

January 13, 2015

Mr. Rick Angrisani
Oakhurst Geologic Hazard Abatement District
6000 Heritage Trail
Clayton, CA 94517

Re: Summary of Geotechnical Monitoring and Inspection Services on December 22, 2014
Inclinometers/Piezometers/Wells at Kelok Way, Clayton, California
SFB Project No: 555-2

Mr. Angrisani:

In accordance with the Oakhurst Geologic Hazards Abatement District's authorization on June 12, 2014, Stevens, Ferrone & Bailey Engineering Company, Inc. (SFB) performed the monitoring of the selected inclinometer casings, vibrating wire and open pipe piezometers, and dewatering wells and outlet pipes located within Kelok Way and within the north facing slope located immediately to the north and below Kelok Way. This service was performed in accordance with the scope of work outlined in our proposal dated January 22, 2013. The approximate locations of these monitoring points are shown on the attached location map, Figure 1. This report summarizes the results of the monitoring, measurements, and inspections performed by SFB at the site on December 22, 2014. The results of our previous monitoring on 6/19/14 and 6/20/14 were presented in our previous report dated July 9, 2014.

1.0 MONITORING, MEASUREMENT & OBSERVATION

1.1 Inclinometer Casings

SFB performed monitoring of the inclinometer casings located at BGC SI-1, CEG SI-1, CSA SI-1, CSA SI-2, CSA SI-3, W SI-1, and W SI-5 (7 locations) using a Slope Indicator Digitilt probe. The monitoring of casing at CSA SI-4 was not completed due to passage obstruction caused by excessive casing deformation at a depth of about 52 feet below the ground surface as first reported on June 19, 2014 by SFB. The profile views of the inclinometer casing measurement results (comparing to initial readings on 6/19/14 and 6/20/14) in both the 'A' (downhill) and 'B' (perpendicular to 'A') direction are presented in Appendix A. Both cumulative and incremental horizontal displacements are shown for each monitored inclinometer.

1.2 Vibrating Wire and Open Pipe Piezometers

The measurement of water pressures at vibrating wire piezometer locations was performed using a Slope Indicator VW DataRecorder. Vibrating wire piezometers allow for the measurement of water pressure at a specific location. Free groundwater levels at open pipe piezometers were measured with a Solinst water level meter. Open pipe piezometers measure the cumulative water pressure along the entire depth of the pipe.

The results of these measurements are tabulated and presented in Appendix B. It should be noted that the piezometers at CEG SI-1, CEG SI-3, BGC SI-1, CSA SI-1, and CSA SI-2 consist of inclinometer casings with an opening at the bottom (previously created by piercing the casing bottoms) and may or may not reflect actual open pipe piezometer water levels. Historical measurement records of the piezometers provided to SFB are included in Appendix C for reference.

1.3 Dewatering Well Outlet Pipes

Discharge from the dewatering well outlet pipes in the collector box was observed on 12/22/14, with Drains H#1, W#2, W#5, and W#6 exhibiting a stream of water, Drains W#1 and W#4 showing dripping water. Drain W#3 appeared to be blocked with only some moisture observed at the pipe end. Drain H#1 is an outlet pipe that was encountered at the approximate collector box location during the construction of the collector box in the fall of 2012; it is unclear what H#1 drains. Field photographs of these outlet pipes taken on 6/20/14 and 12/22/14 are attached as Figure 2 for reference.

1.4 Kelok Way Observations

At the time of our 12/22/14 field reconnaissance, we generally did not observe new cracks on the Kelok Way pavement in the area of the dewatering wells compared to cracks observed at the time of well installation in September, 2012. However, near the cul-de-sac of Kelok way, the cracks and joints on the concrete driveway apron leading to 8053 Kelok Way appear to be widening due to downward slope movement of the cul-de-sac at that location. Photographs taken on 5/19/10, 6/19/14, and 12/22/14 of the driveway are presented on Figure 3 for reference. By comparing photographs taken on 6/19/14 and 12/22/14 of the same concrete joint at 8053 Kelok Way (as shown on Figure 4), it appears that the width of the joint has increased about 1/4 to 1/2 inch in about 6 months. Crack widening also appears to be occurring on the Kelok Way pavement in the cul-de-sac area.

2.0 CONCLUSIONS AND OPINIONS

SFB completed monitoring of selected inclinometer casings, vibrating wire and open pipe piezometers, and dewatering wells and outlet pipes on December 22, 2014. The next monitoring session will be performed around mid-June of 2015.

2.1 Kelok Way and North Facing Slope

By comparing to the initial readings on 6/19/14 and 6/20/14, Inclinometer Casings CSA SI-3 and W SI-1 generally do not indicate obvious horizontal movements (the cumulative displacement shown in CSA SI-3 is likely related to systematic error of the monitoring equipment). Inclinometer Casing CEG SI-1, CSA SI-1, CSA SI-2, and W SI-5 appear to indicate on-going fill expansion with cumulative displacements of about 0.1 to 0.4 inch at ground surface. The movement at Inclinometer Casing BGC SI-1 indicates both on-going fill expansion and slope creep with cumulative displacement of about 0.6 inch at ground surface since June 20, 2014.

2.2 Kelok Way cul-de-sac

The monitoring of casing at CSA SI-4 was not completed due to passage obstruction caused by excessive casing deformation at a depth of about 52 feet below the ground surface. The combined results of the CSA SI-4 monitoring and the observed cracks within the Kelok Way cul-de-sac indicate that the slope below the cul-de-sac is unstable and continues to move downhill under static conditions. Greater rates of movement (including large magnitudes of movement) will likely occur when the slope is subjected to earthquake shaking, increases in water pressures, and/or decreases in shear strength.

The past slope movement in the area of CSA SI-4 has caused movement of the Kelok Way cul-de-sac, associated infrastructure, and the home and improvements at 8053 Kelok Way. The home at 8053 Kelok Way has clearly undergone detrimental movement that affects the structural integrity of the house. Future slope movement will result in significant and detrimental damage to the public and private property and associated improvements located upslope and downslope of CSA SI-4 shown on Figure 1. The magnitude of damage and when the damage will occur cannot be accurately predicted due to numerous variables. We recommend a replacement inclinometer casing be installed in the area for further monitoring. Serious consideration should be given to stabilizing the movement and repairing the damage. We also recommend the existing infrastructure (including underground utilities) be inspected to determine if detrimental damage has occurred. Any damage to water bearing utilities should be repaired immediately to reduce the potential for subsurface water breaks that could decrease the stability of the slope.

2.3 Piezometers

The results of our vibrating wire and open pipe piezometer monitoring generally showed similar results as those indicated by historical monitoring records. The measured groundwater levels in the piezometers generally indicated slightly higher groundwater level conditions on 12/22/14 compared to the previous monitoring results on 6/19/14 and 6/20/14, which may be related to seasonal fluctuations. The discharge conditions of dewatering well outlet pipes are similar to what was observed at the completion of the wells, except for Drain W#3 that appears to be blocked.

We recommend outlet pipes in the collector box shown on Figure 1 be hand cleared of any built up debris or deposits. We recommend this removal occur on a yearly basis.

To increase the water discharge from Wells W#1, W#3, and W#4, consideration should be given to installing sump pumps directly into the wells located within Kelok Way and discharging the pumped water to the existing storm drain system.

2.4 Closing

Based on our monitoring contract with the Oakhurst Geologic Hazard Abatement District, we are scheduled to perform our next monitoring session in mid-June, 2015. Should you have any questions or require additional information, please do not hesitate to contact us.

Sincerely,

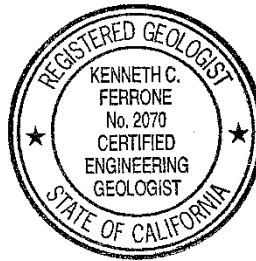
Stevens, Ferrone & Bailey Engineering Company, Inc.



Ken Ferrone, PE, GE, CEG
Civil/Geotechnical Engineer
Certified Engineering Geologist




TC/KCF

Copies: Addressee (1 by e-mail)



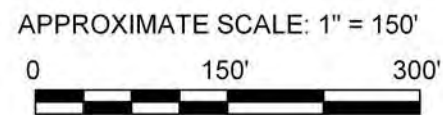
FIGURES

KEY

-  Approximate Locations of Inclinometer Casings, Vibrating Wire Piezometers, Open Pipe Piezometers & Dewatering Wells Monitored by SFB
-  Approximate Location of Dewatering Well Outlet Pipe Collector Box Monitored by SFB
-  Approximate Locations of Inclinometer Casings, Vibrating Wire Piezometers & Open Pipe Piezometers Not Monitored by SFB



NOTE: Base Map Taken From As-Built Rough Grading Plan of Northeast Valley - Tracts 7260, 7261 & 7264 Prepared by UDI-Tetrad Consulting Engineers, Inc. and Dated Oct 1996, and Google Earth Image.



DATE	July 2014
PROJECT NO.	555-2

Stevens
Serrone &
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Engineering Company, Inc

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Concord, CA 94520
Tel 925.688.1001
Fax 925.688.1005
www.SFandB.com

