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June 16, 2016

David R. Lastovka, P.E.
ODOT District 12 Transportation Engineer
Ohio Department of Transportation
5500 Transportation Boulevard
Garfield Heights, Ohio 44125-5396

Re: April 2016 Quarterly Report
CUY-90-15.24 Slope Monitoring
PID 96504
EDP Project No. 069032.00

Dear Mr. Lastovka:

Quarterly instrument readings for the CUY-90-15.24 Slope Monitoring project are presented in the attached report.

If you have any questions or comments regarding this report, please call.

Very truly yours,

SME

Alan J. Esser, P.E., D.GE
Chief Consultant

Attachments

Distribution via e-mail

APRIL 2016 QUARTERLY REPORT

CUY-90-15.24 SLOPE MONITORING
PID 96504
CLEVELAND, OHIO
SME PROJECT NO. 069032.00



June 16, 2016

SME

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TABLE OF CONTENTS

INTRODUCTION	1
CRITICAL INSTUMENTS READ BI-WEEKLY.....	1
STATUS OF INSTRUMENTS	1
PIEZOMETERS	2
INCLINOMETERS	3
STABILIZATION STRUCTURE.....	3
AGGREGATE STOCK PILES	5
APPENDIX A	
Figure 1	6
Figure 2	7
Figure 3	7
Figure 4	8
Figure 5	8
APPENDIX B	
PIEZOMETERS	
P-001-10.....	9
P-002-10.....	10
P-007-13.....	11
B-05-07	14
TGR P-3	16
INCLINOMETERS	
I-001-10.....	17
I-002-10.....	18
I-007-13.....	19
B-05-07A	20
P-3	21
P-8	22
P-10	23
P-17	24
Load Cell Measurements	25
Anchor #1.....	26
Anchor #8.....	27
Anchor #9.....	28
Anchor #17.....	29
Driven Piles.....	30
Tiebeams – Anchor Side.....	33
Tiebeams – Drilled Pier Side	36
Drilled Shaft #1	39
Drilled Shaft #9	42

INTRODUCTION

Instrument readings and interpretations for April 2016 are presented in this report. Figures showing the arrangement of instrumentation are in Appendix A. Instrument plots are included in Appendix B. Labels like P-001-13 for the piezometers and I-001-13 for the inclinometer at that same location are used for all recently installed instruments. For earlier instruments, a label like B-101 is used for both the piezometers and inclinometers at the same location.

CRITICAL INSTRUMENTS READ BI-WEEKLY

Critical instruments are those that are judged to provide a clearer picture of slope performance. The following critical instruments are currently read and reported on a bi-weekly schedule.

Piezometers: P-001-13, P-002-13, P-003-10, P-004-13, P-009-13, B-05-A-03, B-05-04, B-05-A-11, and B-105-A.

Inclinometers: I-001-13, I-002-13, I-003-10, I-004-13, I-009-13, B-05-A-03, B-05-04, B-05-A-11, B-101, B-102, B-105-A, Pier 1, Pier 9N, TGR I-2, and TGR I-4.

Refer to the bi-weekly reports for details and comments on those instruments. This report will only cover those instruments that are not included in the bi-weekly reading schedule.

STATUS OF INSTRUMENTS

Table 1. Instruments currently out of service and needing repair or replacement.

Location	Inclinometer	Piezometers	Comment
B-05-A-03	Will be replaced when location is accessible	Recently installed	Grooves in casing are misaligned at a depth of 100 ft. We are temporarily taking readings from the top 100 feet.
B-303	N/A	Casing cut	Recoverable after fill is removed
I/P-008-10	Temporarily inaccessible	Cables cut	Recoverable after fill is removed
I/P-004-13	Temporarily inaccessible	Temporarily inaccessible	Recoverable after fill is removed
TGR I-2	Inaccessible	N/A	Unsafe to take readings due to deep voids behind the shoring system

B-05-A-03. The inclinometer at this location was installed on April 21, 2016. Baseline readings taken during the following week show very large check sums above 100 feet. Check sums are typically very small. We lowered a camera down the tube to investigate this issue and found that the grooves at the joint at 100 feet are misaligned. We checked with the manufacturer who stated that this could not have been a manufacturing defect. The misalignment cannot be corrected so this casing will be abandoned and replaced.

Piezometers were installed at B-05-A-03 on April 22, 2016 at the same elevations as the original instruments.

B-303 and I/P-008-10. Fill was placed over these instruments during the CCG1 contract. The inclinometer at I-008-10 is buried and inaccessible. The cables and tubing for the piezometers were extended to a clear area near the east fence but these extensions were cut during excavation for the gas line. These instruments will be restored to service after the fill is removed.

I/P-004-13. To protect these instruments TGR installed a section of pipe around the instruments and then filled around the pipe. These instruments will be inaccessible until the fill is removed.

B-105-A. Piezometers were installed at this location on April 19, 2016 at the same elevations as the original instruments.

PIEZOMETERS

P-001-10. Total head in both piezometers at P-001-10 decrease through most of this quarter continuing the trend that began in July 2015. Since July 2015, total head in both piezometers decreased about 2 feet. Average pore pressures this quarter were within the range that existed from April 2013 through April 2015.

P-002-10. Total head in both piezometers at P-002-10 fluctuated slightly over the past quarter, but show virtually no net change.

P-007-13. In both piezometers at P-007-13, pore pressure readings indicate minor fluctuations in total head with no significant change during the quarter. In April 2016, total head increased by about 0.8 feet in the shallow piezometer.

B-05-02. The piezometers at this location were recently uncovered. The last data download at this location was on August 1, 2014. The dataloggers continued to record during the time the instruments were covered and inaccessible. Pore pressure data indicates a decrease in total head that occurred between April and October 2014 in the shallow piezometer, and between June and September 2014 in the deep piezometer. The total head in both piezometers then increased gradually reaching a new equilibrium in May 2015 in the shallow piezometer and September 2015 in the deep piezometer.

Beginning on February 14, 2016, the total head in both piezometers decreased again with a change of 10.3 feet in the shallow piezometer, and 5.7 feet in the deep piezometer. Then on February 24, 2016, the total head in both piezometers began to increase. By mid-April 2016, the total head increased by 8.6 feet in the shallow piezometer and 3.8 feet in the deep piezometer. Variations since then may indicate that pore pressures have reached equilibrium. The large decrease in pore pressure that occurred on February 14, was the result of excavation in the area.

B-05-07. Pore pressure readings in all three piezometers at B-05-07 indicate fluctuations in total head, but virtually no net change for the quarter.

TGR P-3. On December 23, 2015, total head increases of 3 to 5 feet are shown in all three piezometers. This increase was caused by the placement of fill in the area which we observed during our biweekly visit. The pore pressures then began to decrease with the rate of decrease slowing with depth. Through most of this quarter, the total head in the two deep piezometers continued to decrease with a change or about 2 feet. Total head in the shallowest piezometer increased by about 1 foot.

INCLINOMETERS

I-001-10, I-002-10, I-007-13, B-05-07, and P-3. Inclinator readings at these locations indicate virtually no movement since the April 2015 quarterly readings.

P-8. Inclinator readings at this location indicate negative movement in the B-axis direction throughout the length of the tube.

P-10. Inclinator readings this quarter show less than 0.1 inches of displacement in the positive A-axis direction between 60 and 140 feet, and in the negative B-axis direction between 40 and 120 feet.

P-17. Inclinator readings at this location indicate positive A-axis and negative B-axis displacement direction from the surface to 70 feet. Maximum displacement was less than 0.1 inches.

STABILIZATION STRUCTURE

The general arrangement of the stabilization structure and its instrumentation is shown in Figures 2 and 3 in Appendix A.

Load Cells

Seasonal variations are apparent in the plots for all of the load cells with the usual decrease in load seen during the winter months. Loads in Load Cells 1 and 9 have continued to trend downward and the load in Load Cell 17 has continued to trend upward. The many spikes shown in the Load Cell 8 plot this quarter occur when one or more of the gauges in the load cell fail to record. Table 2 shows which gauges were active in each of the load cells this quarter. A plot of the load cell data is included in Appendix B.

Table 2. Active gages (indicated by check mark) in load cells on the four instrumented anchors.

Load Cell	Gage					
	1	2	3	4	5	6
1	✓			✓	✓	✓
8	✓	✓	✓		✓	✓
9	✓	✓	✓	✓	✓	✓
17	✓	✓	✓	✓	✓	✓

Anchors

Loads recorded for all active strandmeters on the instrumented anchors remained virtually constant this past quarter with the exception of an occasional spike caused by gages failing to record. The plot for Gage 5 on Anchor 1 indicates the continuing upward trend that has been ongoing since 2010. The magnitude of the load is obviously incorrect since it is unrealistically high. Average loads this quarter for the load cells and active strandmeters are listed in Table 3. We also report the percent change in load from last quarter. Strandmeter gages that have failed are indicated by an "x" in the table.

Table 3. Average strandmeter loads and % change from last quarter, tension loads are positive.

Anchor	Load Cell (kips)	Strandmeter (kips)				
		1	2	3	4	5
1	443.4	-9.8	x	+/- 0	x	2061.0
% change		-0.8	x	0	x	1.5
8	273.9	28.3	65.7	-176.2	x	x
% change		2.4	0.4	-0.4	x	x
9	450.6	-19.3	8.6	3.8	194.2	778.5
% change		0.0	3.0	75.0	0.1	0.5
17	367.5	-40.2	x	-25.0	x	232.0
% change		1.1	x	-2.2	x	0.2

Driven piles

Axial loads in all driven piles except Pile 1 increased by 3 to 9 kips during the first half of the quarter and then decreased by 4 to 11 kips during the second half of the quarter. The axial load in Pile 1 increased by about 10 kips, continuing the upward trend that started in October 2015.

Strong axis bending moments in all of the driven piles decreased this quarter. The greatest decrease of 6 kip-feet occurred in Pile 1. Since September 2015, the strong axis bending moment in Pile 1 has decreased by 22 kip-feet. Decreases in the remaining piles ranged from 0.4 to 0.9 kip-feet. Weak axis bending moments decreased slightly in Piles 1 and 34. Changes in weak axis bending moments in the remaining piles were negligible.

Tiebeams General

Data for all tiebeams was a slightly less stable than the previous quarter. A small amount of erratic data was deleted to "clean up" the plots in the attachments. The following interpretations refer to the trends that are visible after the data was "cleaned".

Tiebeams Anchor Side

Axial loads at the anchor end of the tiebeams continued the seasonal increase that began in October 2015. Axial loads reached a peak in early May and then began to decrease. With the exception of Tiebeam 1, strong axis bending moments were constant this quarter. The strong axis bending moment in Tiebeam 1 increased by about 1 kip-foot. Changes in weak axis bending moments were negligible.

Tiebeams Drilled Pier Side

With the exception of Tiebeams 1 and 26, axial loads at the drilled pier end of the tiebeams reached a seasonal peak at about mid-quarter and then began to decrease following the seasonal variation. Axial loads have gradually increased since 2012. The axial load in Tiebeam 26 appears to be gradually decreasing. A similar trend is apparent in the strong axis bending moments. Changes in weak axis bending moments were negligible.

Drilled Piers

The profile plots for both instrumented piers suggest a general increase in axial load over most of the length of the piers this quarter. Plots of axial load vs. time show that axial loads are approaching a seasonal low in Pier 1 and are increasing in Pier 9. The load vs. time plots continue to show a gradual increase in axial load over time in both shafts at all depths. Some erratic data was again recorded for the gages at 84 feet in Pier 1. This affects both the axial load and bending moment plots but the data does not appear to indicate a significant change from past trends at this depth.

Bending moments in Pier 1 changed most at the top end of the pier. Moments are decreasing over time at 29 and 35.5 feet, and are increasing at 22.5 feet and above and at 58 feet below. A similar trend occurs in Pier 9 where the seasonal changes in bending moments are greatest at 50 feet and above and are muted at other depths. Changes in Pier 1 bending moments this quarter at 29 and 35.5 feet were greater than we have seen in the past.

AGGREGATE STOCKPILES

We observed and photographed the aggregate stockpiles on May 5, 2016. The photos are Figures 4 and 5 which are included in Appendix A. Only a small pile of aggregate closest to the right-of-way fence remains. This pile has been virtually unchanged since January 2014. The pile is about 8 feet high and covers only a small area of the property.

This completes the April 2016 quarterly report for the CUY-90-15.24 Slope Monitoring Project, ODOT PID 96504.

Report prepared by:

Brendan P. Lieske, P.E.
Senior Staff Engineer

Report reviewed by:

Alan J. Esser, P.E., D.GE
Chief Consultant

APPENDIX A
ARRANGEMENT OF INSTRUMENTATION



REVISION	DATE	DESCRIPTION
A	11/21/13	REVISIONS BASED ON INSTRUMENTATION STATUS AFTER COMPLETION OF CCG1.

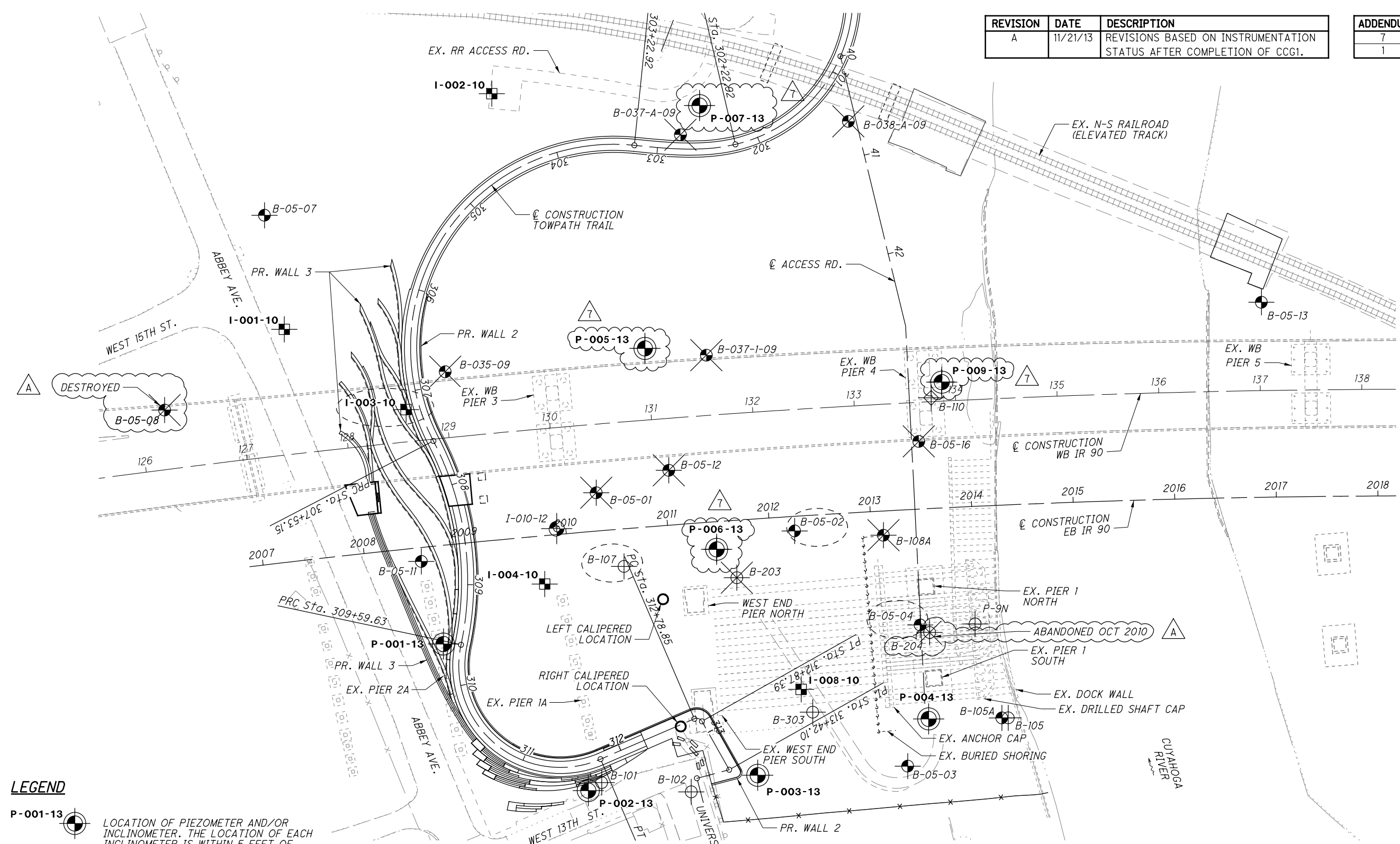
ADDENDUM	DATE
7	8/2/13
1	4/16/13




DRAWN: CDS
CHECKED: JN


INSTRUMENTATION PLAN
CUYAHOGA RIVER WEST BANK


CUY-90-14.90





LEGEND


- 
P-001-13 LOCATION OF PIEZOMETER AND/OR INCLINOMETER. THE LOCATION OF EACH INCLINOMETER IS WITHIN 5 FEET OF THE LOCATION OF THE PIEZOMETER.


- 
B-05-01 LOCATION OF INCLINOMETER/PIEZOMETER INSTALLED BY BBCM IN 2006 (B-05-01 THROUGH B-05-04, B-05-07, B-05-08, B-05-11 THROUGH B-05-13, AND B-05-16). THESE INSTRUMENTS ARE NOT AFFECTED BY THE GRADING AND REMAIN IN SERVICE.


- 
B-105A LOCATION OF REPLACEMENT INCLINOMETER INSTALLED BY BBCM IN 2006 (B-105A AND B-108A).

- 
B-101 LOCATION OF INCLINOMETER AND/OR PIEZOMETER INSTALLED BY BBCM BETWEEN 1994 AND 1999 (B-101, B-102, B-105, B-107, B-203, B-204, B-303, AND P-9N).

- 
B-110 LOCATION OF INCLINOMETER AT B-110, WHICH WAS DESTROYED BY EXCAVATION ACTIVITIES IN MARCH, 2006

- 
I-010-12 LOCATION OF INCLINOMETER INSTALLED DURING PIER 3 CONSTRUCTION, 2012

- 
I-001-10 LOCATION OF EXISTING INCLINOMETER AND/OR PIEZOMETER (I-001-10 THROUGH I-004-10 & I-008-10 AND P-001-10 THROUGH P-004-10 & P-008-10 INSTALLED AS PART OF THE CCG1 CONTRACT). THE LOCATION OF EACH PIEZOMETER IS WITHIN 5 FEET OF THE LOCATION OF THE INCLINOMETER. DEVELOPER IS RESPONSIBLE FOR THE REPLACEMENT INSTRUMENTATION, IF DAMAGED. (NOT USED: I-005-10 THROUGH I-007-10 & I-009-10 AND P-005-10 THROUGH P-007-10 & P-009-10).

- 
B-05-01 LOCATION OF ABANDONED/DESTROYED INCLINOMETER AND/OR PIEZOMETER (B-05-01, B-05-12, B-05-16, B-035-0-09, B-037-1-09, AND B-037-A-09, B-038-A-09, B-107, B-108A, B-203, B-204, B-05-08)

INCLINOMETER AND/OR PIEZOMETER TO BE REPLACED. THE FUTURE INSTALLATION WILL HAVE THE SAME DESIGNATION PRECEDED BY LETTER 'A' (B-05-02, B-05-04, B-107, I-003-10)

NOTE: THE DEVELOPER NEEDS TO PROTECT ALL THE INSTRUMENTS AND REPLACE ANY IF DAMAGED, PER SCOPE REQUIREMENTS.

P:\82119\geotechnical\sheets\82119ZP410 Addendum 7 - Revision A.dgn 11/21/2013 8:08:35 AM csteck

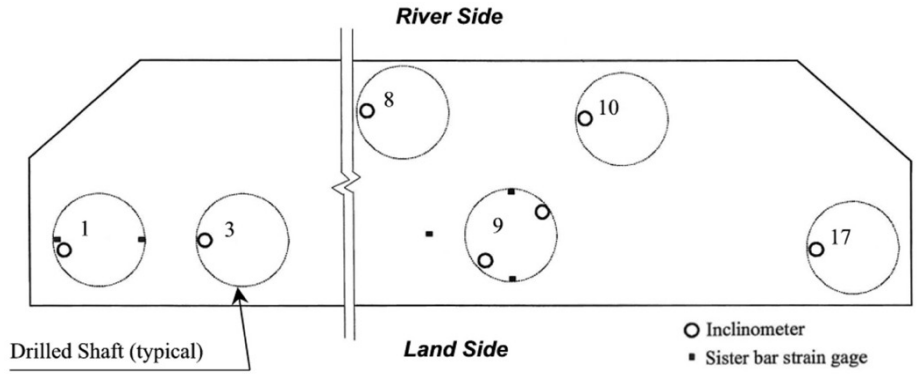


Figure 2. Pier cap with the location of inclinometers and strain gauges.

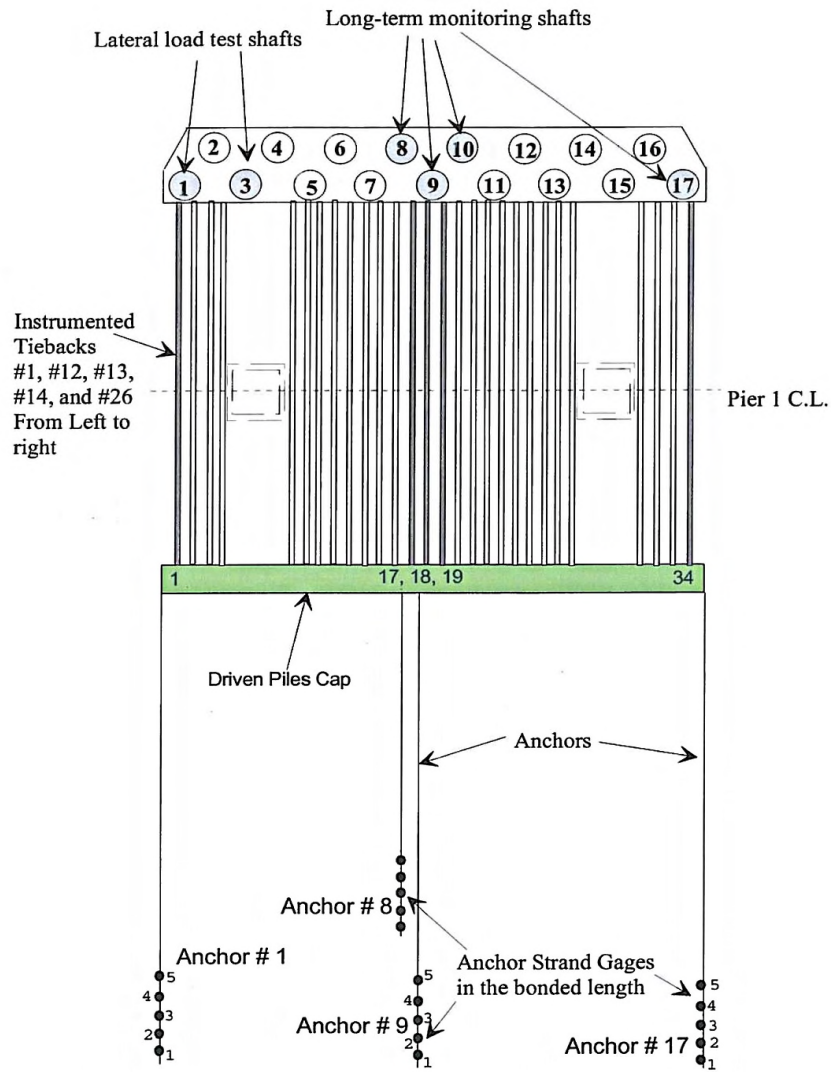


Figure 3. Plan of the stabilization system showing the locations of the instrumented foundation elements.



