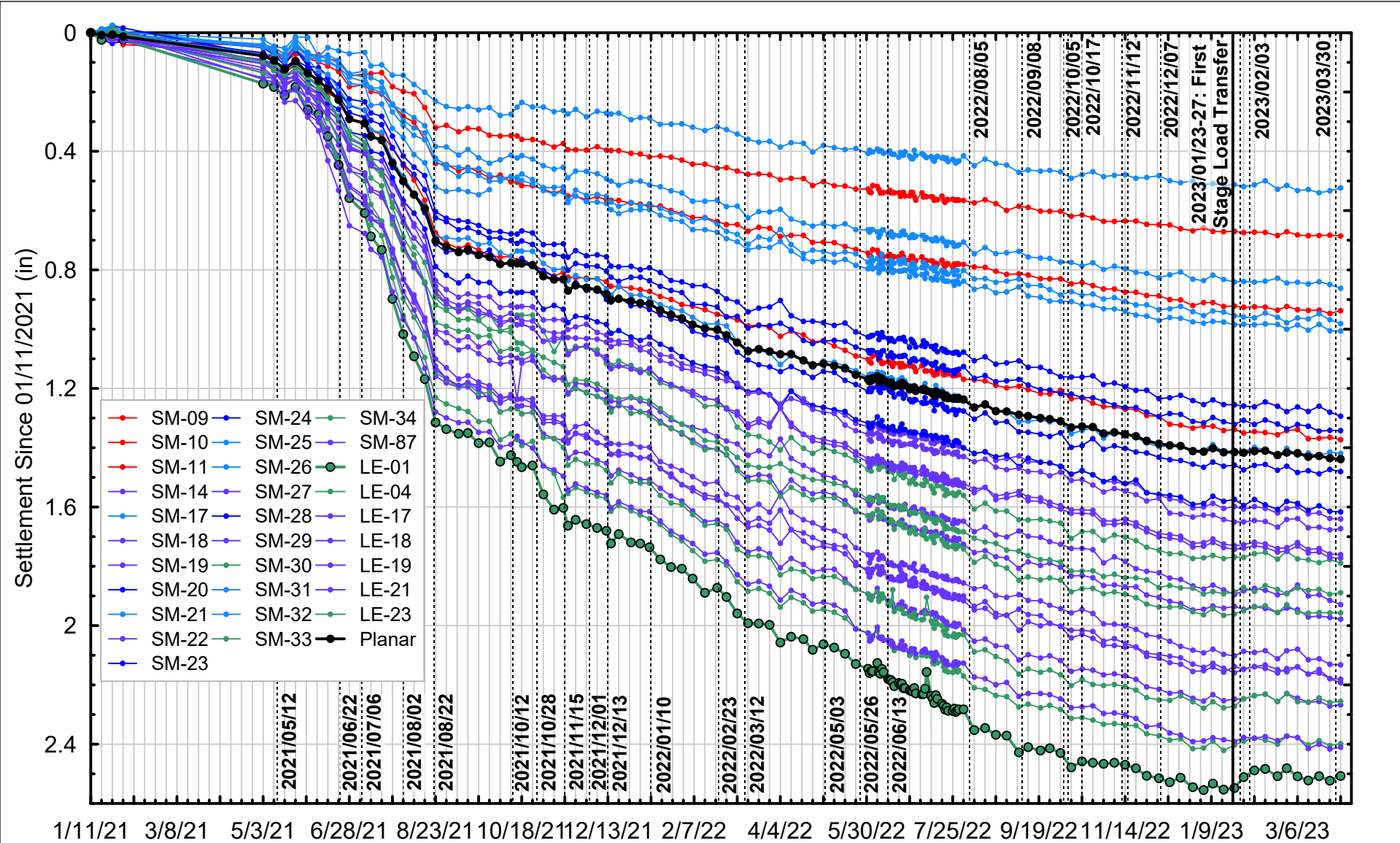


Project No: 19-009.00	Date: 4/5/2023	Created By: NBW	Checked By: DGM	Figure No: <b>100-03A</b>
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SETTLEMENT MARKER DATA  
SINCE 05/10/2021 THROUGH 04/03/2023

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

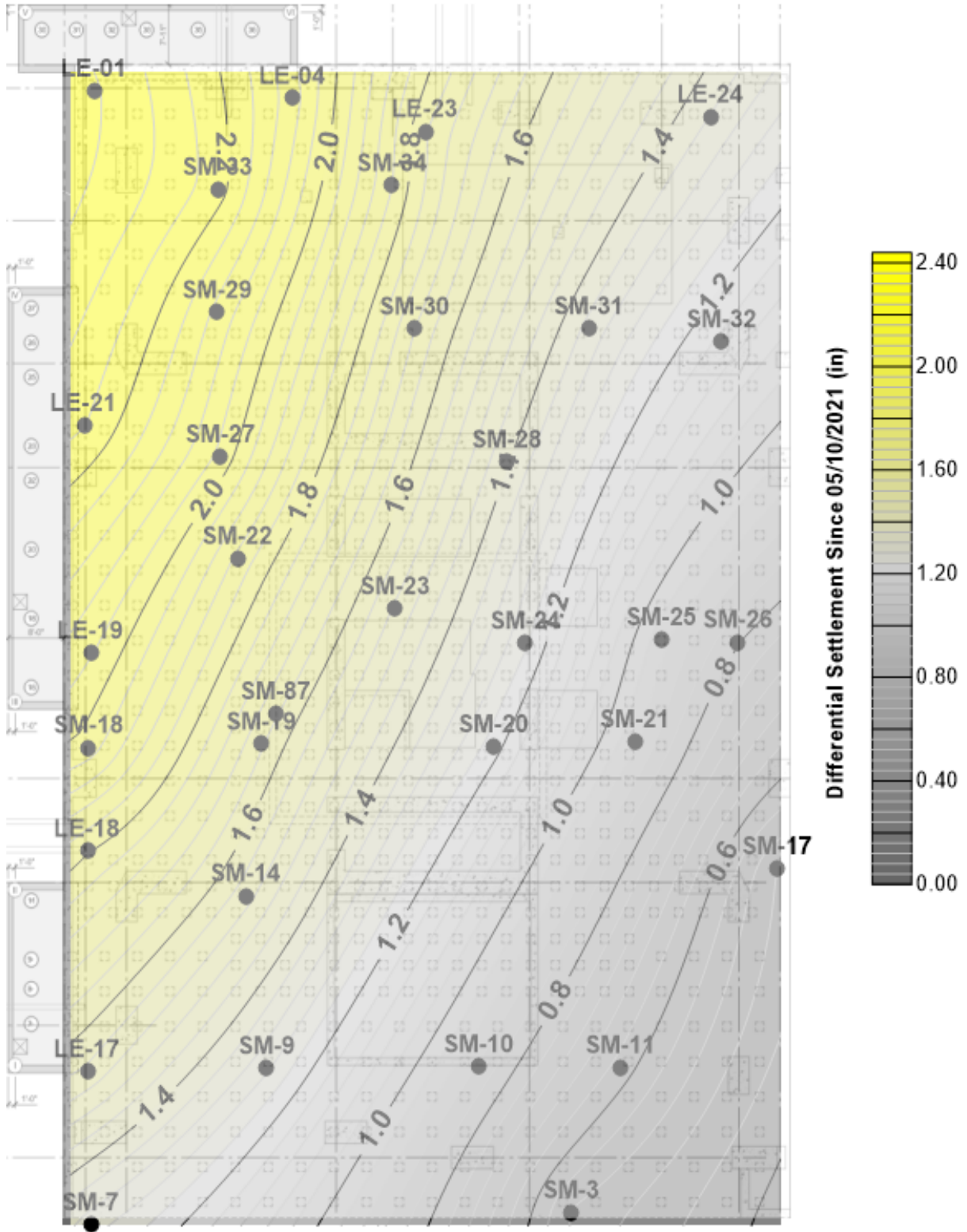


Project No: 19-009.00	Date: 4/5/2023	Created By: NBW	Checked By: DGM	Figure No: <b>100-03B</b>
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**SETTLEMENT MARKER DATA**  
 SINCE 01/11/2021 THROUGH 04/03/2023  
 Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data  
 City and County of San Francisco, California