SITE PLAN
KELOK WAY MONITORING LOCATION MAP
Clayton, California

FIGURE
1



Figure 2, Photograph of Outlet Pipes



Figure 3, 8053 Kelok Way



Figure 3 (Continued), 8053 Kelok Way

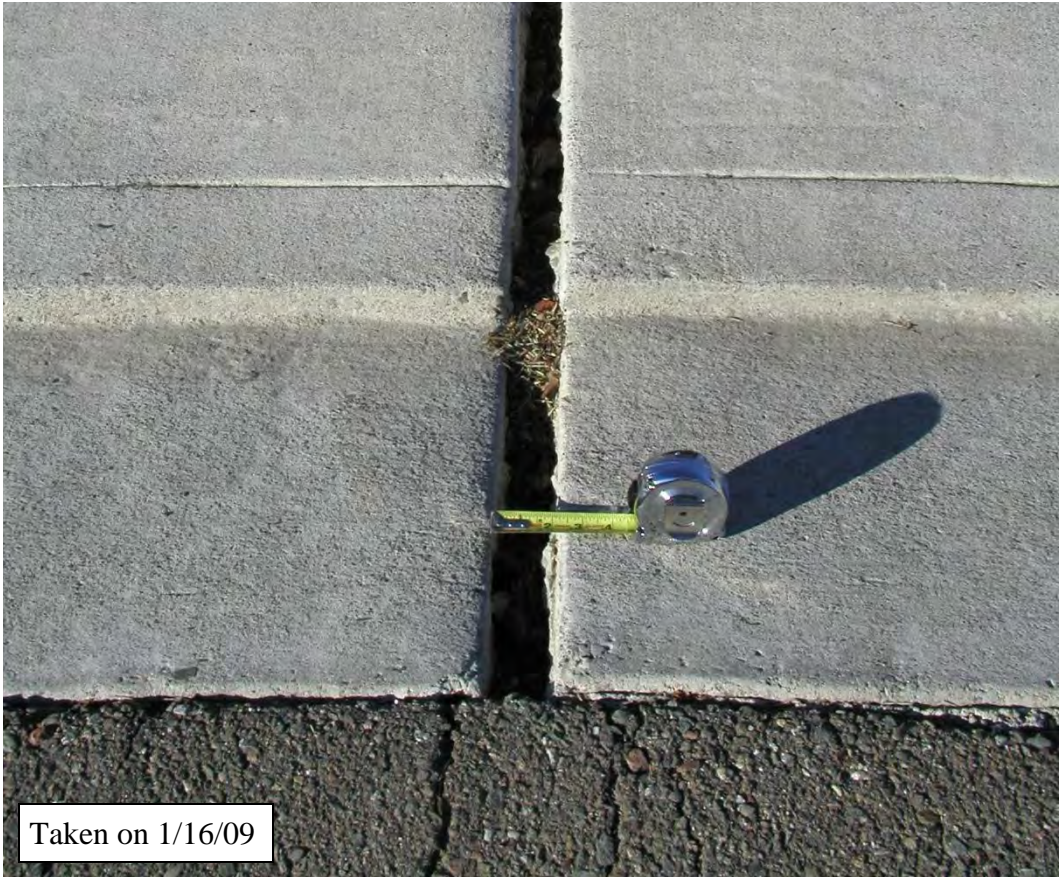


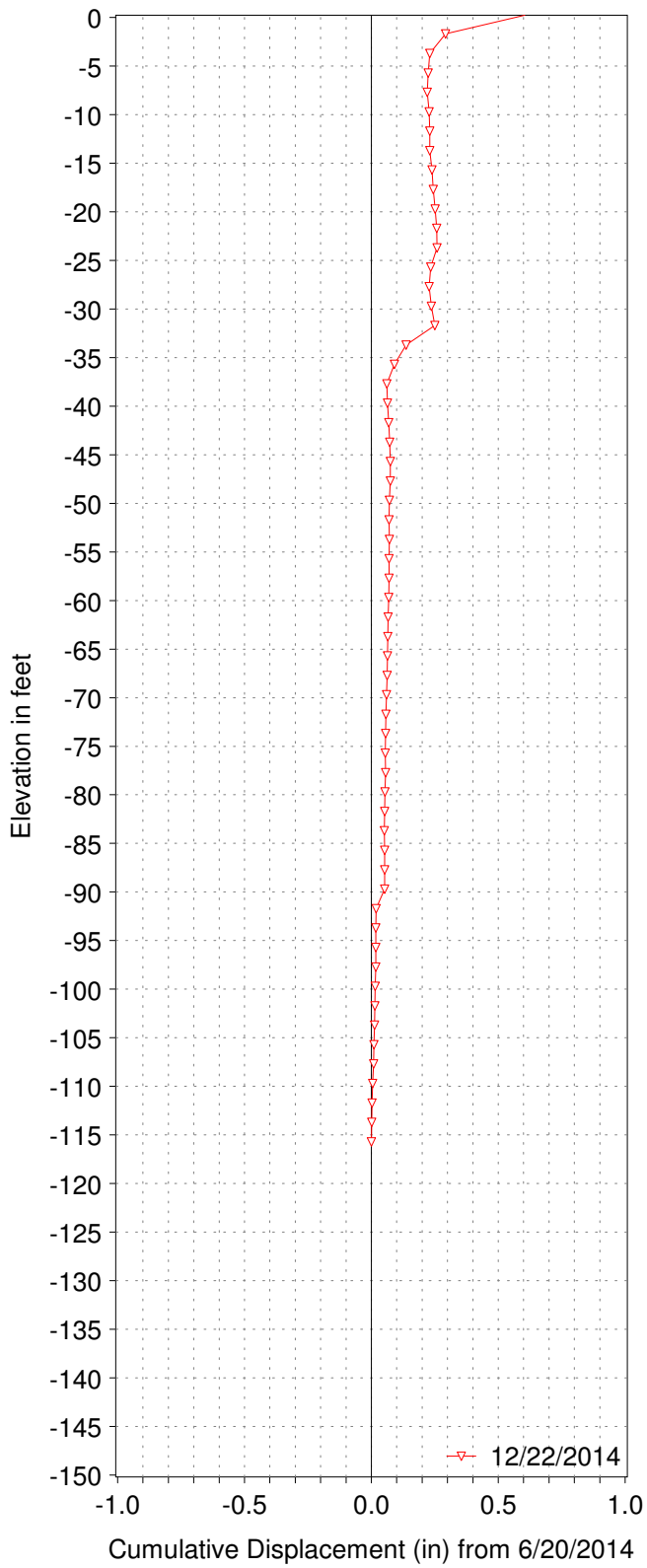
Figure 4, 8053 Kelok Way



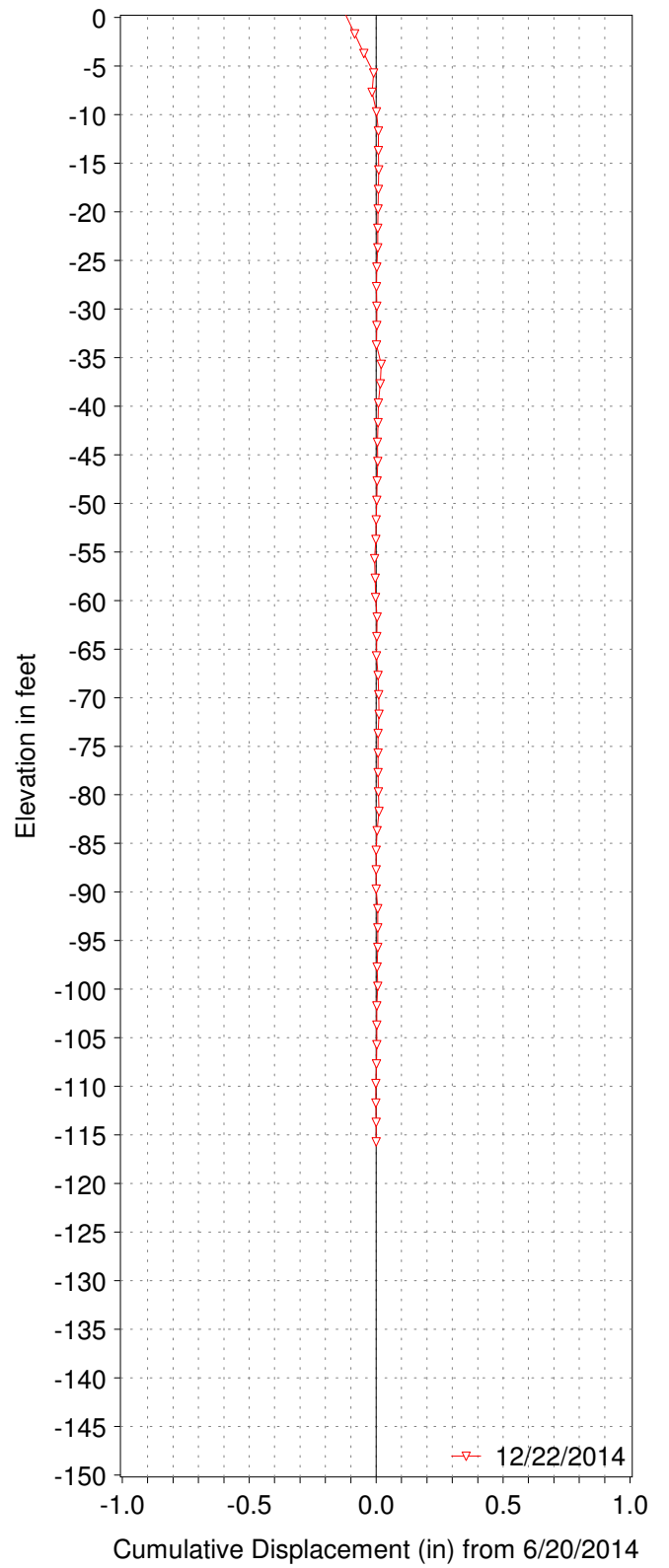