Figure 4. Aggregate stockpile east of the ODOT right-of-way (May 5, 2016)



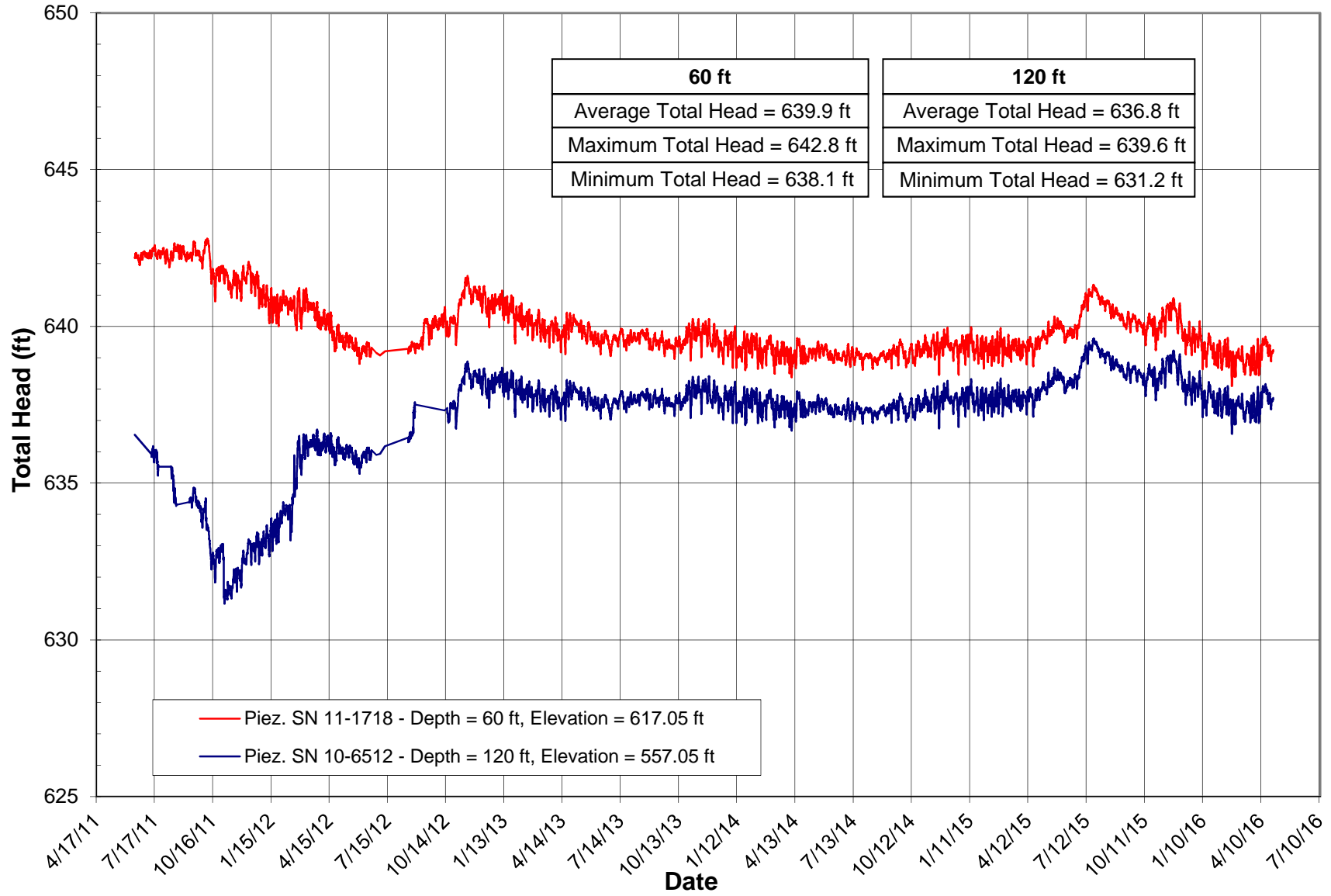
Figure 5. Aggregate stockpile near ODOT's east right-of-way fence (May 5, 2016)