Project No: 19-009.00

Date: 4/5/2023

Created By: NBW

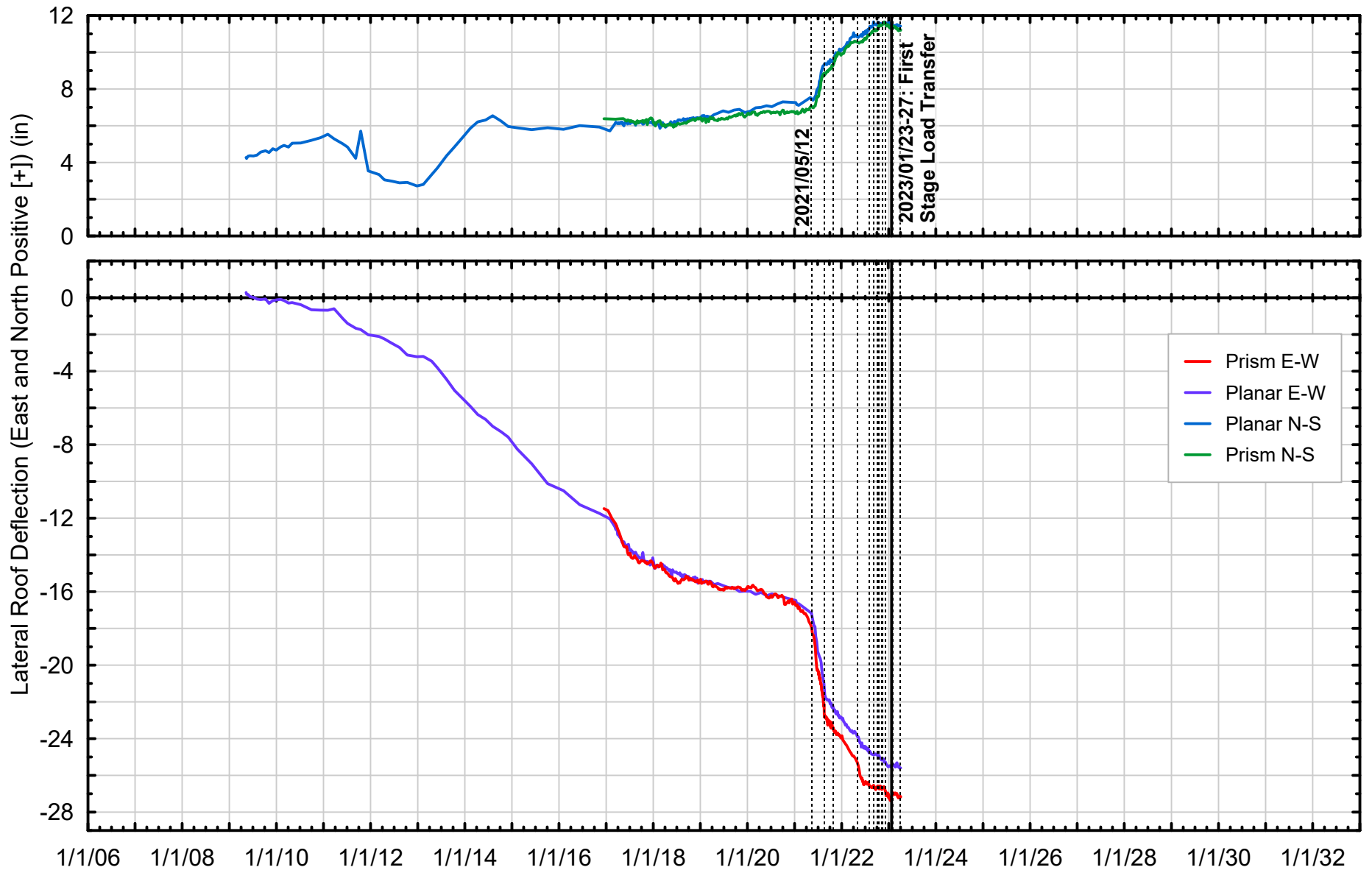
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Figure No: **100-04**



SETTLEMENT CONTOURS  
SINCE 05/10/2021 THROUGH 04/03/2023

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

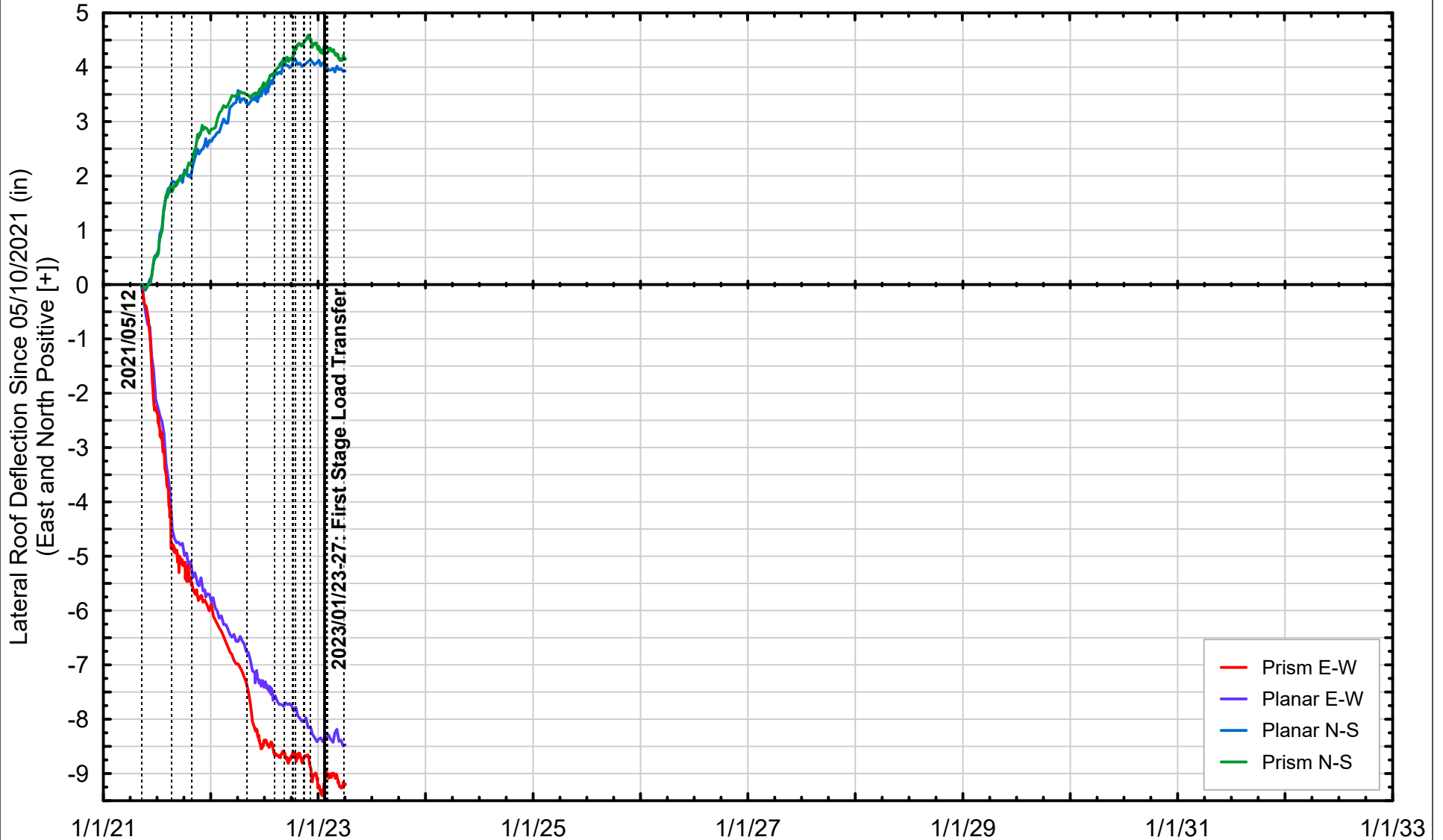


Project No: 19-009.00	Date: 4/5/2023	Created By: NBW	Checked By: DGM	Figure No: <b>100-05</b>
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HISTORICAL LATERAL ROOF DEFLECTION DATA

