STATE OF COLORADO

Cazier - DNR, Tim <tim.cazier@state.co.us>

Pikeview January Monitoring report

1 message

Kos, Paul <paul.kos@stantec.com> Wed, Mar 10, 2021 at 1:16 PM
To: "Cazier - DNR, Tim" <tim.cazier@state.co.us>
Cc: Jerald Schnabel <Jerald_Schnabel@castleaggregate.com>

Tim,

Attached is the January monitoring report for your review. Also, the blocked culvert has been cleared, and we will discuss that in the February report.

Paul Kos P.E., P.Eng.

Senior Geological Engineer

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Pikeview Monitoring Memo January 03092021v2.pdf
10795K

To:	Jerald Schnabel	From:	Paul Kos
	Continental Materials Corp.		Denver, CO 80222
File:	January 2021 Monitoring Summary	Date:	February 28, 2021

Reference: January 2021 Geotechnical Monitoring Summary Pikeview Quarry

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) has prepared this January 2021 Geotechnical Monitoring Summary for the Pikeview Quarry. The Pikeview Quarry is situated along the foothills of the Rocky Mountains, northwest of Colorado Springs, Colorado. Continental Materials Corp. operates the quarry, which is currently closed, pending reclamation. A geotechnical monitoring program was established to monitor reclamation activities which will affect the geotechnical performance of the existing and reclaimed slopes during and following reclamation grading. This report presents the geotechnical monitoring results for the slope reclamation activities at the site through the month of January 2021.

It is important to note that there is currently little activity at the Pikeview Quarry. Operations are limited to importing fill and preparing the growth medium, and no fill is being placed on the slopes. Continuous monitoring by the robotic survey system began in 2010 and has continued through the month of January 2021 uninterrupted. Visual inspections of the slopes are performed monthly by Stantec engineers; however, the January 2021 visual inspection was cancelled due to schedule and weather conflicts.

1.1 PURPOSE

The purpose of this report is to summarize the January 2021 geotechnical monitoring results and verify the geotechnical performance of the existing and reclaimed slopes with respect to the historical performance record. The goals of the geotechnical instrumentation monitoring program can be described as:

- Meet corporate risk management requirements,
- Provide ongoing slope monitoring and advance warning of any changed conditions that could pose a hazard to workers or to the public,
- Document the geotechnical performance of the slope, and
- Document monthly site grading activities and construction quality assurance.

1.2 MONITORING SUMMARY

Major components of the instrumentation monitoring program are listed in Table 1 and shown on Figure 1.

Table 1 Monitoring Frequency

Monitoring Type	Frequency
Visual inspection	Daily/Monthly
Robotic theodolite/prism	Continuous
Drone inspection	Monthly
Compaction testing	Every 5,000 yd^3 (min.)

2.0 VISUAL INSPECTIONS

Inspections are completed daily by site personnel and monthly by Stantec personnel to document visual observations of slope conditions, including conditions of instability (i.e. cracking, slumping, over-steepened slopes, seeps, perched boulders, rock falls, erosion, and areas undercut by construction or maintenance activities). Certain areas of the landslide have been designated as safety exclusion zones, and these areas are inspected from adjacent locations.

When present, site operators inspect their work areas for signs of instability on a daily basis before starting work per MSHA rules and regulations. The limited work performed in January 2021 resulted in the operator visual inspections being limited to stockpiles.

Stantec conducted visual inspections of the Pikeview Quarry slopes on January 5, 2021 for the December inspection; however, no inspection took place for this January 2021 report due to scheduling and weather conflicts. The engineering inspections were conducted by traversing each area of the mine and observing the uphill slope and the downhill slope for signs of instability, and areas in need of maintenance. Slopes that have been graded and are 2 horizontal (H):1 vertical (V) or shallower are also traversed on foot. The findings are listed below, and photographs of notable observations are included on Figure 2 in Appendix A. The following notes are carried over from the December 2020 report. These observations will be updated for the February 2021 report.

- Survey Station: Based on the survey data, the total station is in operating condition.
- Prisms: Several prisms were passed along the walking route and appeared to be in their original position and operating normally. Control points are permanently cemented into the ground while some of the monitoring points are cemented into 5-gal buckets to be portable as needed.
- Several new prisms were in the process of being placed during the site visit and will appear on the next report.
- Gullies: Gullies have formed on the slopes above the slide area as well as in the burn areas above the quarry. (Note 2)
- Pooled Water: The grading at the top of the first ridge causes a small amount (0.03 ac) of water to pool.
- Open Cracks: An open crack was observed during this visit. This feature is in an area where cracking is expected to occur as a result of ongoing slope settlement and relaxation. The edges of the crack have eroded suggesting it is not a new feature. (Note 7)
- Healed Cracks: A crack was observed on the slope adjacent to the slide where cracking had previously been observed. This crack runs parallel to the slide and appears to be “healed” and did not indicate any recent movement. (Note 6)

- Crack Free: No cracking was observed on the native granite slopes above the extents of the disturbed area. The hummocky field in the area immediately above the southern extent of the slide shows shows evidence of cracking but they are not fresh or active. No new or open cracks were found immediately inside or next to the slide area.
- Fill: Material is being imported and temporarily placed on the “production floor”. During the visit, different types of material including mulch and general fill were being deposited here for future placement. Based on the drone survey, approximately 2,195 cubic yards of temporary fill were imported during the month of December. (Note 3)
- Culverts: A 6-ft culvert was observed to be blocked on the upstream end. There is evidence that water is collecting at the inlet during rain events and likely seeping through the loose material and through the culvert. (Note 1).
- The North Peak, usually walked during the monthly site visit, was not inspected due to the new snow covering the steep slopes.

Visual inspections of the Pikeview Quarry did not reveal any evidence of large-scale instability outside of the landslide areas previously identified. No bulging, rippling, over-steepening, depressions, slumps, or dry slip-offs were observed in areas that have been graded and/or reclaimed.

3.0 PRISM SURVEY

A Leica Robotic station is used to continuously survey the prisms onsite to document slope movements. The station records the location of each prism every four hours. Three new prisms were added at the toe of the slope in January 2021 and are now online: TOE-1, TOE-2, and TOE-3. There are now 20 prisms: 3 prisms are control points located outside the slope movement area, 13 prisms are located on the slopes surrounding the landslide area, and 4 prisms are located at the toe of the landslide. As the slope is backfilled and graded, additional prisms will be installed. The existing prism locations are shown on the current topography in Figure 3.

The monitoring software, GeoMos, has been programed to provide automatic alarms if there is a movement recorded that is greater than 0.35 feet or if a prism cannot be located. The alarm notes and actions taken are logged, and the alarms are summarized in Table 2. All alarms were determined to be caused by system maintenance, snow, fog, or frost. There were no alarms caused by slope movements.