APPENDIX B
PLOTS OF INSTRUMENT READINGS
DISCUSSED IN THE REPORT



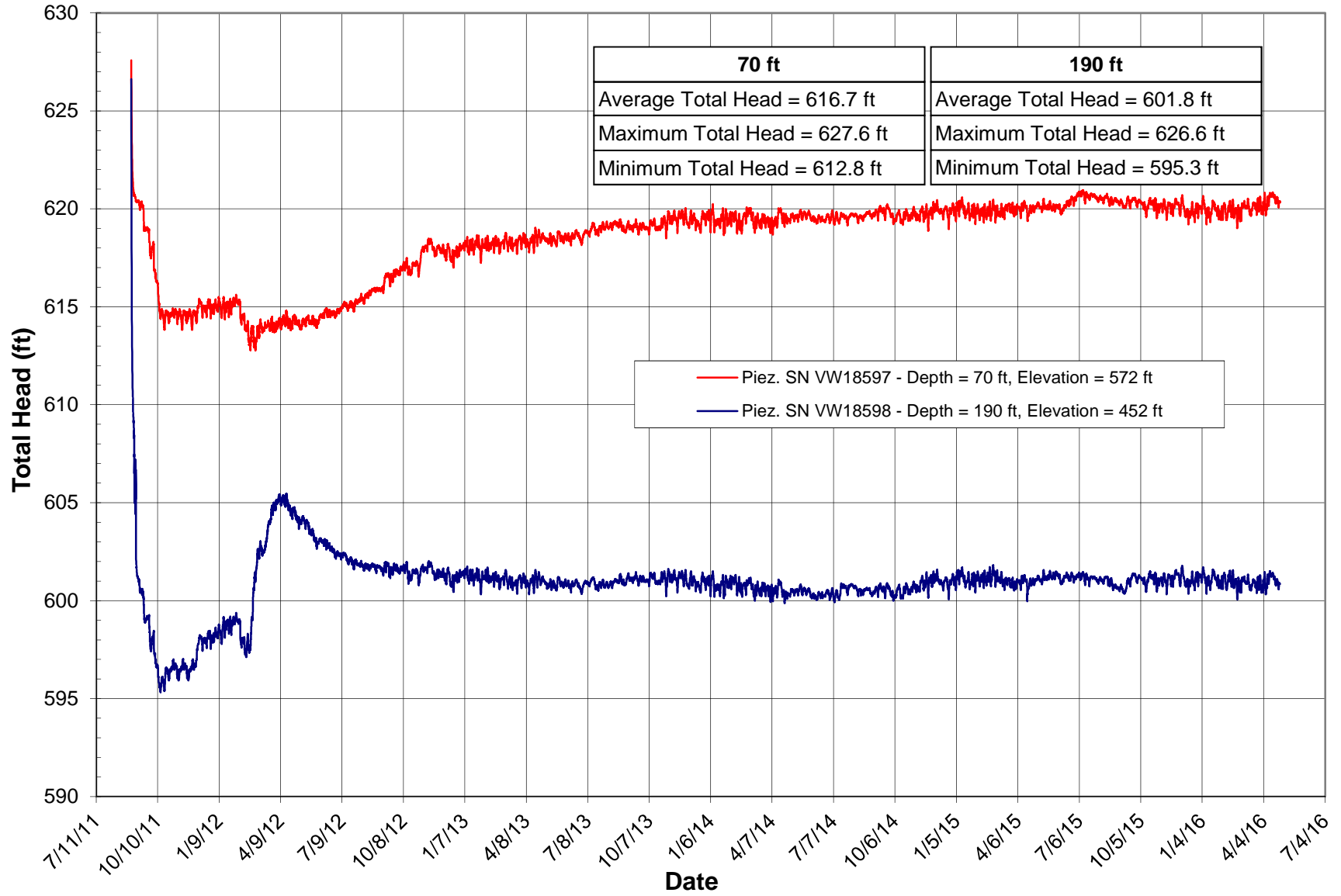
P-001-10 VW Piezometer Readings

Ground surface elevation = 677.05 ft



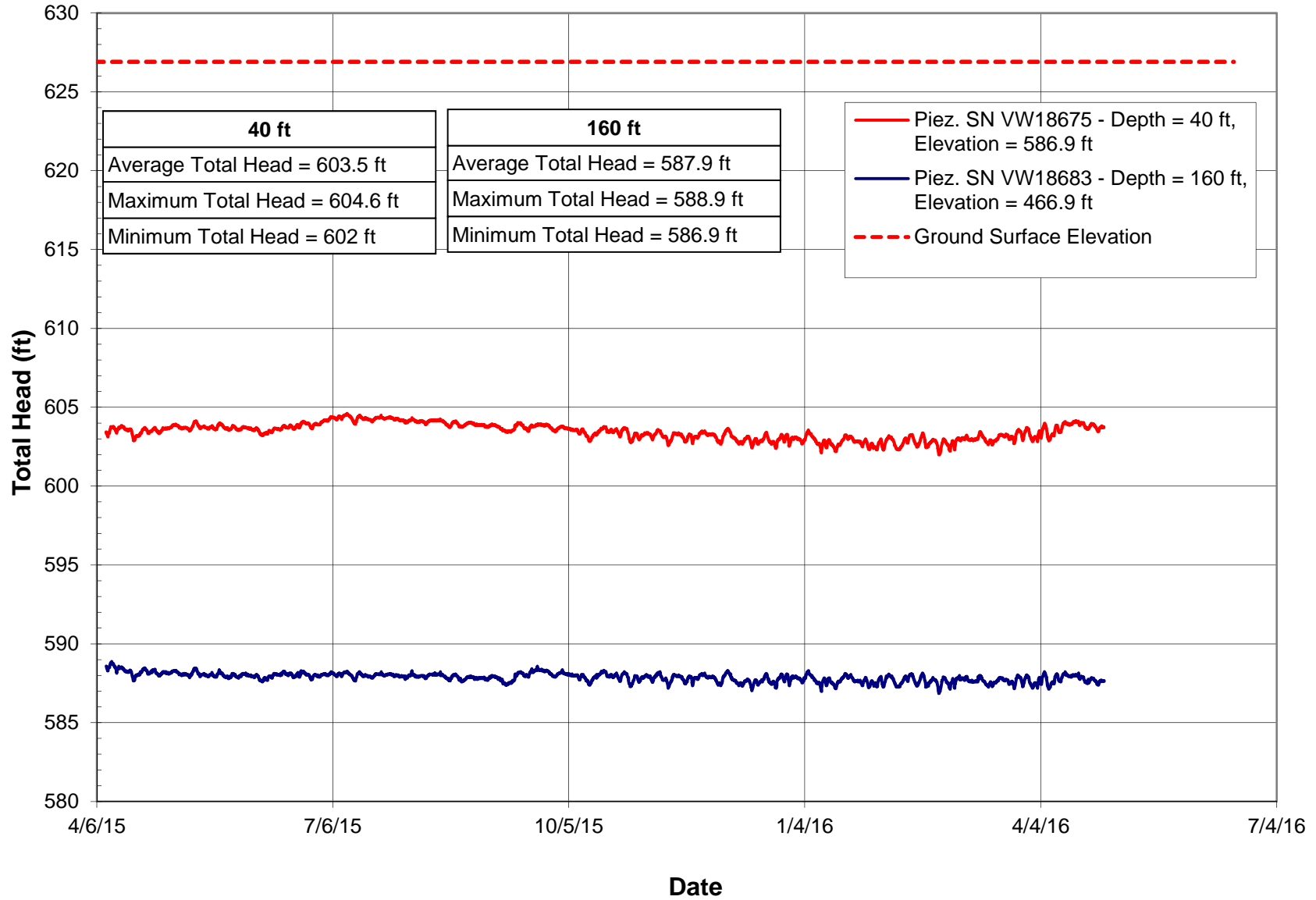
P-002-10 VW Piezometer Readings

Ground surface elevation = 644 ft



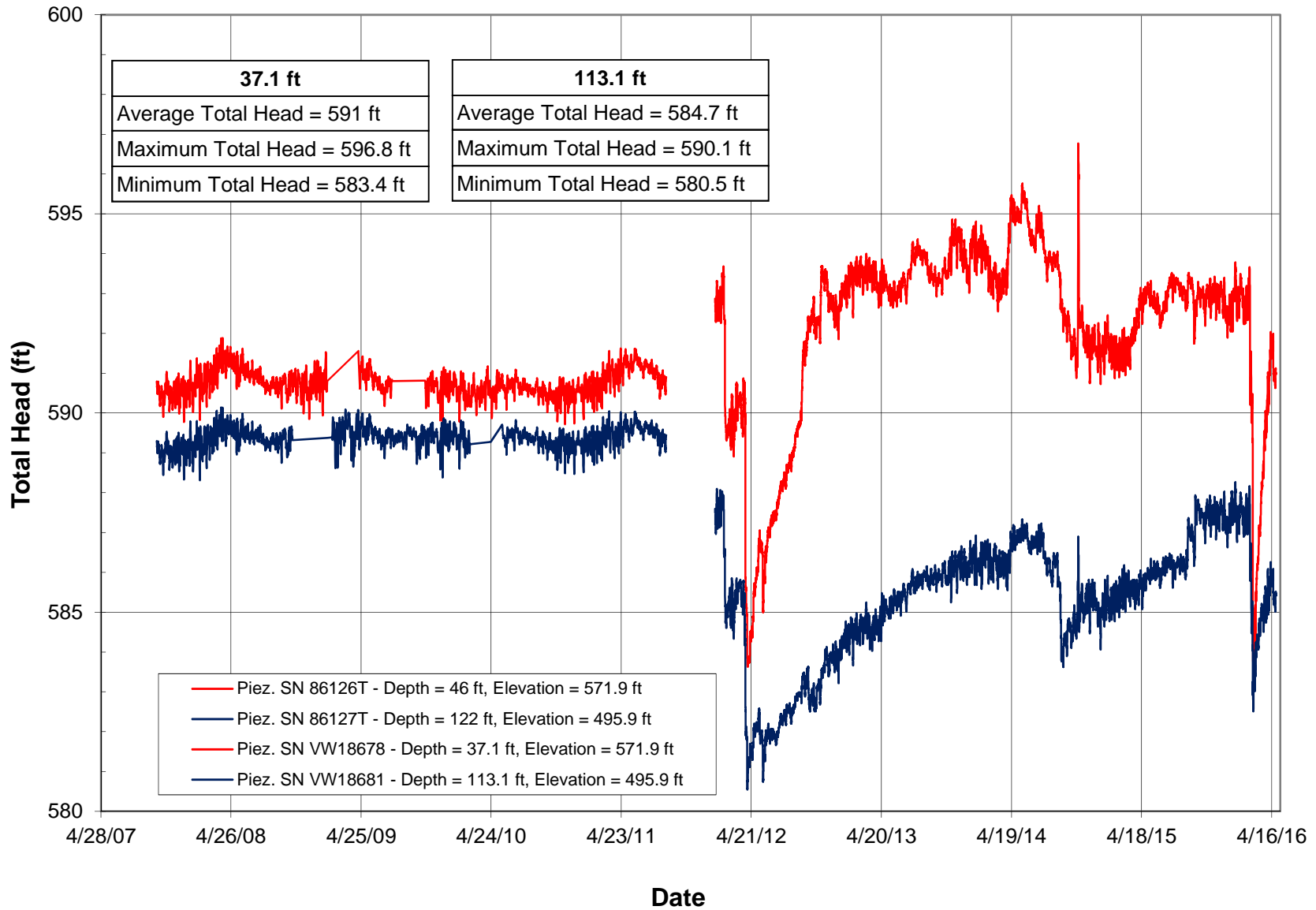
P-007-13 VW Piezometer Readings

Ground surface elevation = 626.9 ft



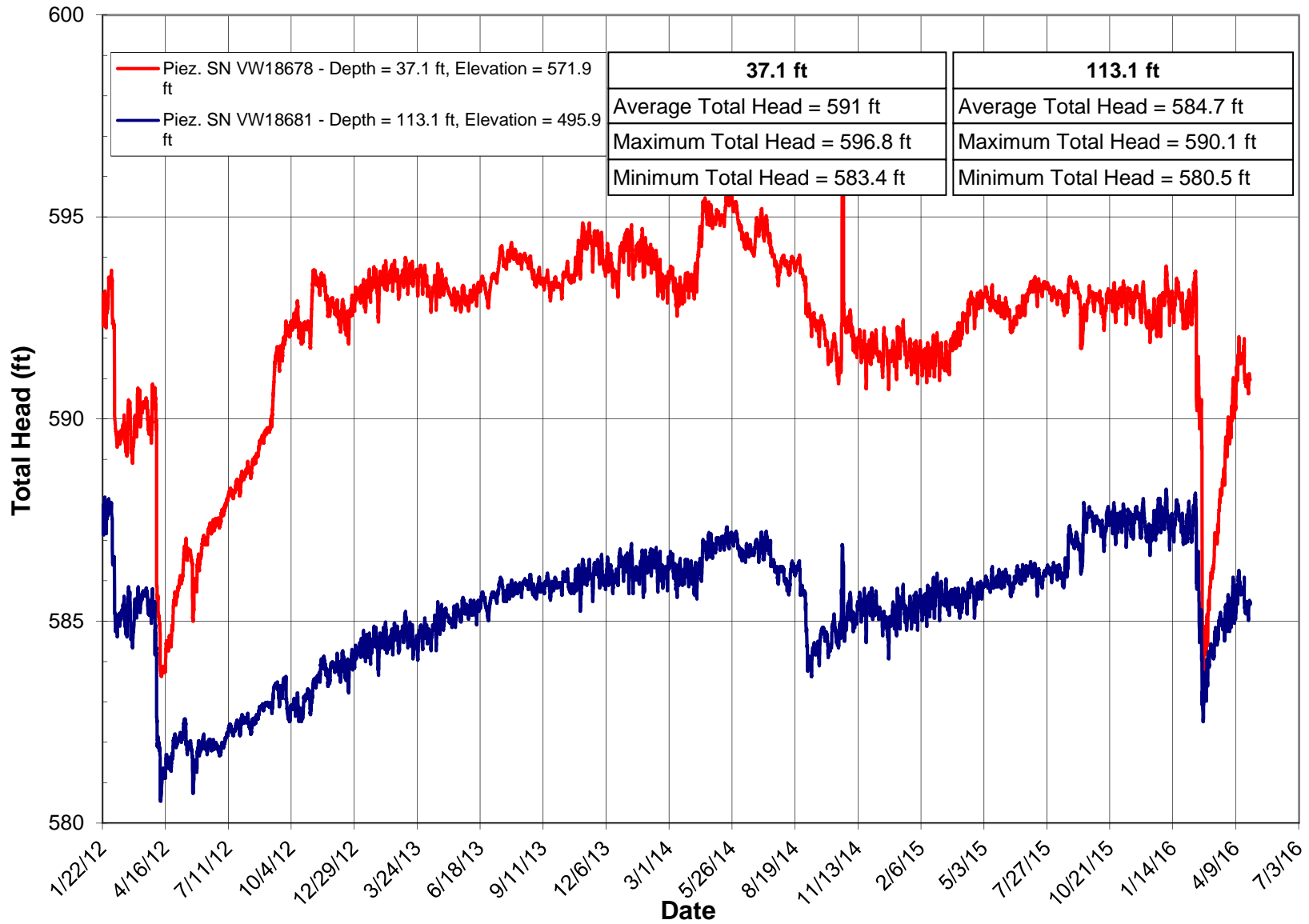
B-05-02 VW Piezometer Readings

Ground surface elevation = approx 609.0 ft



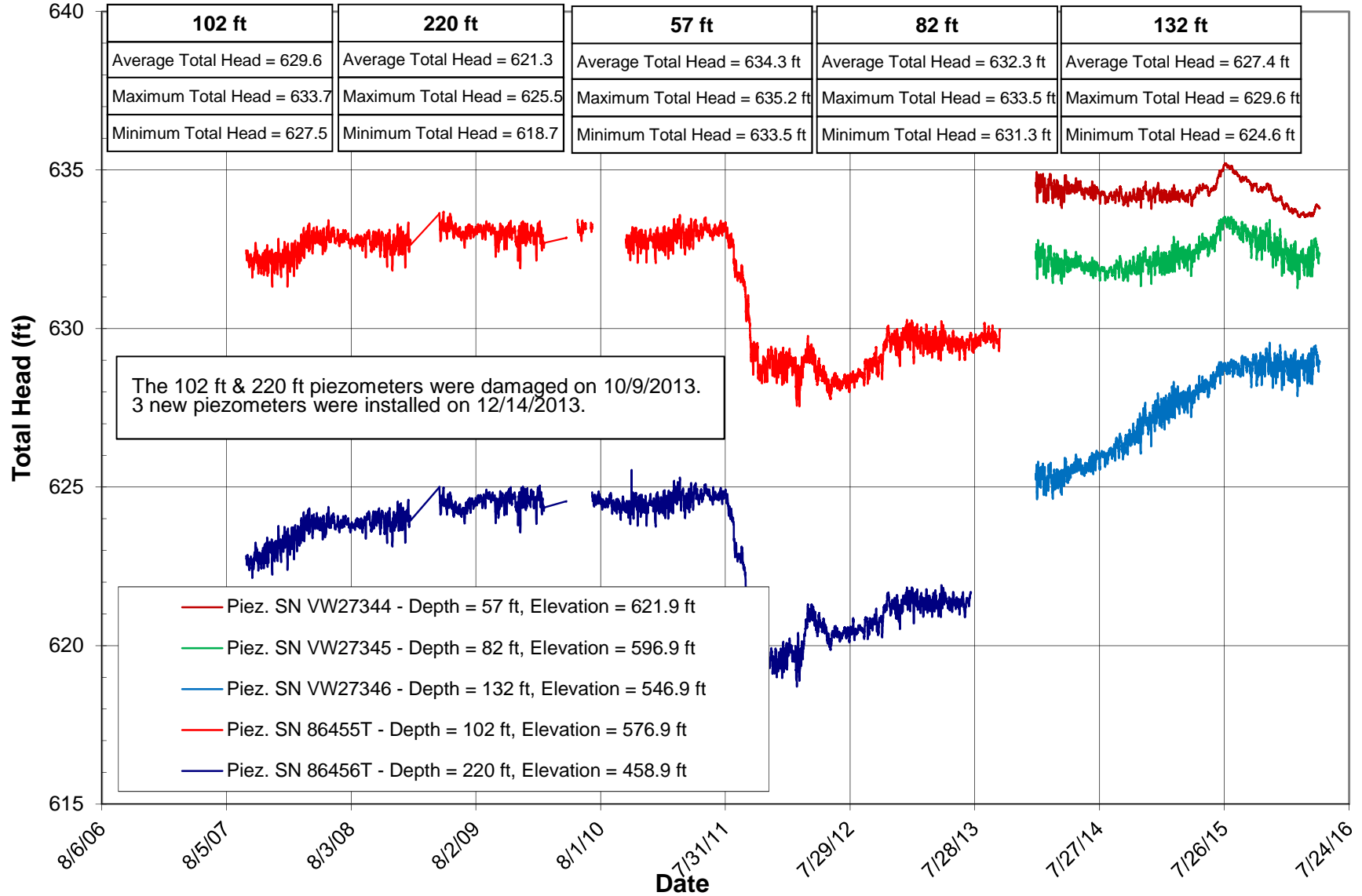
B-05-02 VW Piezometer Readings

Ground surface elevation = approx 609.0 ft



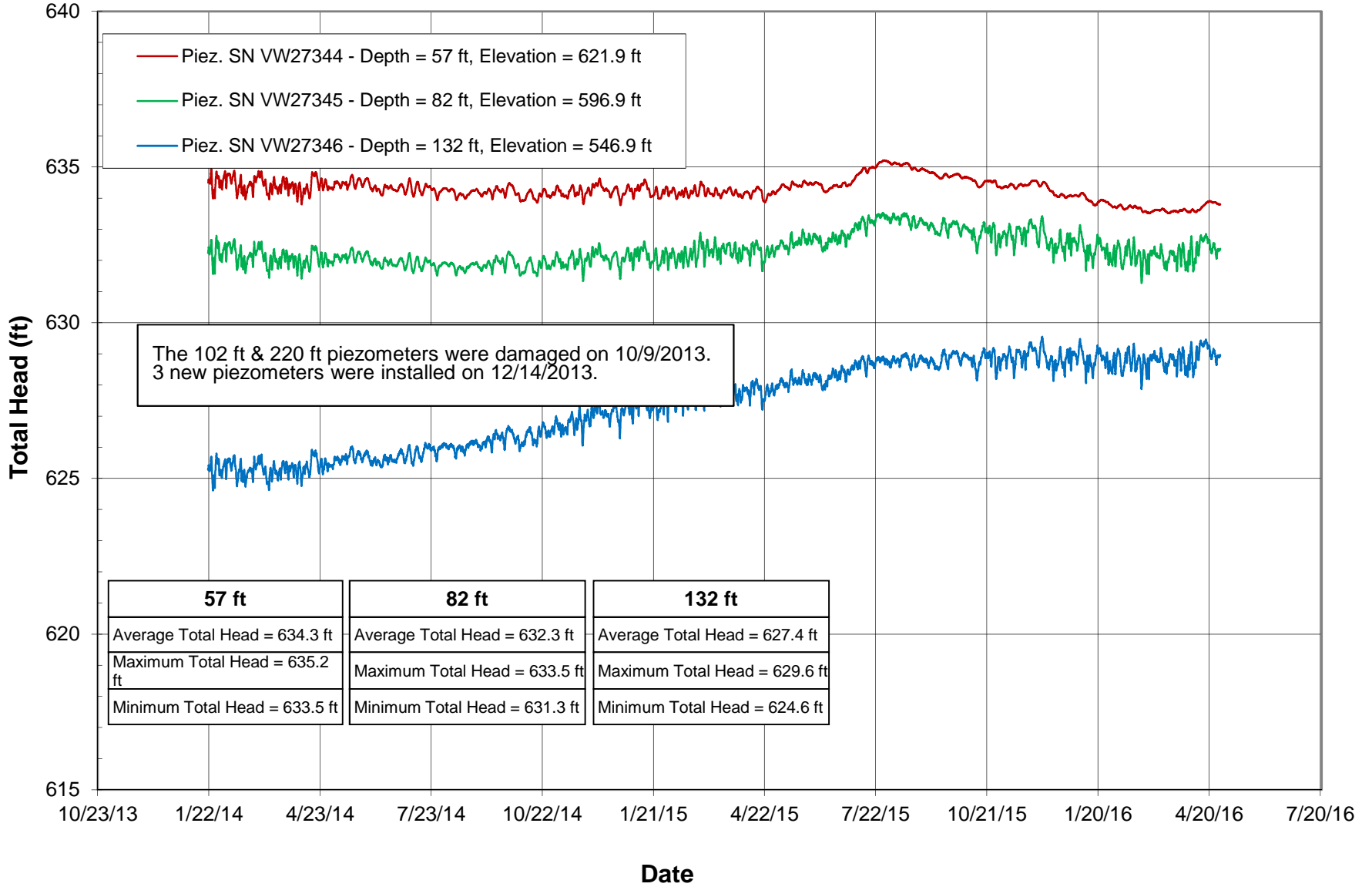
B-05-07 VW Piezometer Readings

Ground surface elevation = 678.9 ft

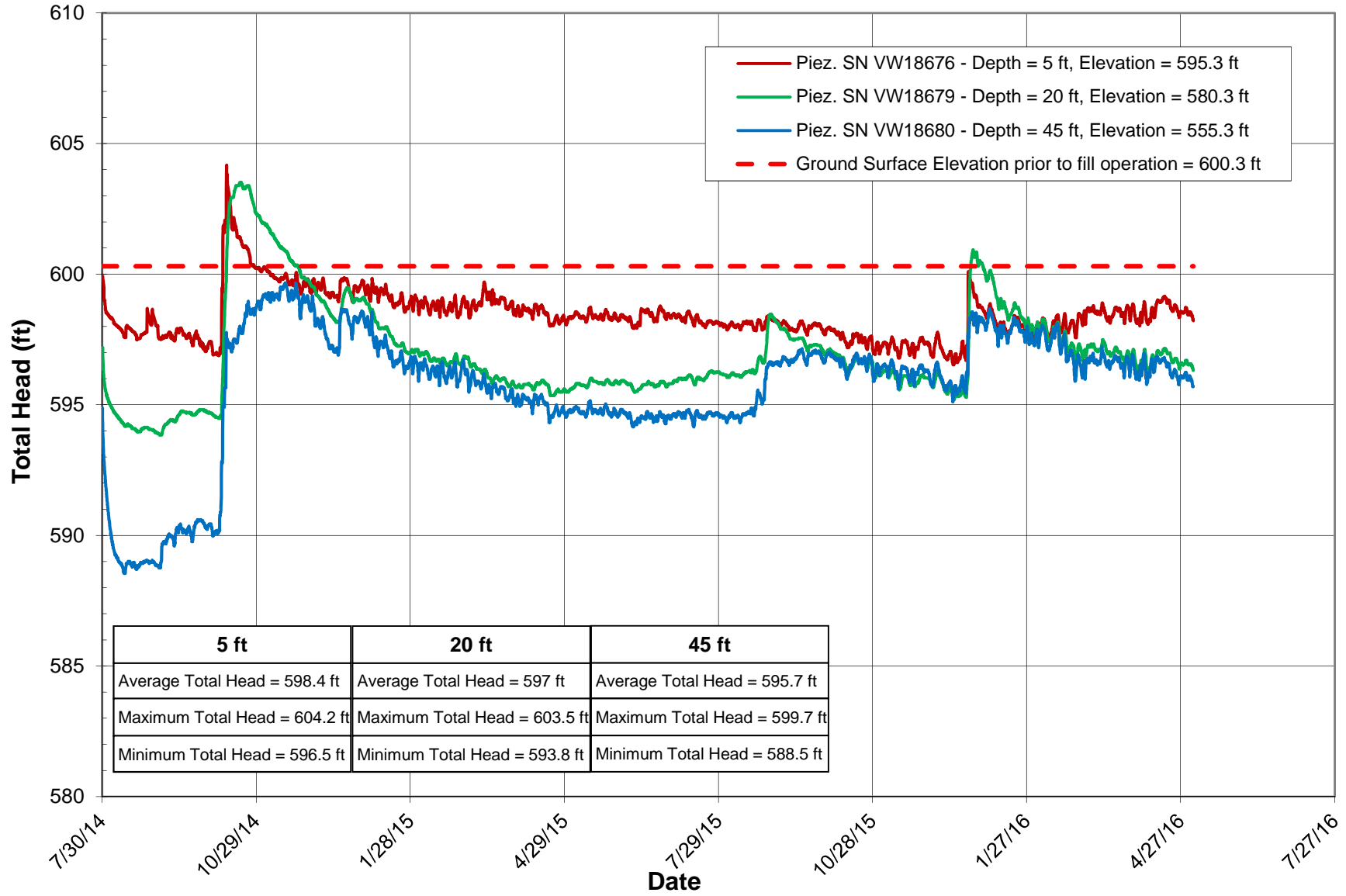


B-05-07 VW Piezometer Readings

Ground surface elevation = 678.9 ft



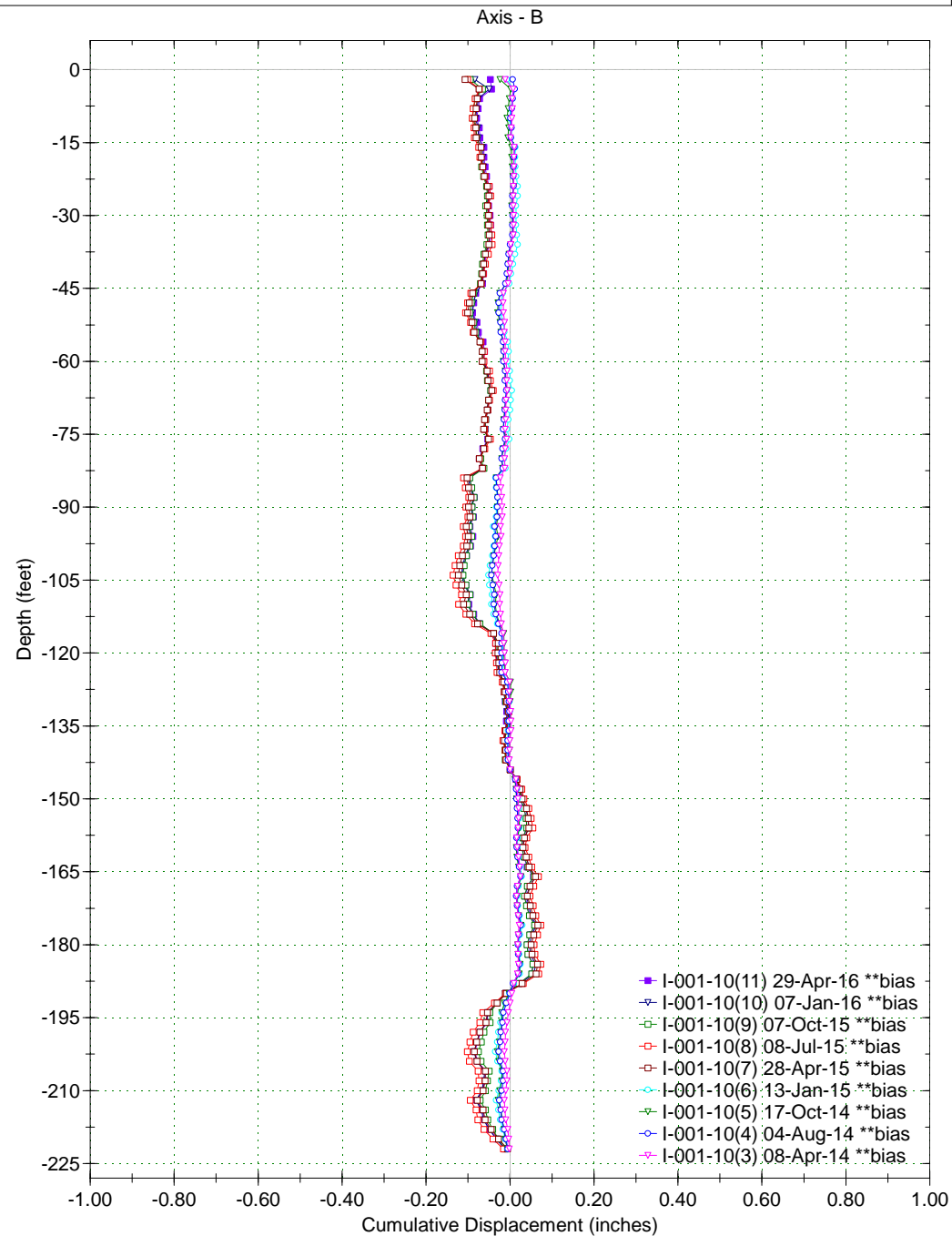
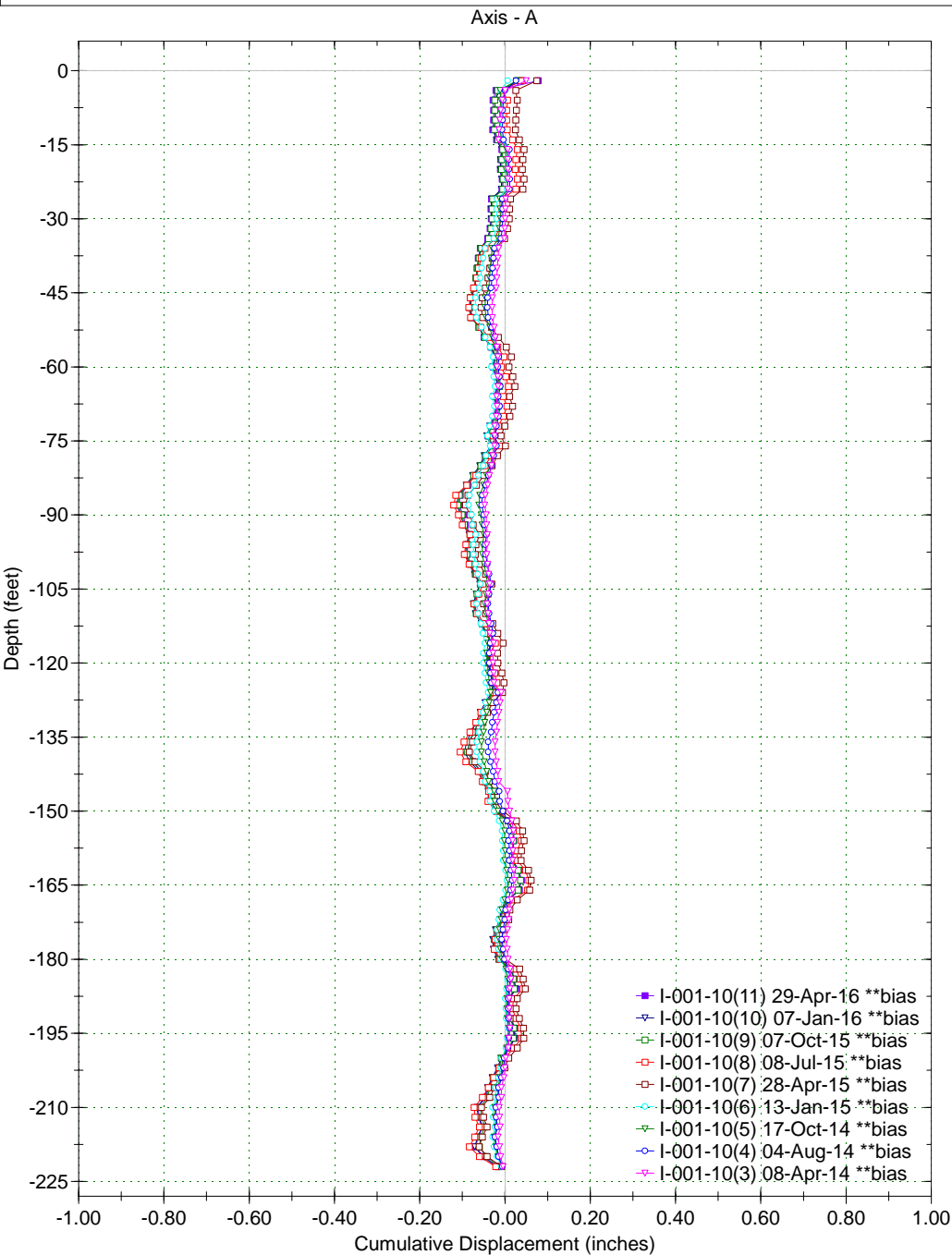
TGR P-3 VW Piezometer Readings



Borehole : I-001-10
Project : CUY-90-15-24
Location : Cleveland, Ohio
Northing : 663346.19
Easting : 2189917.266
Collar :



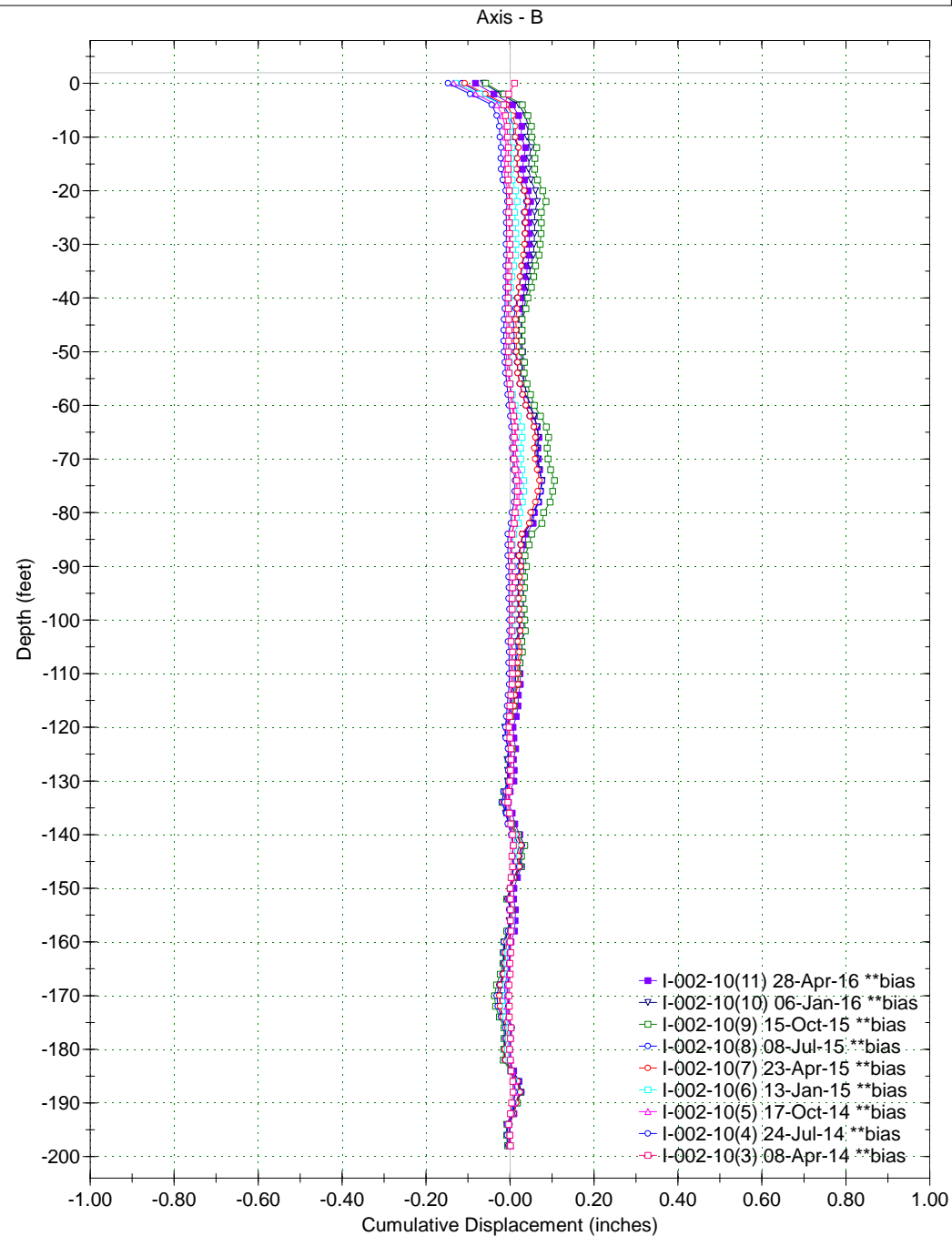
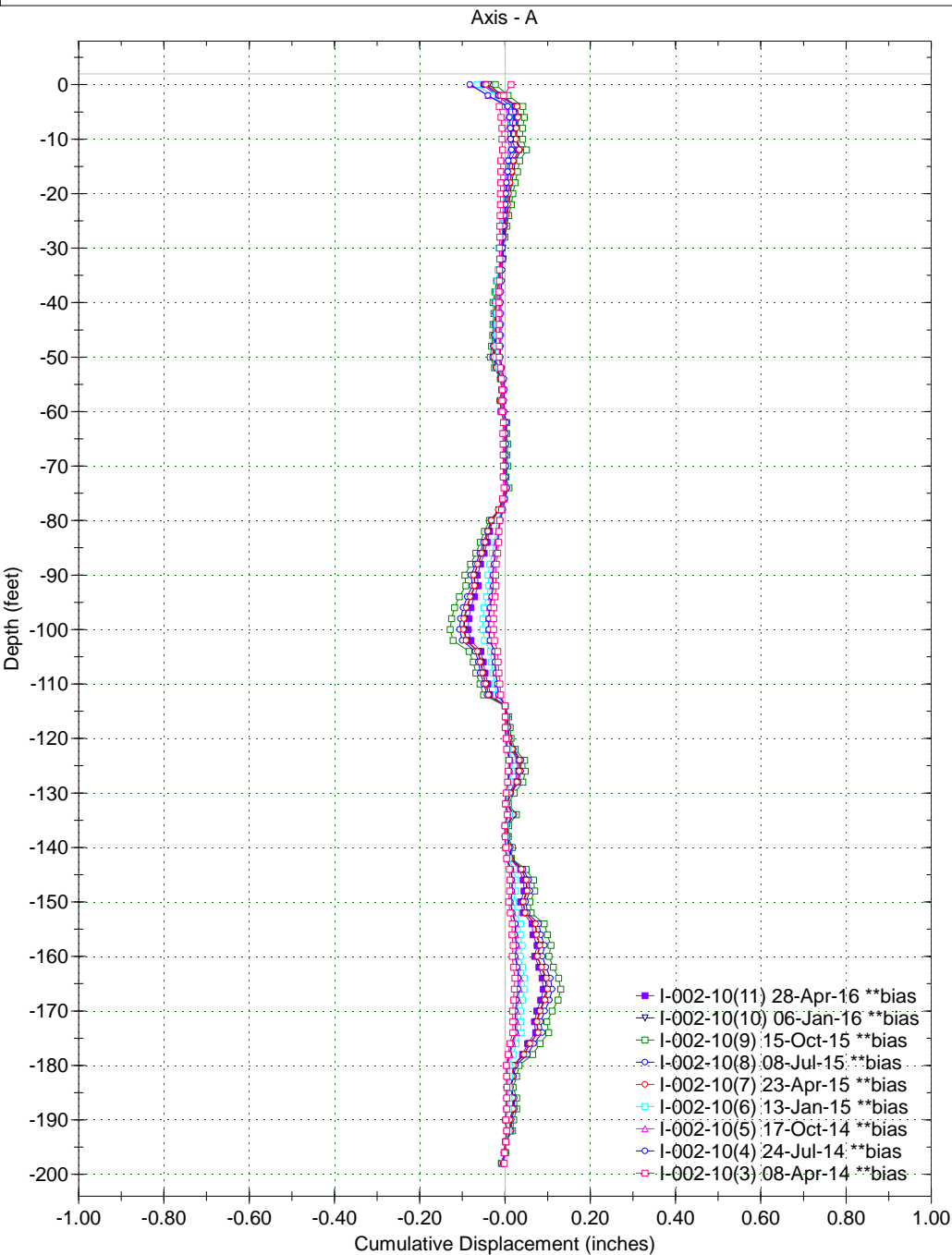
Spiral Correction : N/A
Collar Elevation : 0.0 feet
Borehole Total Depth : 222.0 feet
A+ Groove Azimuth :
Base Reading : 2014 Jan 10 07:36
Applied Azimuth : 0.0 degrees



Borehole : I-002-10
Project : CUY-90-15-24
Location : Cleveland, Ohio
Northing : 663622.262
Easting : 2189778.413
Collar :