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

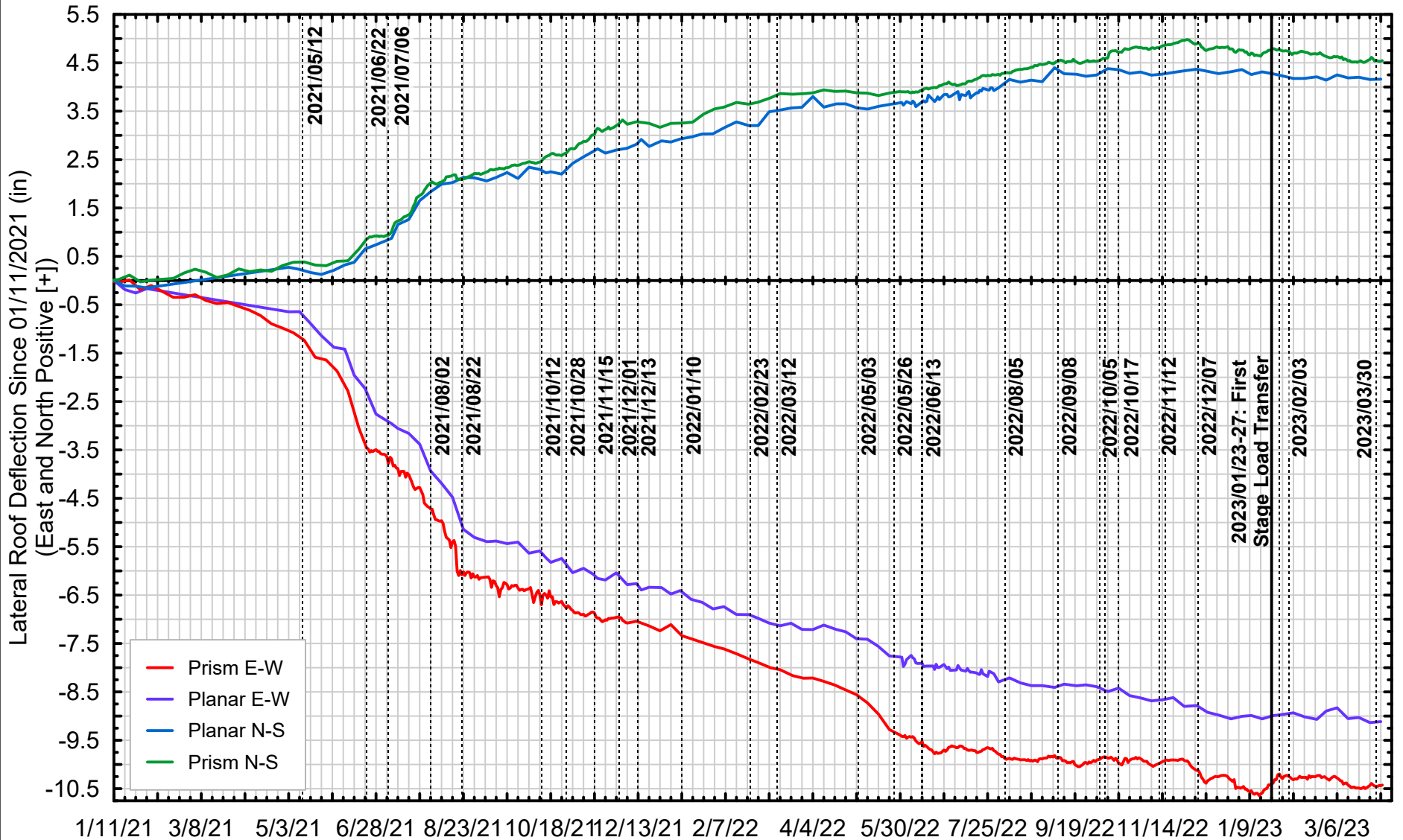


Project No: 19-009.00	Date: 4/5/2023	Created By: NBW	Checked By: DGM	Figure No: <b>100-06A</b>
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LATERAL ROOF DEFLECTION DATA  
SINCE 05/10/2021 THROUGH 04/04/2023

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

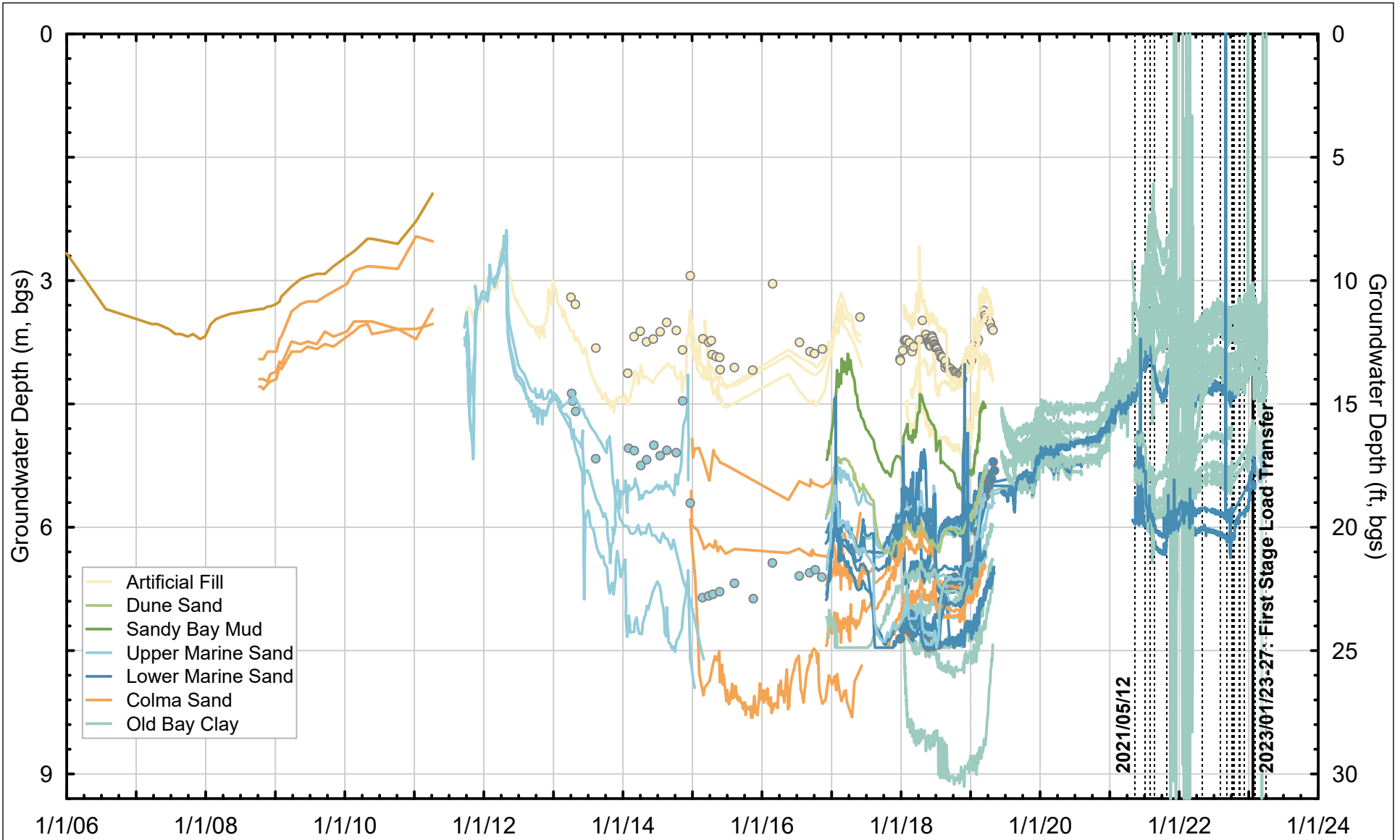


Project No: 19-009.00	Date: 4/5/2023	Created By: NBW	Checked By: DGM	Figure No: 100-06B
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LATERAL ROOF DEFLECTION DATA  
SINCE 01/11/2021 THROUGH 04/04/2023