Figure 4 (Continued), 8053 Kelok Way

APPENDIX A
Inclinometer Casing Readings

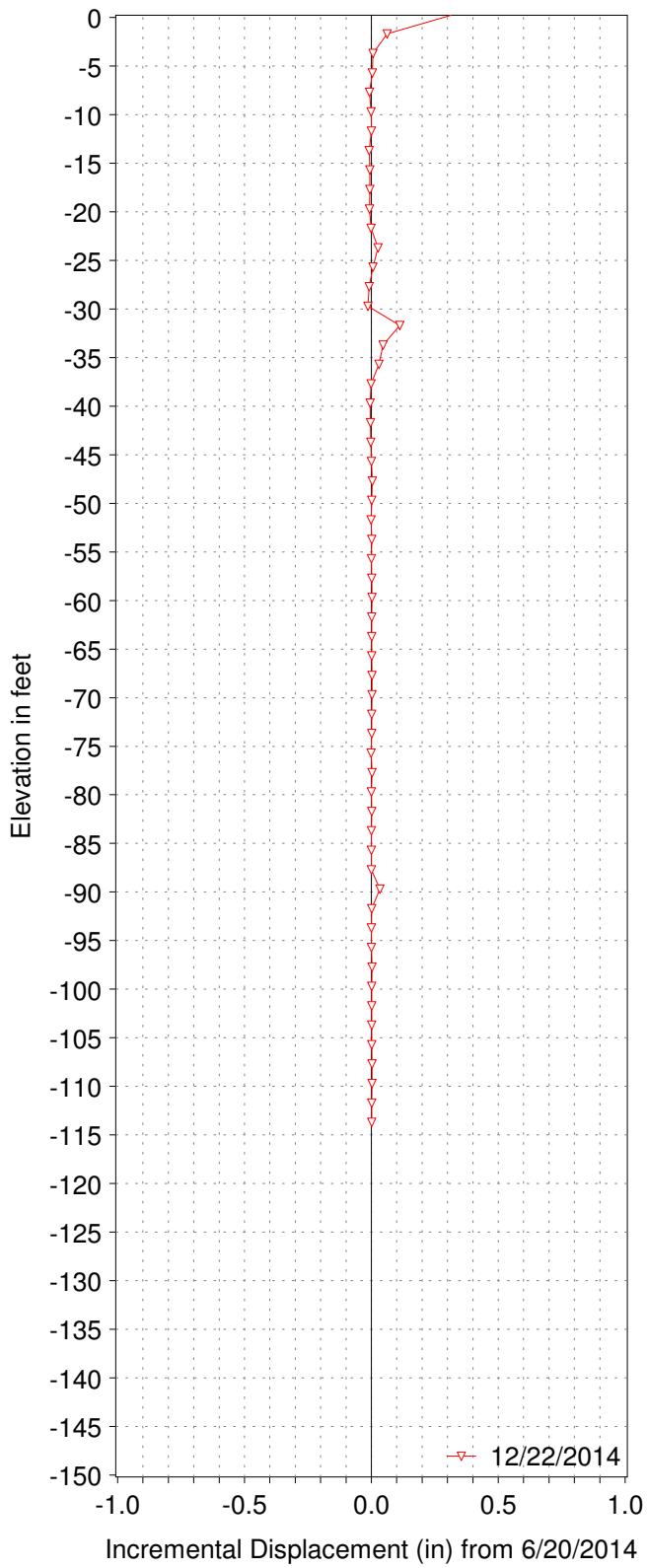
555-2 BGC SI-1, A-Axis



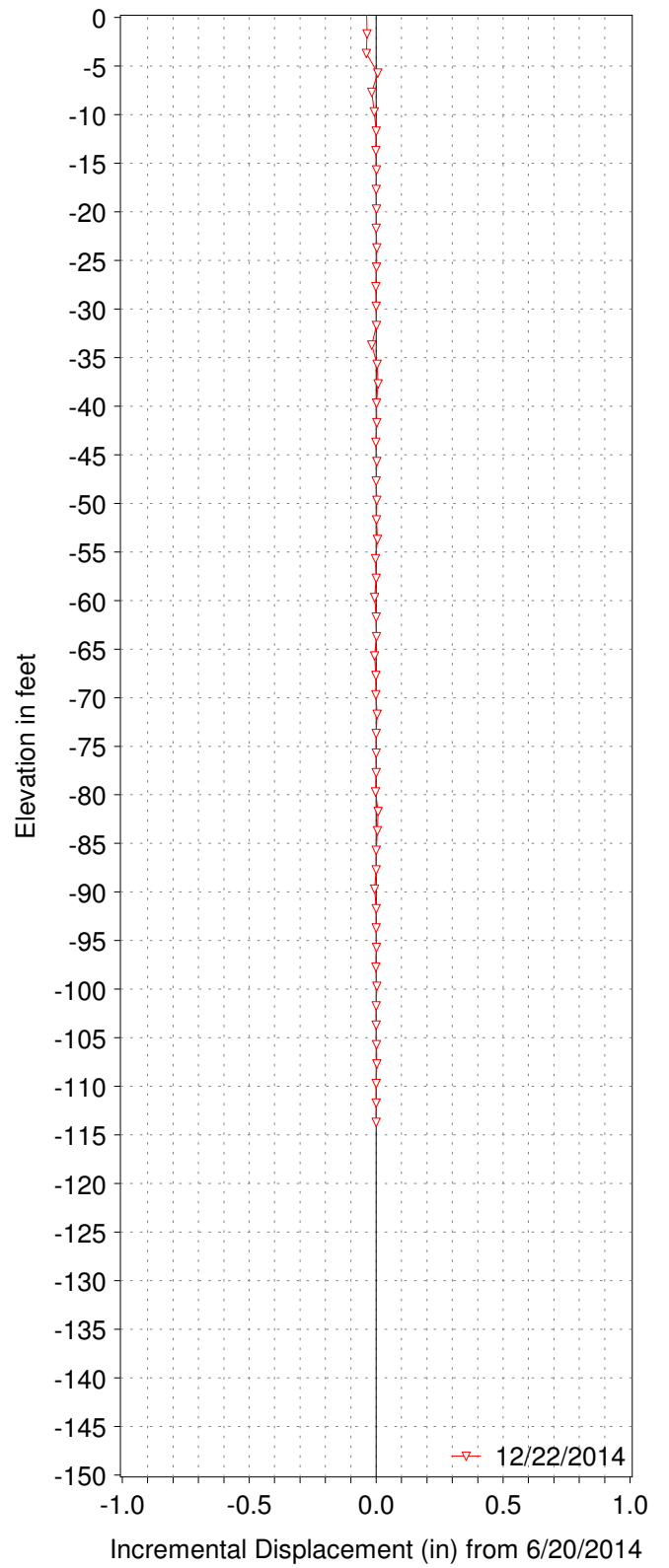
555-2 BGC SI-1, B-Axis



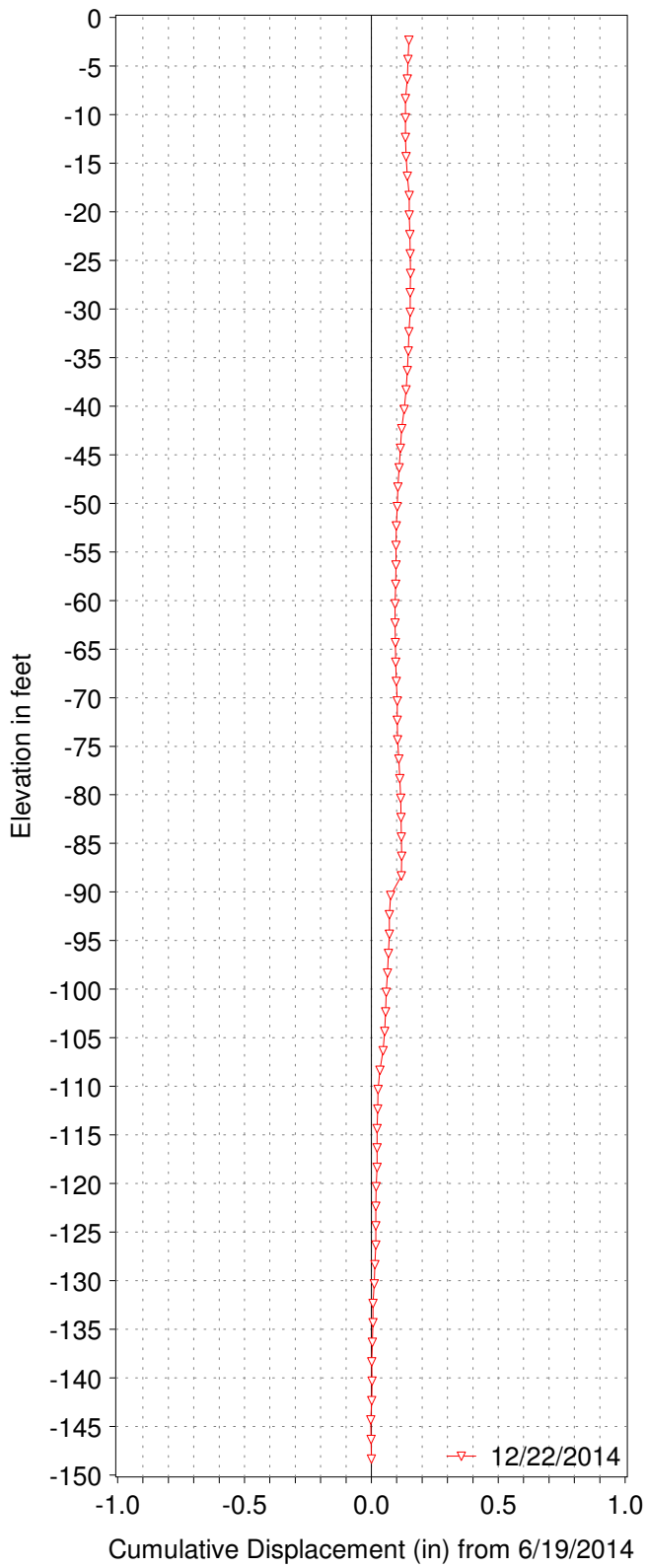
555-2 BGC SI-1, A-Axis



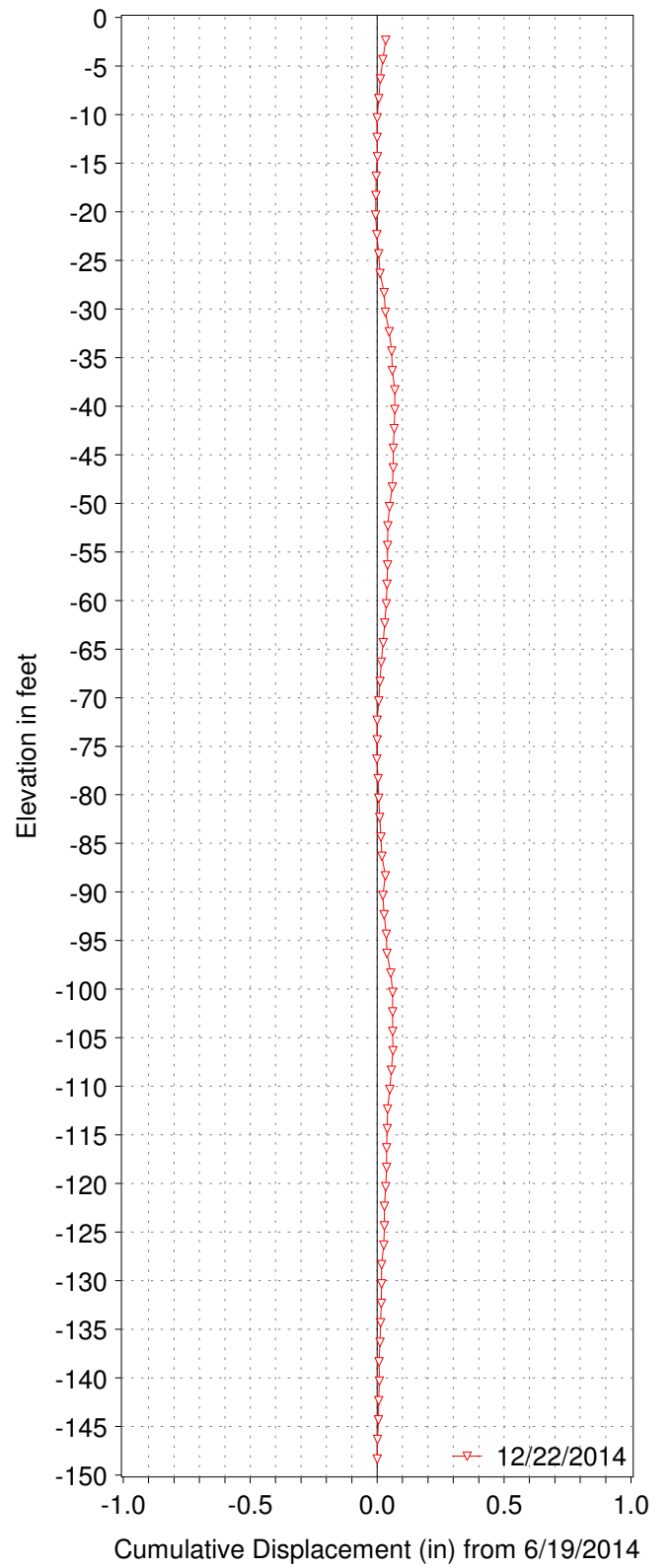
555-2 BGC SI-1, B-Axis