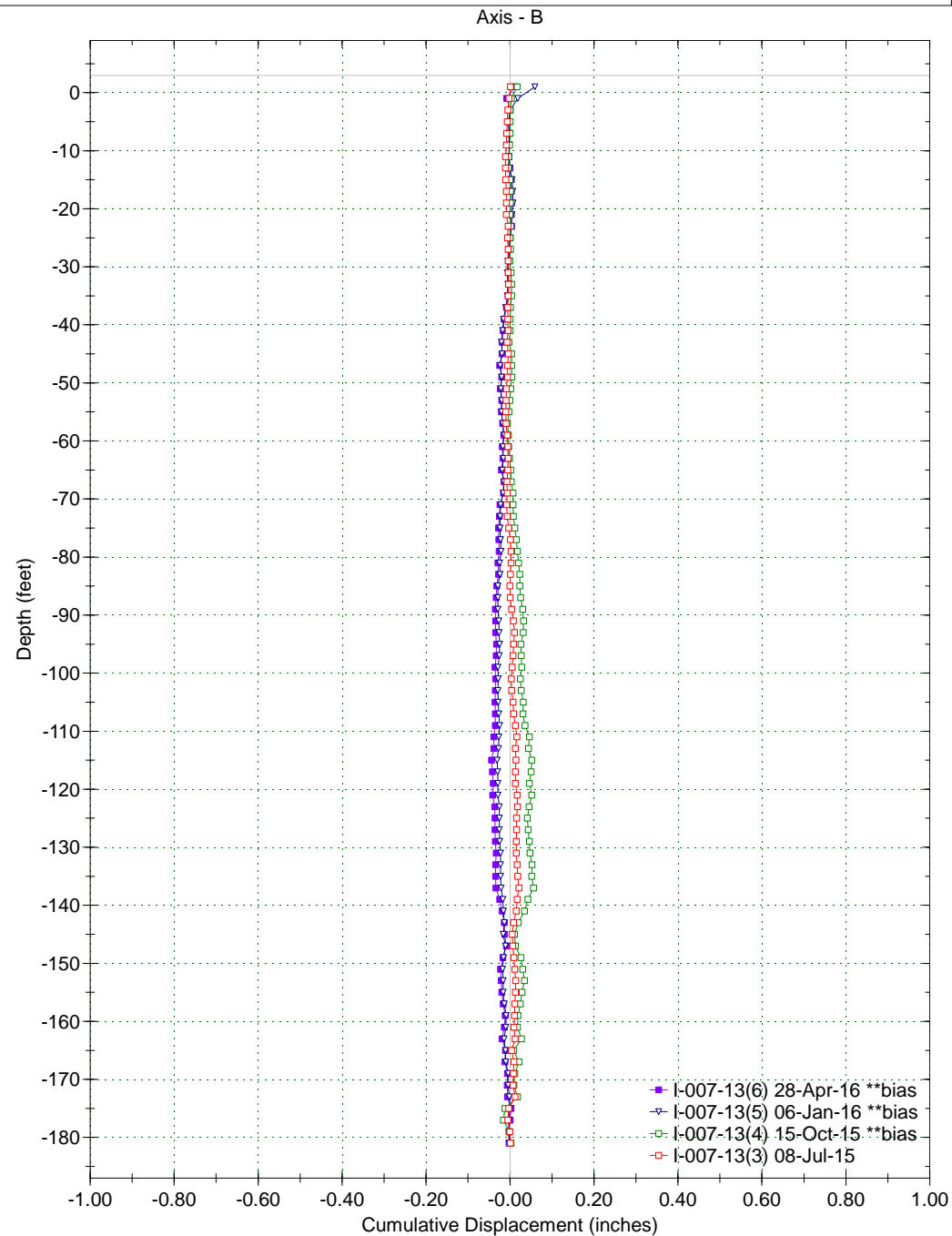
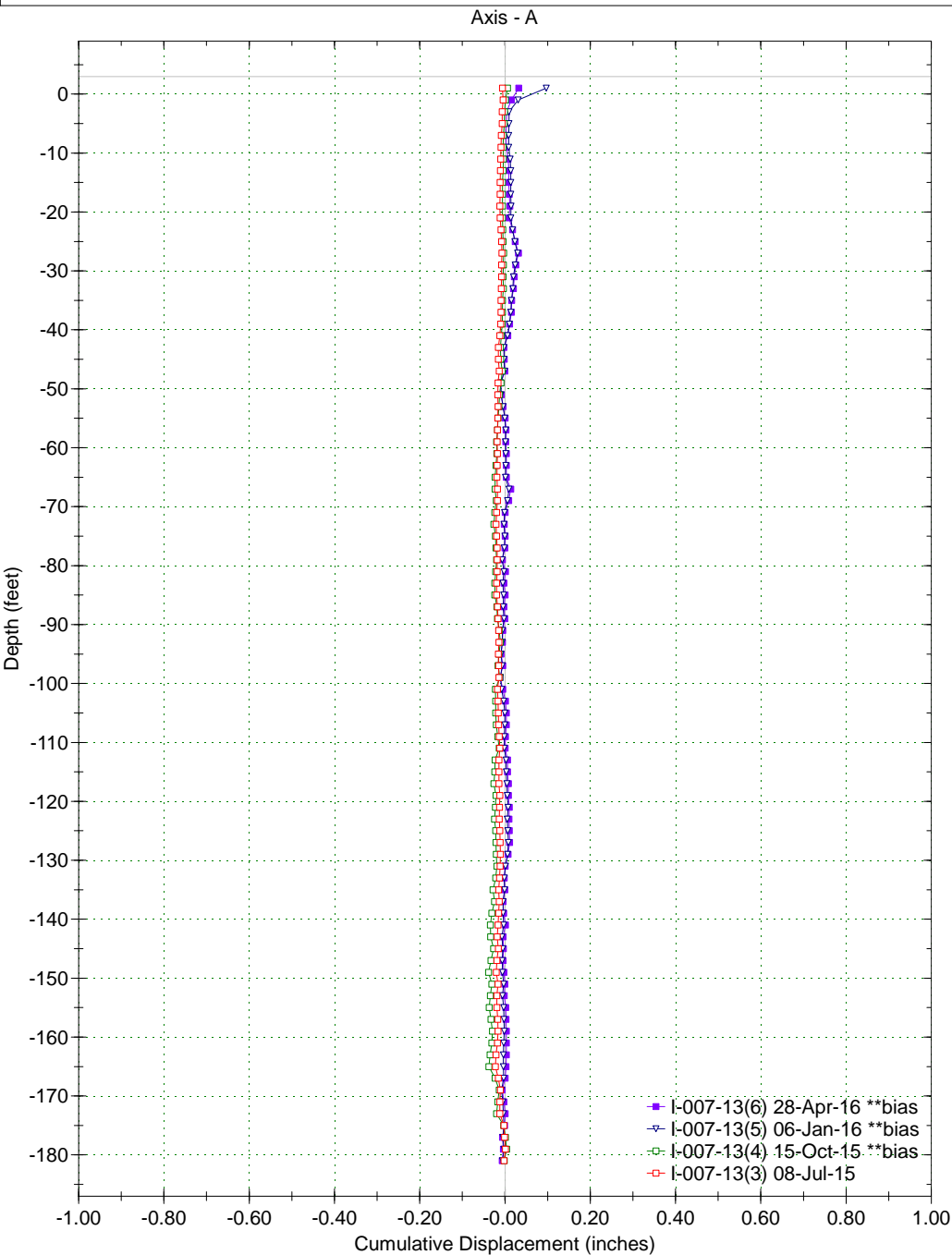
Spiral Correction : N/A
Collar Elevation : 2.0 feet
Borehole Total Depth : 200.0 feet
A+ Groove Azimuth :
Base Reading : 2014 Jan 09 09:59
Applied Azimuth : 0.0 degrees



Borehole : I-007-13
Project : CUY-90-15-24
Location :
Northing :
Easting :
Collar :



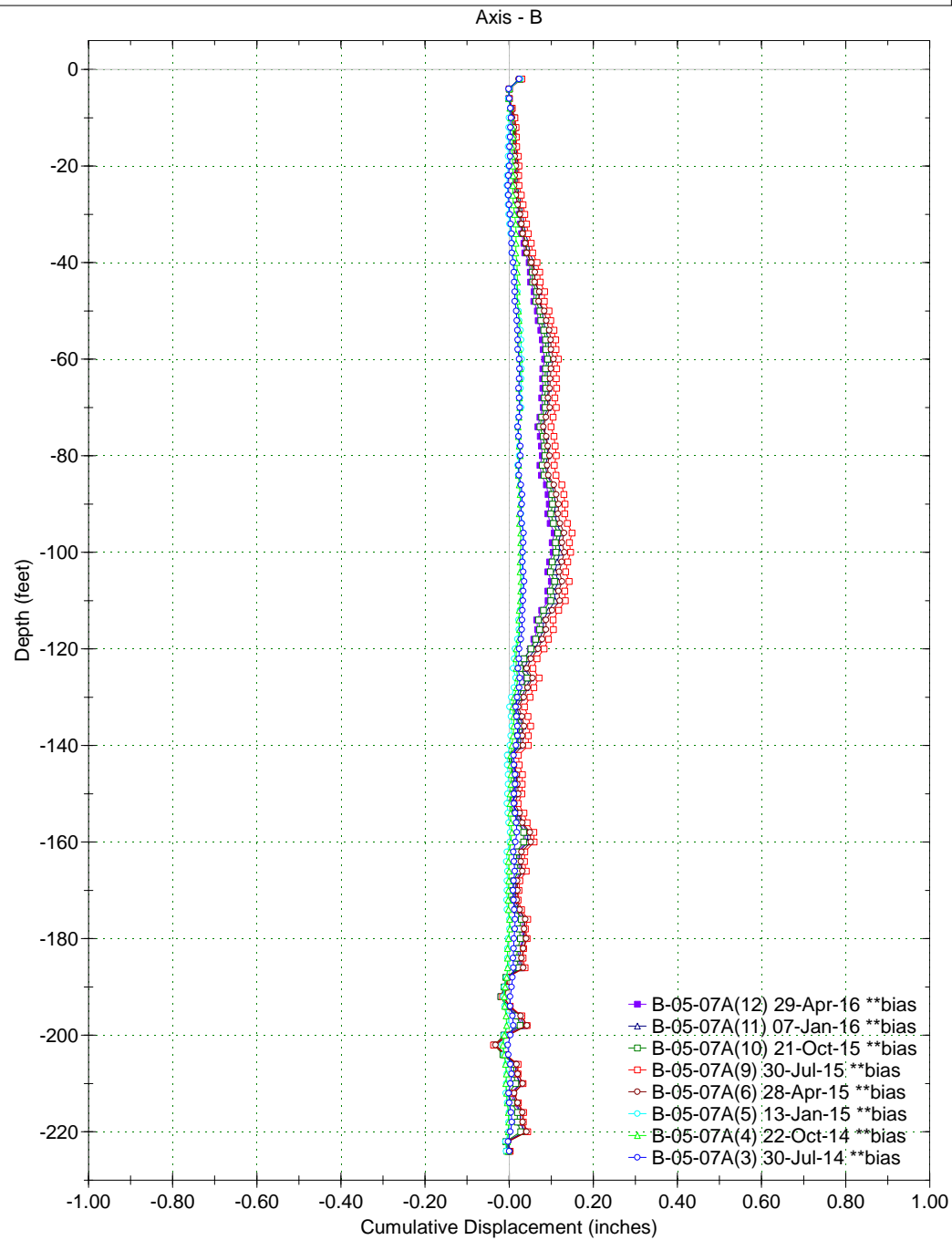
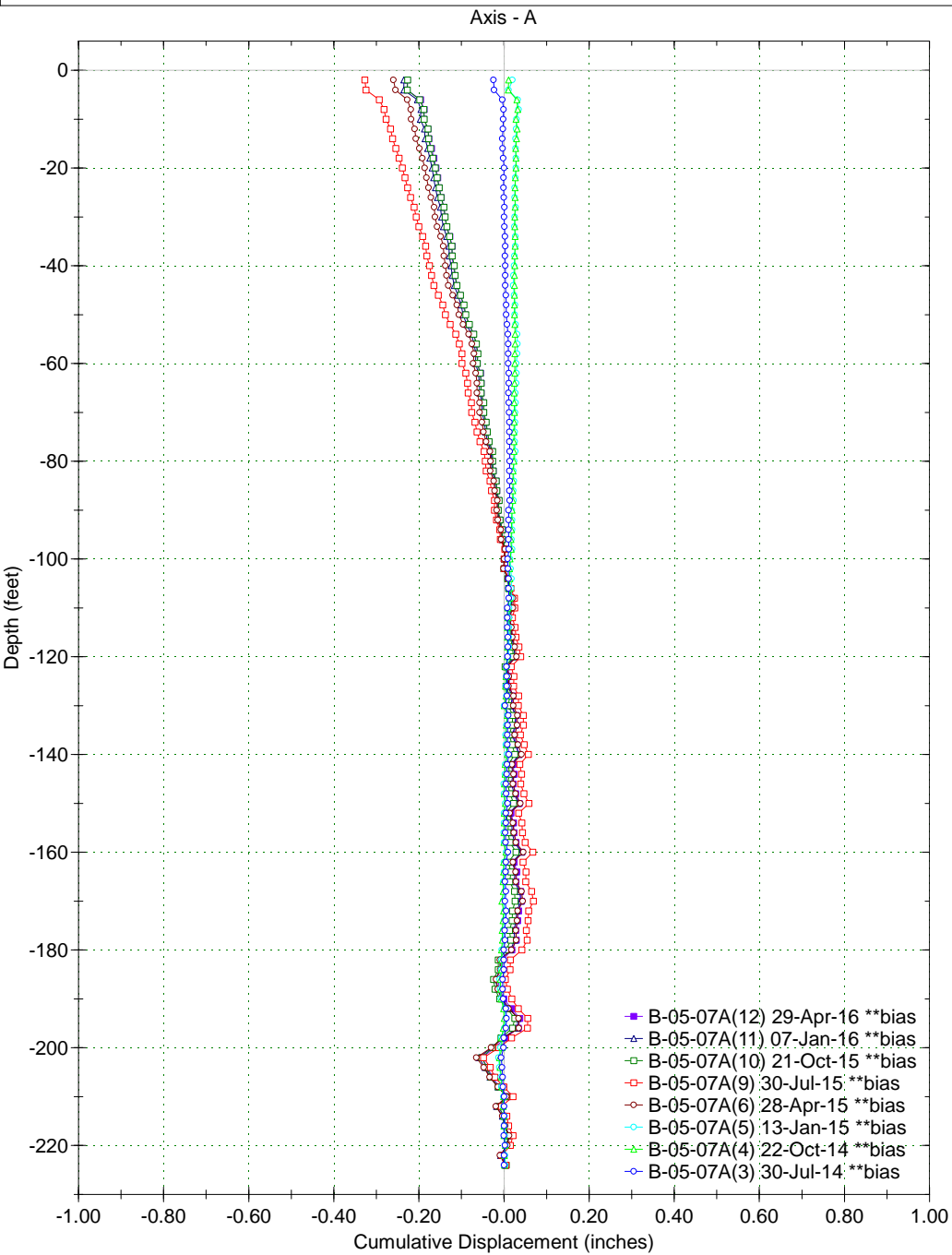
Spiral Correction : N/A
Collar Elevation : 3.0 feet
Borehole Total Depth : 184.0 feet
A+ Groove Azimuth :
Base Reading : 2015 Apr 28 15:31
Applied Azimuth : 0.0 degrees



Borehole : B-05-07A
Project : CUY-90-15-24
Location : Cleveland, Ohio
Northing : 663369.991
Easting : 2189805.799
Collar :



Spiral Correction : N/A
Collar Elevation : 0.0 feet
Borehole Total Depth : 224.0 feet
A+ Groove Azimuth :
Base Reading : 2014 Apr 11 09:50
Applied Azimuth : 0.0 degrees

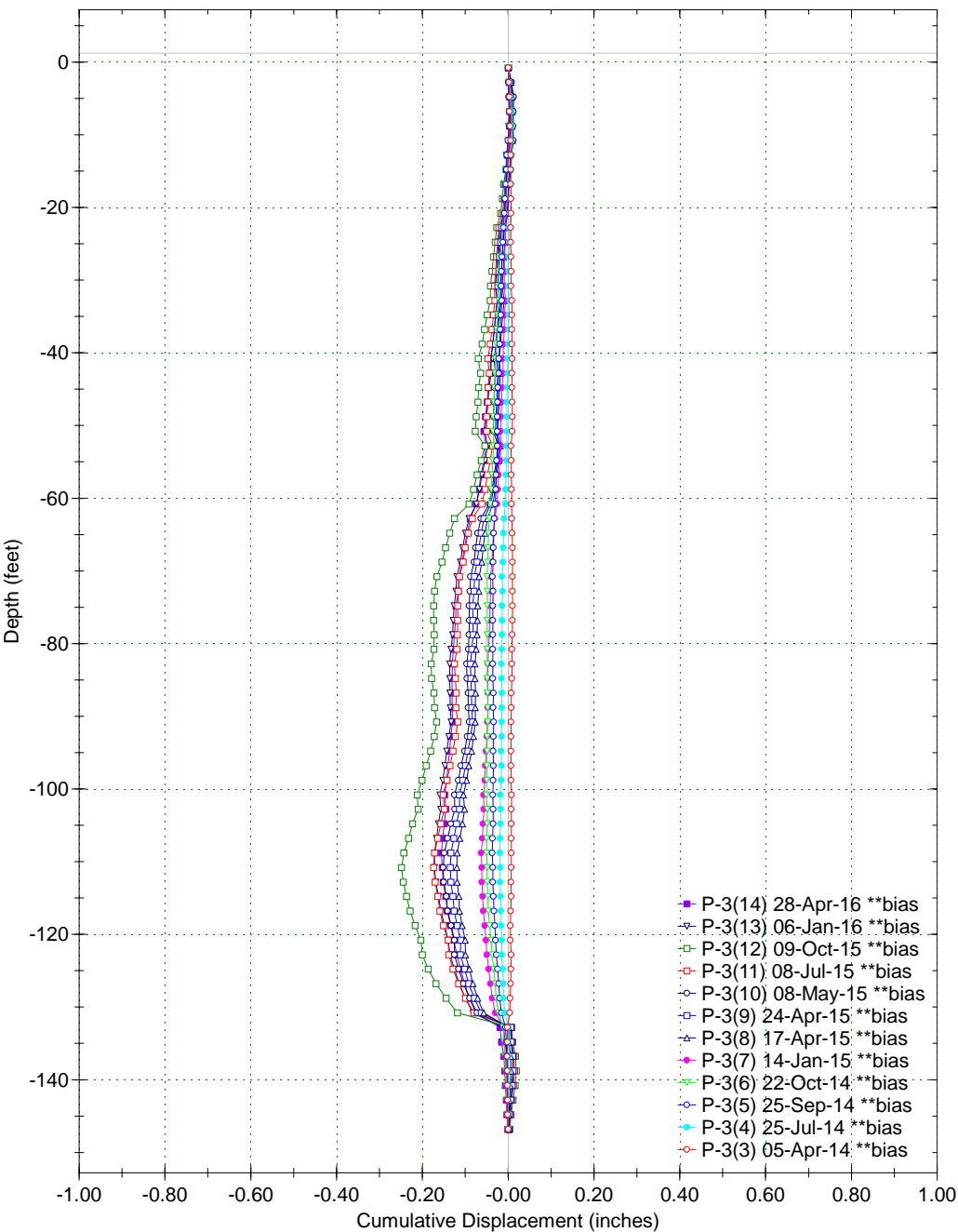


Borehole : P-3
Project : CUY-90-15-24
Location : Cleveland, Ohio
Northing :
Easting :
Collar :

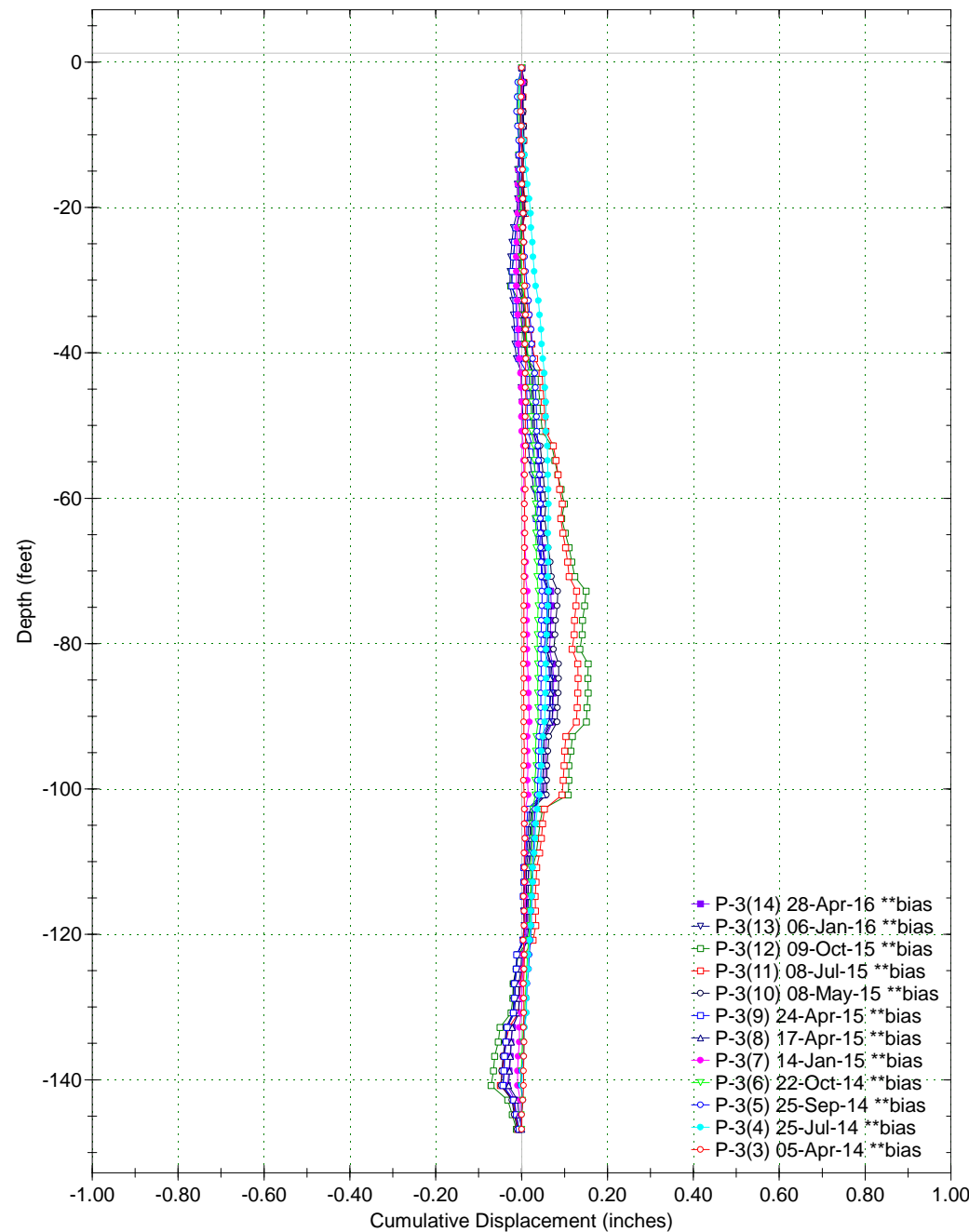


Spiral Correction : N/A
Collar Elevation : 1.2 feet
Borehole Total Depth : 148.0 feet
A+ Groove Azimuth :
Base Reading : 2014 Jan 21 10:48
Applied Azimuth : 0.0 degrees