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

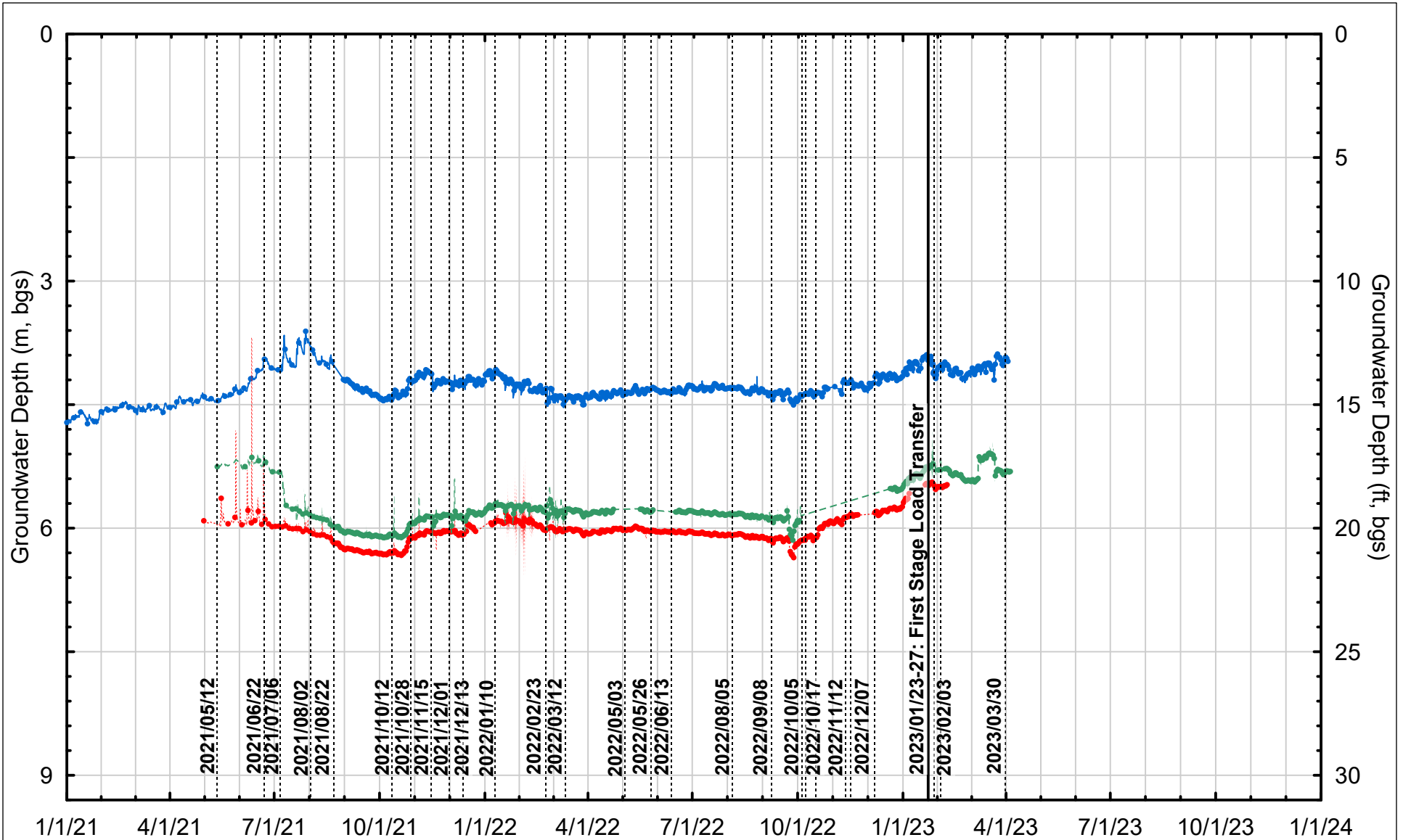


Project No: 19-009.00	Date: 4/5/2023	Created By: NBW	Checked By: DGM	Figure No: <b>100-07</b>
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HISTORICAL GROUNDWATER ELEVATION MEASUREMENTS  
AT LOCATIONS NEAR 301 MISSION

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: 19-009.00

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Created By: NBW

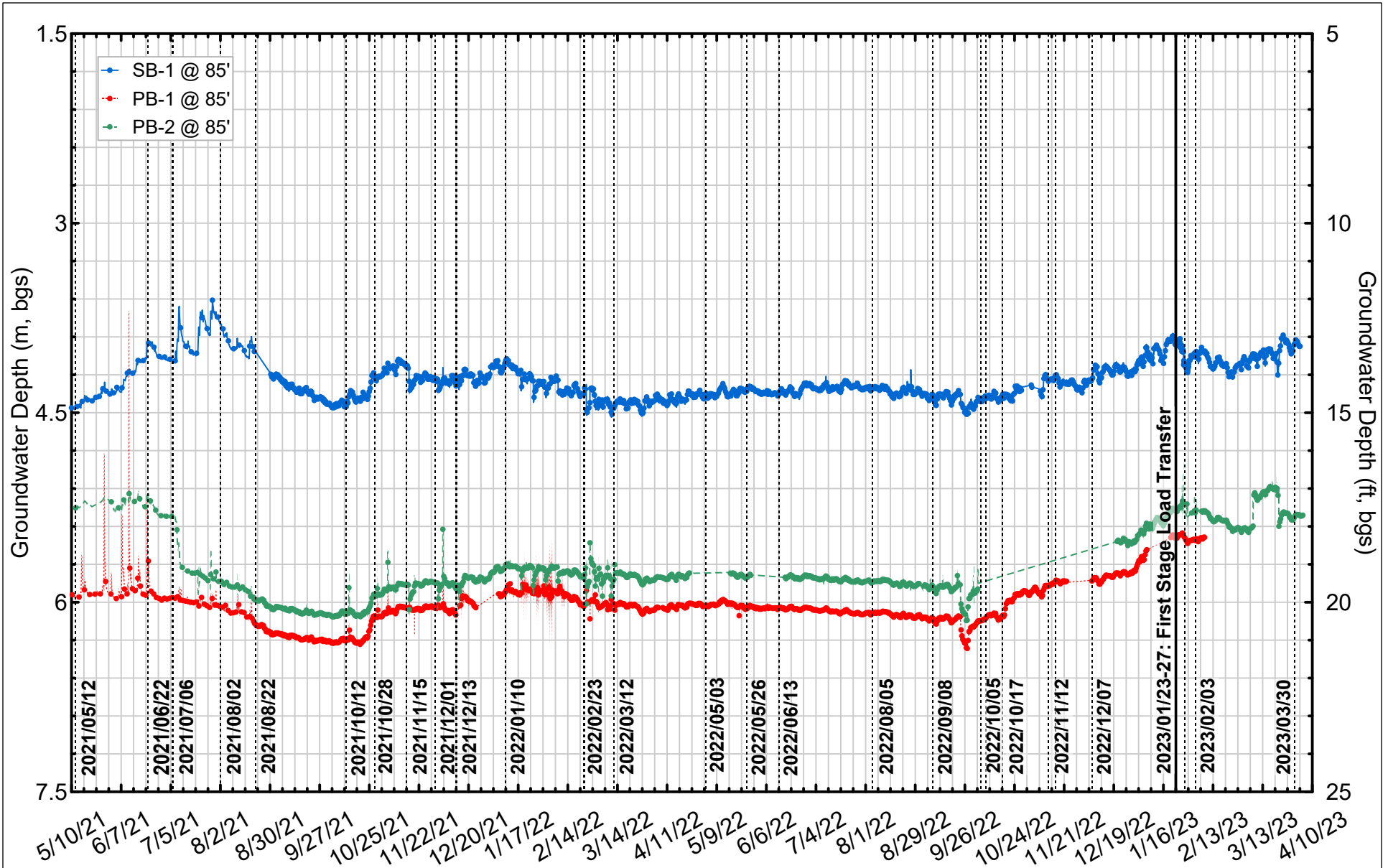
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Figure No: **100-08A**



GROUNDWATER ELEVATION MEASUREMENTS IN MARINE AND COLMA SAND  
SINCE 01/01/2021 THROUGH 04/04/2023

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



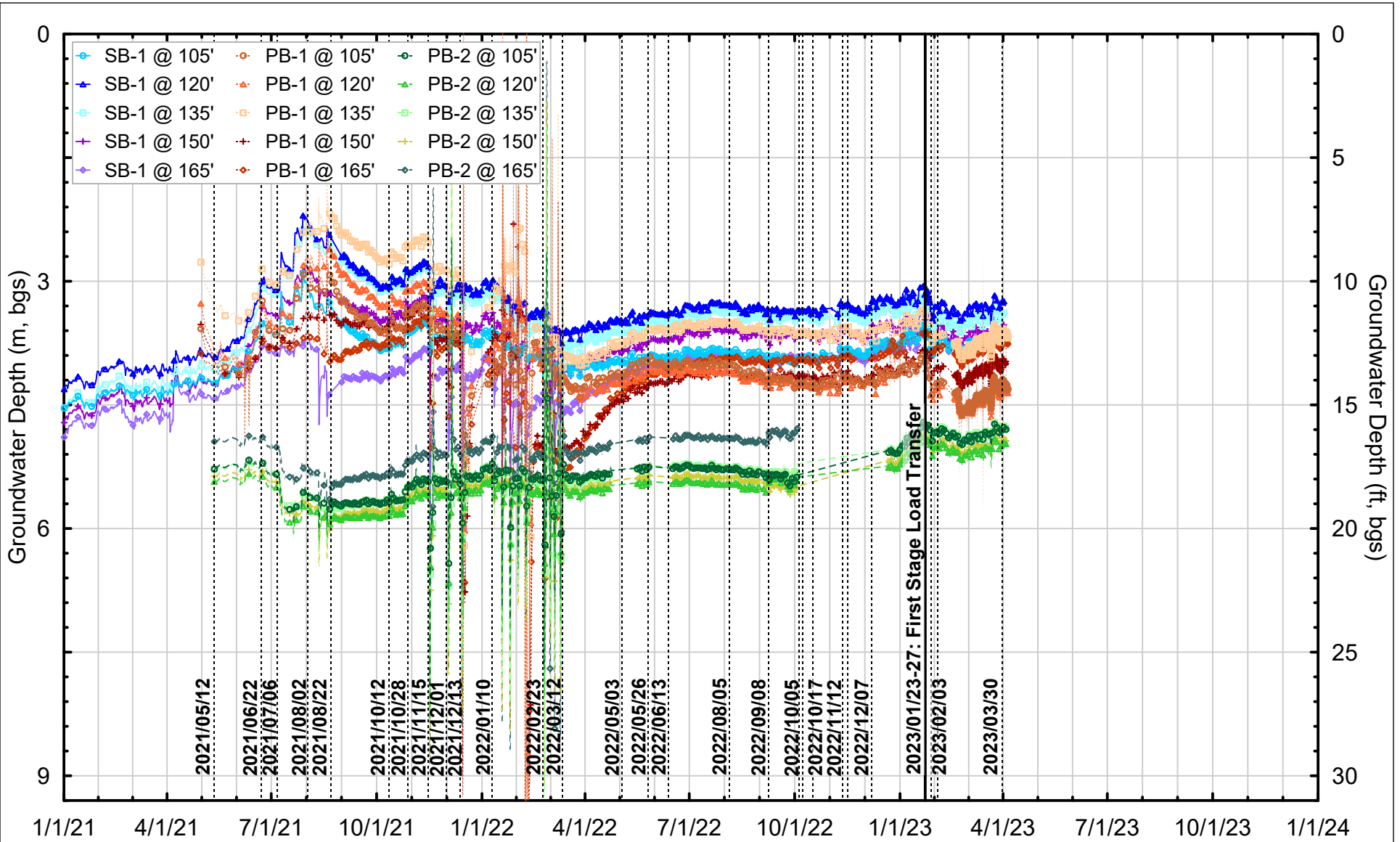
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Project No: 19-009.00    Date: 4/5/2023    Created By: NBW    Checked By: DGM    Figure No: **100-08B**