Table 2 Alarm Summary

Date	Notes	Actions taken	Issue Resolved
1/8/2021	Multiple prisms missing after multiple scans	Adding new prisms	1/8/2021
1/9/2021	Multiple prisms missing after multiple scans	Snow	1/9/2021
1/10/2021	Multiple prisms missing after multiple scans	Snow	1/10/2021
1/18/2021	Multiple prisms missing after multiple scans	Snow and Fog	1/18/2021
1/19/2021	Multiple prisms missing after multiple scans	Frost on prisms	1/19/2021
1/25/2021	Multiple prisms missing after multiple scans	Snow and Frost	1/25/2021
1/25/2021	Multiple prisms missing after multiple scans	Snow	1/25/2021
1/26/2021	Multiple prisms missing after multiple scans	Snow	1/26/2021
1/27/2021	Multiple prisms missing after multiple scans	Snow	1/27/2021

The prism monitoring results for transverse and height displacements, monthly change, and cumulative change are summarized in Table 3 below. The transverse displacement measures the change in the horizontal distance from the robotic station to the prism; positive displacements indicate less distance between the station and prism (movement towards the total station). The height displacement measures the change in the vertical distance from the robotic station to the prism; positive displacements indicate upward movement. The values for the last reading in the month are included in Table 3. The monthly delta is the most recent reading cumulative delta displacement (horizontal, lateral, and vertical) subtracted from the last reading from the previous month. The cumulative delta values are a total displacement and are not associated with a direction. The transverse, height, and cumulative delta displacements are the total displacement over the life of the monitoring, which has been several years for all the prisms except P69 and TOE1, 2, and 3. Prism P69 was moved on June 20, 2020, and the displacements included in Table 3 are the displacements since that date. Prisms TOE1, 2, and 3 were installed on January 8, 2021, and the displacements are since that date. According to Leica documentation, the survey accuracy is +/-4 mm+1.5 ppm for prisms located greater than 500m from the station; these equate to an accuracy of +/-0.016 ft. The data show stable conditions with no movement for 18 of 20 prisms with recorded displacements limited to data scatter and not actual movements. Prisms P63 and TOE3 are located at the toe of the landslide, and these locations show slope creep movements at slow velocities (0.001 feet per day or less). Plots of the transverse and height displacements for each prism are included in Appendix B.

Table 3 Prism Summary

Prism ID	Cumulative Transverse Displacement (ft)	Cumulative Height Displacement (ft)	Monthly Delta (ft)	Cumulative Delta (ft)	Needs / Recommendations
CP1	-0.004	-0.015	-0.0269	0.0170	
CP2	-0.070	-0.003	-0.0108	0.3894	
CP3	0.267	-0.220	-0.0040	0.3484	
NP1	0.039	0.011	-0.0151	0.0498	
NP2	-0.013	-0.082	0.0063	0.0985	
NP66	0.132	-0.212	0.0025	0.3038	
P1	0.338	-0.051	0.0062	0.3419	
P2	0.135	-0.038	-0.0054	0.1975	
P25	-0.029	0.040	-0.0001	0.1541	
P32	-0.094	-0.088	-0.0025	0.2821	
P33	-0.121	-0.041	0.0025	0.2207	
P35	0.022	-0.183	0.0003	0.4250	
P4	0.347	-0.127	-0.0033	0.4600	
P5	0.381	-0.144	-0.0056	0.5952	
P63	15.256	-6.247	0.0099	16.4856	Prism at toe of slide. Movements are within expected range.
P69	-0.064	-0.025	0.0119	1.9992	
P70	0.340	-0.302	-0.0067	0.5636	
TOE1	0.000	0.021	0.0210	0.0210	New prism at toe of slide. Movements are within expected range.
TOE2	-0.004	-0.001	0.0046	0.0046	New prism at toe of slide. Movements are within expected range.
TOE3	0.023	0.029	0.0396	0.0396	New prism at toe of slide. Movements are within expected range.

4.0 DRONE SURVEY

The site was flown for aerial imagery using an unmanned aircraft system (UAS or 'drone') on January 16, 2021. The imagery was inspected for signs of instability and used to supplement the onsite visual inspections. Features noted in the aerial imagery review were inspected during Stantec's engineering inspection and are summarized in Section 2 above. The imagery was also used create site topography.

The December topography was also compared to the January topography to identify changes in the site topography. Comparison of the two surveys showed that approximately 1,084 yd^3 of fill had been imported and temporarily placed. No slope movements or other changes in topography were identified. The current imagery and topography are included in Figures 1 and 3, and the comparison surface is included as Figure 5 in Appendix C.

As previously reported in the September 2020 monitoring report, there are limitations with the method of comparing drone surveys from different months. The drone data indicate changes in the slopes along each of the reclamation benches, buildings, and areas with trees or shrubs. These areas are stable, and the changes are the result of survey limitations on or near vertical slopes.

5.0 COMPACTION TESTING

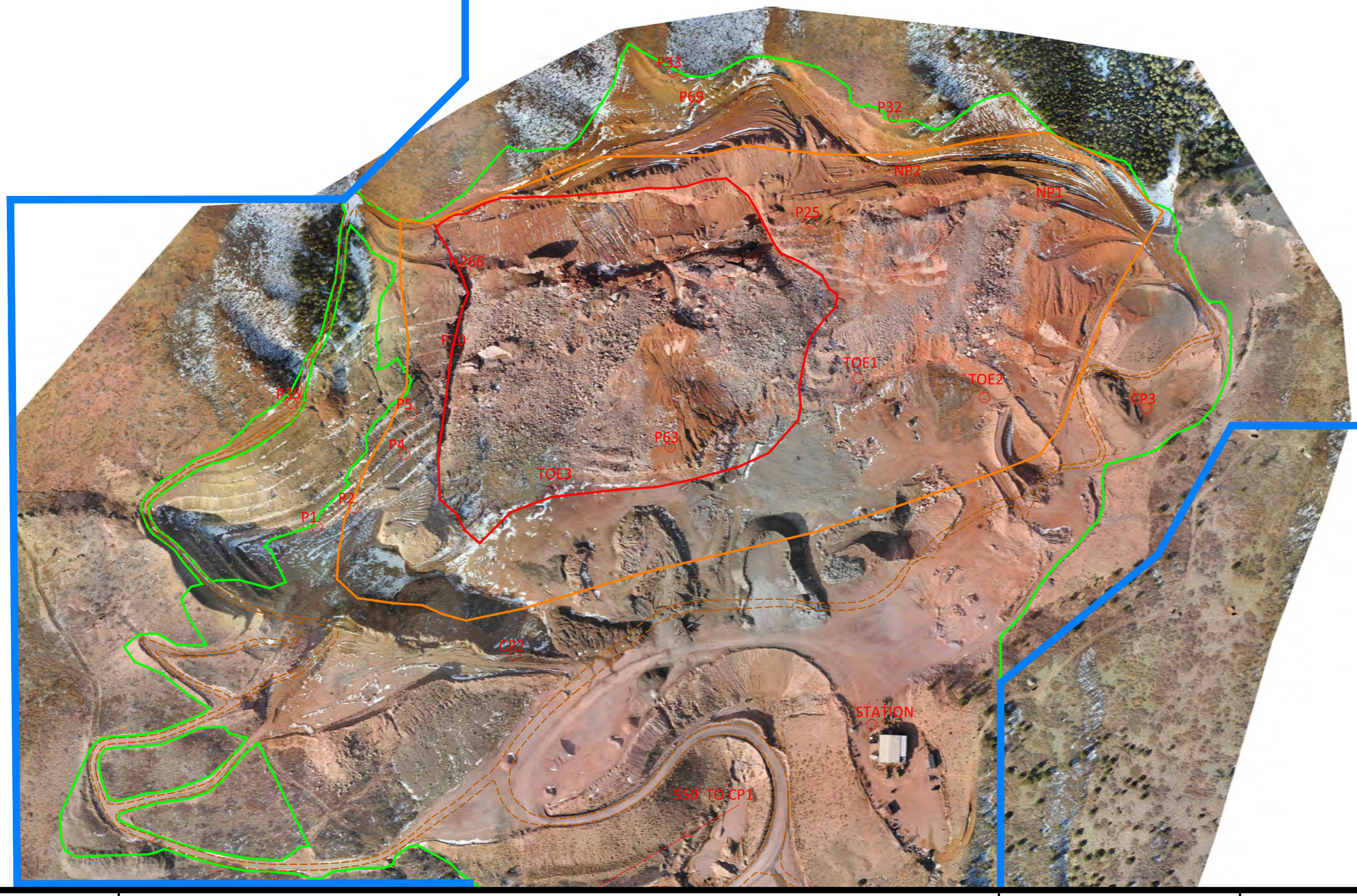
No fill was permanently placed at the quarry in January. Once fill placement starts, the fill will be placed in one-foot thick lifts, moisture conditioned as necessary, and compacted. Compaction testing will commence at the rate of at least one test per 5,000 yd^3 placed.