Axis - A



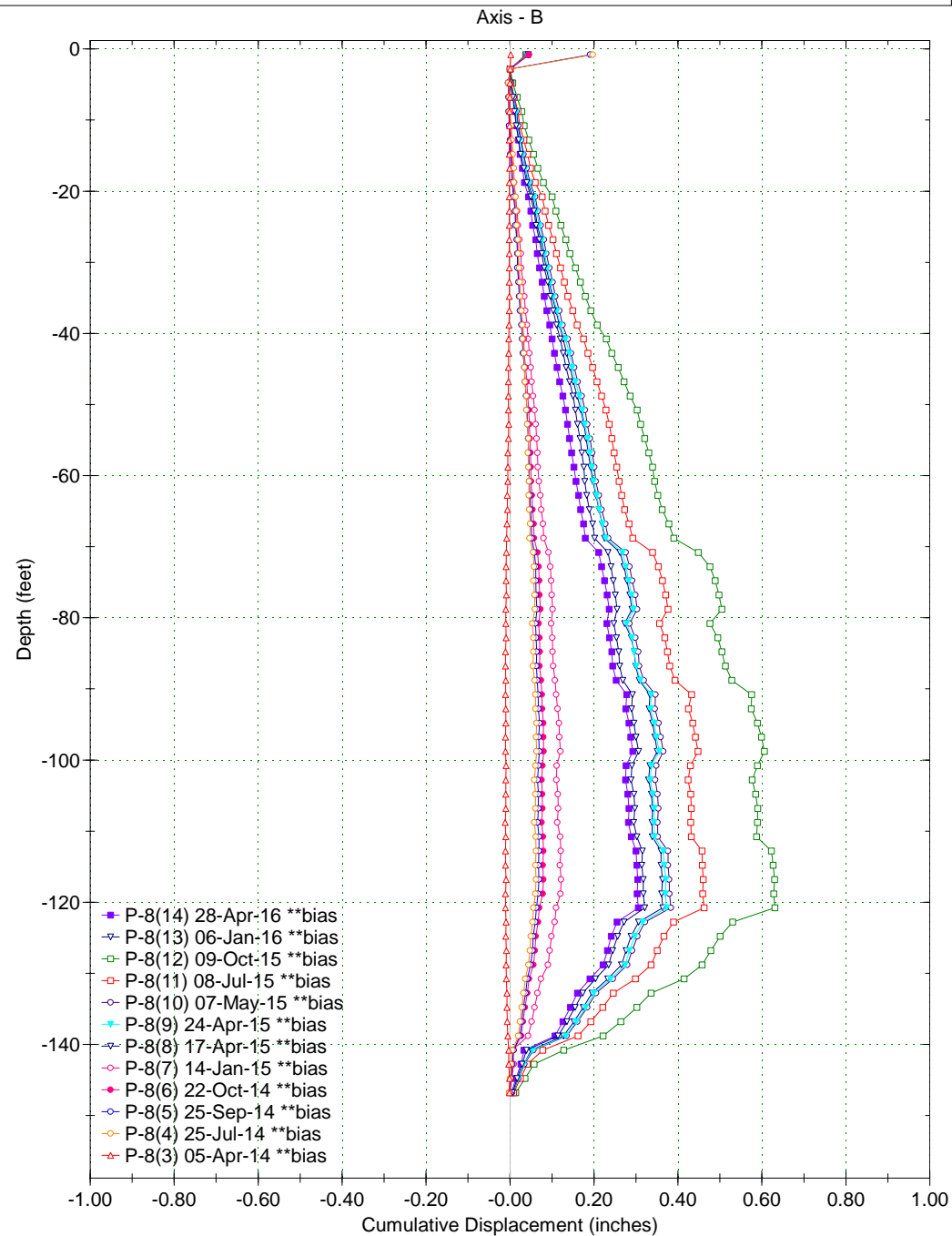
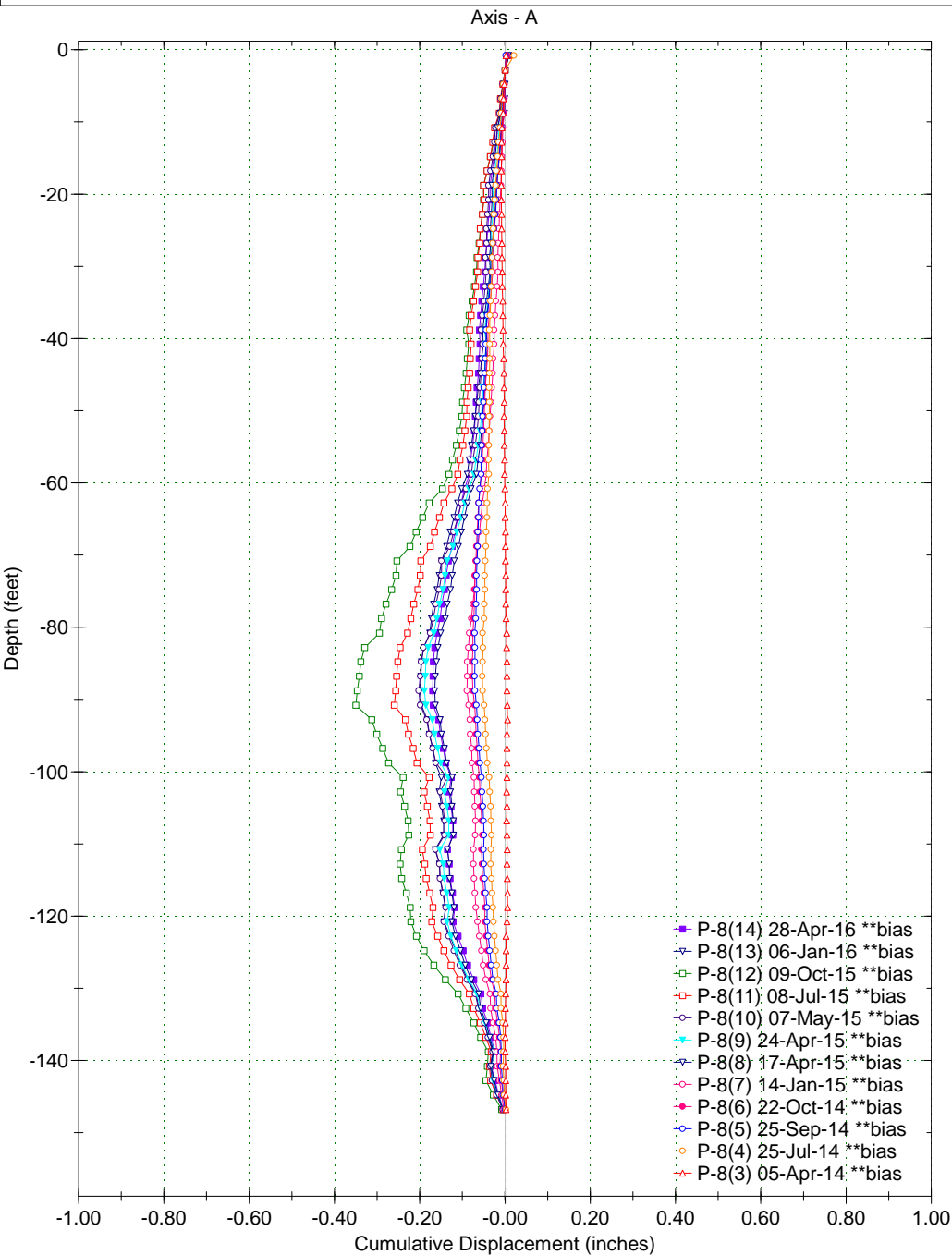
Axis - B



Borehole : P-8
Project : CUY-90-15-24
Location : Cleveland, Ohio
Northing :
Easting :
Collar :



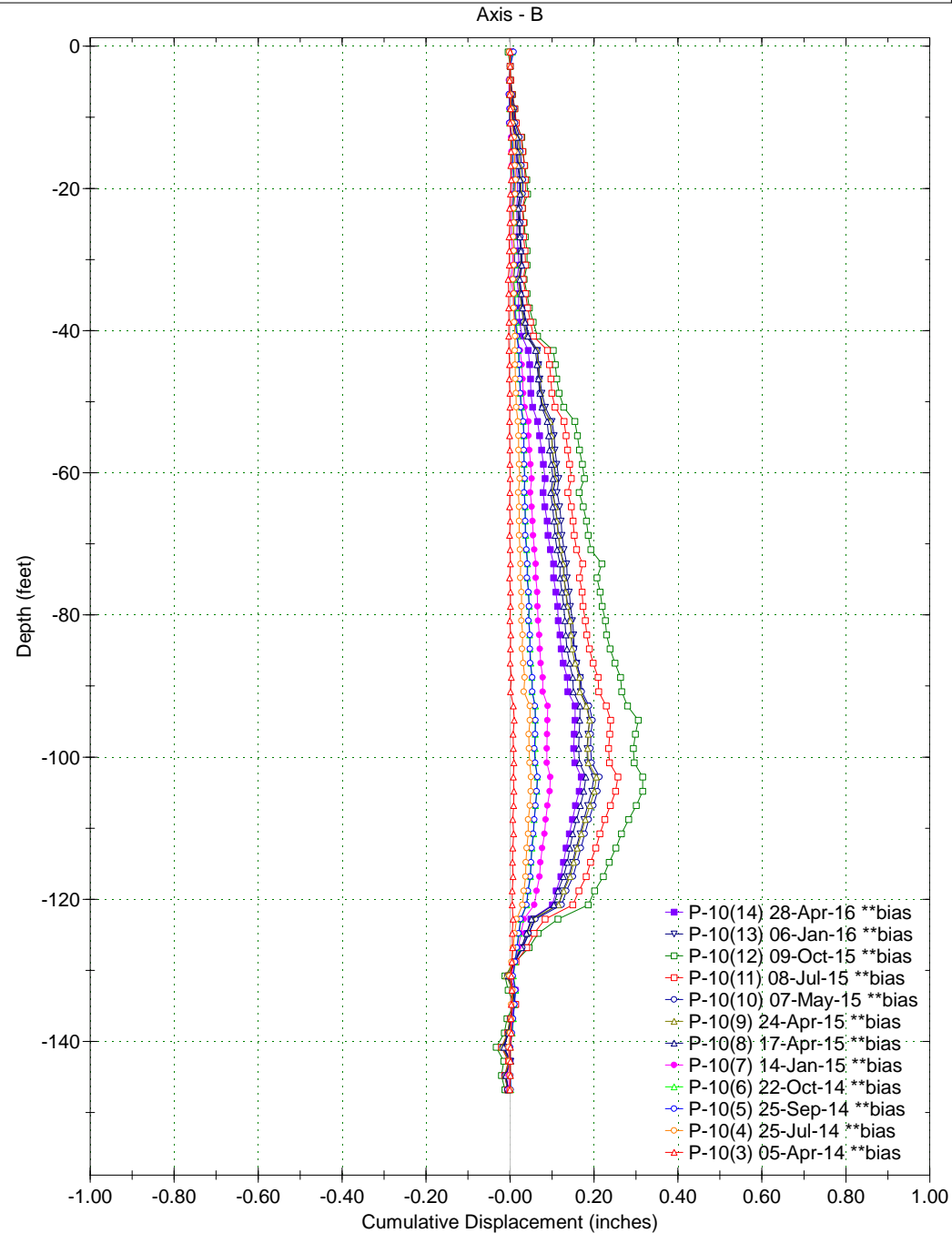
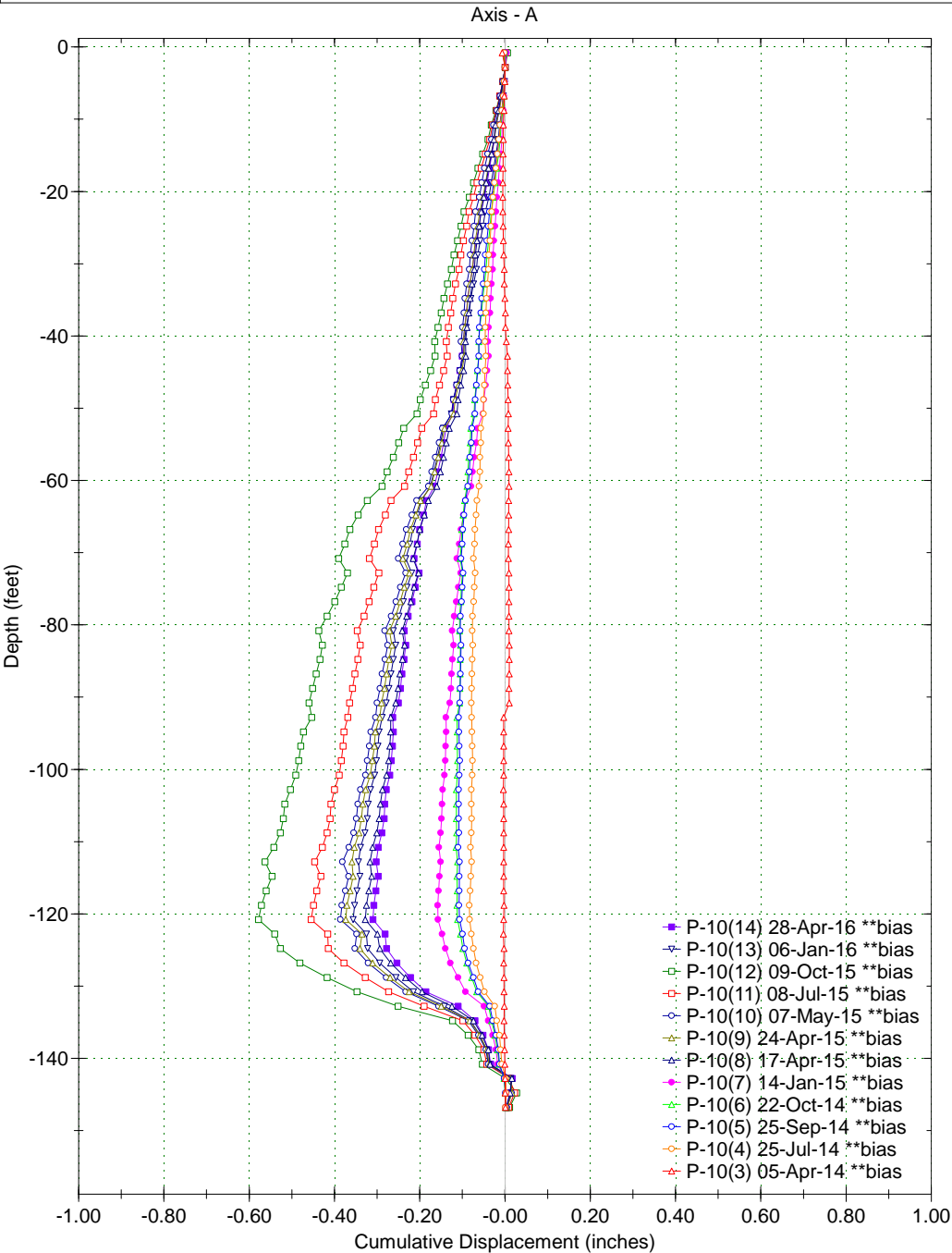
Spiral Correction : N/A
Collar Elevation : 1.2 feet
Borehole Total Depth : 148.0 feet
A+ Groove Azimuth :
Base Reading : 2014 Jan 16 10:23
Applied Azimuth : 0.0 degrees



Borehole : P-10
Project : CUY-90-15-24
Location : Cleveland, Ohio
Northing :
Easting :
Collar :



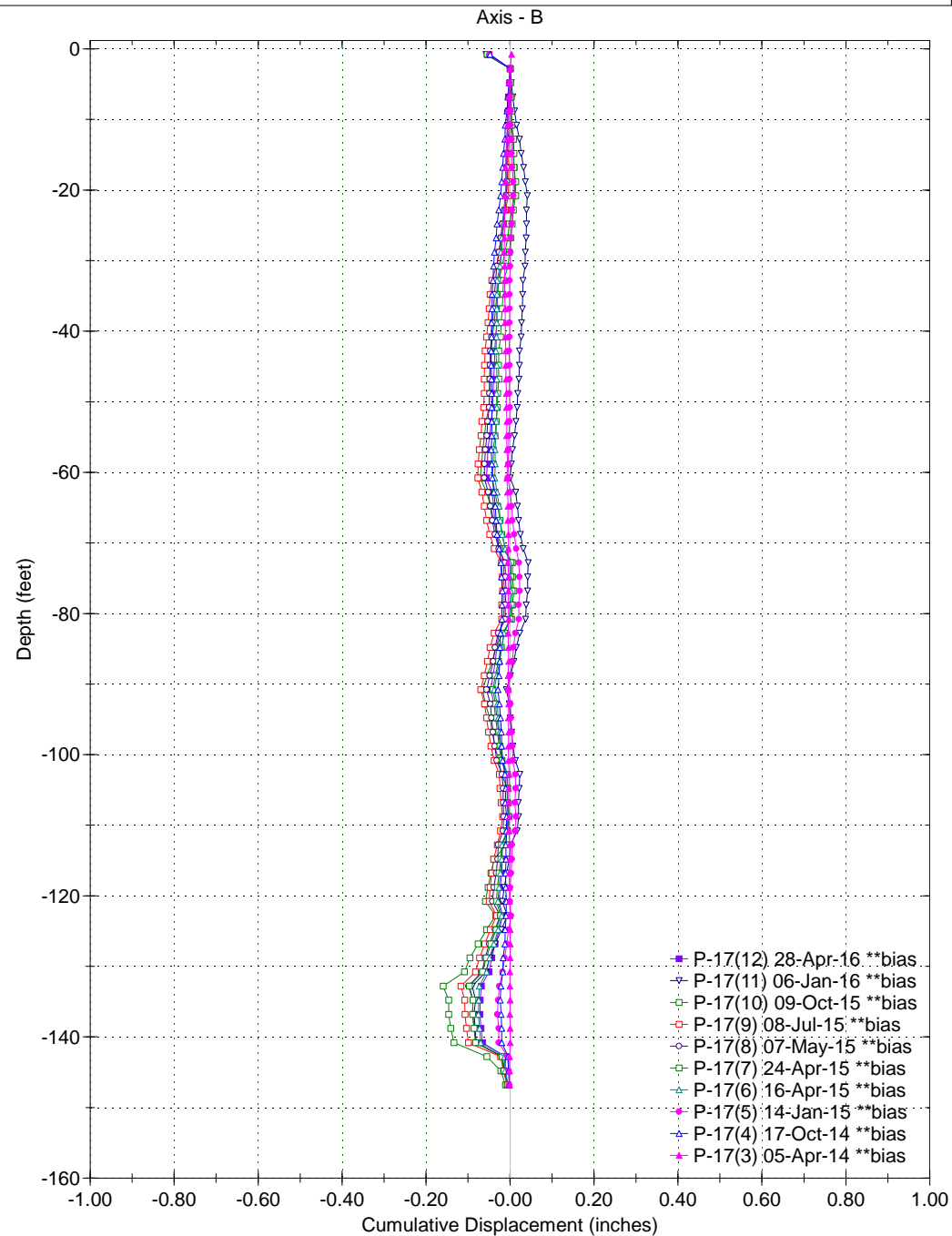
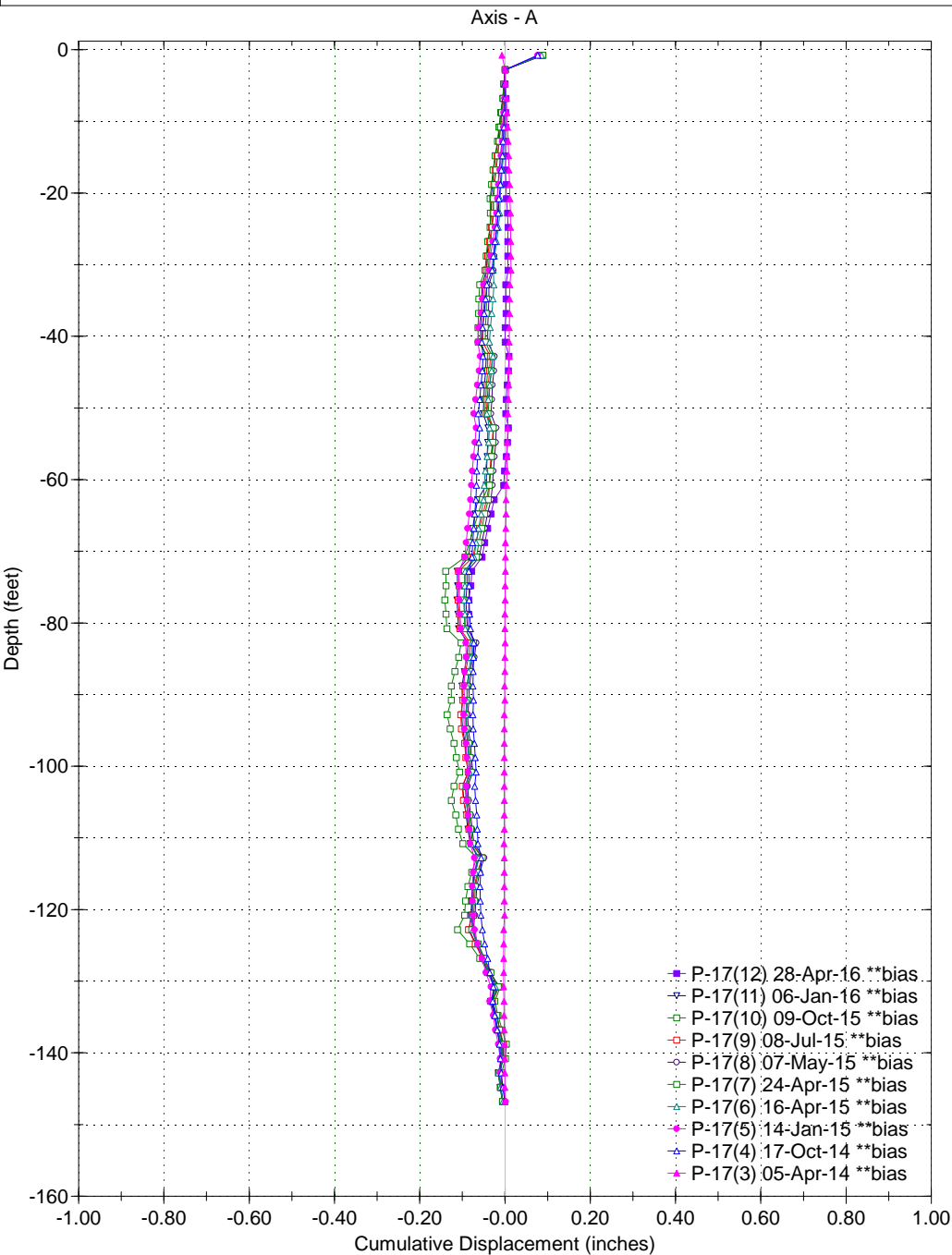
Spiral Correction : N/A
Collar Elevation : 1.2 feet
Borehole Total Depth : 148.0 feet
A+ Groove Azimuth :
Base Reading : 2014 Jan 16 06:45
Applied Azimuth : 0.0 degrees



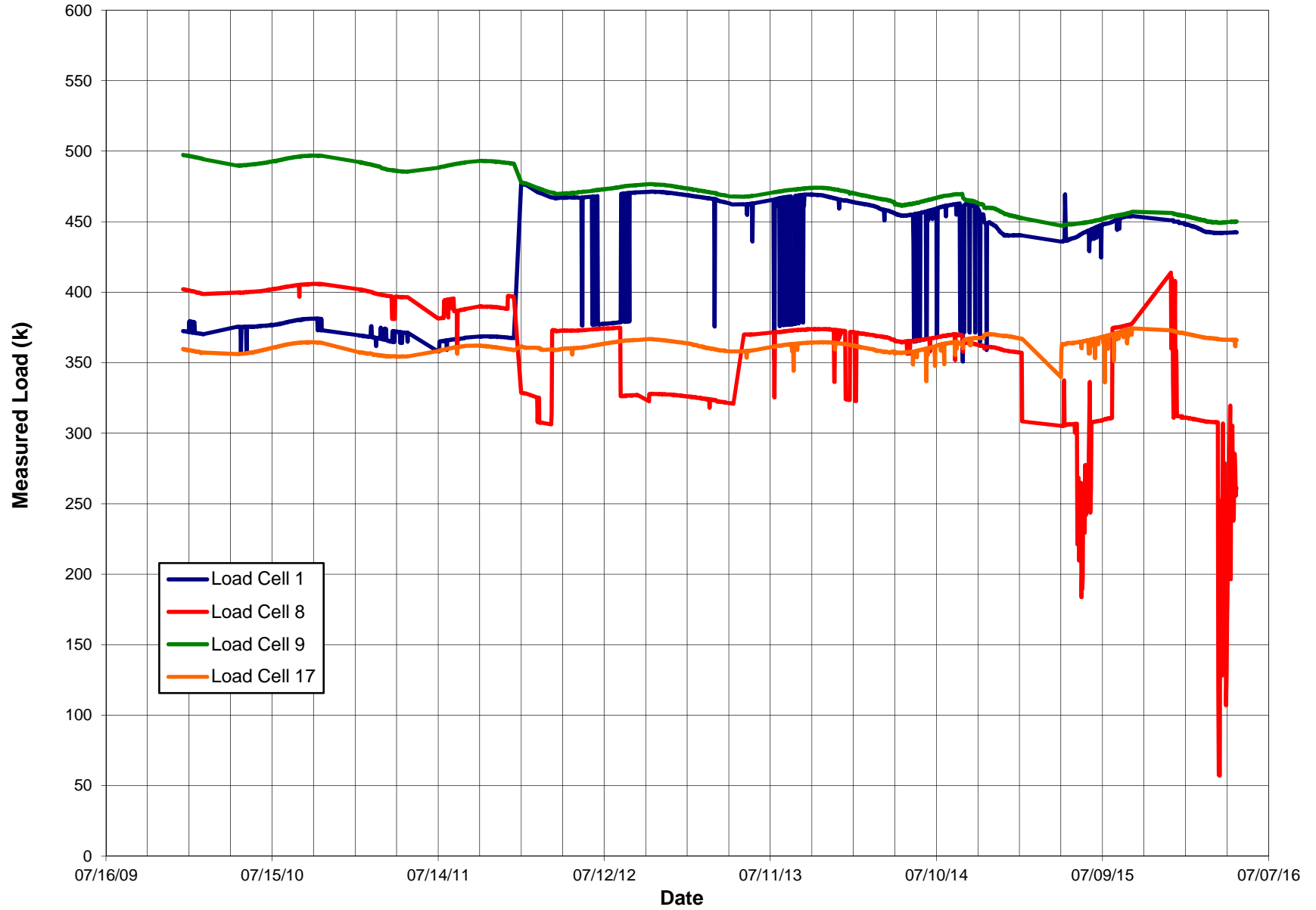
Borehole : P-17
Project : CUY-90-15-24
Location : Cleveland, Ohio
Northing :
Easting :
Collar :