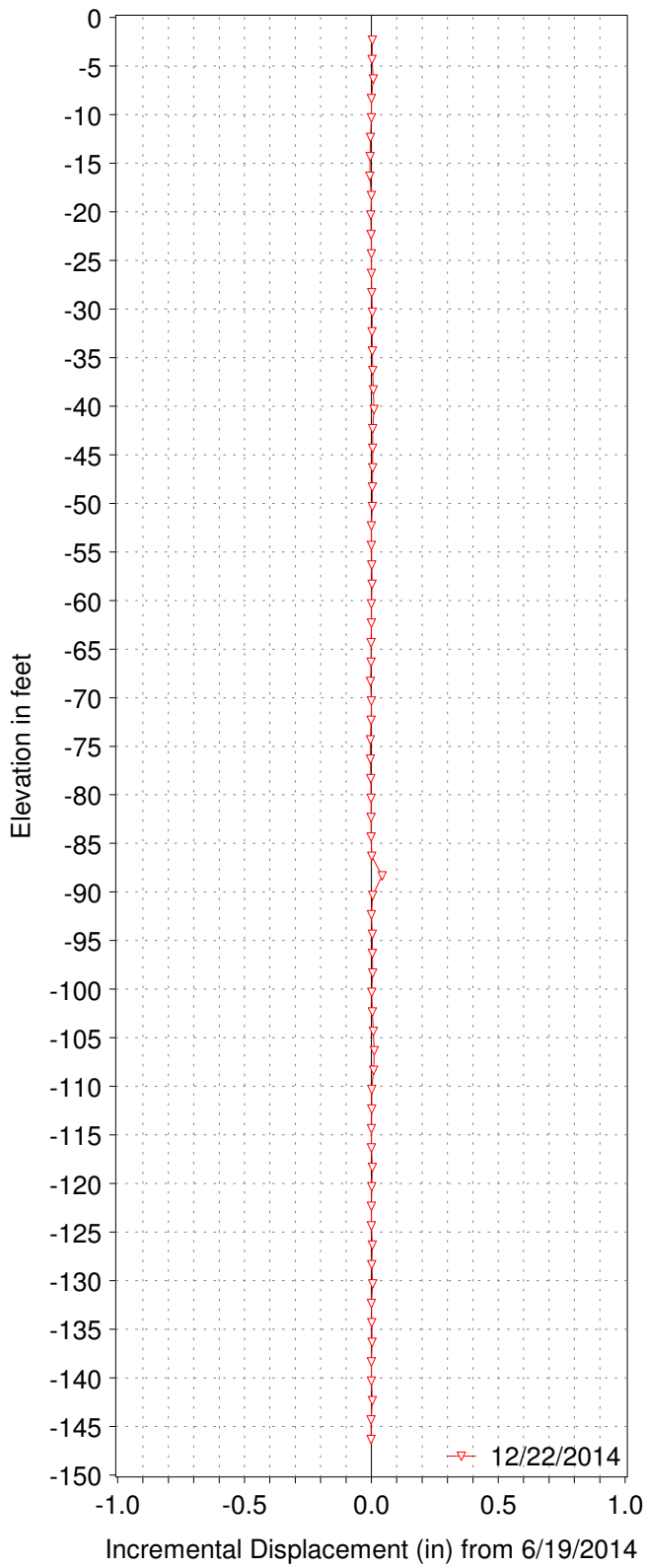
555-2 CEG SI-1, A-Axis



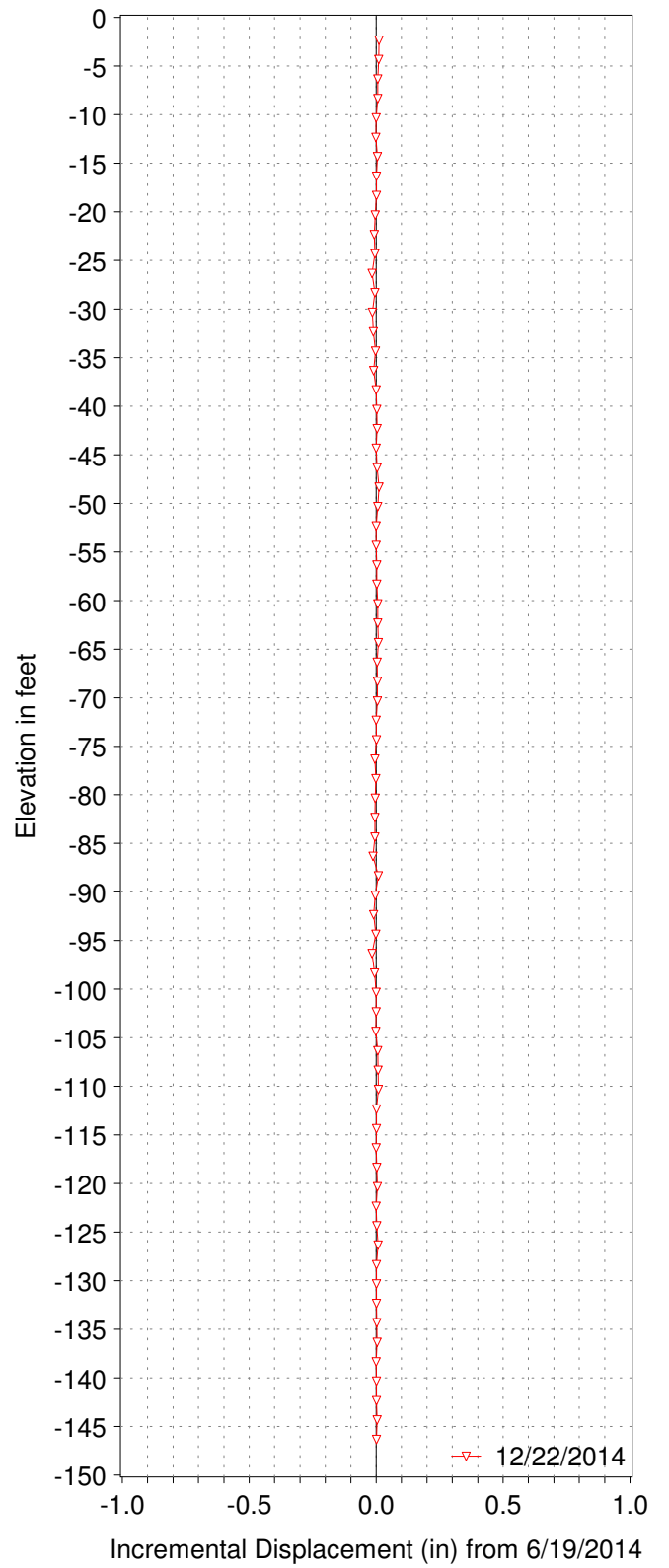
555-2 CEG SI-1, B-Axis



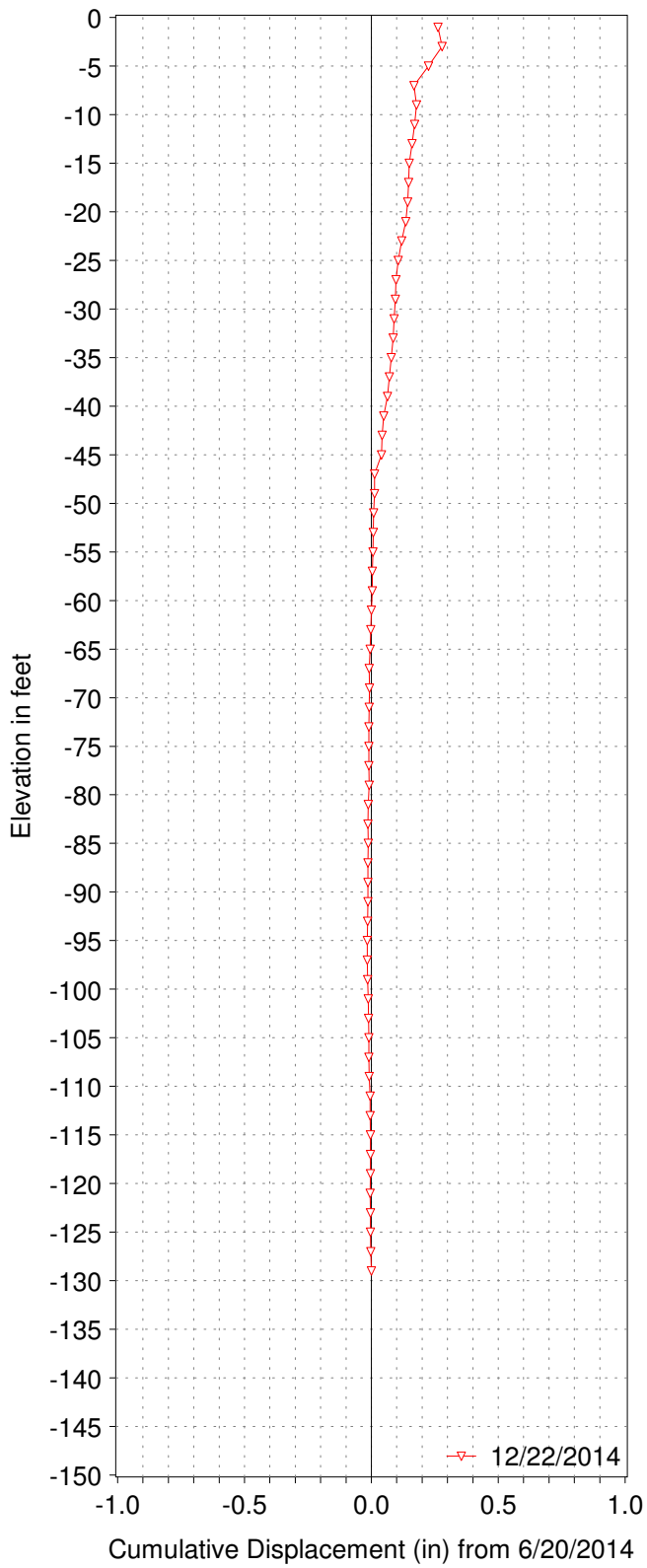
555-2 CEG SI-1, A-Axis



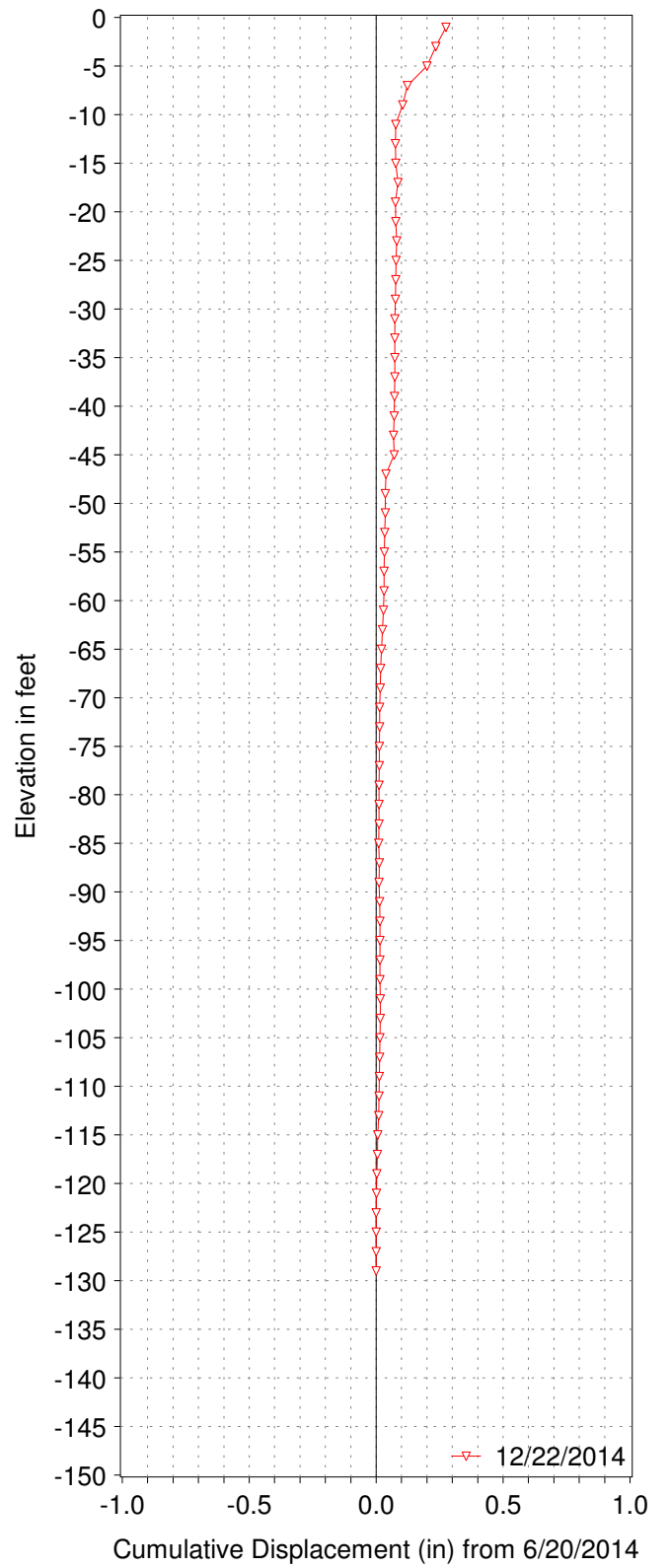
555-2 CEG SI-1, B-Axis



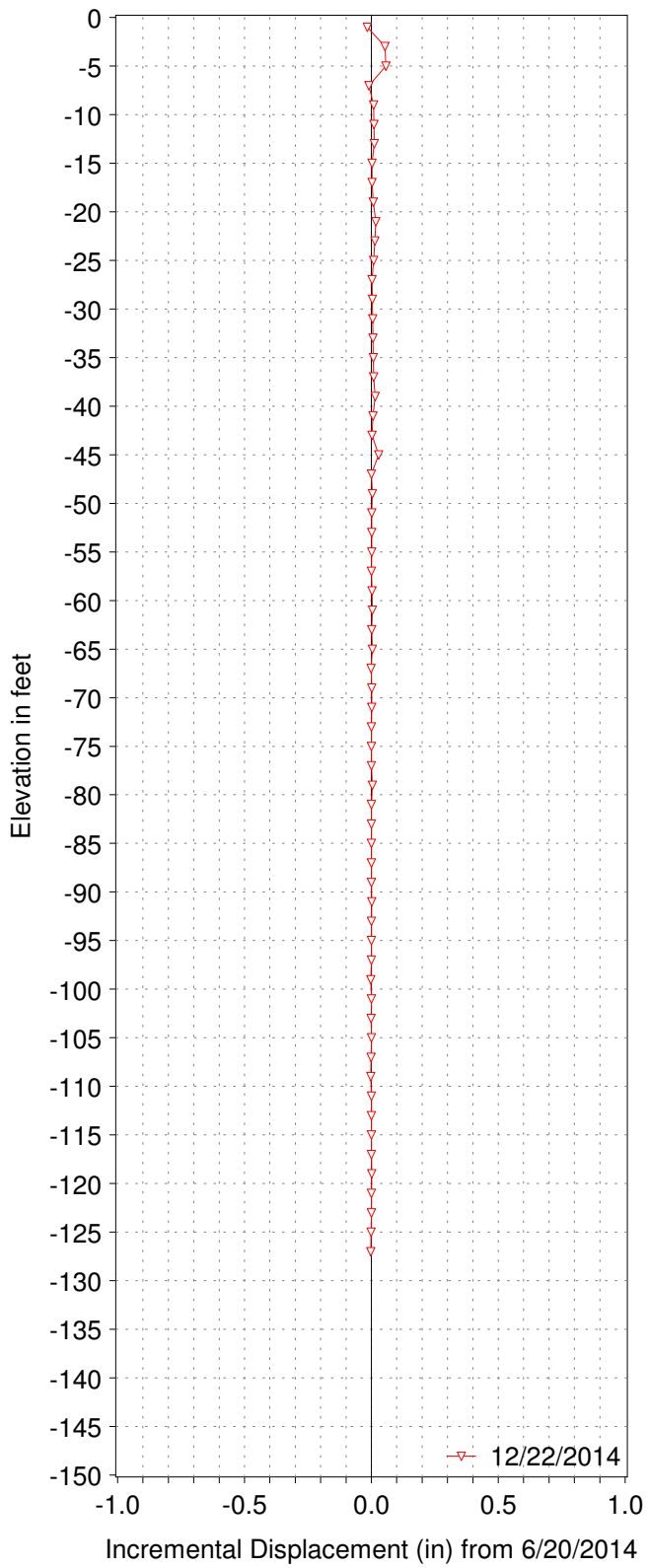
555-2 CSA SI-1, A-Axis