Per CMC, imported material is being stockpiled onsite for placement at a later date. The material will be tested for compaction level and areas failing compaction testing will either be further compacted until the specification is met or removed and replaced in a compacted manner.

6.0 CONCLUSIONS

None of the data collected in January 2021 indicate evidence of any large-scale movements that increase risk to workers or to the public. The landslide area continues to show slope creep movements with slow velocities. Shallow surface erosion continues to occur requiring ongoing maintenance and cleanup.

- Restricted access to the ungraded landslide slopes should continue.
- All monitoring should continue at current frequencies.



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LEGEND

- Permit/Affected Lands Boundary
- Proposed Disturbance Limit
- Landslide Extent
- Buttress Fill Extent
- Existing Prism
- Proposed Prism

N

0 300' 600'

Client/Project
CONTINENTAL MATERIALS CORP.
PIKEVIEW QUARRY SLOPE MONITORING

Project No.
227419041

Title
SITE MAP

Revision
#

Date
2021.02.28

Drawn By
PK

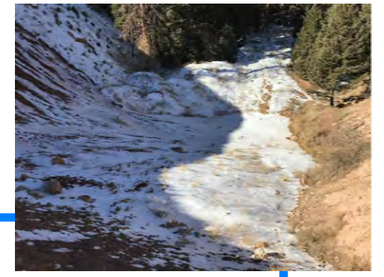
Figure No.
1

Appendix A

Visual Inspections

6. AREA ABOVE THE SLIDE

5. DEMOLITION DEBRIS PLACED AT TOE OF SLIDE

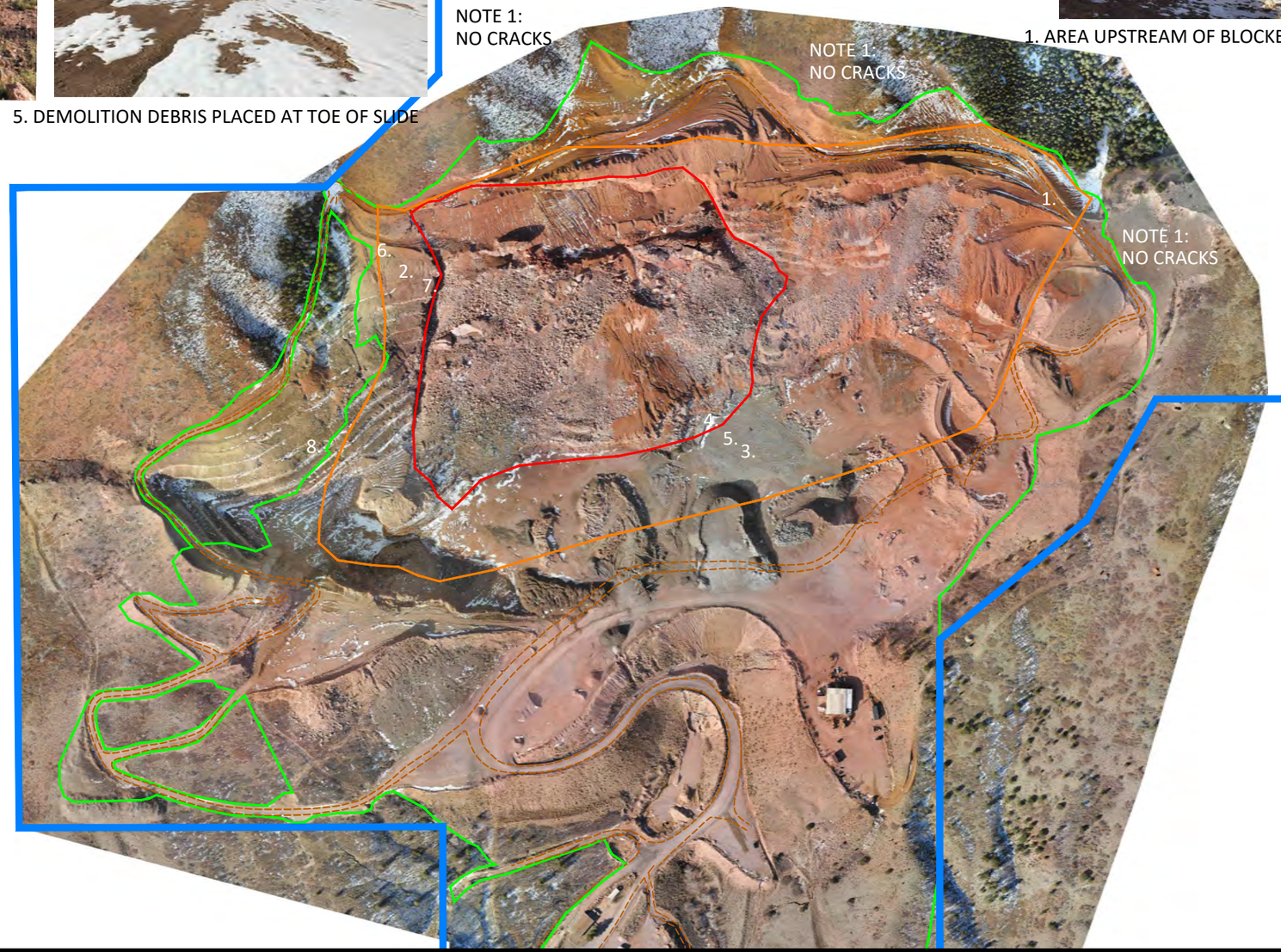


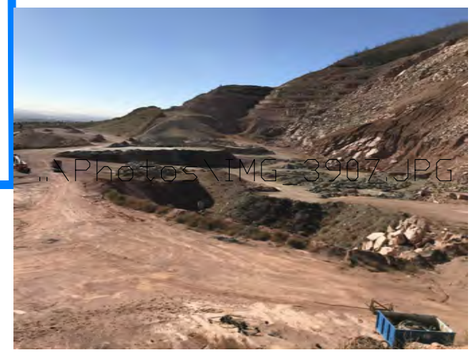
1. AREA UPSTREAM OF BLOCKED CULVERT

2. EROSION GULLEY

7. OPEN CRACK PARALLEL TO SLIDE

8. VIEW UP SOUTH ESCARPMENT





3. DEBRIS AND RUBBLE FILL AREA

4. FILL DEPOSITED AT TOE OF SLIDE AREA

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LEGEND

- Permit/Affected Lands Boundary
- Proposed Disturbance Limit
- Landslide Extent
- Buttress Fill Extent