GROUNDWATER ELEVATION MEASUREMENTS IN MARINE AND COLMA SAND  
SINCE 05/10/2021 THROUGH 04/04/2023

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



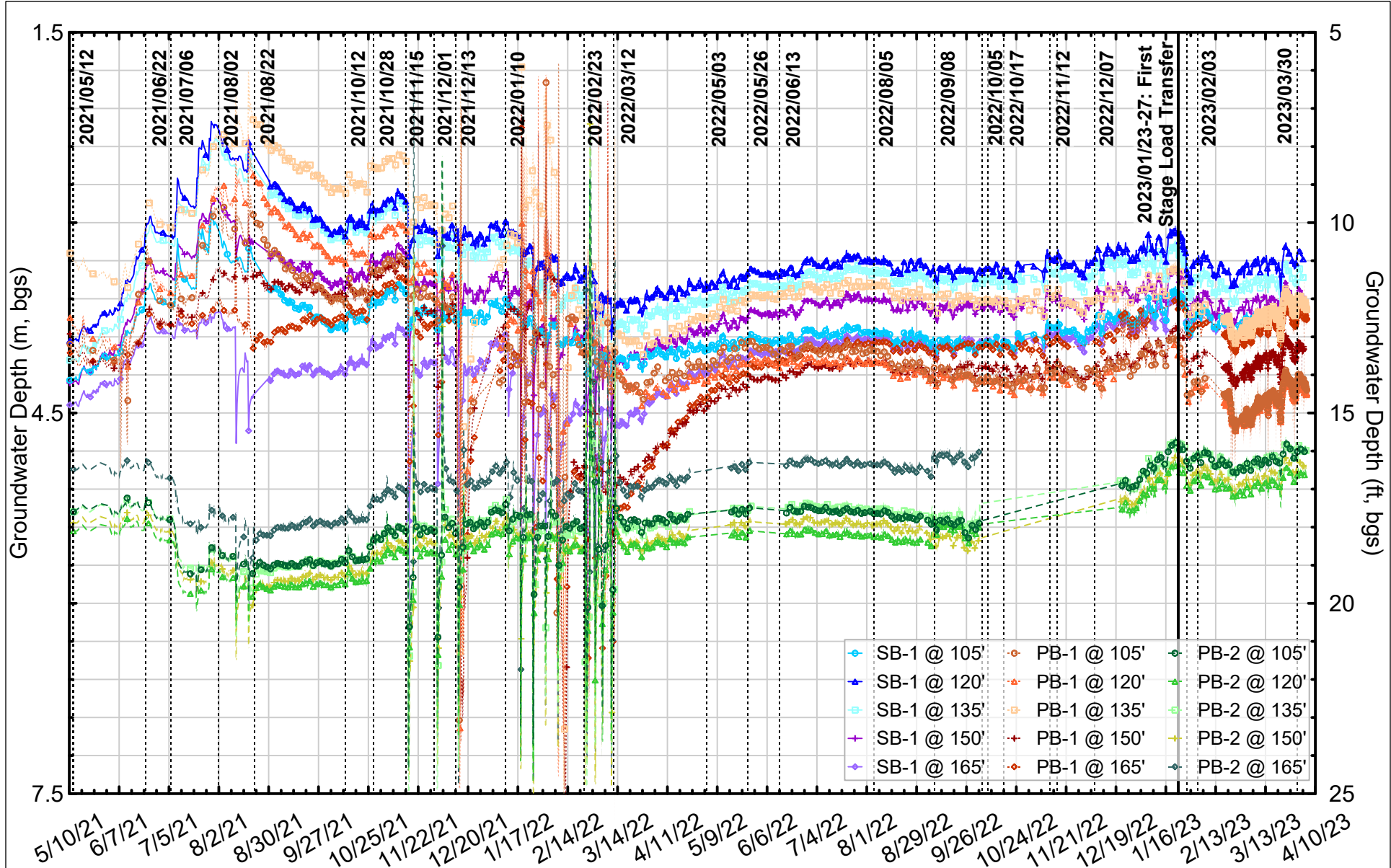
Project No: 19-009.00	Date: 4/5/2023	Created By: NBW	Checked By: DGM	Figure No: <b>100-09A</b>
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GROUNDWATER ELEVATION MEASUREMENTS IN OLD BAY CLAY  
 SINCE 01/01/2021 THROUGH 04/04/2023

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





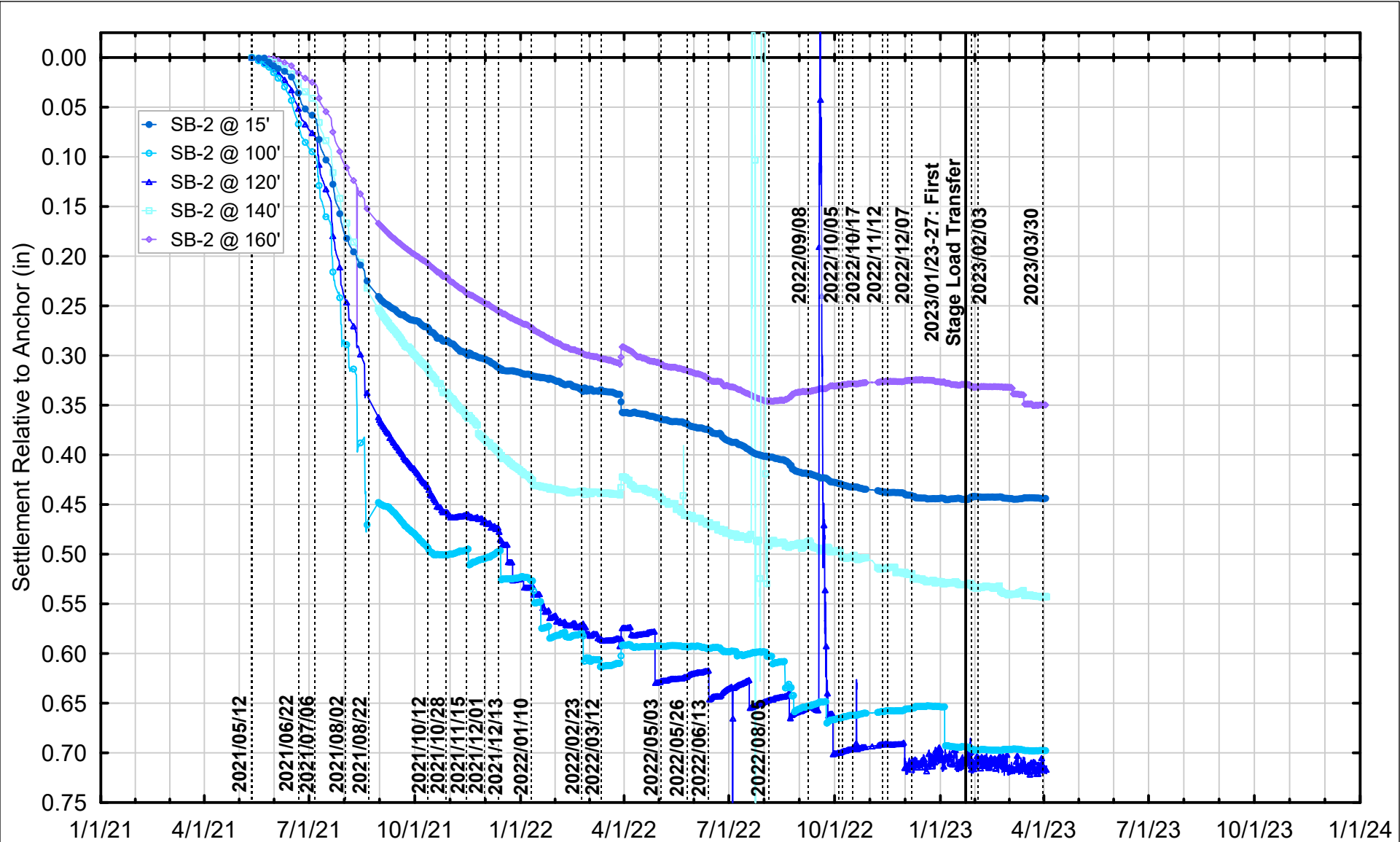
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- SB-1 @ 120'
- SB-1 @ 135'
- SB-1 @ 150'
- SB-1 @ 165'
- PB-1 @ 105'
- PB-1 @ 120'
- PB-1 @ 135'
- PB-1 @ 150'
- PB-1 @ 165'
- PB-2 @ 105'
- PB-2 @ 120'
- PB-2 @ 135'
- PB-2 @ 150'
- PB-2 @ 165'