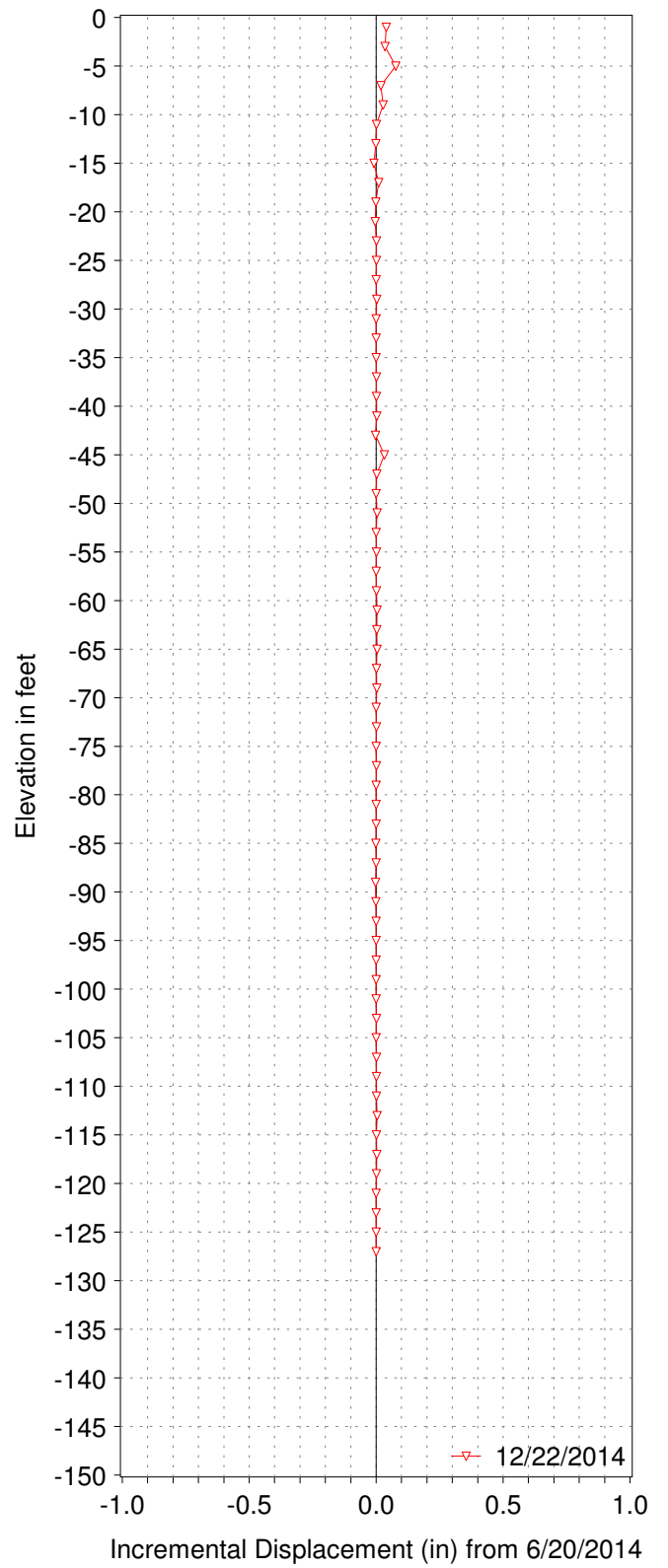
555-2 CSA SI-1, B-Axis



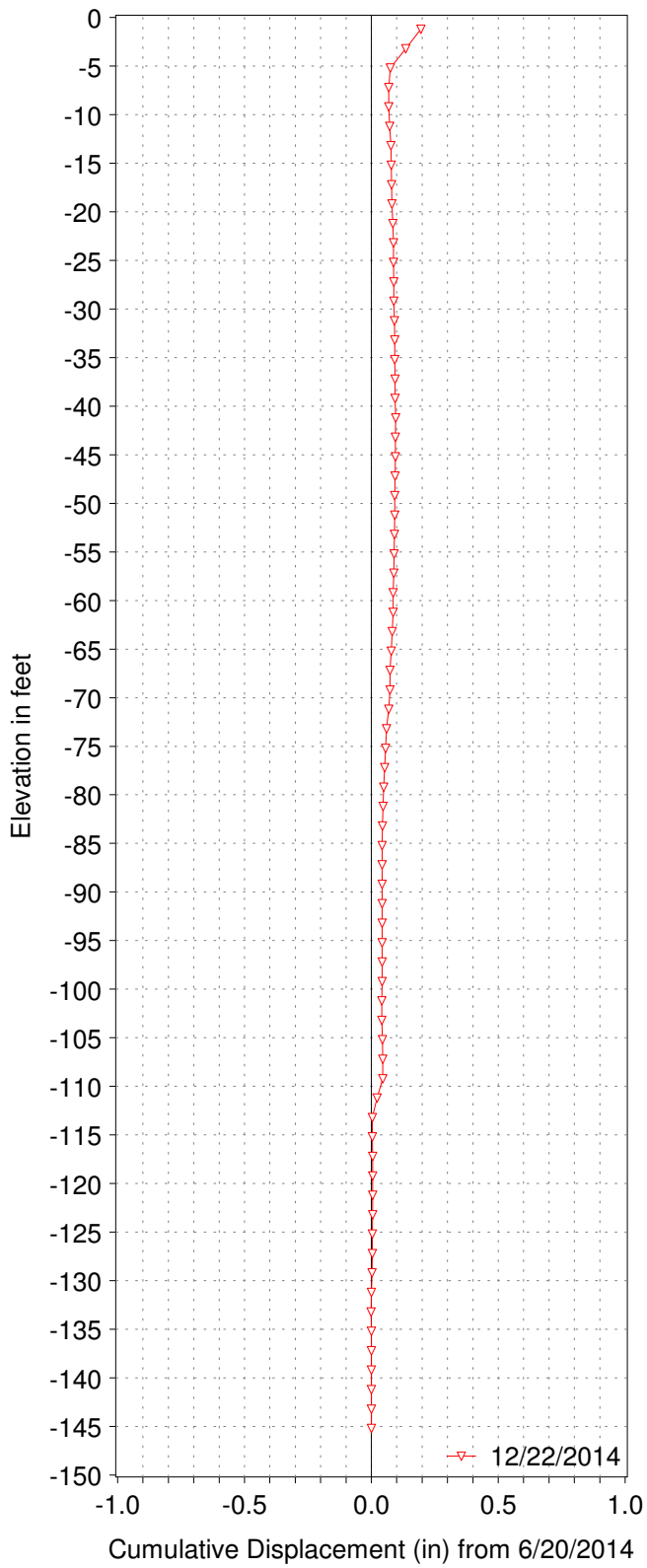
555-1 CSA SI-1, A-Axis



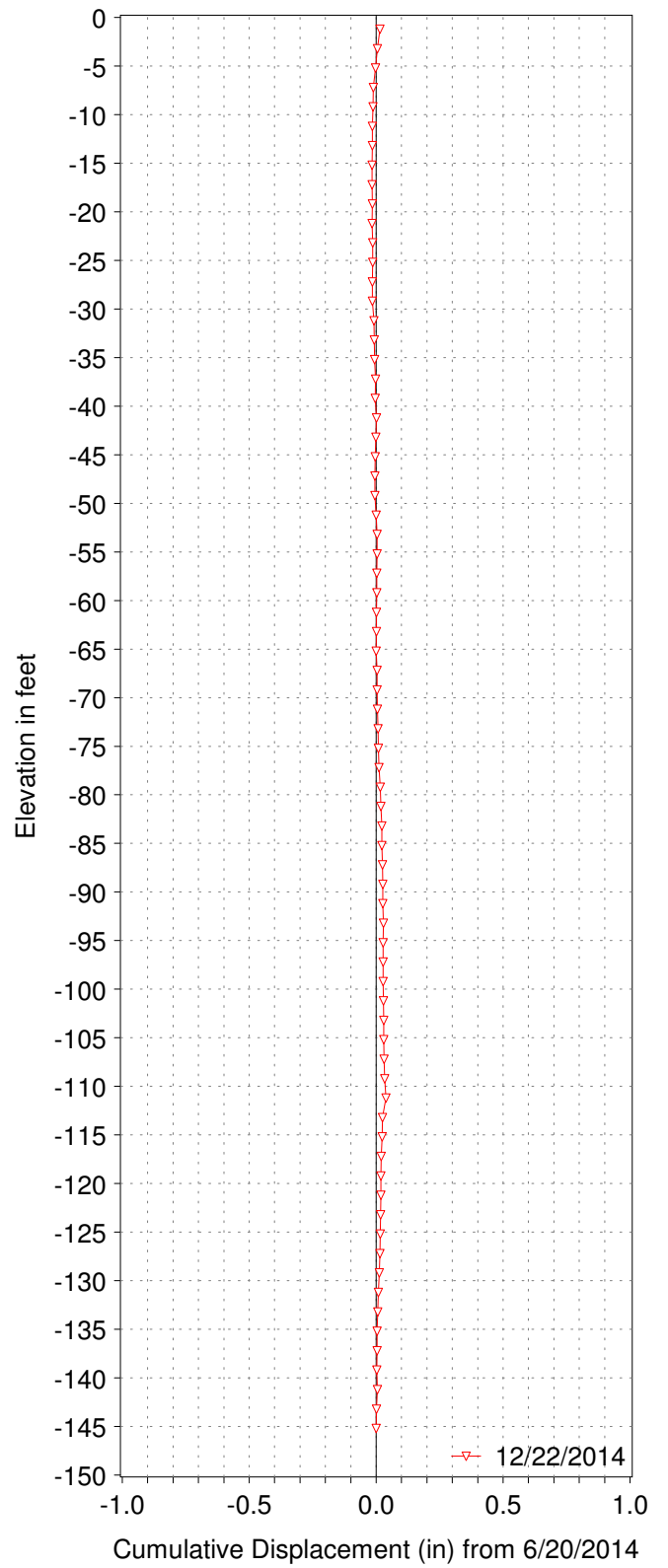
555-2 CSA SI-1, B-Axis



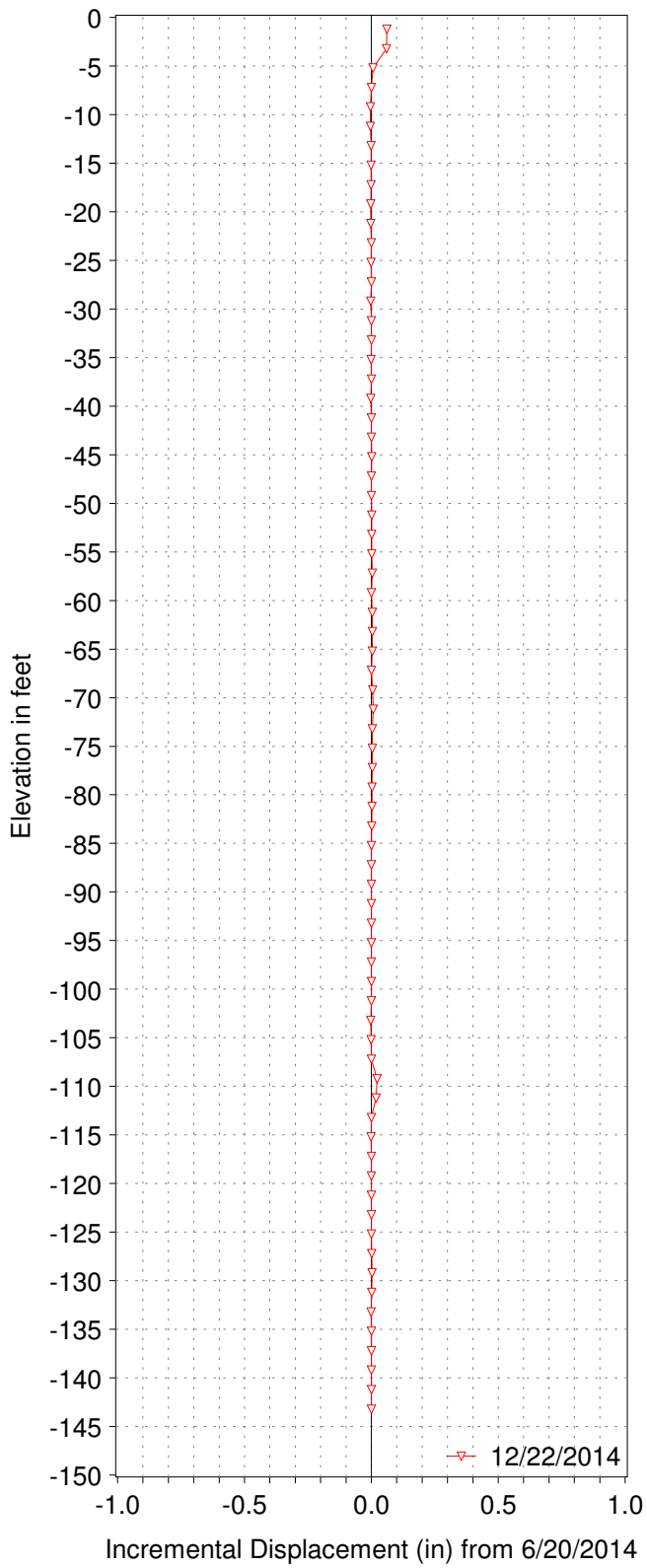
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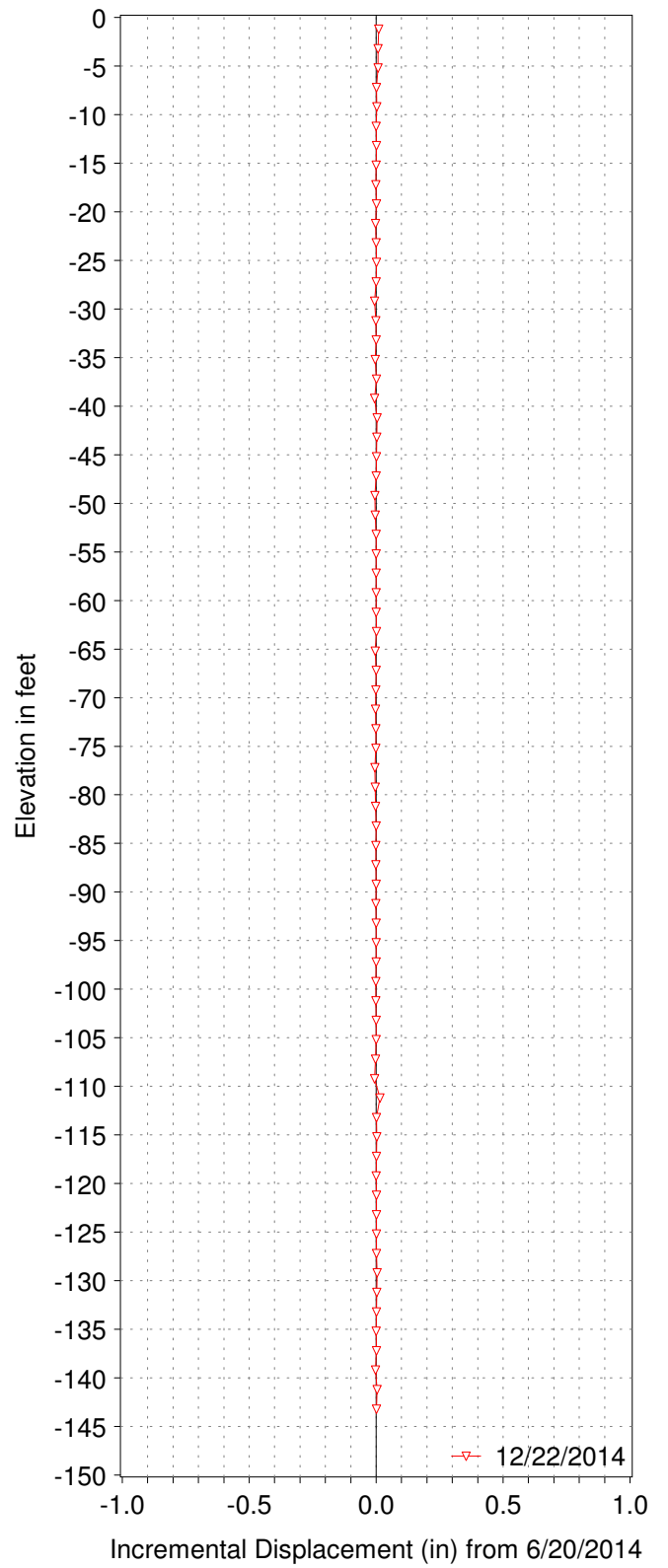
555-2 CSA SI-2, B-Axis