NOTES

1. NO CRACKS OBSERVED IN THIS AREA.
2. ALL PHOTOS TAKEN JANUARY 5, 2020.

N

0 400’ 800’

Client/Project
CONTINENTAL MATERIALS CORP.
PIKEVIEW QUARRY SLOPE MONITORING

Project No.
227419041

Title
OBSERVATIONS FROM DECEMBER INSPECTION

Revision
#

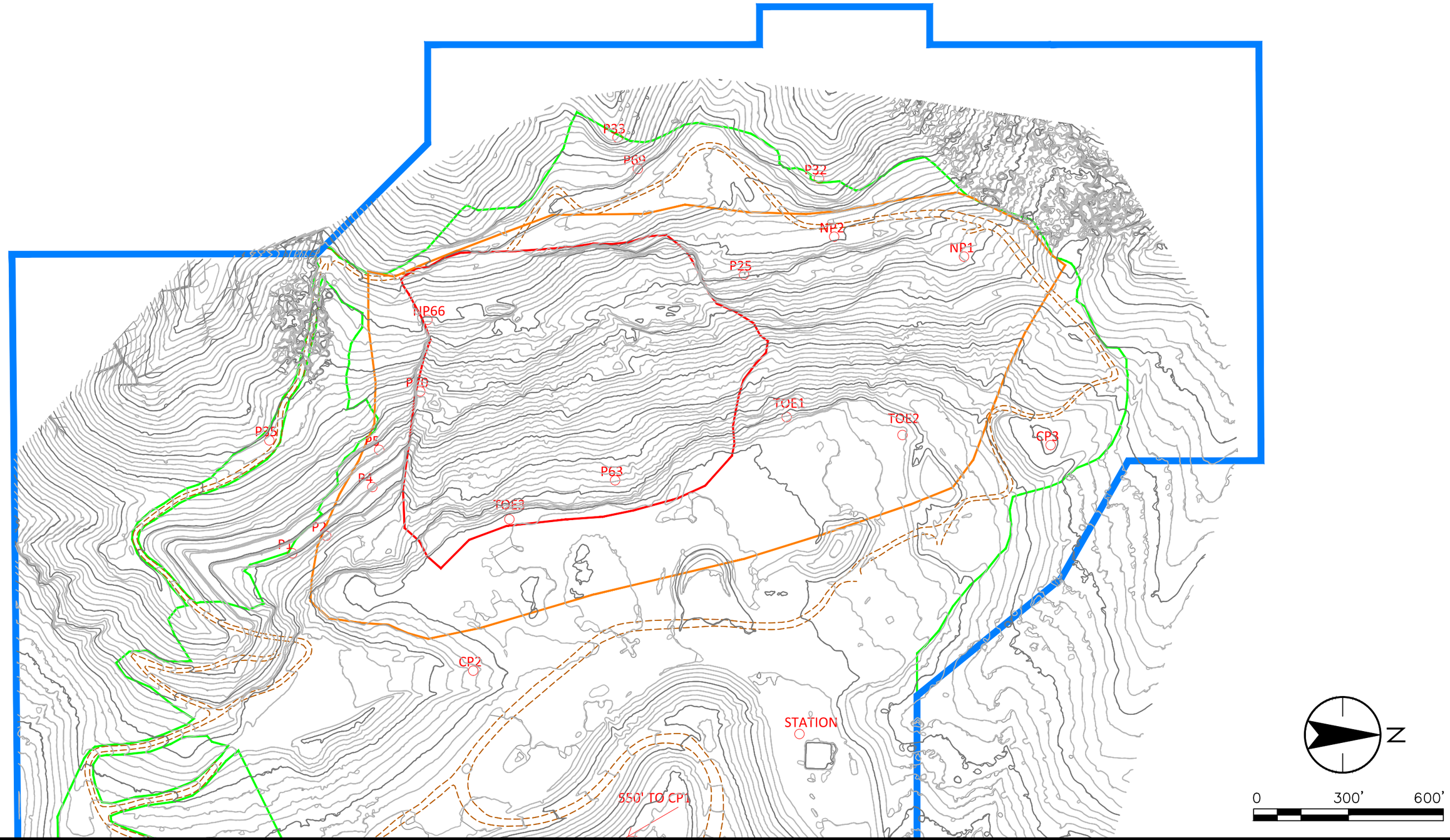
Date
2021.02.28

Drawn By
PK

Figure No.
2

Appendix B

Prism Survey



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LEGEND

- Permit/Affected Lands Boundary
- Proposed Disturbance Limit
- Landslide Extent
- Buttress Fill Extent
- Existing Prism
- Proposed Prism

1. GRADING AND MOVEMENT OF STATION WILL BE EXTENDED AS LONG AS POSSIBLE.
2. PRISMS WILL BE INSTALLED AS EACH BENCH IS FINISHED.
3. ALL PRISMS WILL BE RETAINED AS LONG AS POSSIBLE.
4. TOPOGRAPHY FROM JANUARY 16, 2021 DRONE SURVEY.
5. CONTOUR INTERVAL IS 10 FEET