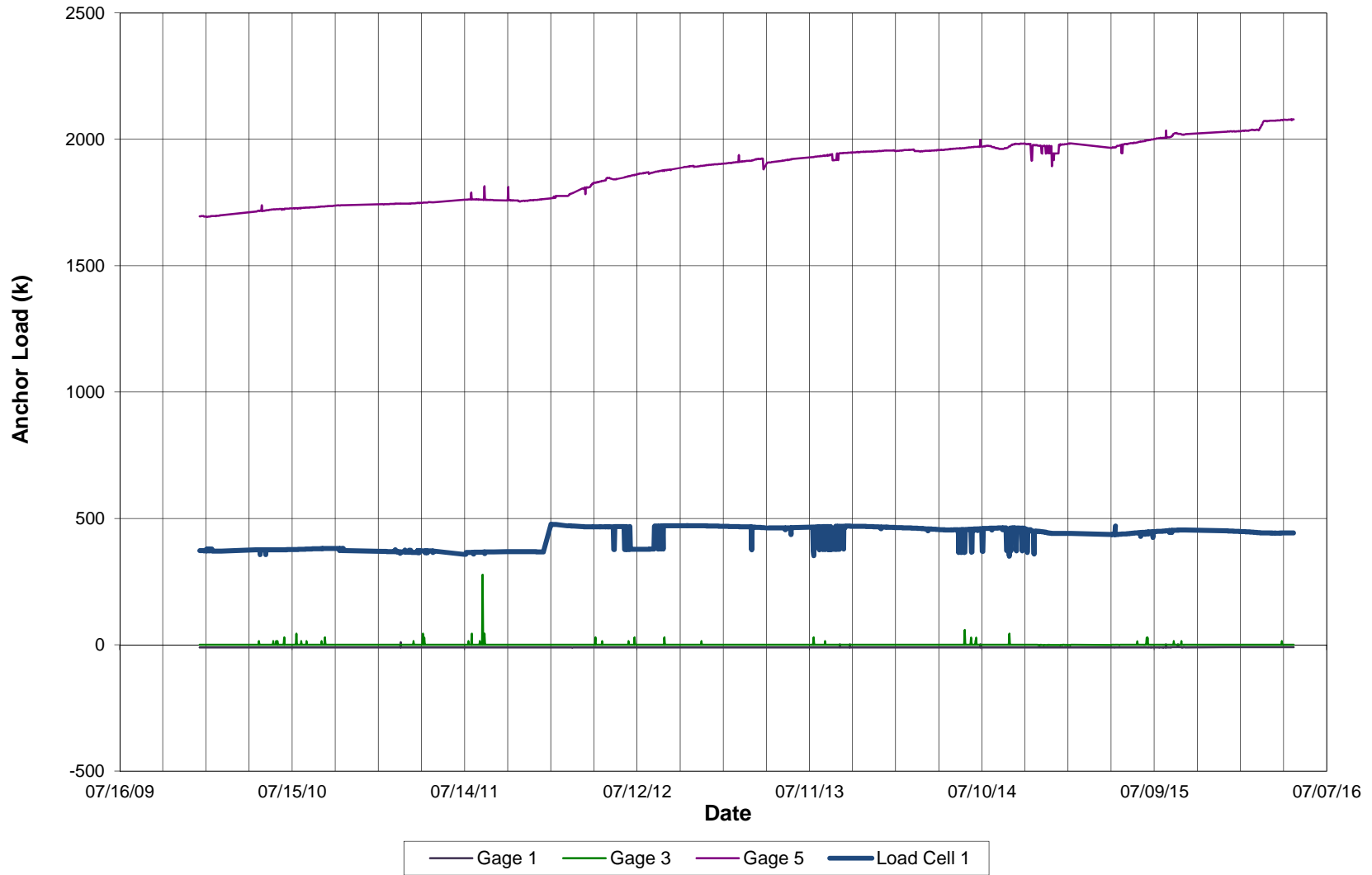
Spiral Correction : N/A
Collar Elevation : 1.2 feet
Borehole Total Depth : 148.0 feet
A+ Groove Azimuth :
Base Reading : 2014 Jan 15 12:02
Applied Azimuth : 0.0 degrees