5/10/21 6/7/21 7/5/21 8/2/21 8/30/21 9/27/21 10/25/21 11/22/21 12/20/21 1/17/22 2/14/22 3/14/22 4/11/22 5/9/22 6/6/22 7/4/22 8/1/22 8/29/22 9/26/22 10/24/22 11/21/22 12/19/22 1/16/23 2/13/23 3/13/23 4/10/23

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GROUNDWATER ELEVATION MEASUREMENTS IN OLD BAY CLAY  
 SINCE 05/10/2021 THROUGH 04/04/2023  
 Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data  
 City and County of San Francisco, California

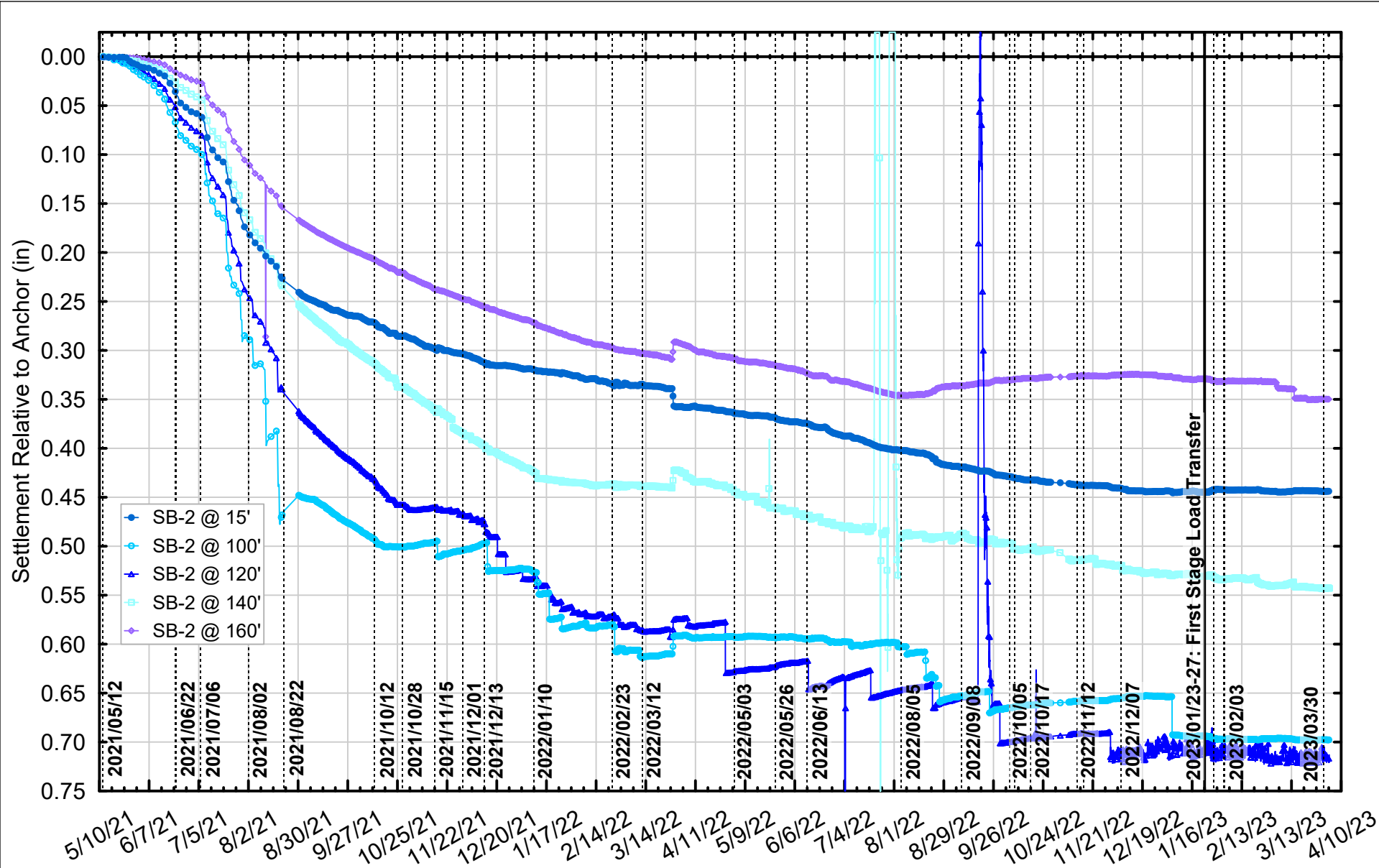


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EXTENSOMETER DATA FROM WITHIN TOWER BASEMENT  
SINCE 01/01/2021 THROUGH 04/03/2023

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

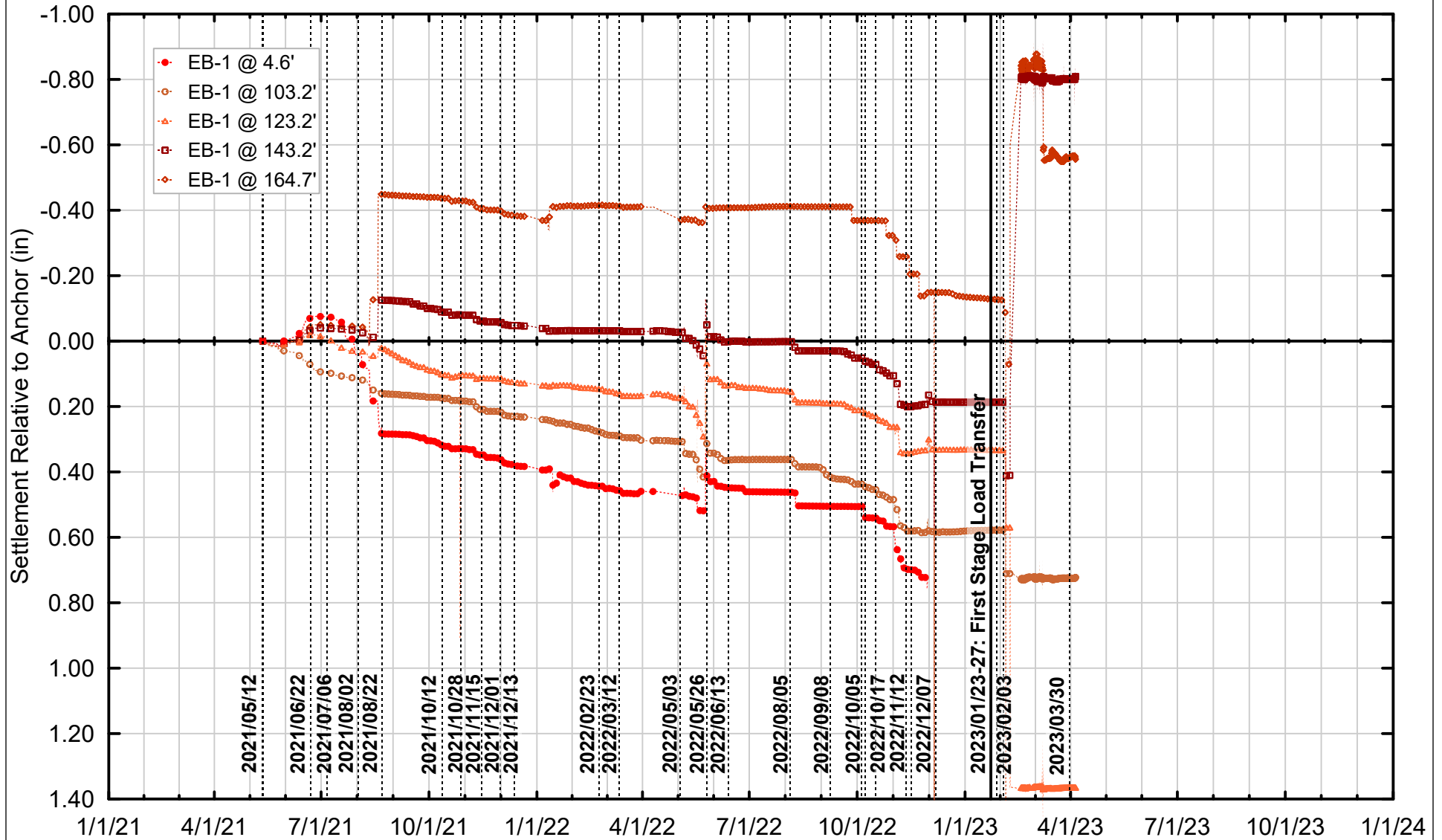


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EXTENSOMETER DATA FROM WITHIN TOWER BASEMENT  
SINCE 05/10/2021 THROUGH 04/03/2023