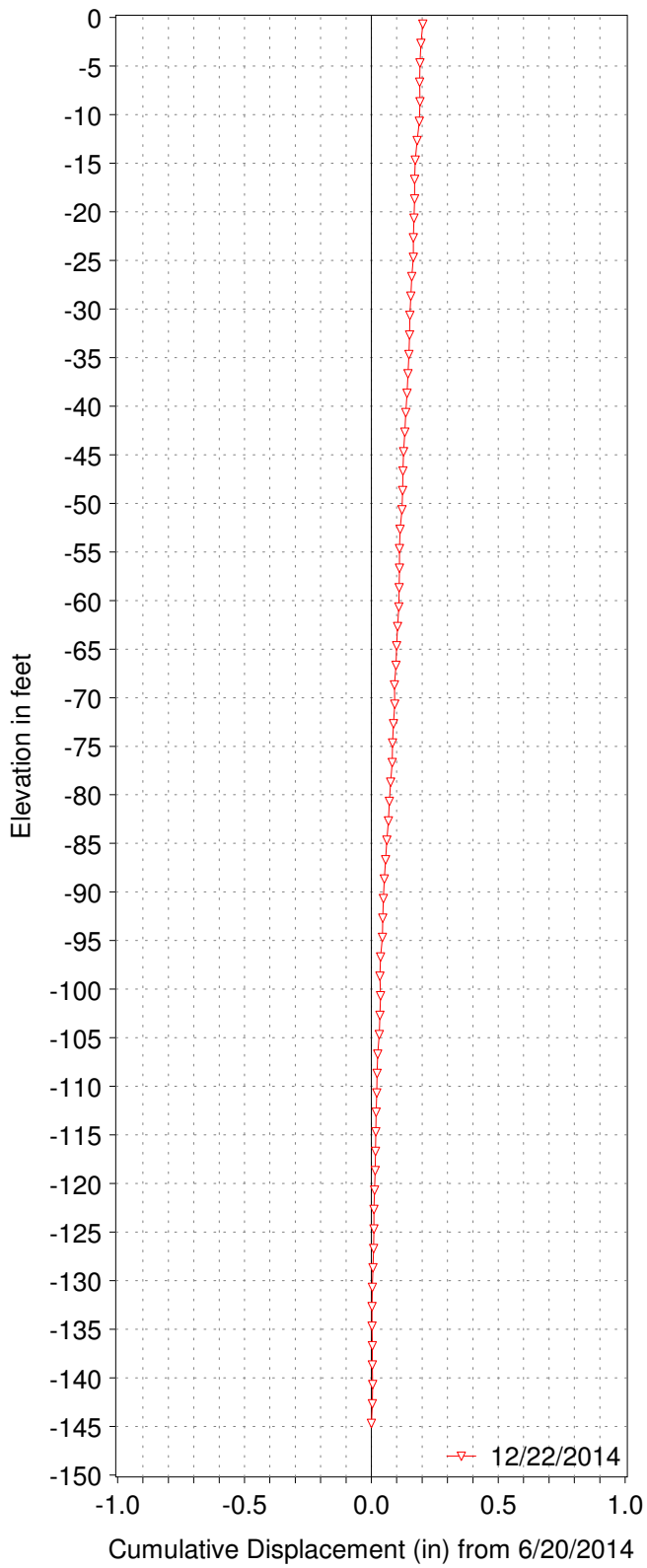
555-2 CSA SI-2, A-Axis



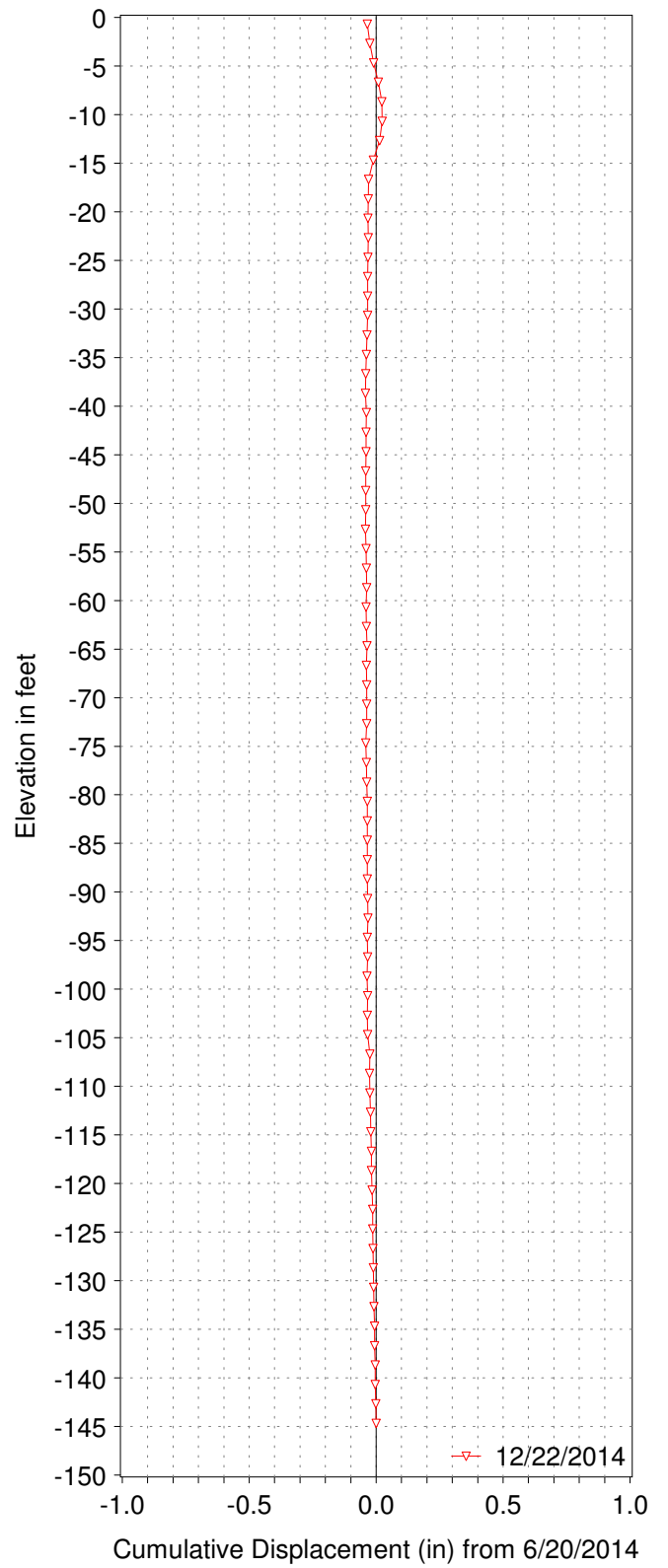
555-2 CSA SI-2, B-Axis



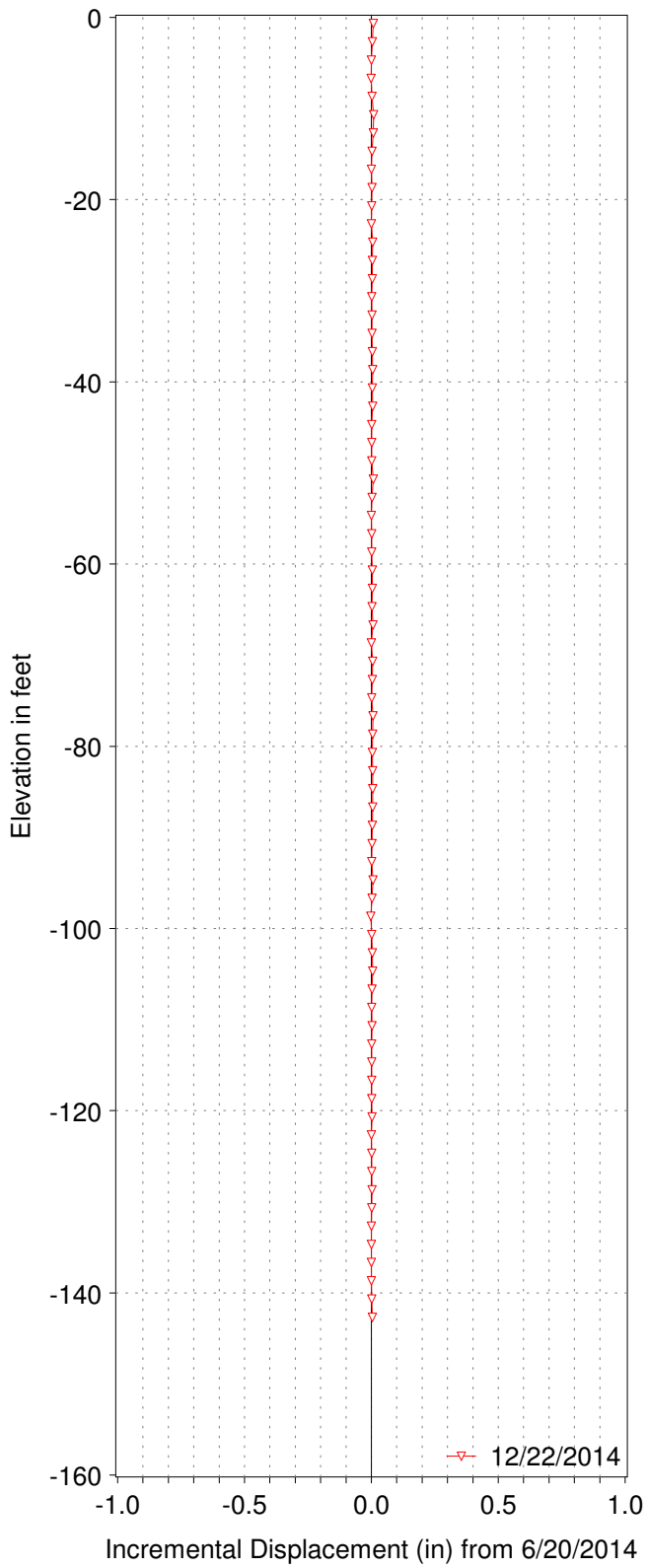
555-2 CSA SI-3, A-Axis



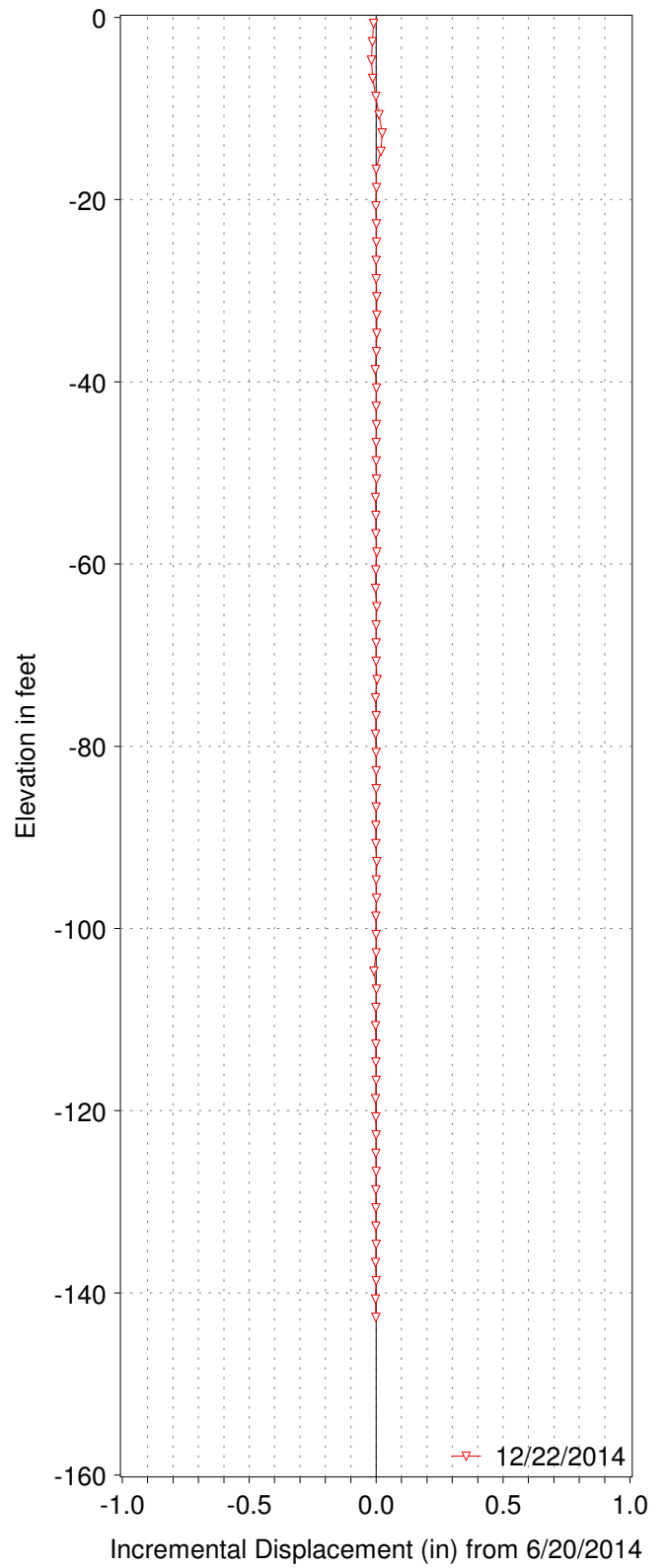
555-2 CSA SI-3, B-Axis



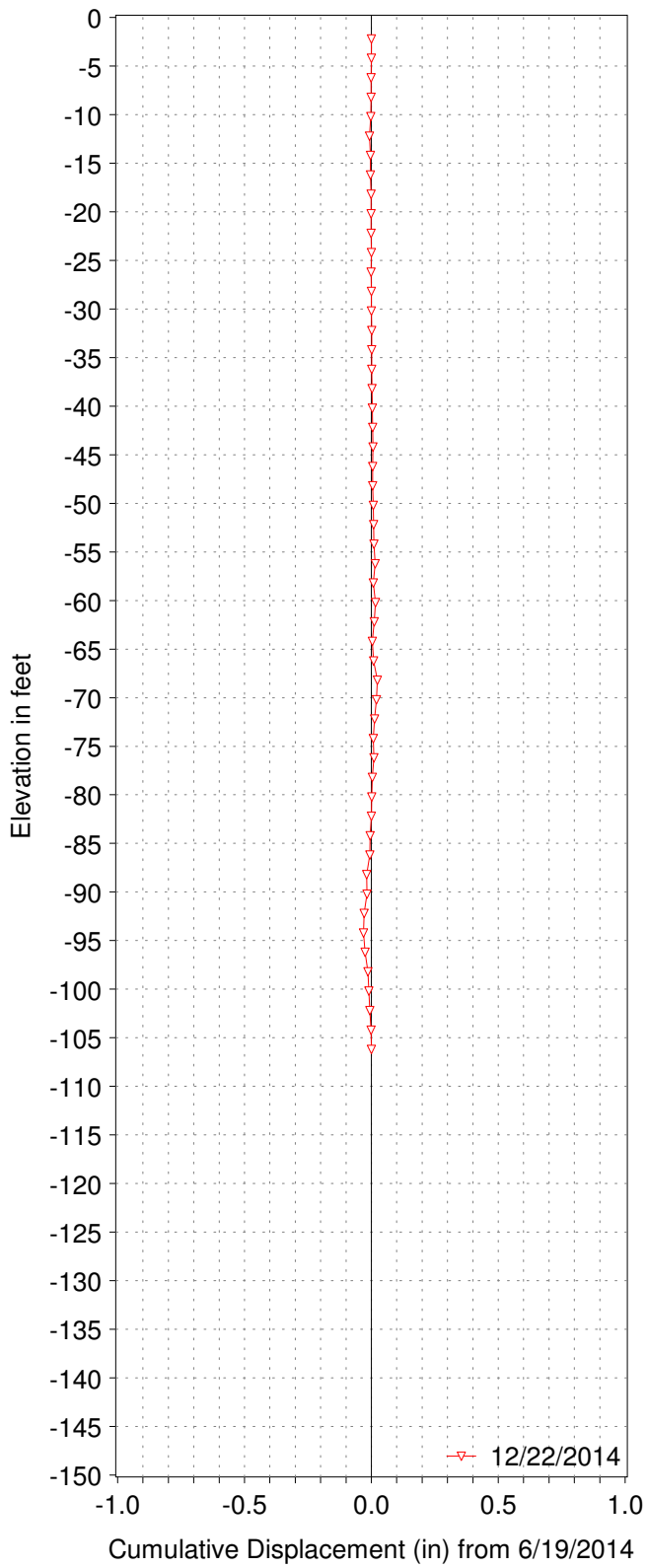
555-2 CSA SI-3, A-Axis



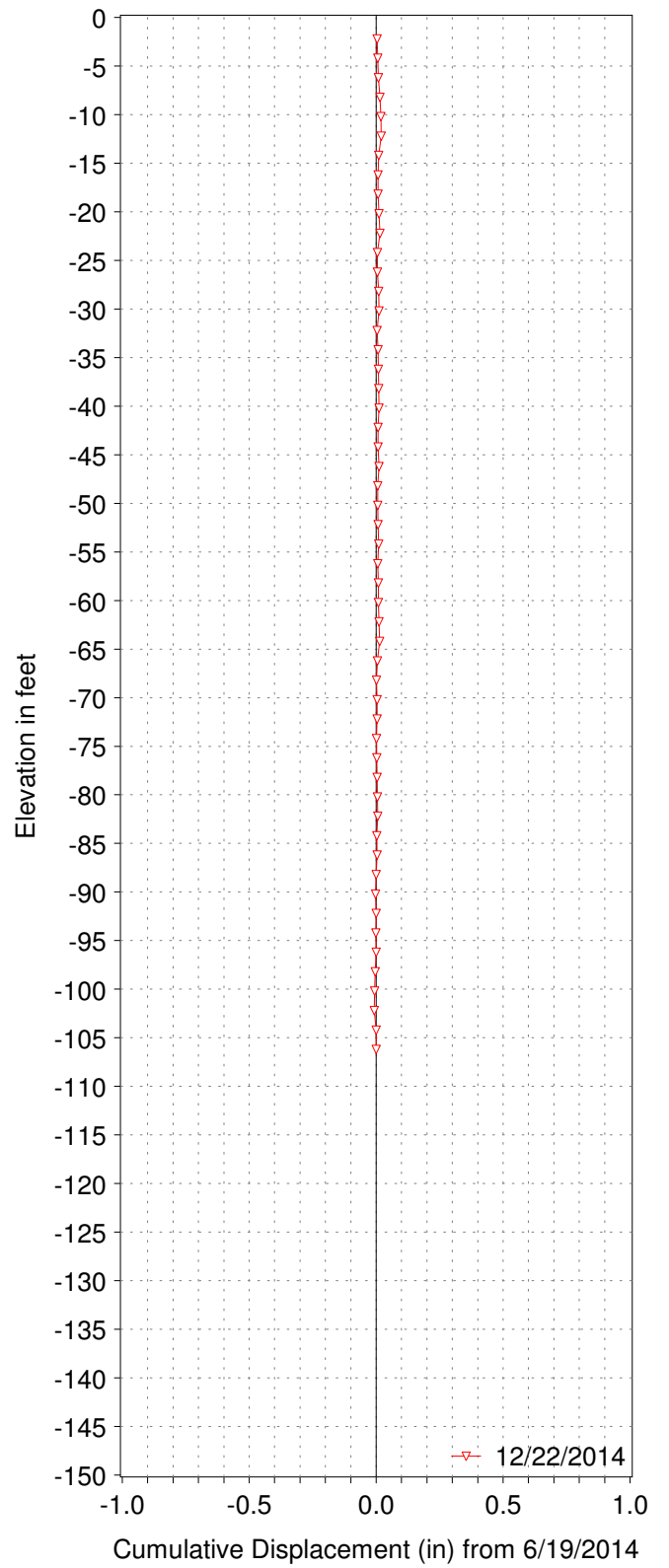
555-2 CSA SI-3, B-Axis



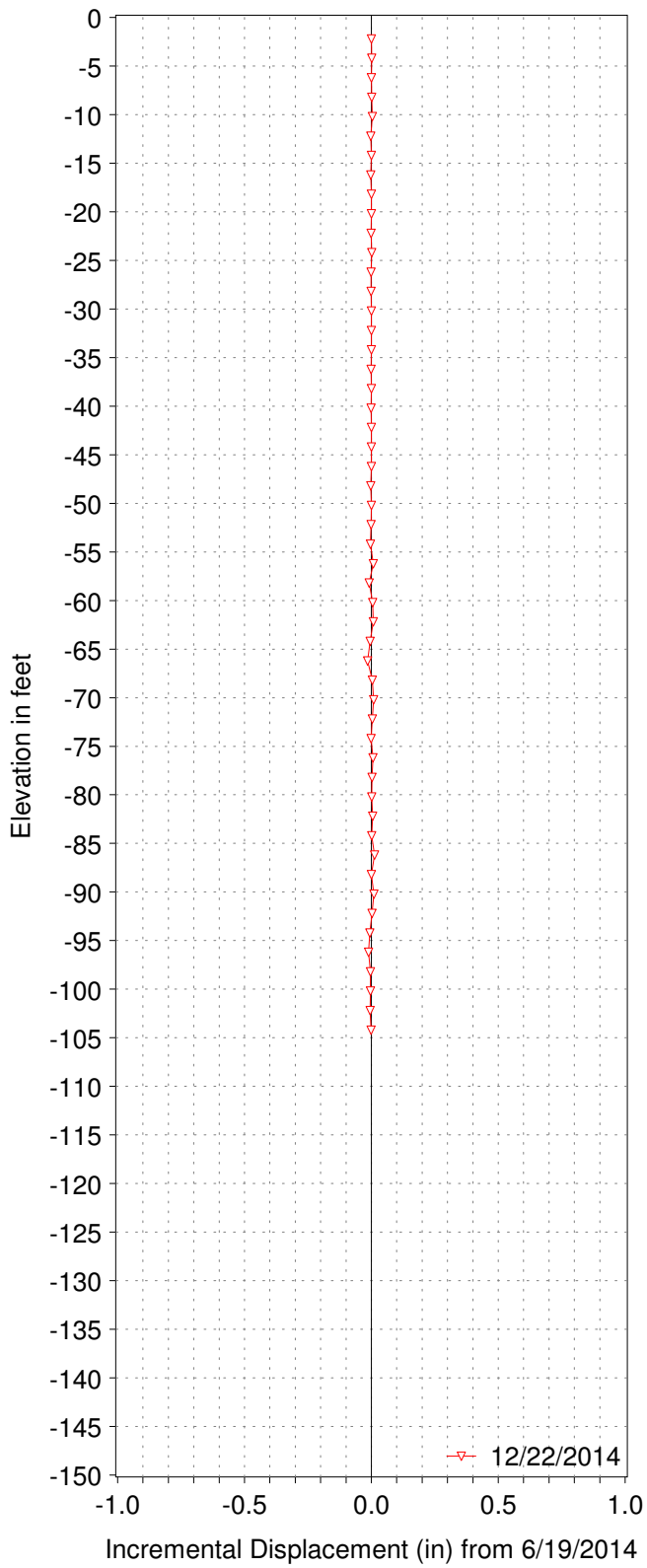
555-2 W-1, A-Axis



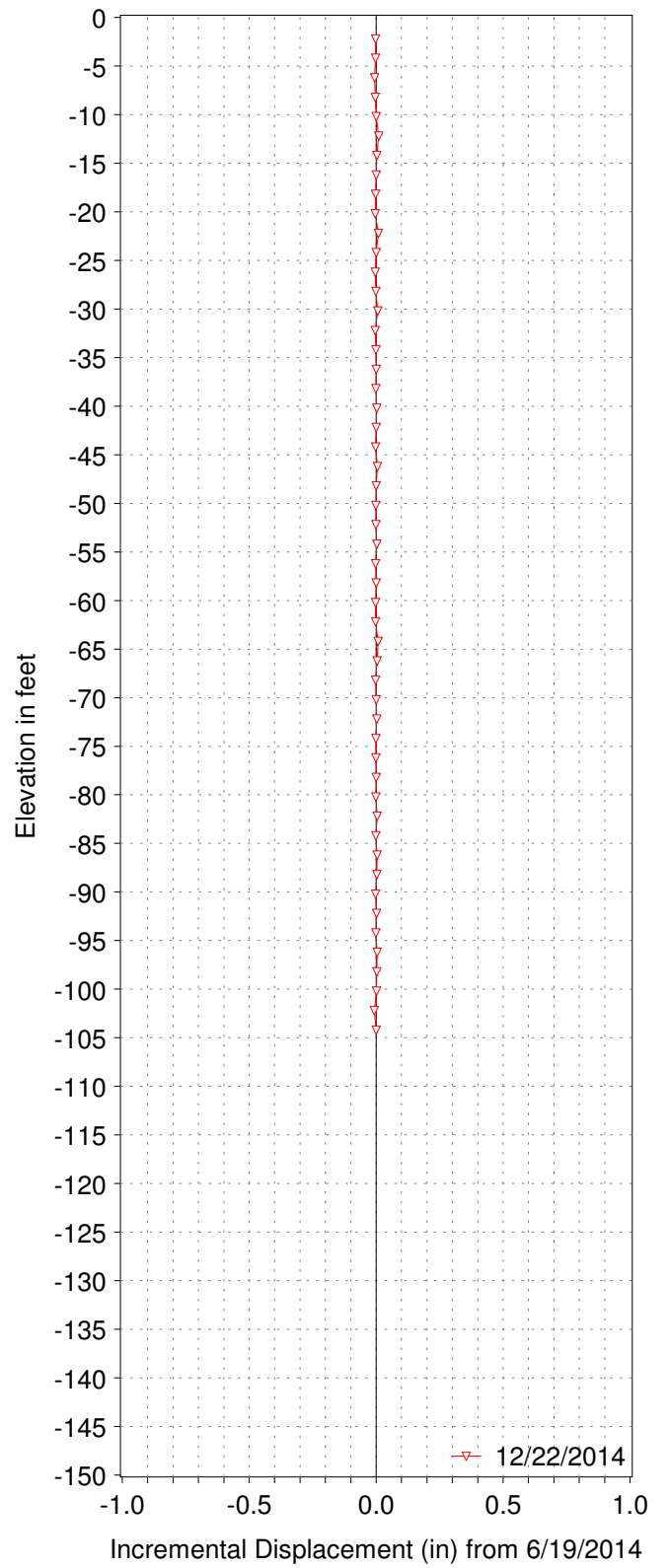
555-2 W-1, B-Axis



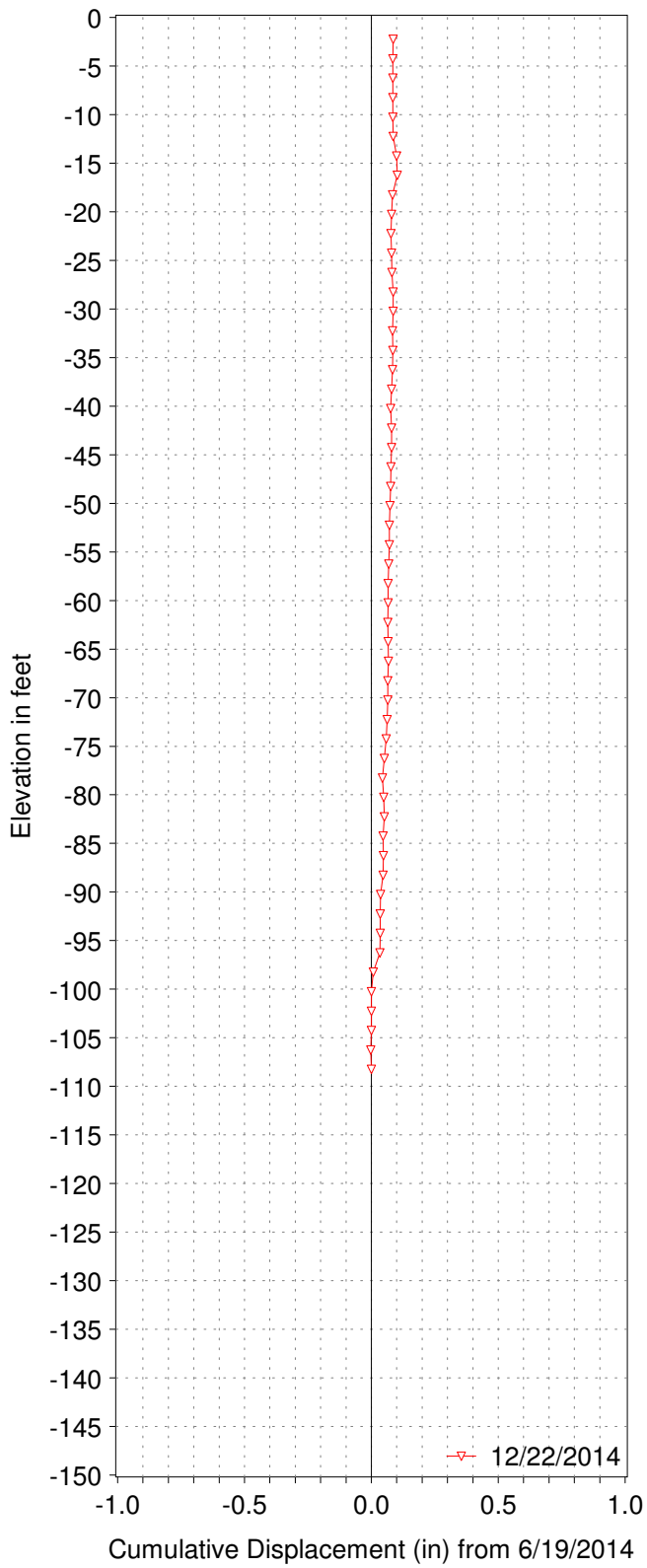
555-2 W-1, A-Axis



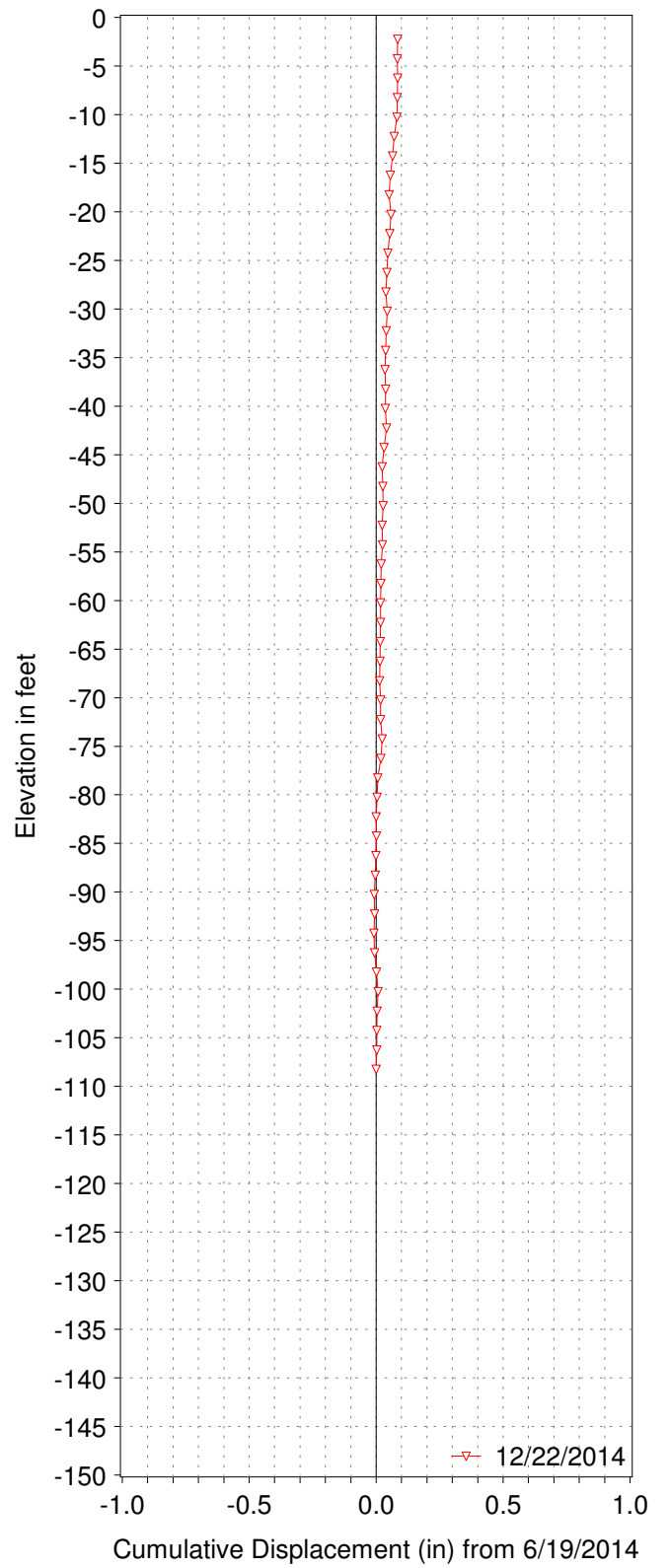
555-2 W-1, B-Axis



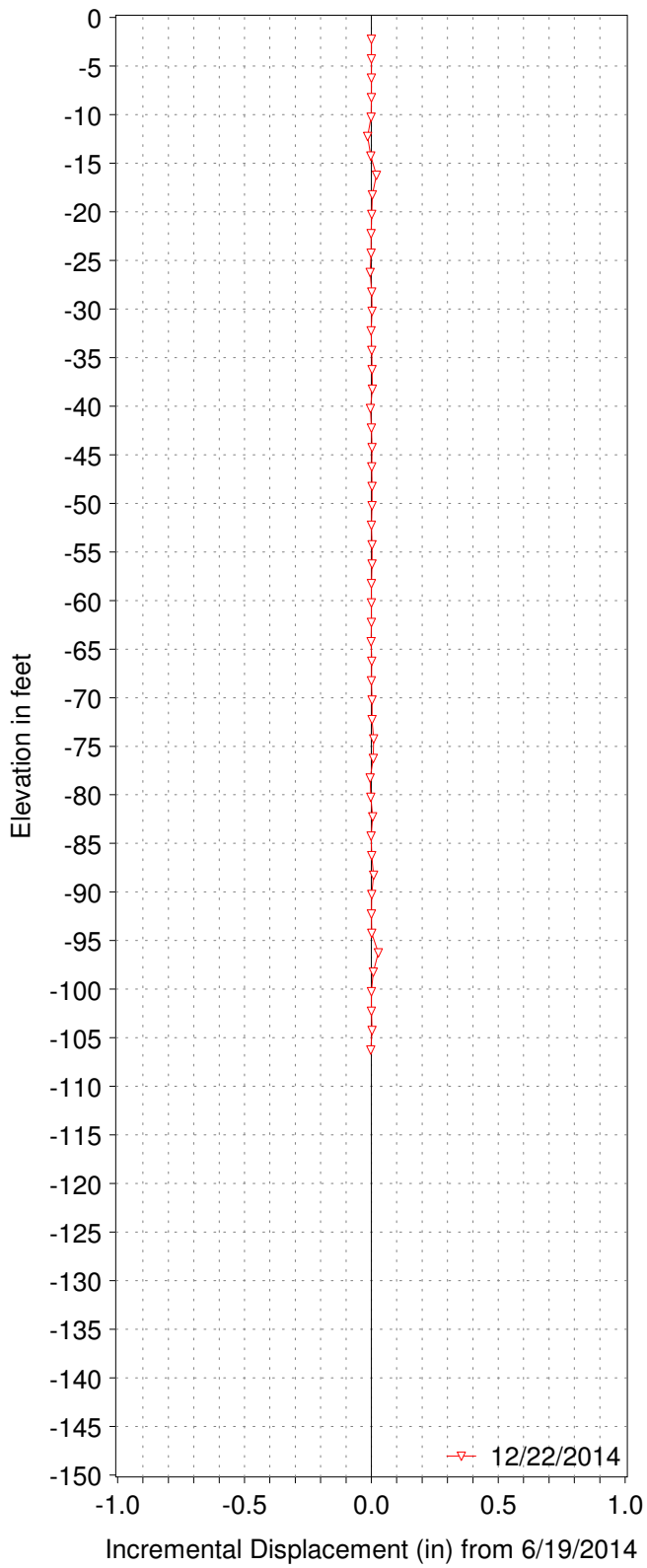
555-2 W-5, A-Axis



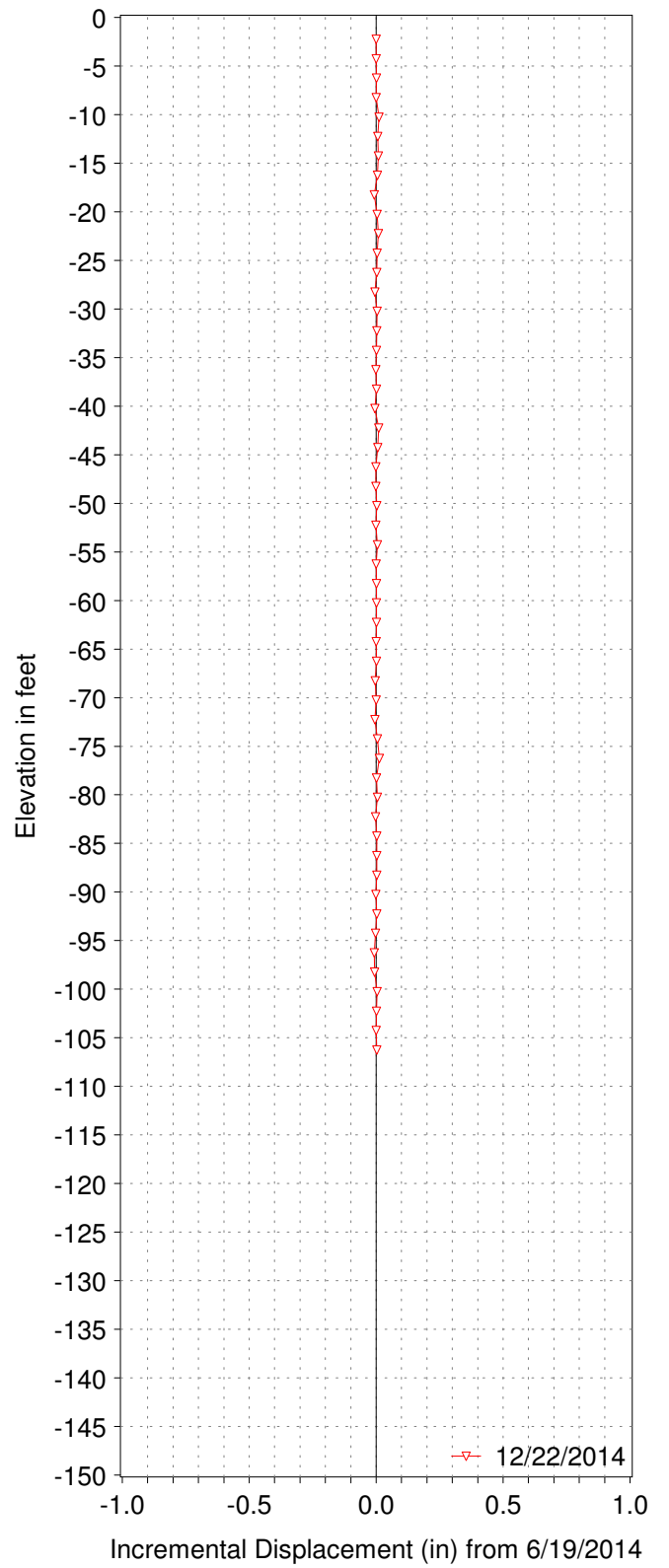
555-2 W-5, B-Axis



555-2 W-5, A-Axis



555-2 W-5, B-Axis



APPENDIX B

Vibrating Wire and Open Pipe Piezometer Measurements

SFB 555-2

Kelok Way Monitoring, Clayton, CA

Date of Monitoring: 12/22/14

Open Standpipe Piezometer	Depth to GW (ft)
W SI-1	22.5
W-2	27.4
W-3	18.4
W-4	23.8
W SI-5	83.2
W-6	85.6
CEGPZ-1	22.3
CEGPZ-2	47.3
MW-1	22.0
CEGSI-1*	10.7
CEGSI-3*	22.9
BGCSI-1*	61.4
CSASI-1*	65.8
CSASI-2*	55.3

*Note: Inclinator casing with open bottom.

VW Piezometer	Depth (ft)	S/N	R0	T0 (°C)	G	K	Hz	T1(°C)	R1	P (psi)	P (psf)	Water (ft) Above VW Piezo	Depth to GW (ft)
CSA-1	36	07-17286	9110	22.8	0.01497	-0.01814	3027.9	16.4	9168.2	-0.7548	-108.7	-1.7	Dry**