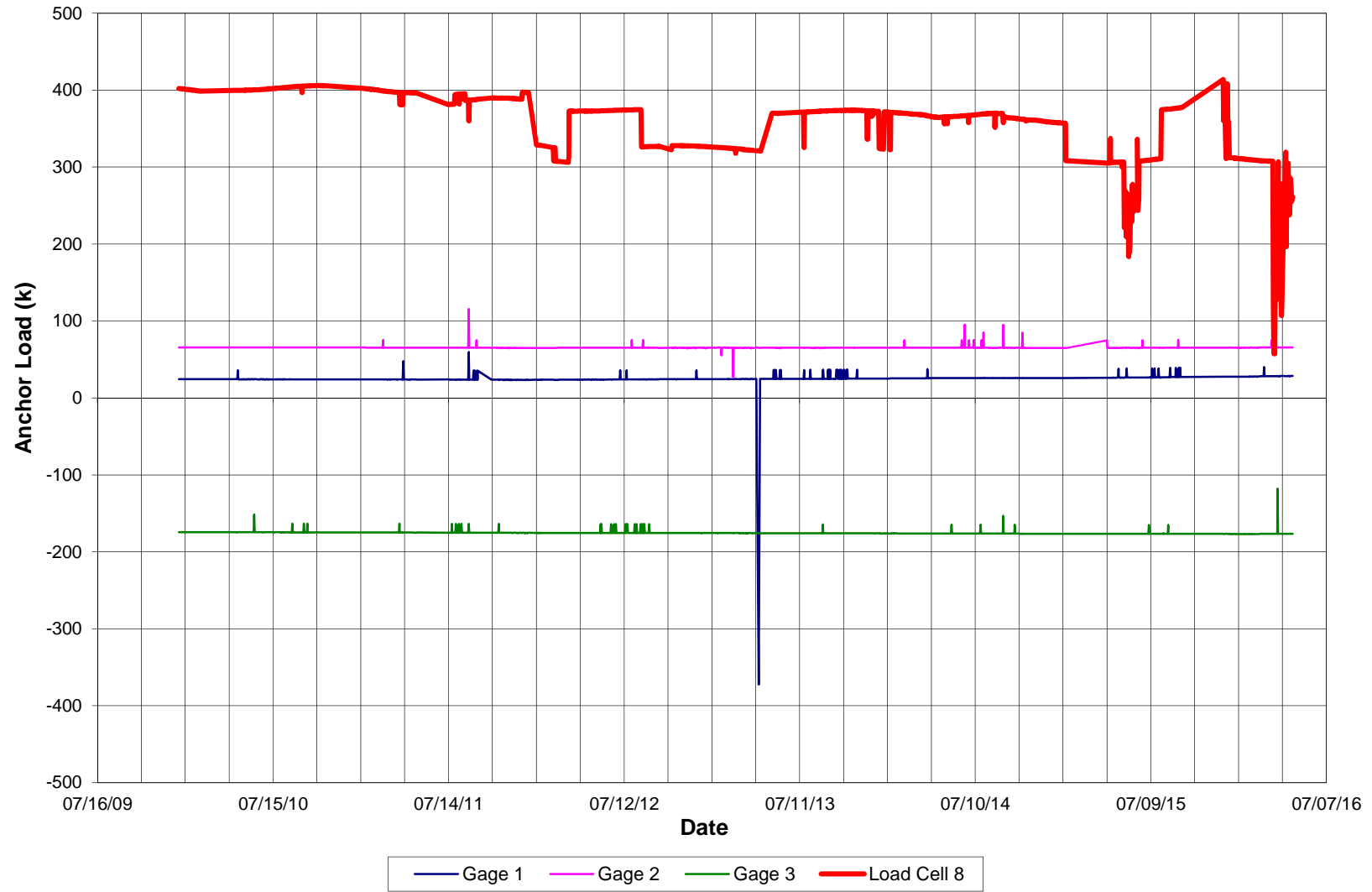
Load Cell Measurements



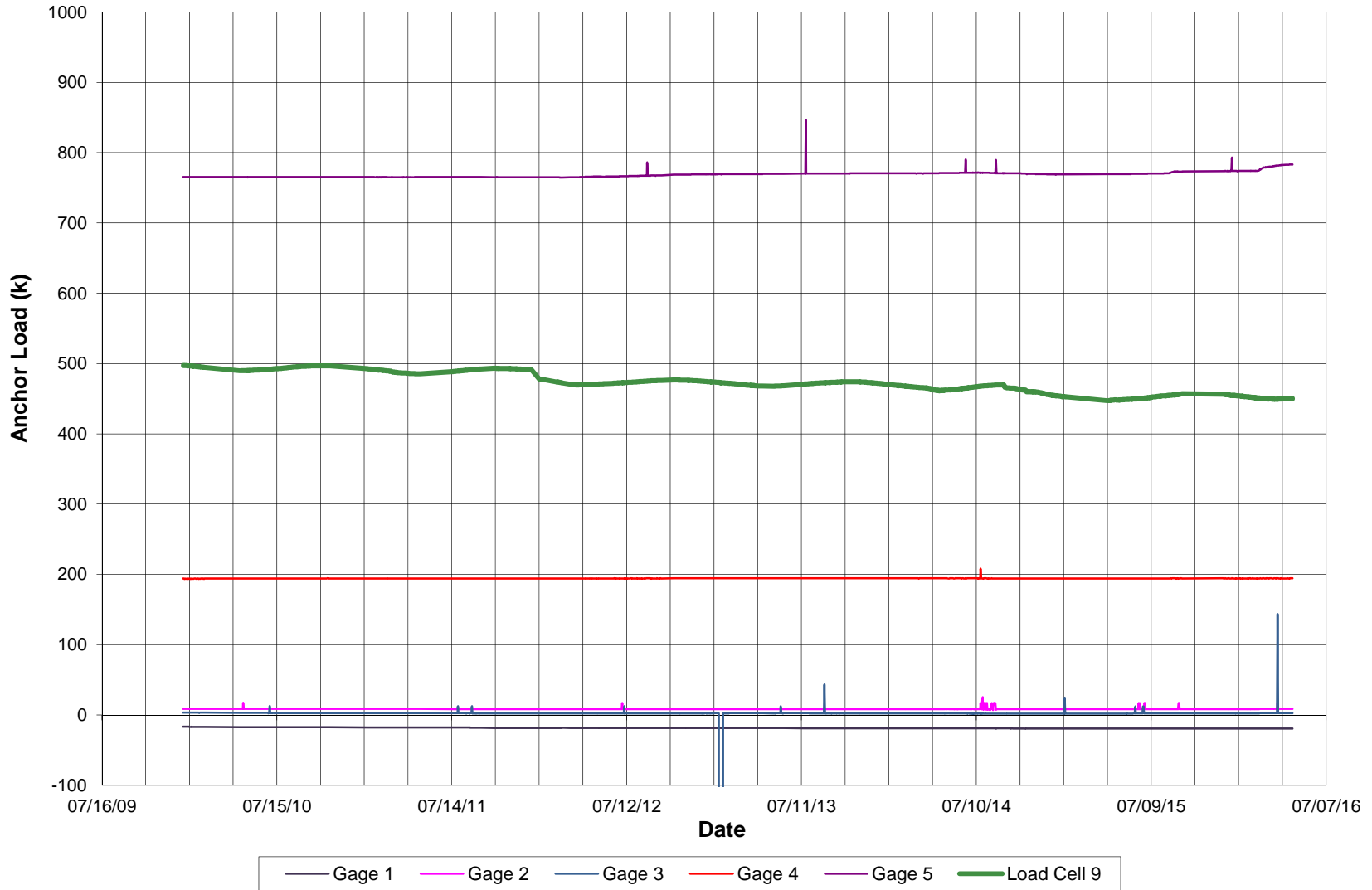
Anchor #1 - Load Cell #1



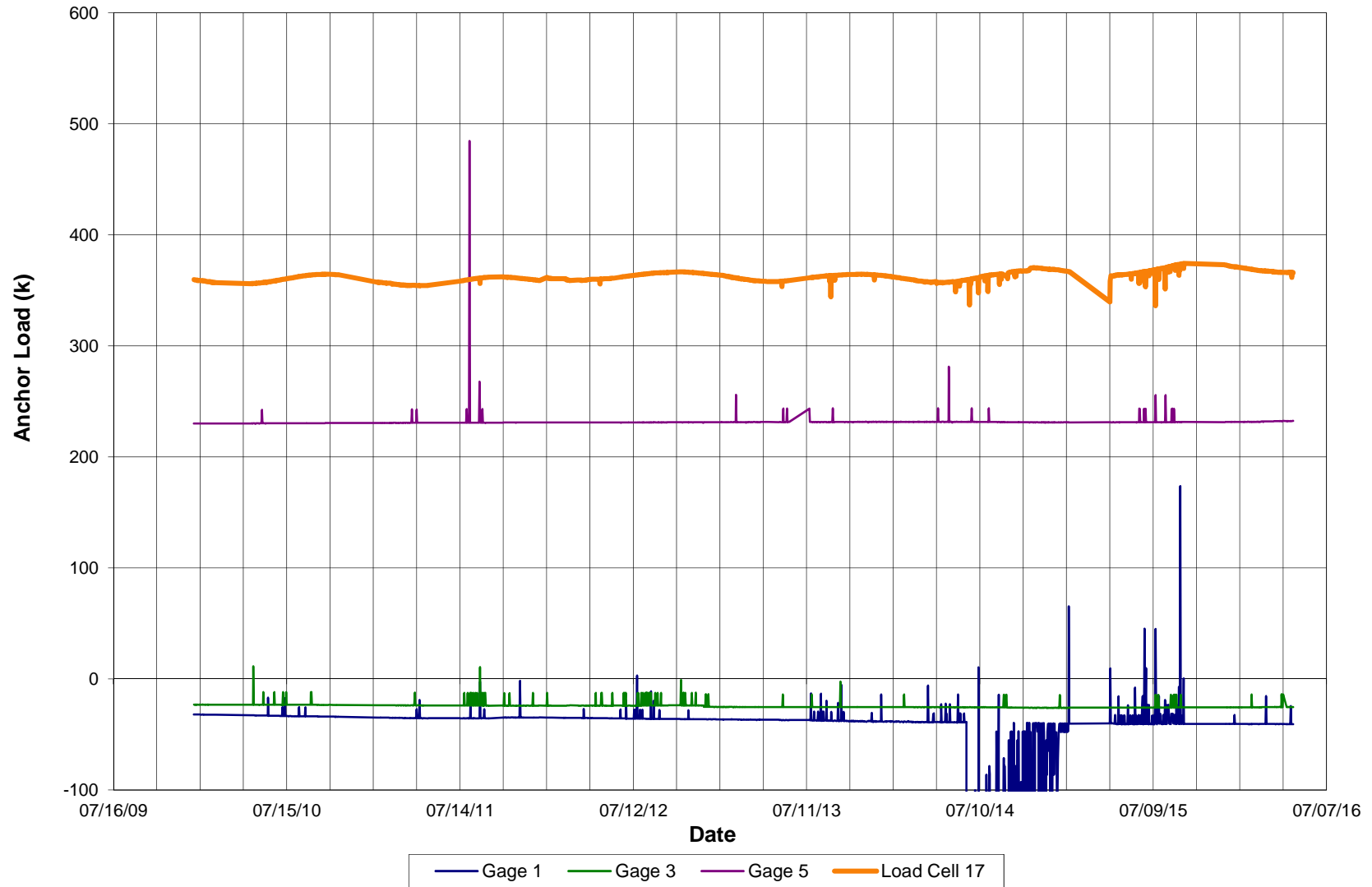
Anchor #8 - Load Cell #8



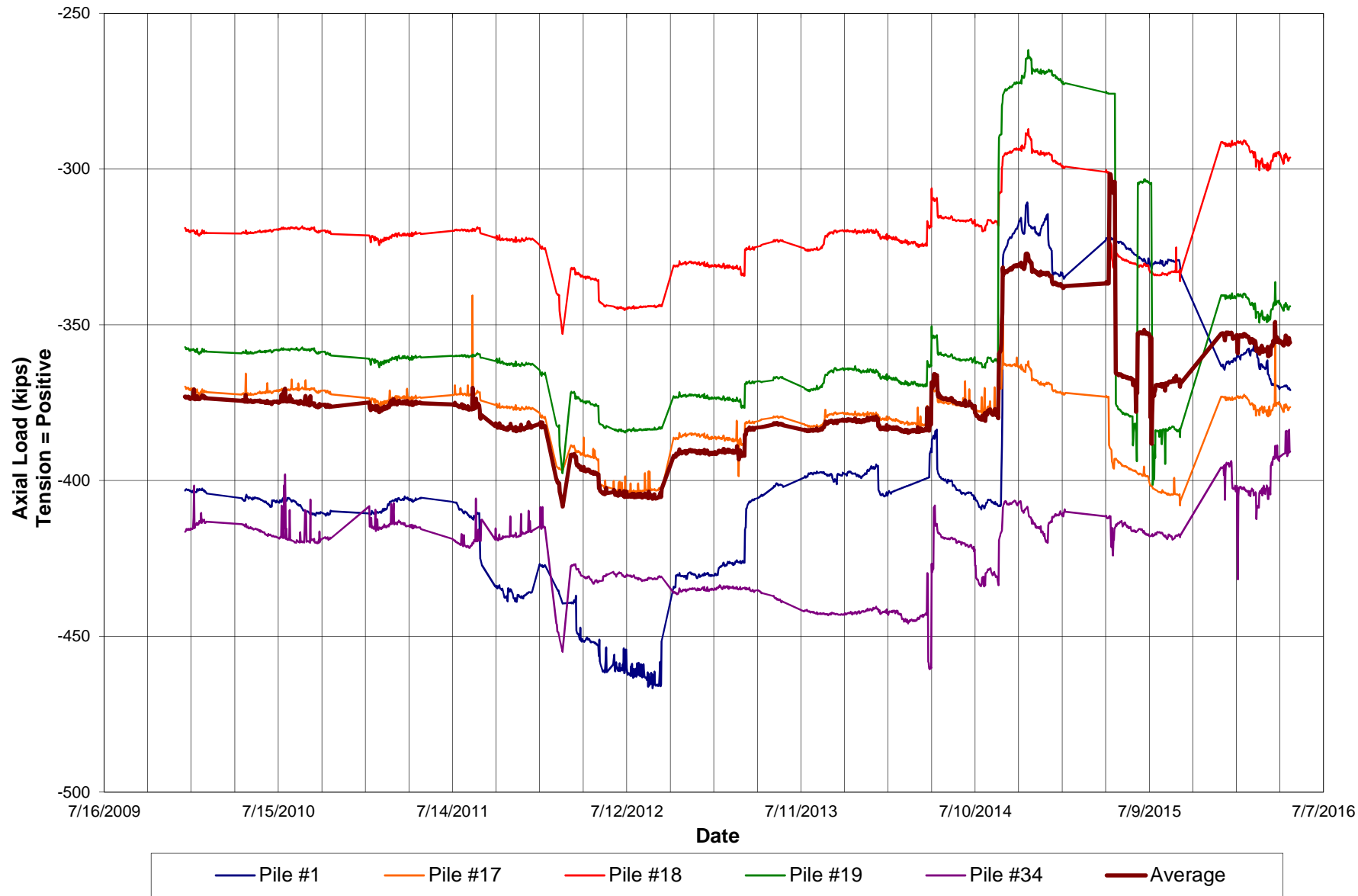
Anchor #9 - Load Cell #9



Anchor #17 - Load Cell #17

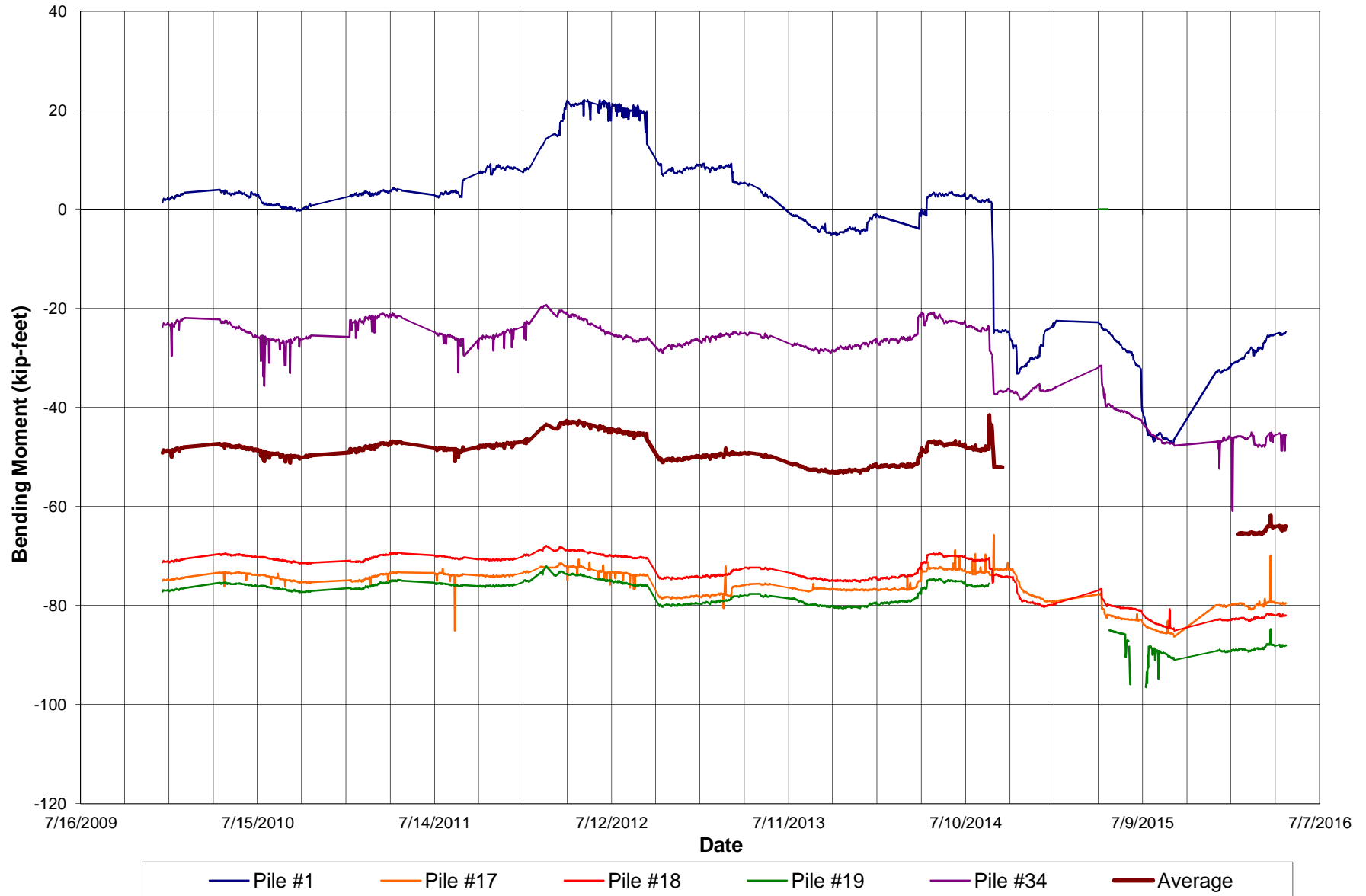


AXIAL LOADS



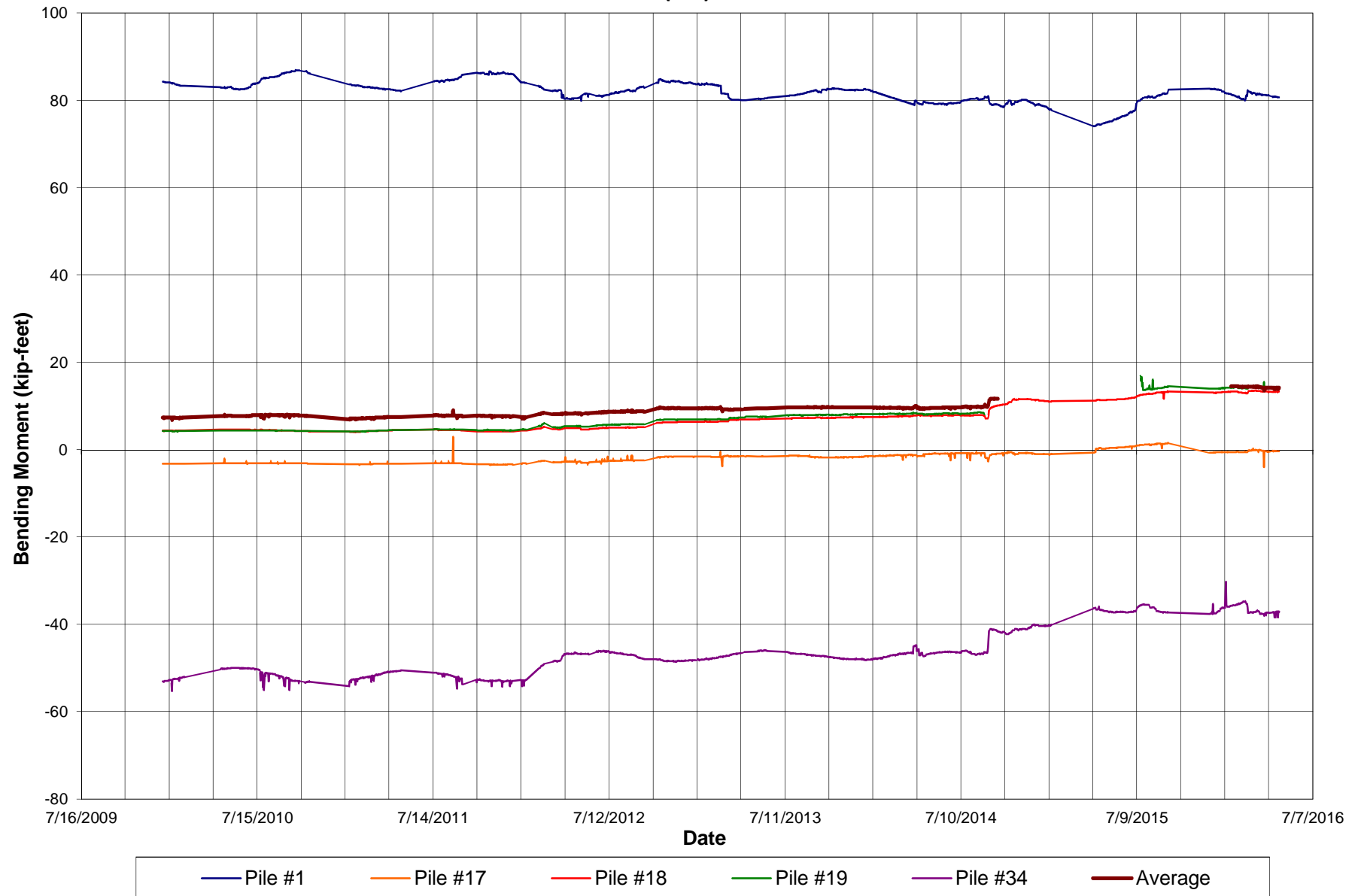
Driven Piles

STRONG AXIS (X-X) BENDING



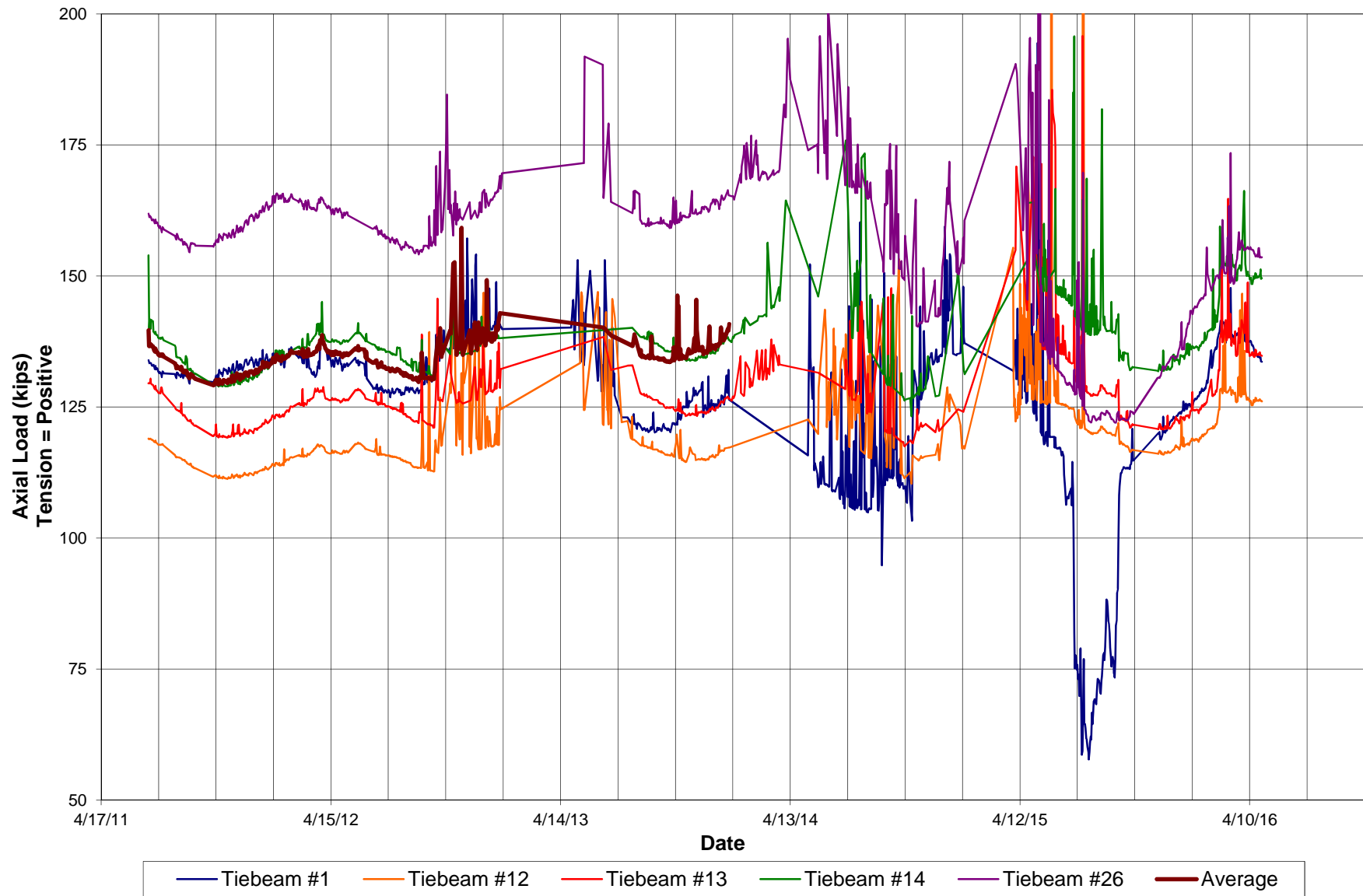
Driven Piles

WEAK AXIS (Y-Y) BENDING



Driven Piles

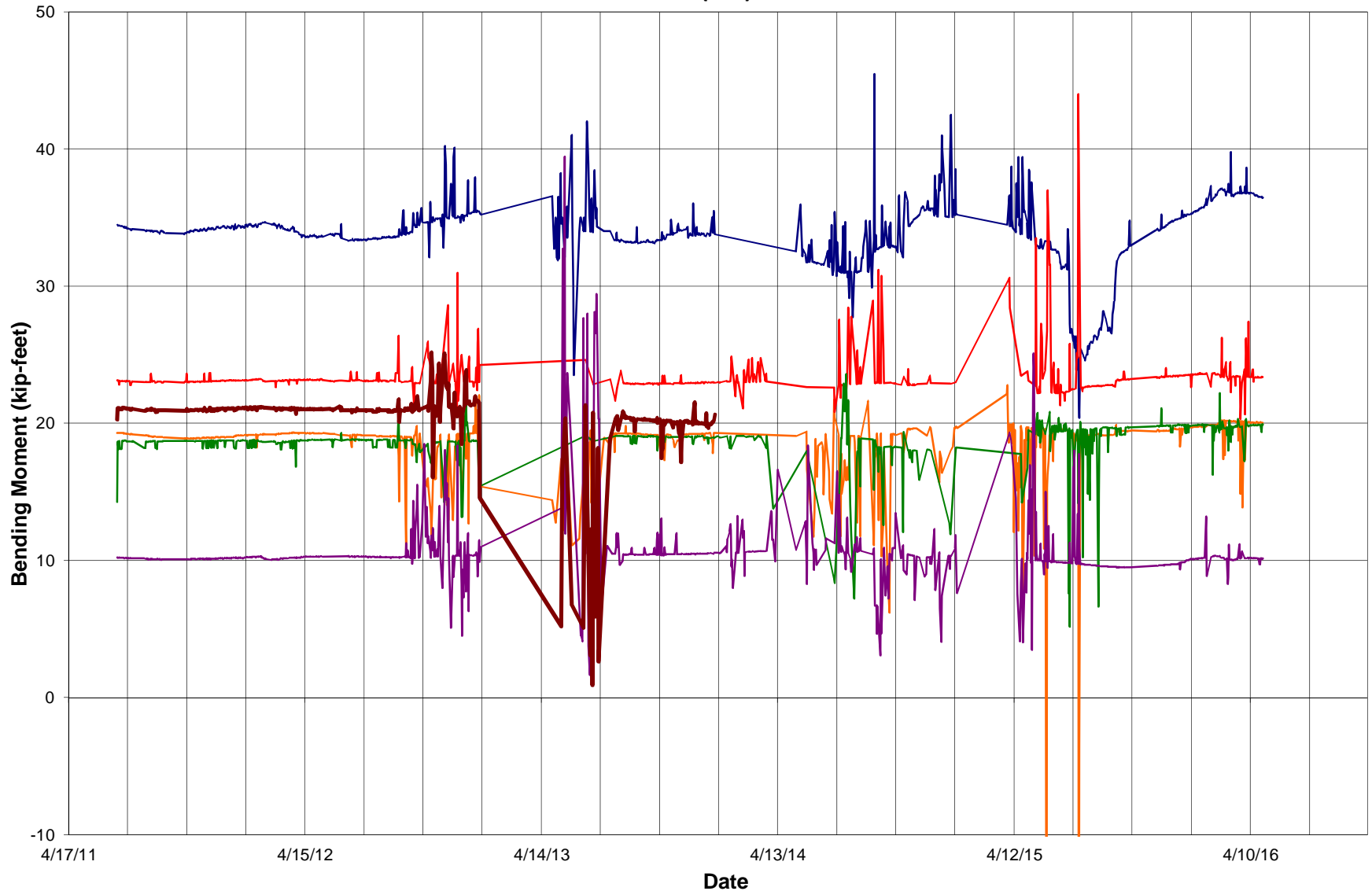
AXIAL LOADS



Tiebeams - Anchor Side

CUY-90-15.24 Slope Monitoring
Cleveland, Ohio
PID 96504
SME#: 069032.00

STRONG AXIS (X-X) BENDING

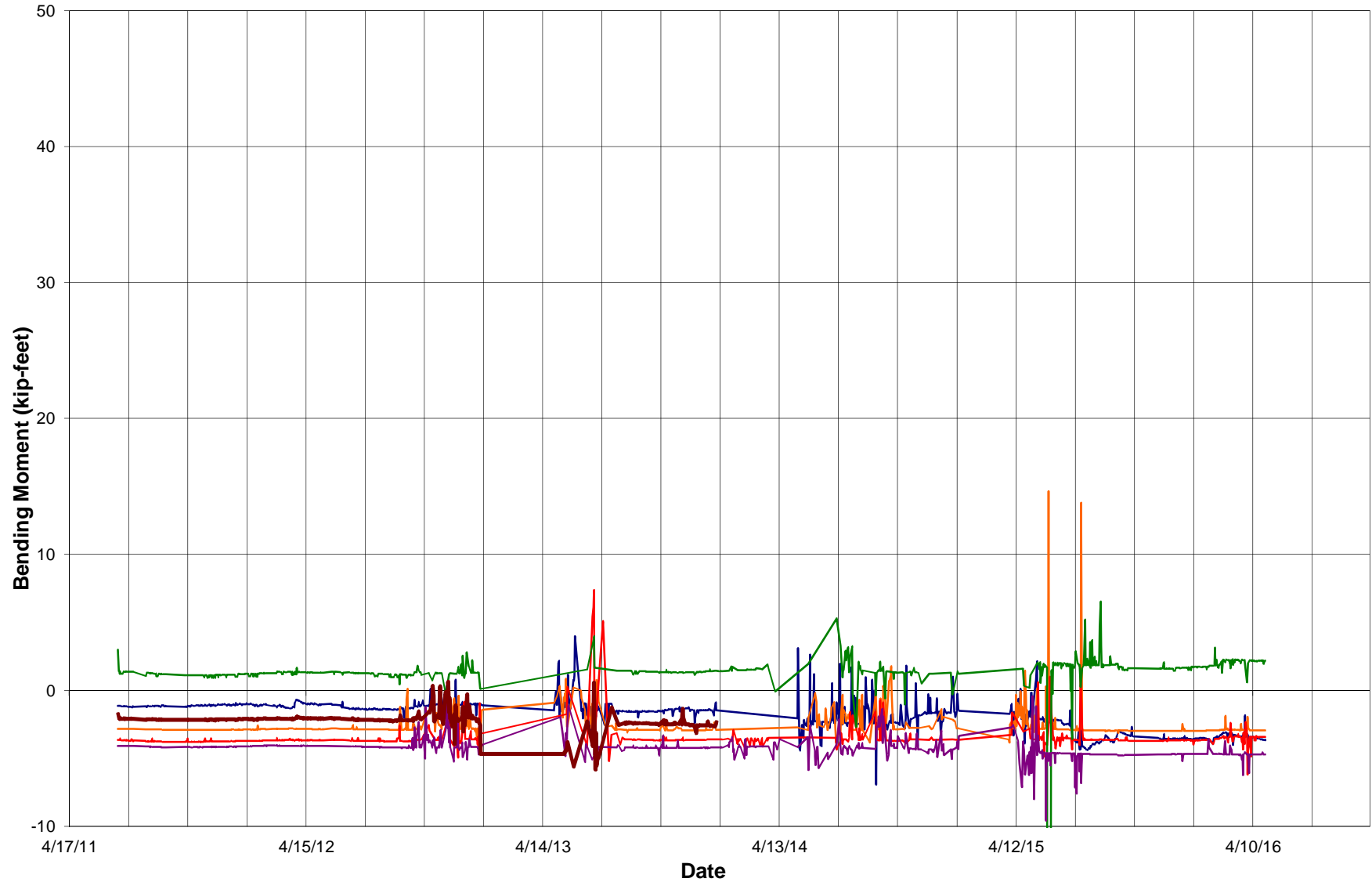


— Tiebeam #1 — Tiebeam #12 — Tiebeam #13 — Tiebeam #14 — Tiebeam #26 — Average

Tiebeams - Anchor Side

CUY-90-15.24 Slope Monitoring
Cleveland, Ohio
PID 96504
SME#: 069032.00

WEAK AXIS (Y-Y) BENDING

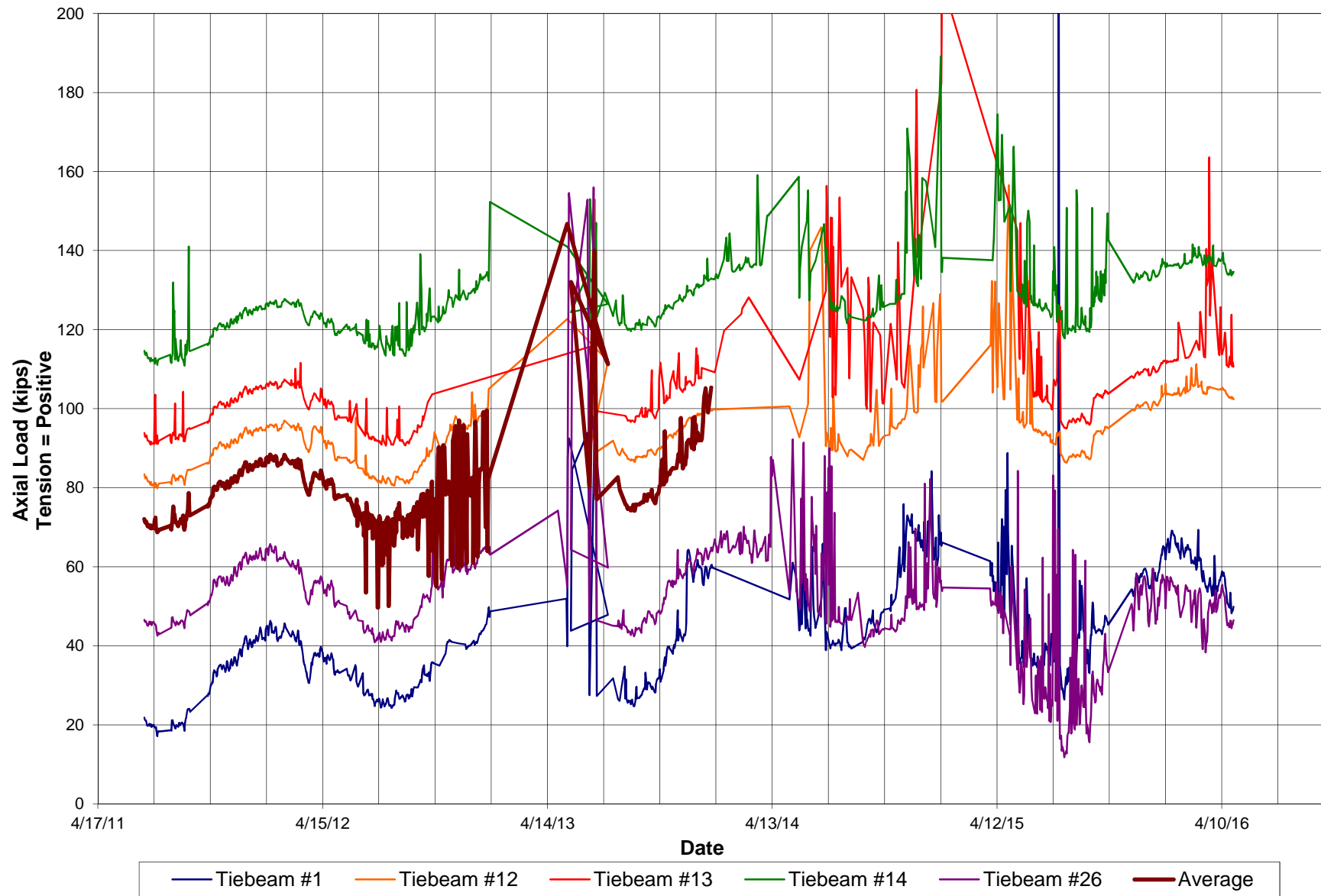


— Tiebeam #1 — Tiebeam #12 — Tiebeam #13 — Tiebeam #14 — Tiebeam #26 — Average

Tiebeams - Anchor Side

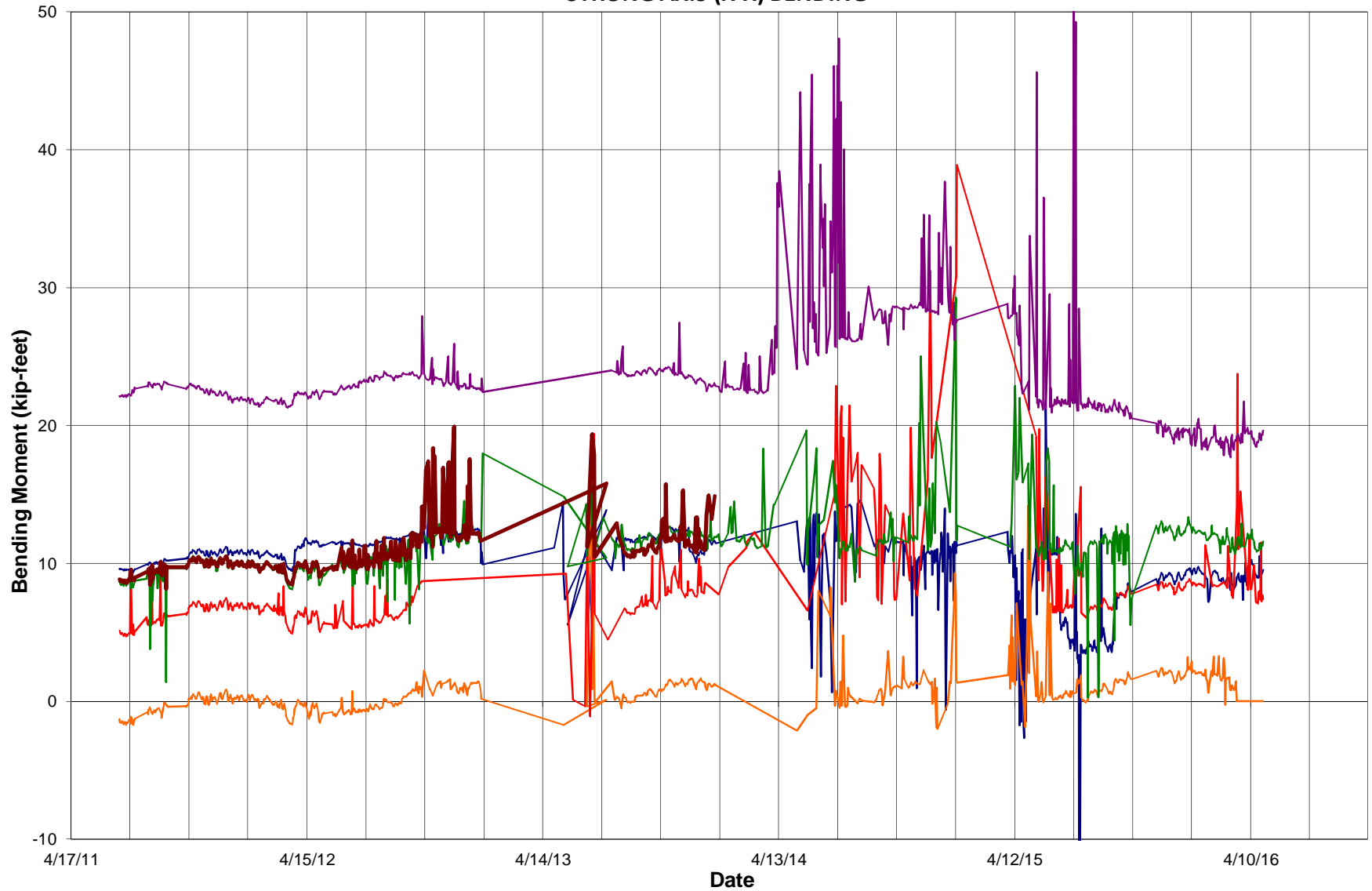
CUY-90-15.24 Slope Monitoring
Cleveland, Ohio
PID 96504
SME#: 069032.00