Client/Project
CONTINENTAL MATERIALS CORP.
PIKEVIEW QUARRY SLOPE MONITORING

Project No.
227419041

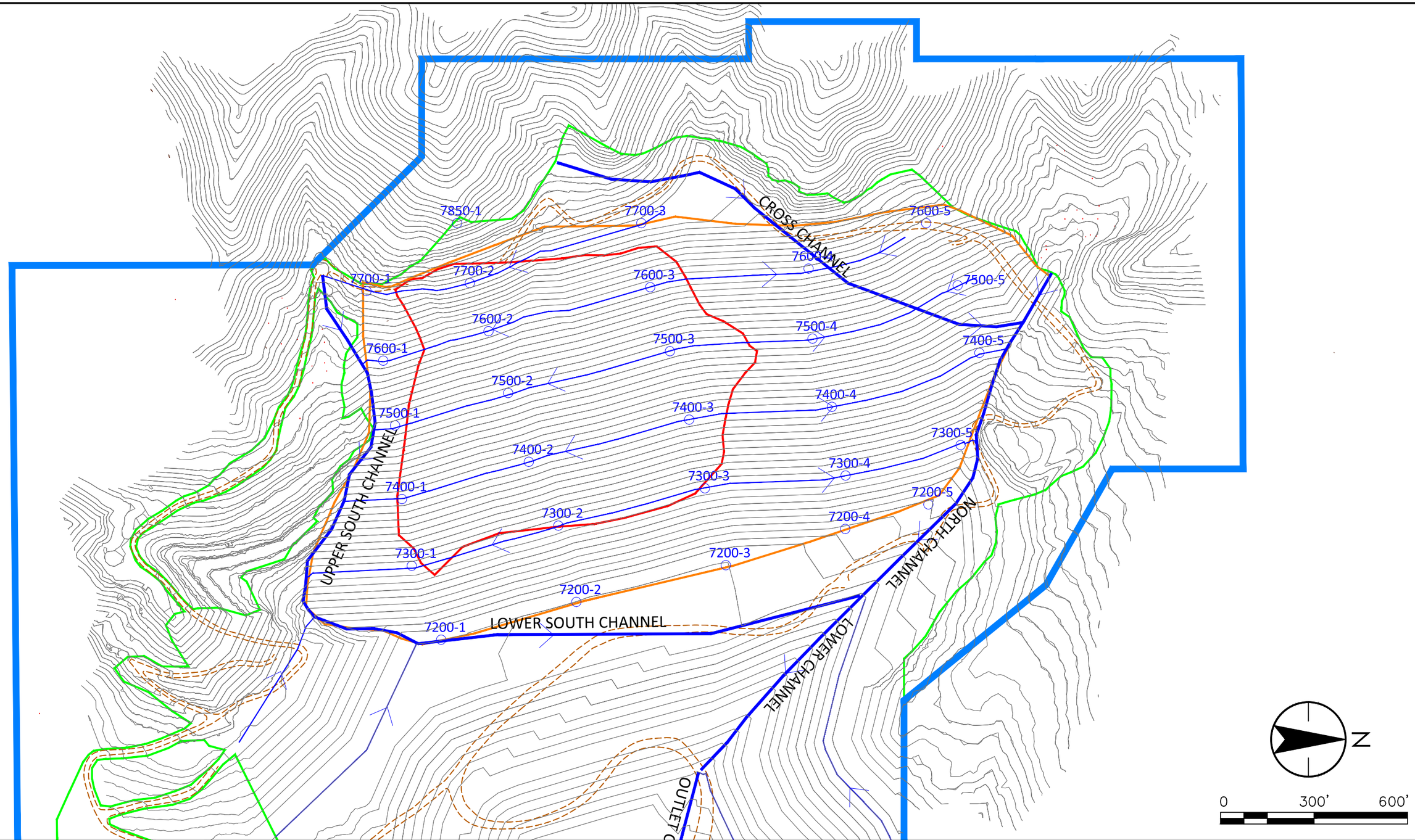
Title
EXISTING PRISMS WITH CURRENT SURFACE

Revision
#

Date
2021.02.28

Drawn By
PK

Figure No.
3



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LEGEND

- Permit/Affected Lands Boundary
- Proposed Disturbance Limit
- Landslide Extent
- Buttress Fill Extent
- Proposed Prism

NOTES

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2. PRISMS WILL BE INSTALLED AS EACH BENCH IS FINISHED.
3. ALL PRISMS WILL BE RETAINED AS LONG AS POSSIBLE.