	70	07-13836	8876	21.8	0.02439	-0.01615	2917.4	16.5	8511.2	8.9825	1293.5	20.7	49.3
	125	07-14513	9095	21.0	0.02356	-0.03009	2835.3	16.8	8038.9	25.0075	3601.1	57.7	67.3
CSA-2	77	07-17287	9002	22.4	0.01562	-0.01583	3011.2	17.4	9067.3	-0.9412	-135.5	-2.2	Dry**
	97	07-13835	8874	21.9	0.02318	-0.02480	2927.7	17.2	8571.4	7.1302	1026.7	16.5	80.5
	127	07-14512	8278	22.2	0.02452	-0.02357	2693.0	17.3	7252.2	25.2669	3638.4	58.3	68.7
CSA-3	77	07-17309	8954	22.1	0.01842	-0.02201	2988.9	17.1	8933.5	0.4872	70.2	1.1	75.9
	97	07-15712	8901	21.5	0.02413	-0.02937	2892.2	17.5	8364.8	13.0555	1880.0	30.1	66.9
	127	07-15716	8914	21.4	0.02465	-0.02996	2784.6	17.6	7754.0	28.7079	4133.9	66.2	60.8
CSA-4	44	07-17310	8894	22.2	0.01538	-0.00761	3000.7	16.3	9004.2	-1.6500	-237.6	-3.8	Dry**
	60	07-15711	7692	21.1	0.02356	-0.00656	2787.5	16.1	7770.2	-1.8086	-260.4	-4.2	Dry**
	125	07-15715	8929	21.3	0.02343	-0.02363	2822.8	16.6	7968.2	22.6226	3257.7	52.2	72.8

**Note: No positive water pressure measured by VW piezometer.

APPENDIX C

Historical Piezometer Measurement Records

SFB 555-2

Kelok Way Monitoring, Clayton, CA

Measured Groundwater Level in Feet Below Ground Surface

Monitored by	CEG	CEG	CEG	CEG	CEG	CEG	CEG	CEG	CEG	CEG	CEG	CEG	CEG	CEG	SFB	SFB	SFB
Open Standpipe Piezometer	9/24/07	10/18/07	4/3/08	6/26/08	1/15/09	1/27/10	3/24/10	9/31/10	1/28/11	5/10/11	5/16/11	6/3/11	6/20/11	7/22/11	11/29/12	6/19/14 to 6/20/14	12/22/14
W SI-1															22.4	23.8	22.5
W-2															37.3	33.1	27.4