AXIAL LOADS



Tiebeams - Drilled Pier Side

STRONG AXIS (X-X) BENDING

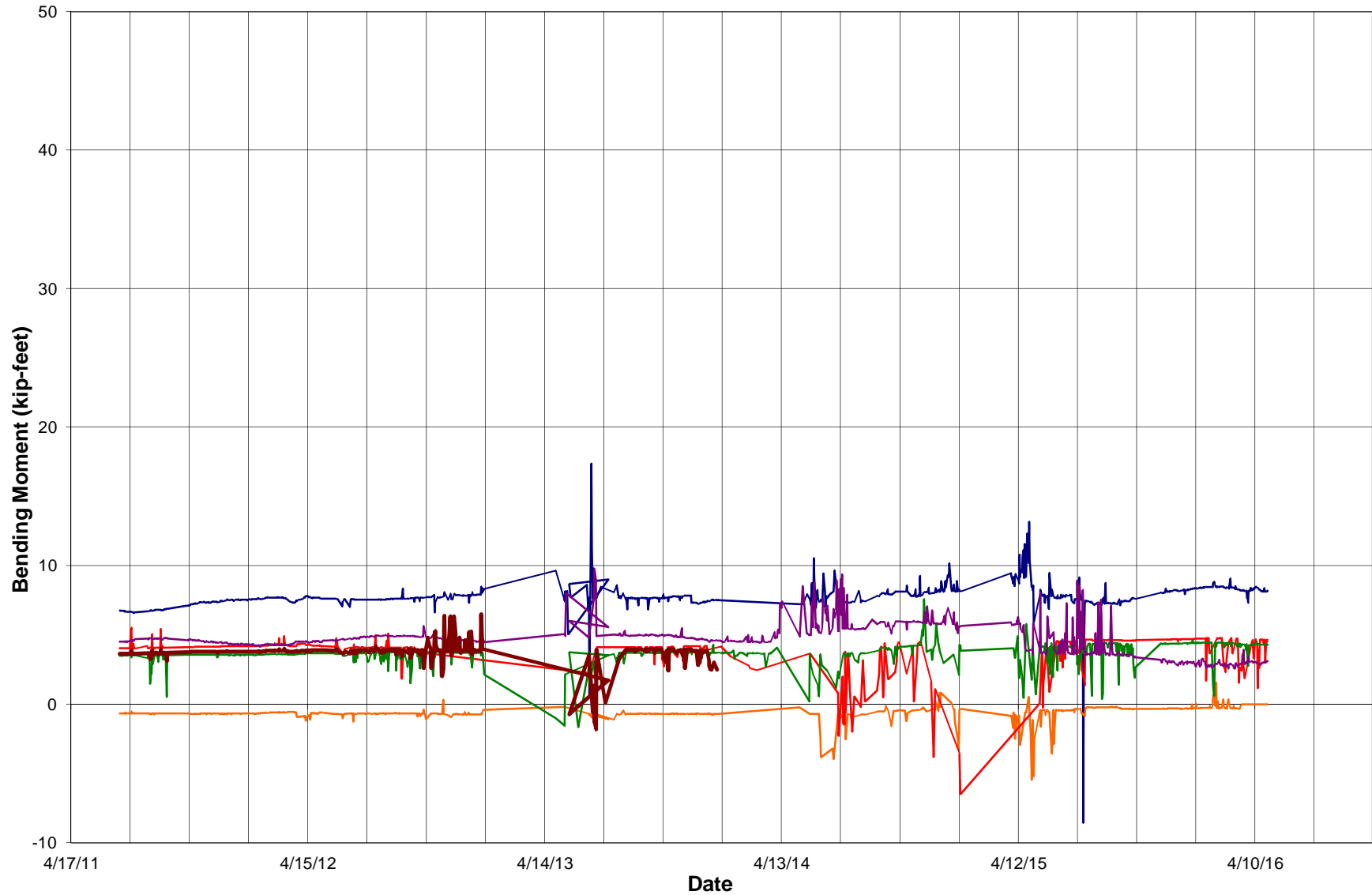


— Tiebeam #1 — Tiebeam #12 — Tiebeam #13 — Tiebeam #14 — Tiebeam #26 — Average

Tiebeams - Drilled Pier Side

CUY-90-15.24 Slope Monitoring
Cleveland, Ohio
PID 96504
SME#: 069032.00

WEAK AXIS (Y-Y) BENDING



— Tiebeam #1 — Tiebeam #12 — Tiebeam #13 — Tiebeam #14 — Tiebeam #26 — Average

Tiebeams - Drilled Pier Side

CUY-90-15.24 Slope Monitoring

PID 96504

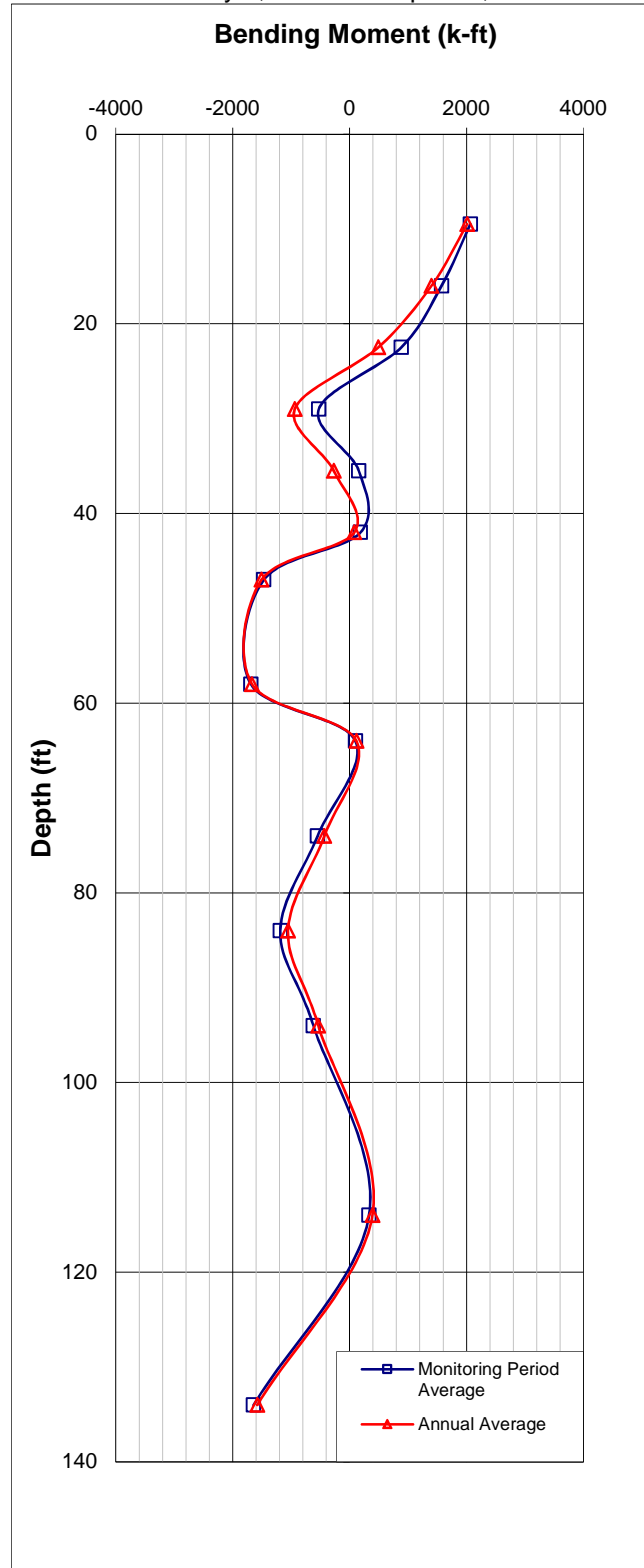
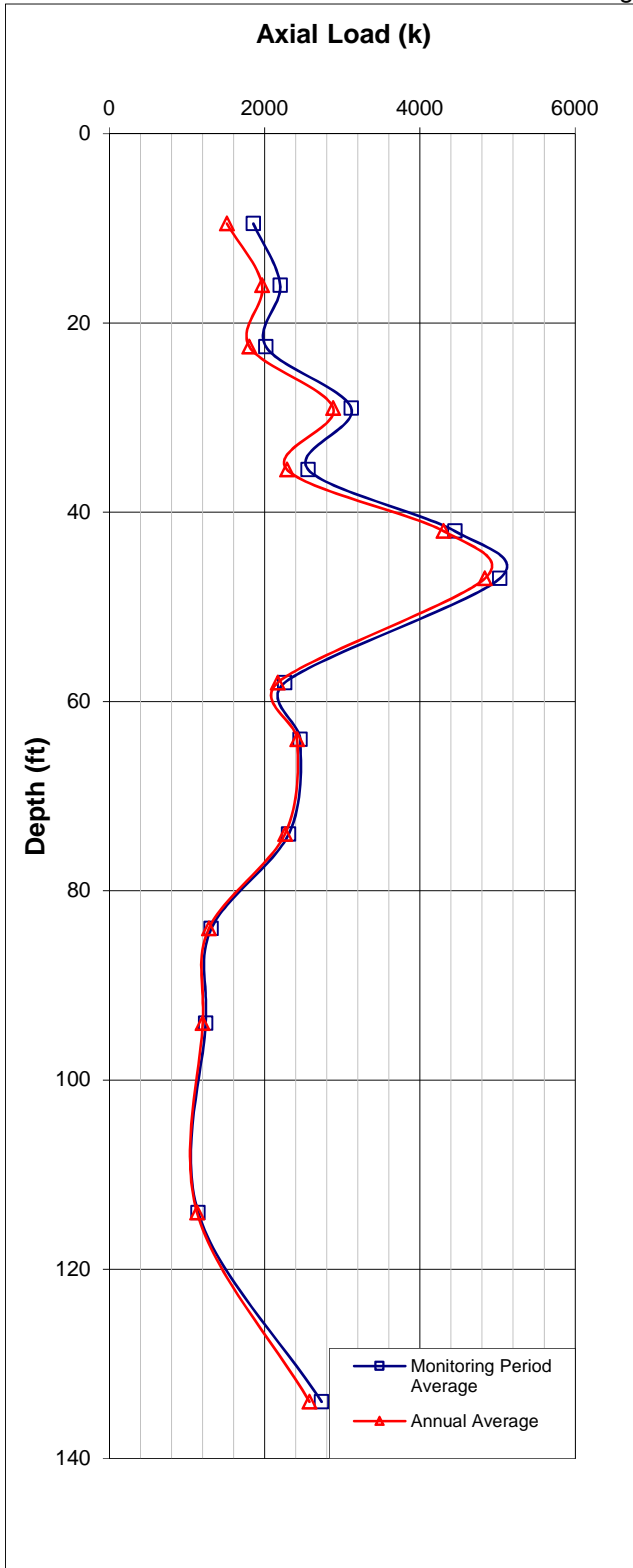
Cleveland, Ohio

SME#: 069032.00

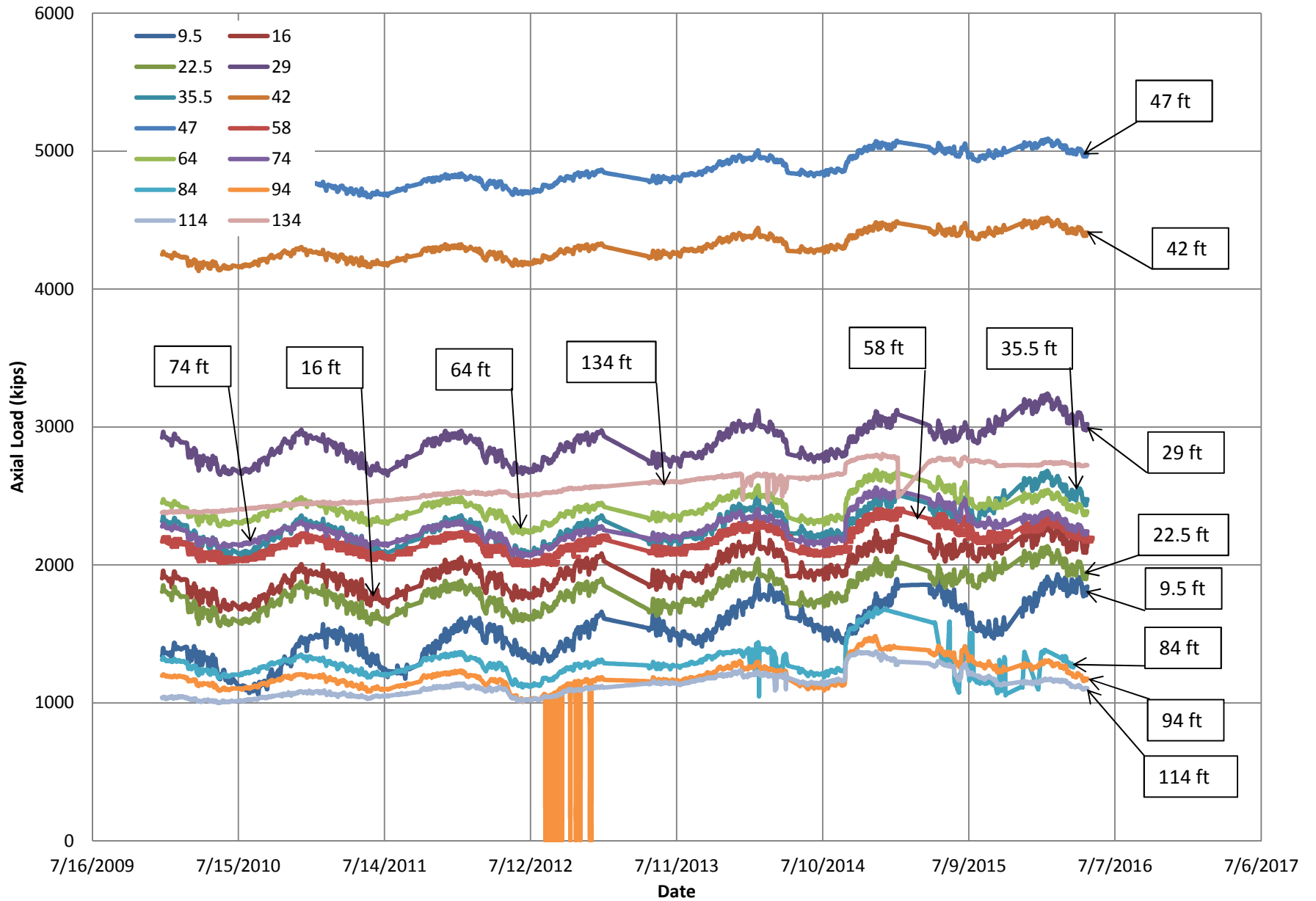
Drilled Shaft #1

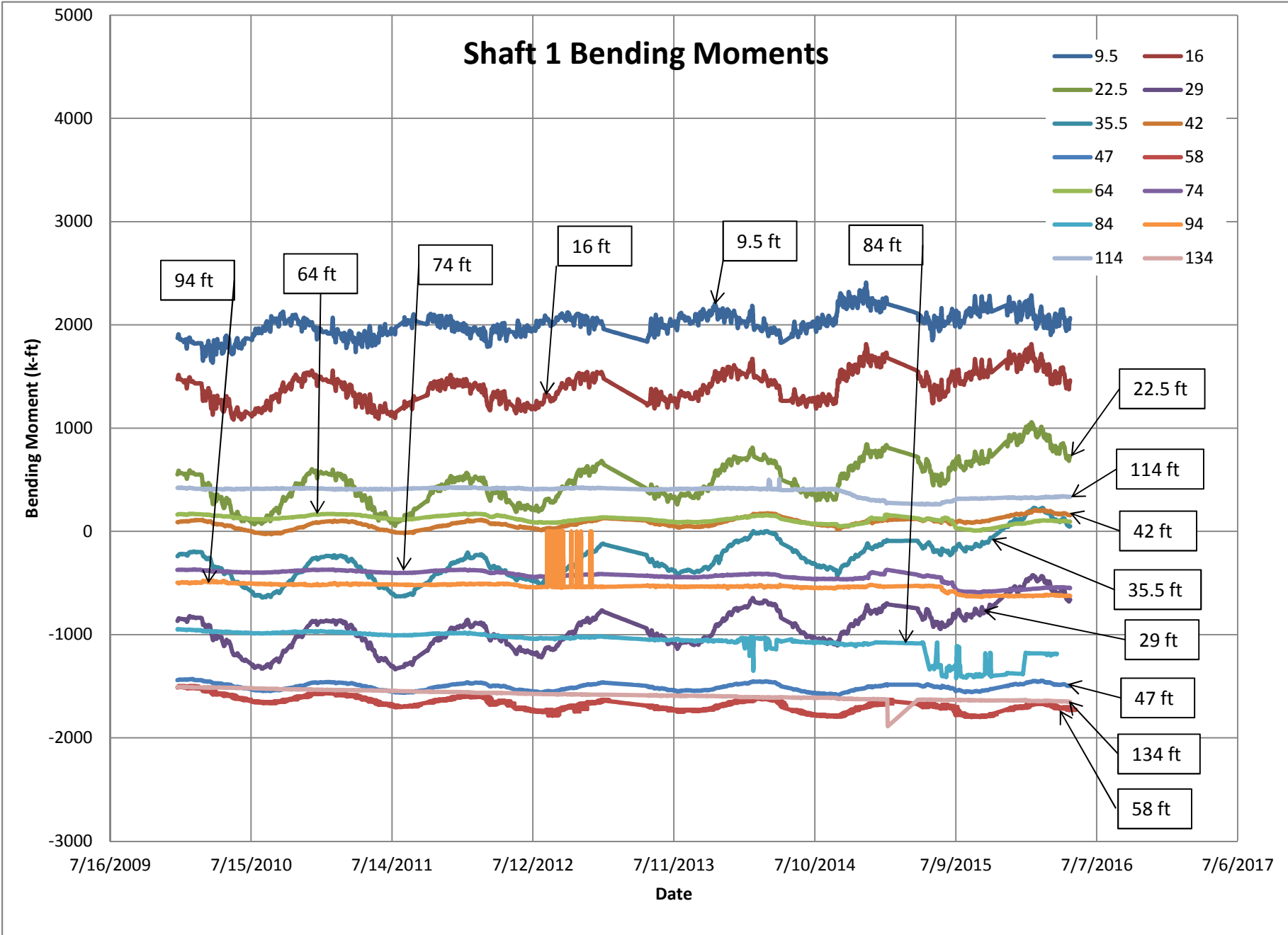
(Weak Axis Bending)

Average for Period: January 8, 2016 thru April 29, 2016



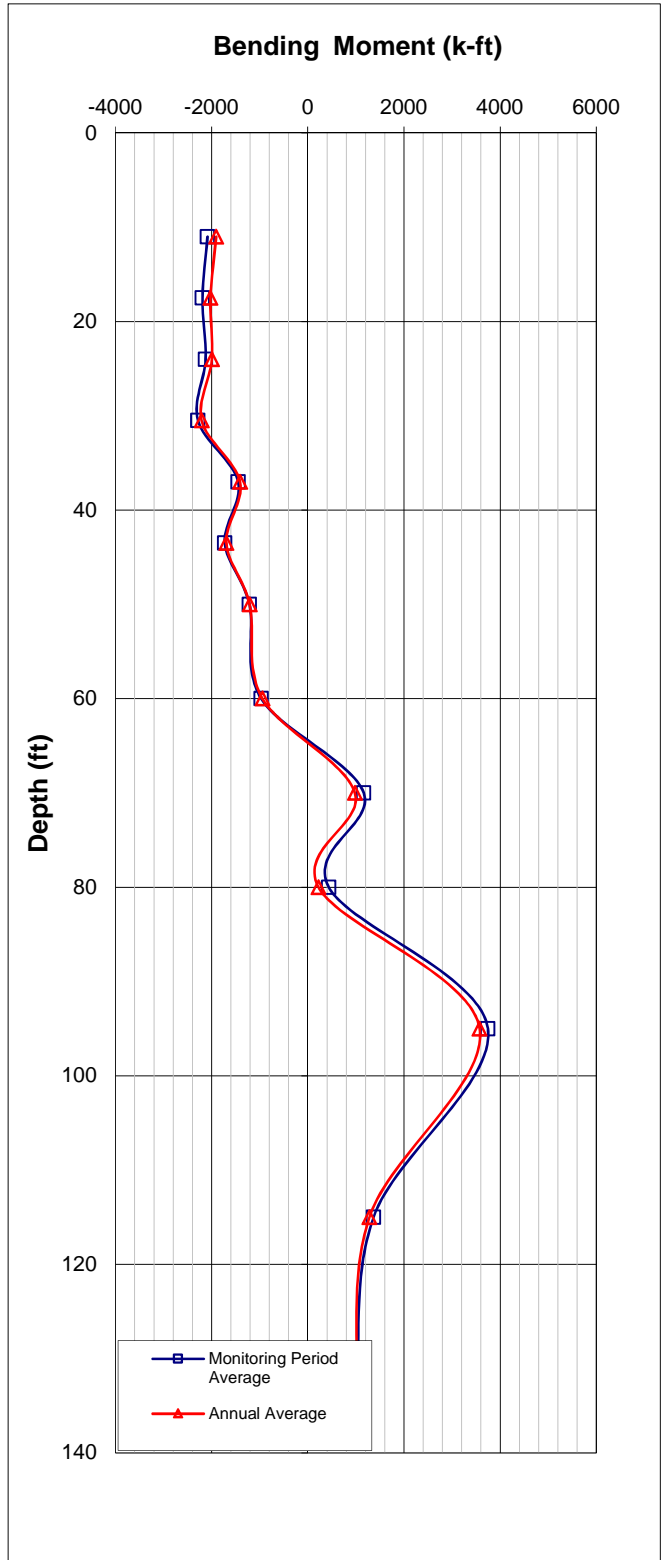
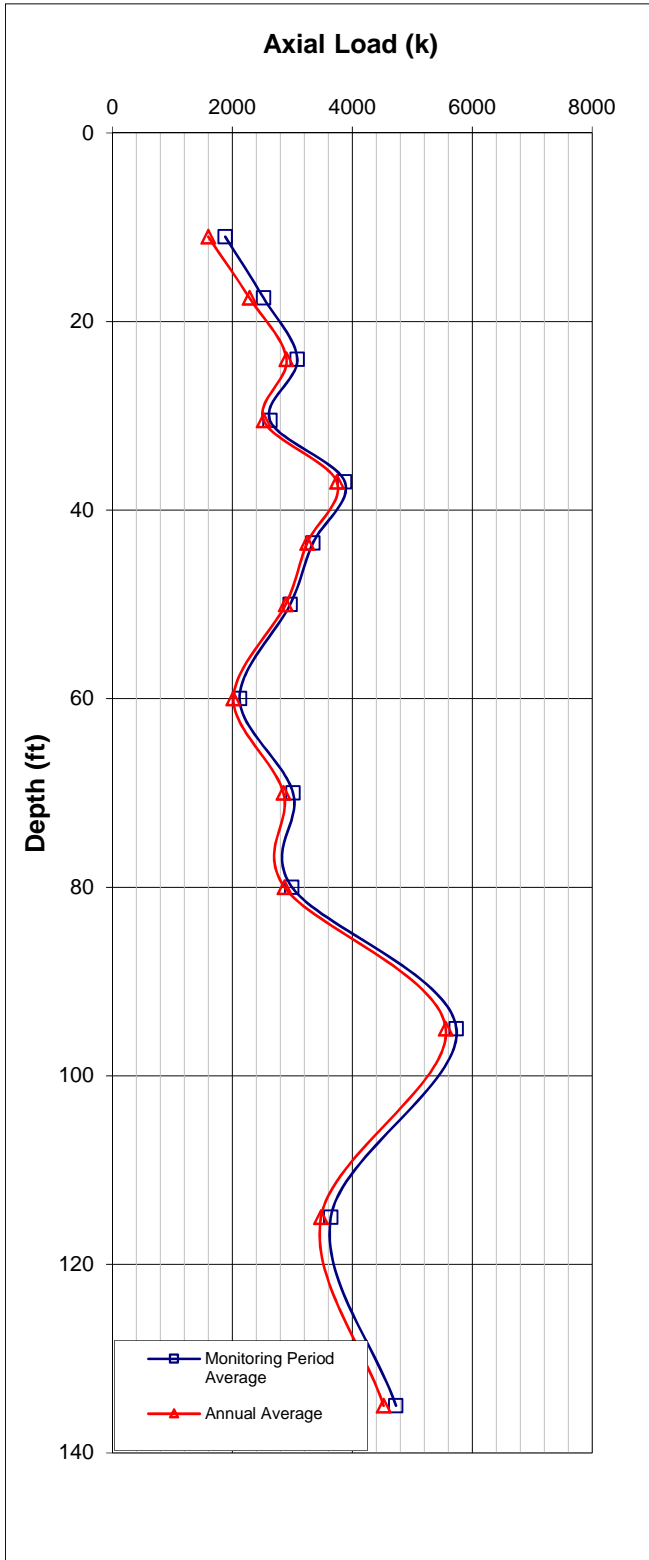
Shaft 1 Axial Loads





CUY-90-15.24 Slope Monitoring
PID 76117
Cleveland, Ohio
EDP #09305G

Drilled Shaft #9
Strong Axis Bending
Average for Period: January 8, 2016 thru April 29, 2016



Shaft 9 Axial Loads