Client/Project
CONTINENTAL MATERIALS CORP.
PIKEVIEW QUARRY SLOPE MONITORING

Project No.
227419041

Title
PROPOSED PRISMS WITH RECLAMATION SURFACE

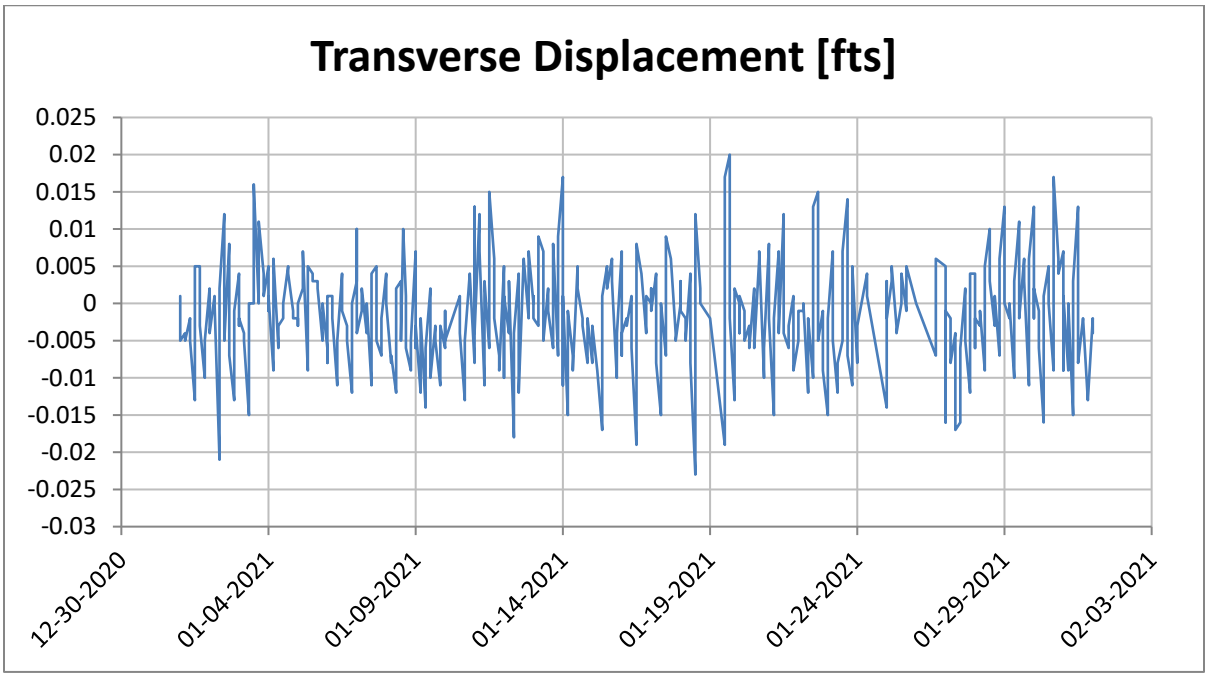
Revision
#

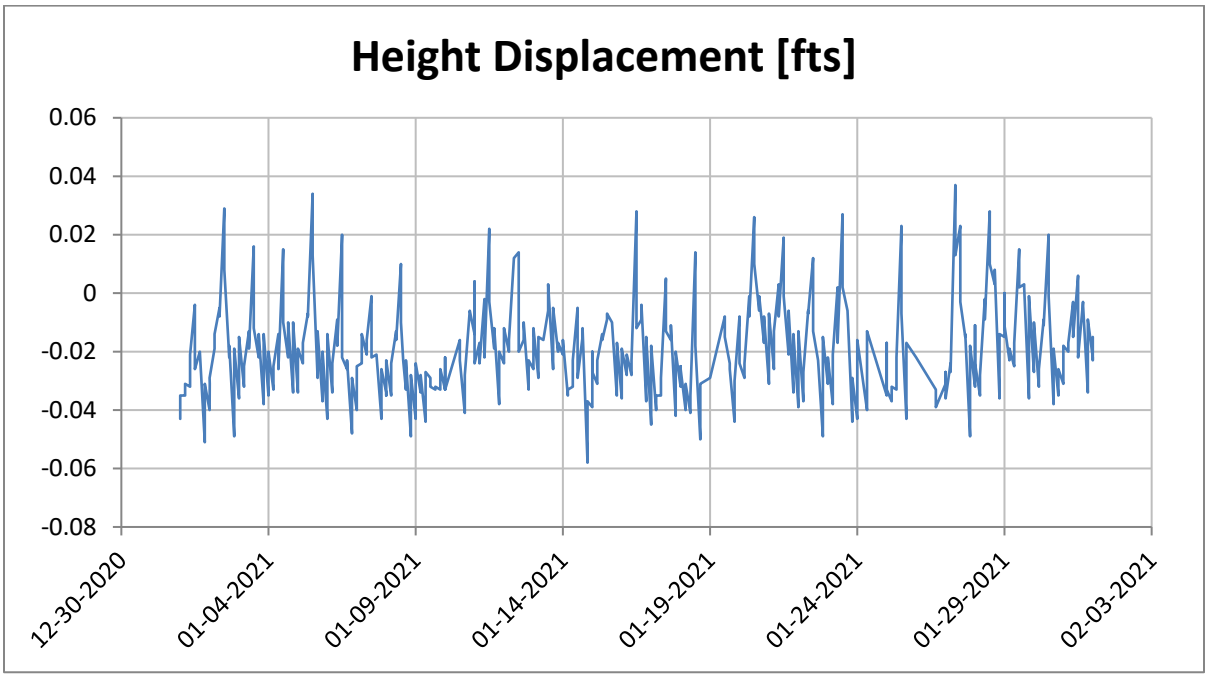
Date
2021.02.28

Drawn By
PK

Figure No.
4

Prism CP1

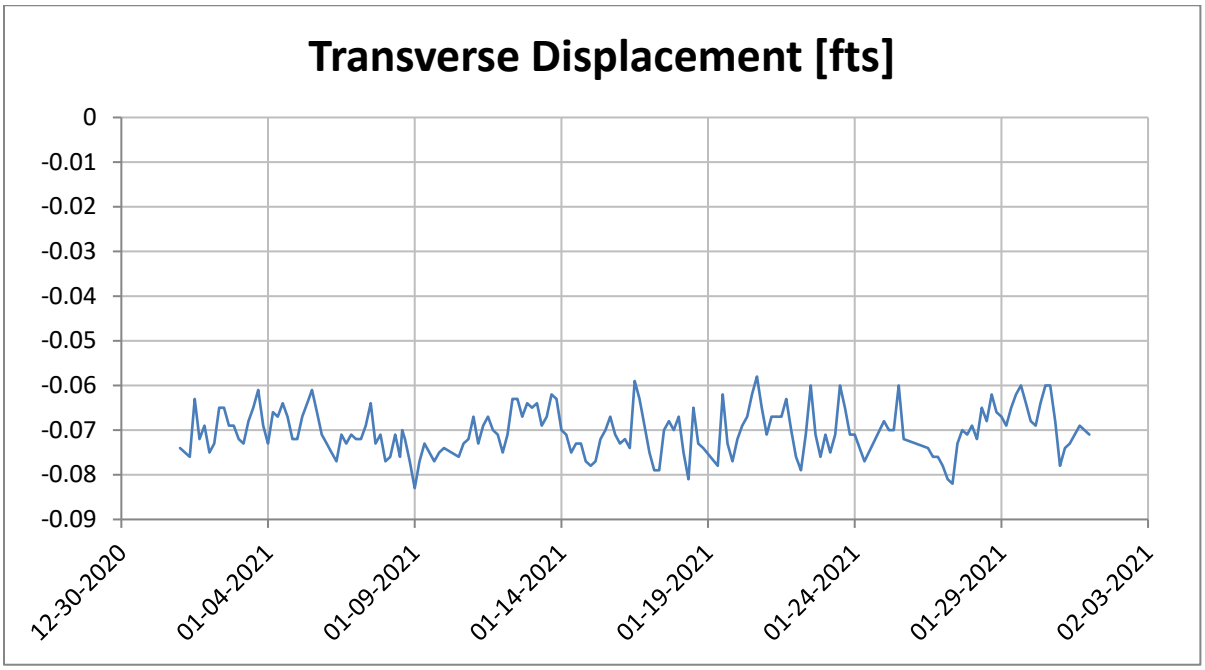


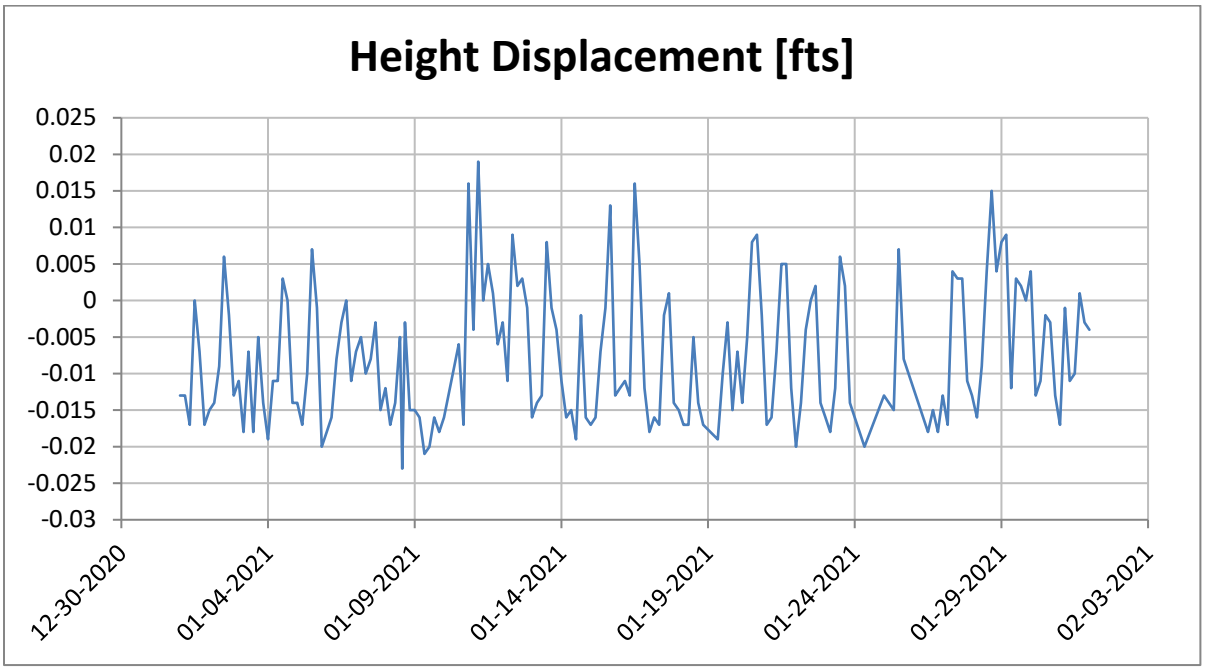


Notes:

1. Survey accuracy is +/-0.016 feet.
2. Alarm threshold is +/-0.35 feet.
3. Transverse displacement is in the horizontal direction. Positive direction means closer to the robotic station.
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism CP2