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

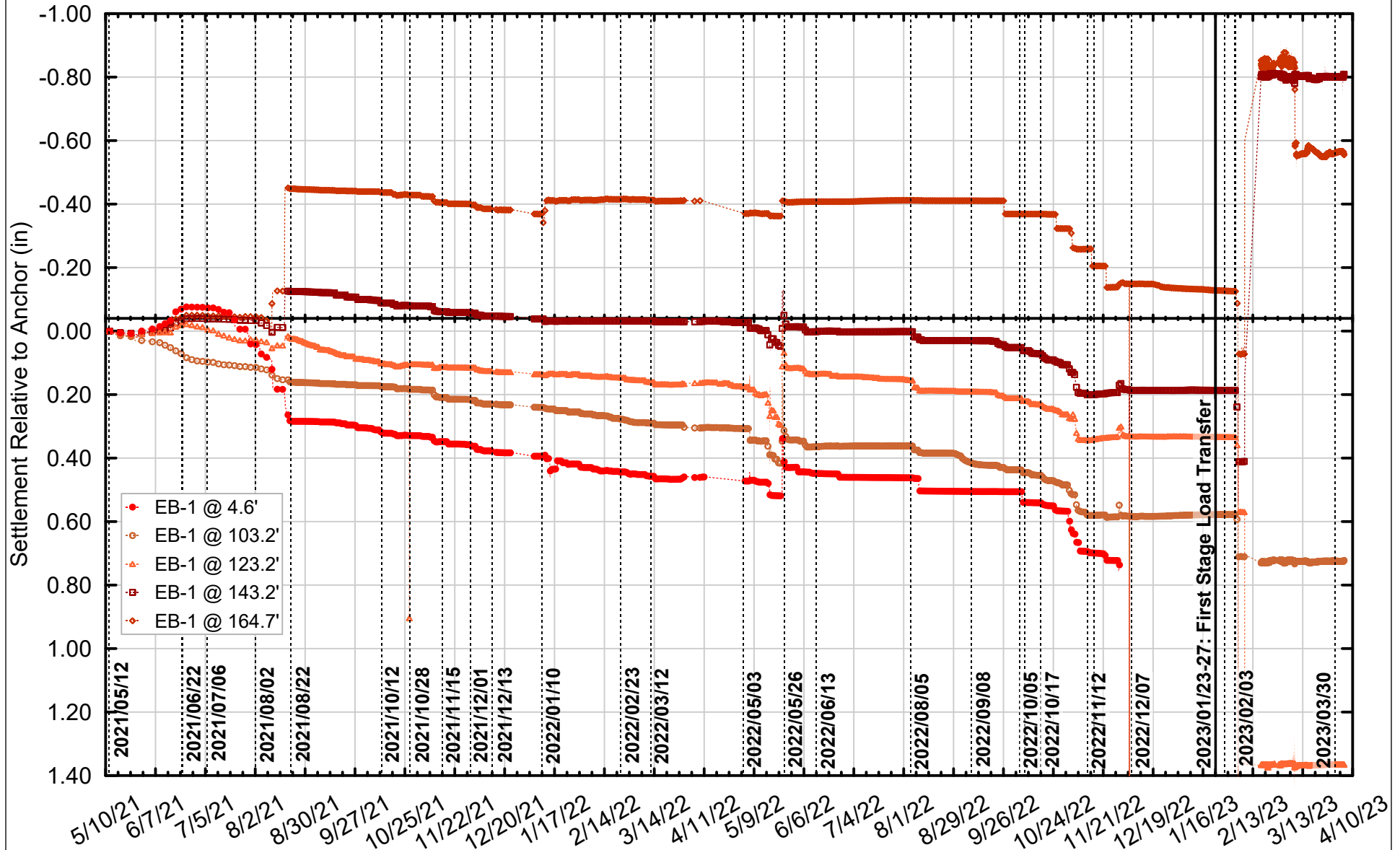


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EXTENSOMETER DATA FROM FREMONT STREET  
SINCE 01/01/2021 THROUGH 04/04/2023

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



Project No: 19-009.00

Date: 4/5/2023

Created By: NBW

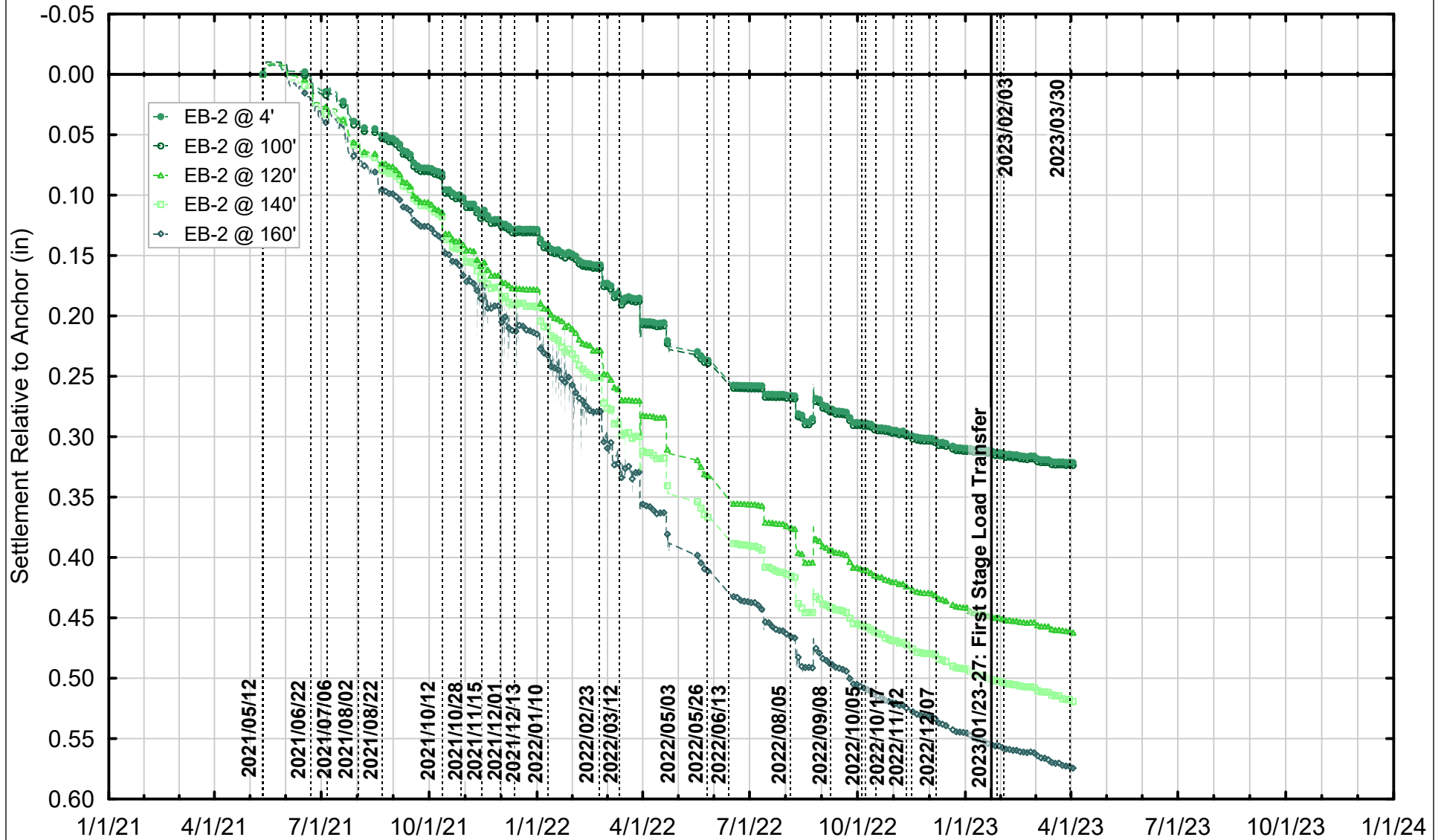
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Figure No: 100-11B