W-3															26.1	20.4	18.4
W-4															25.6	23.4	23.8
W SI-5															83.2	83.2	83.2
W-6															85.7	85.6	85.6
CEGPZ-1	23	22.3	23.7	22.2	24.4	23.4	24.1	23.1	23.1	21.8				21		22.2	22.3
CEGPZ-2	46.5	45.9	46.2	45.8	46.2	45.7	46.9	46.4	46.9	46.4				46		47.0	47.3
MW-1											15.2	17.3	17.2	17.5		21.0	22.0
CEGSI-1*												49.0	35.0	22.5		10.6	10.7
CEGSI-3*																21.4	22.9
BGCSI-1*														66.2		61.6	61.4
CSASI-1*														71.9		66.3	65.8
CSASI-2*														86.1		57.6	55.3

*Note: Inclinator casing with open bottom.

Monitored by	CEG	CEG	CEG	CEG	CEG	CEG	CEG	CEG	SFB	SFB
VW Piezometer	Depth (ft)	1/13/09	12/2/09	3/4/10	9/30/10 to 10/1/10	1/28/11 to 1/31/11	5/10/11 to 5/16/11	7/22/11	6/19/14 to 6/20/14	12/22/14
CSA-1	36	Dry**	Dry**	Dry**	Dry**	Dry**	Dry**	Dry**	Dry**	Dry**
	70	54.9	58.0	55.9	55.8	55.6	53.0	53.6	51.0	49.3
	125	50.9	54.8	53.7	54.3	55.2	53.7	69.4	68.0	67.3
CSA-2	77	Dry**	Dry**	Dry**	Dry**	Dry**	Dry**	Dry**	Dry**	Dry**
	97	79.7	80.6	80.8	81.3	81.2	81.1	80.6	80.8	80.5
	127	59.0	61.8	61.9	63.7	63.5	63.6	66.0	69.2	68.7
CSA-3	77	70.0	68.8	68.9	69.1	68.8	68.9	68.9	75.8	75.9
	97	71.7	73.4	73.6	74.6	74.5	74.0	74.4	67.7	66.9
	127	68.4	69.4	69.2	69.7	69.2	68.6	69.0	61.4	60.8
CSA-4	44	Dry**	Dry**	Dry**	Dry**	Dry**	Dry**	Dry**	Dry**	Dry**
	60	Dry**	Dry**	Dry**	Dry**	Dry**	Dry**	Dry**	Dry**	Dry**
	125	70.6	71.4	68.4	68.3	68.9	61.3	63.1	72.2	72.8

**Note: No positive water pressure measured by VW piezometer.