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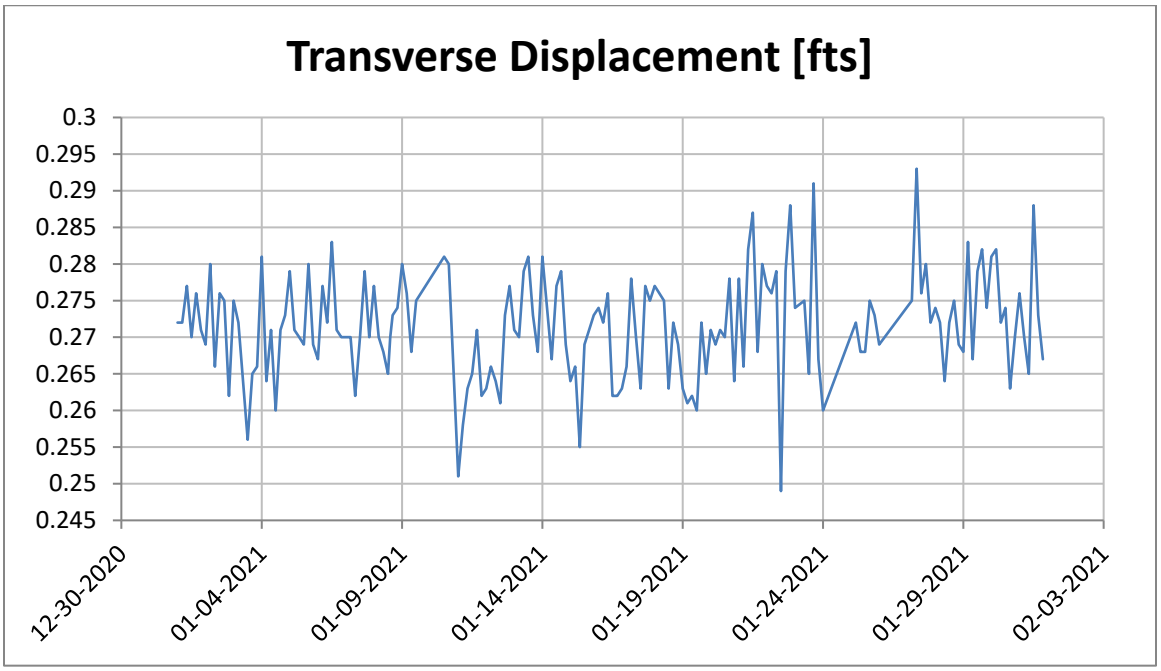
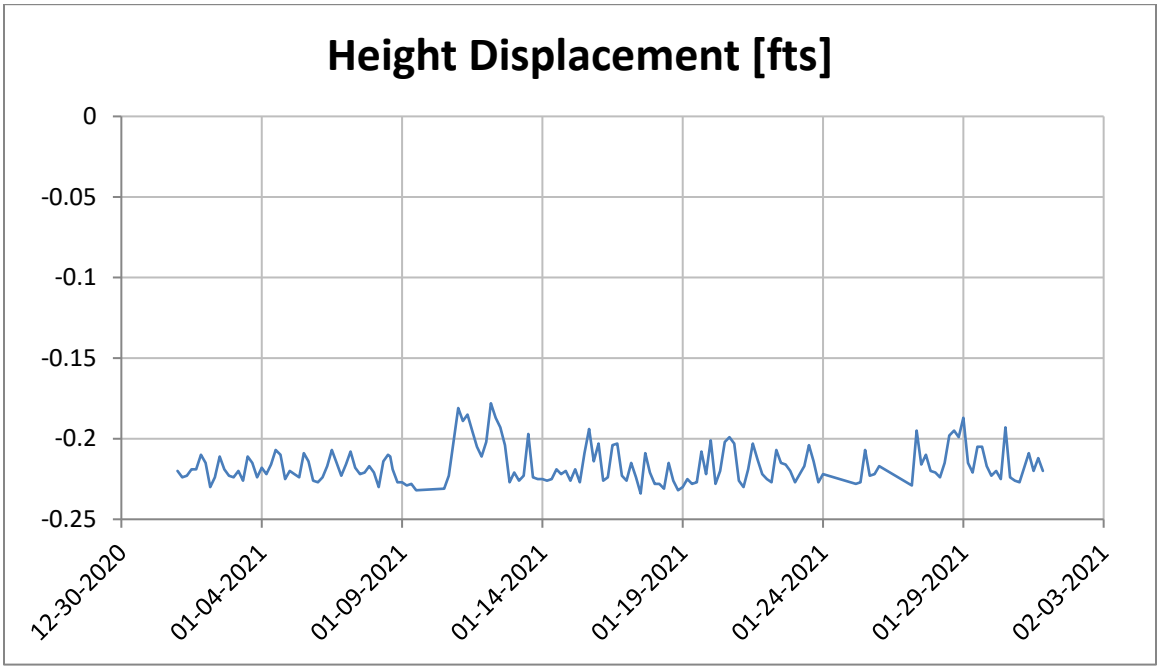
Prism CP3





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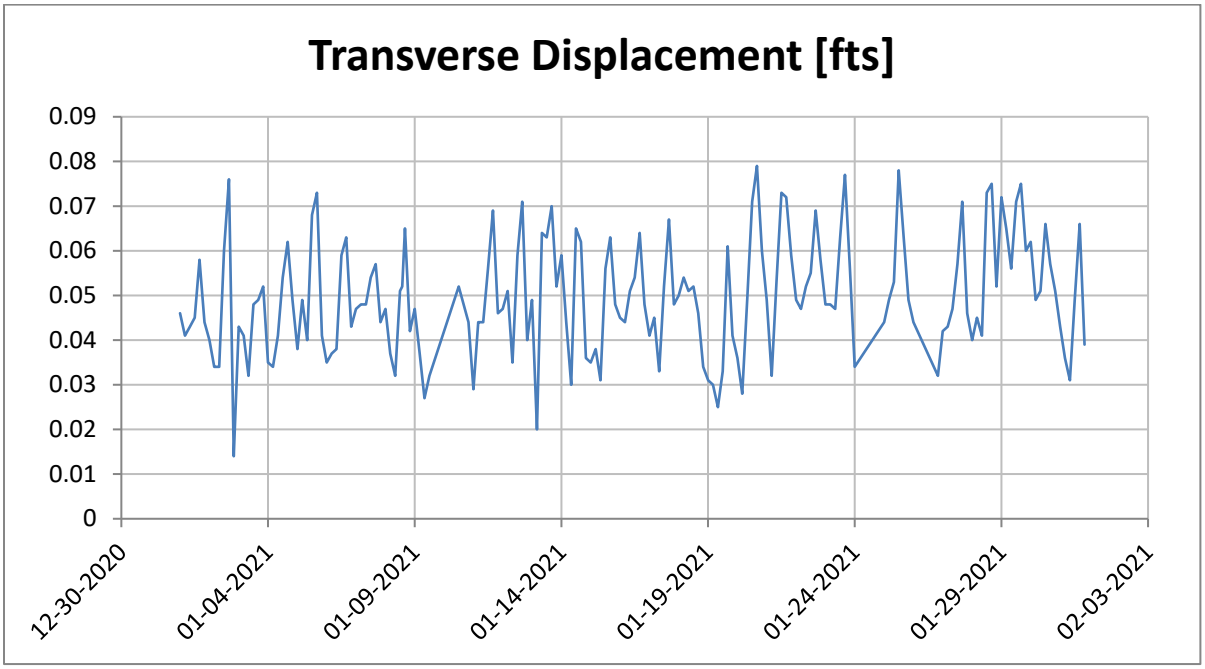
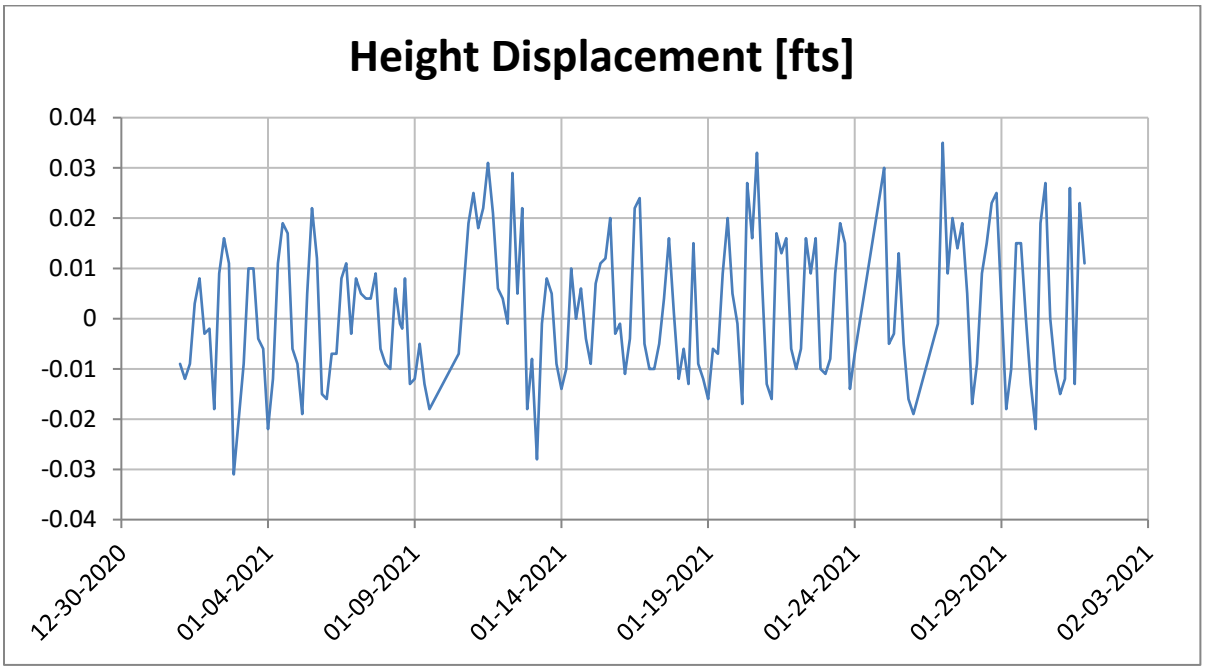
Prism NP1