EXTENSOMETER DATA FROM FREMONT STREET  
SINCE 05/10/2021 THROUGH 04/04/2023

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



Project No: 19-009.00

Date: 4/5/2023

Created By: NBW

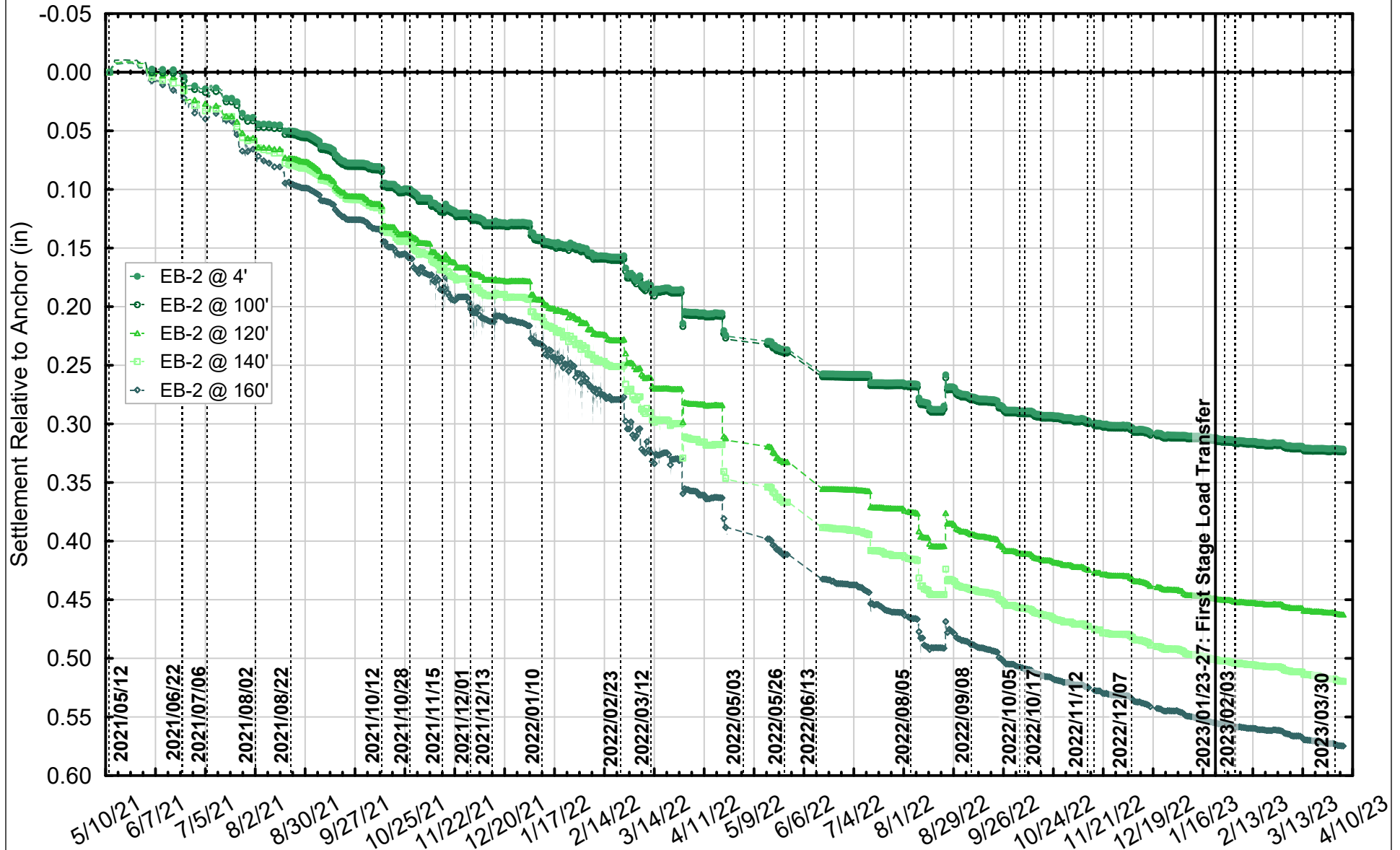
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Figure No: 100-12A



EXTENSOMETER DATA FROM MISSION STREET  
SINCE 01/01/2021 THROUGH 04/04/2023

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

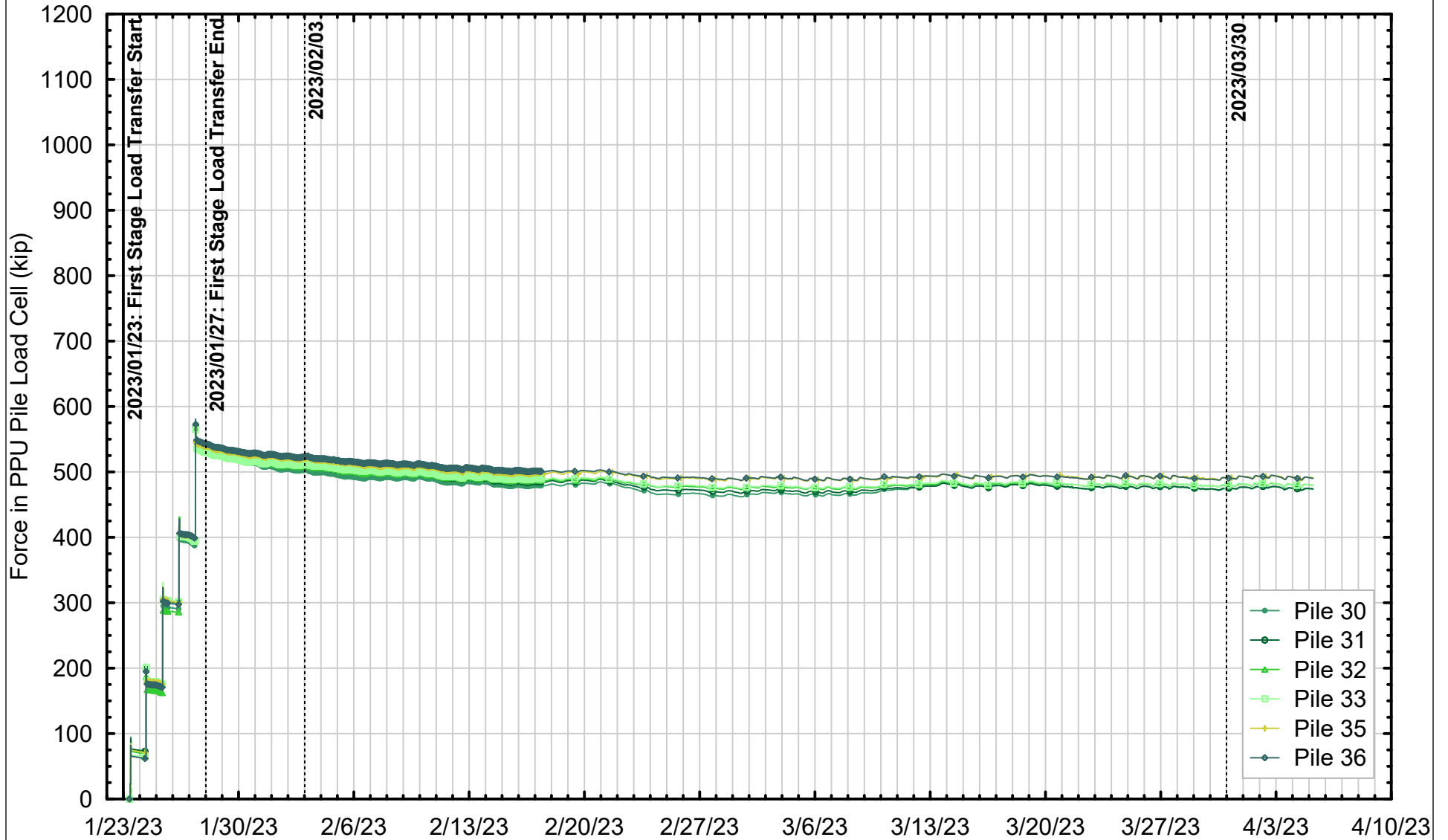



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EXTENSOMETER DATA FROM MISSION STREET  
SINCE 05/10/2021 THROUGH 04/04/2023

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



Project No: 19-009.00	Date: 4/5/2023	Created By: NBW	Checked By: DGM	Figure No: <b>100-13</b>
		<p style="text-align: center;">PILE LOAD CELL DATA SINCE 01/23/2023 THROUGH 04/04/2023</p> <p style="text-align: center;">Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data City and County of San Francisco, California</p>		