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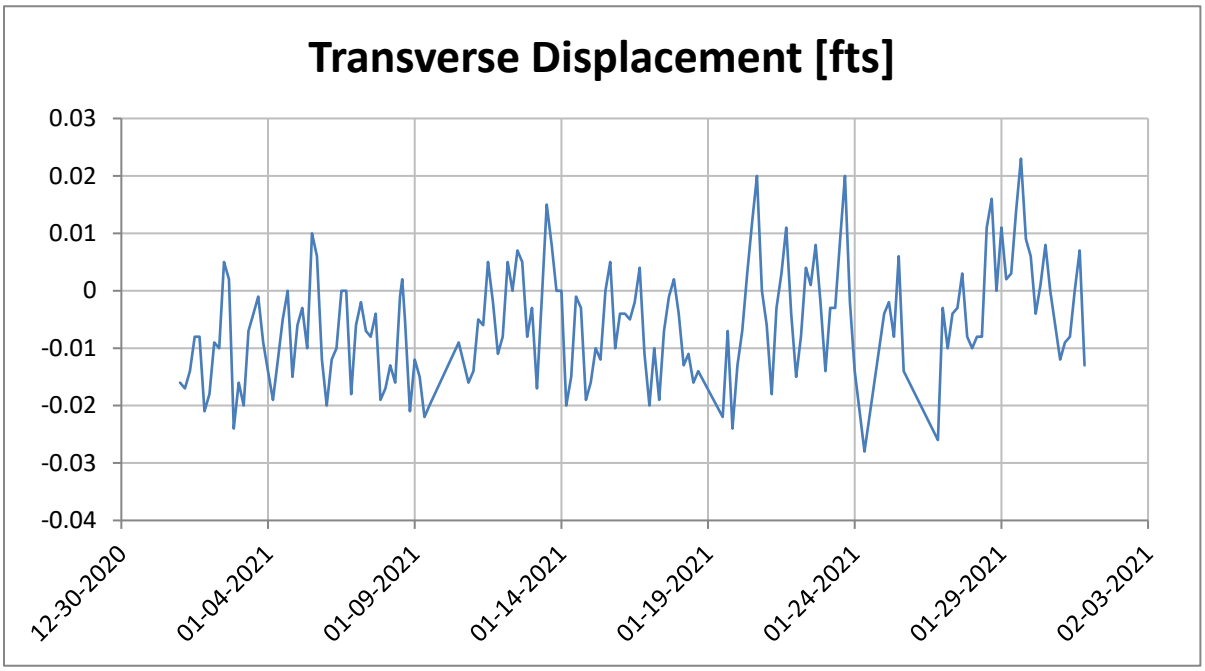
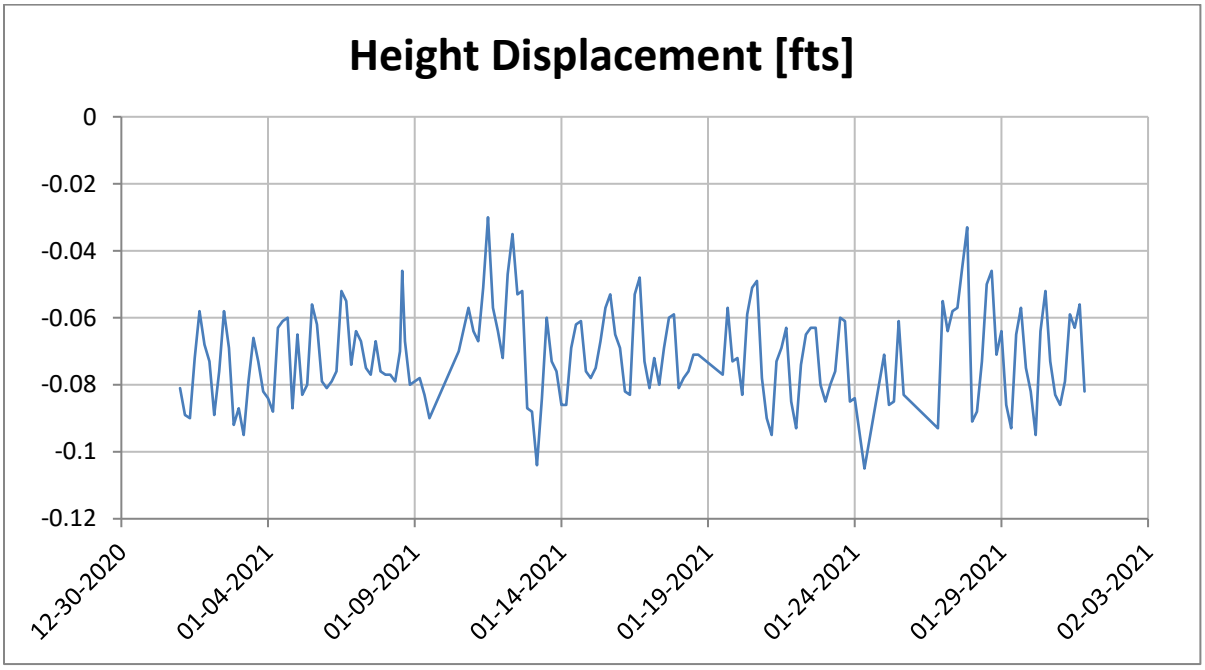
Prism NP2





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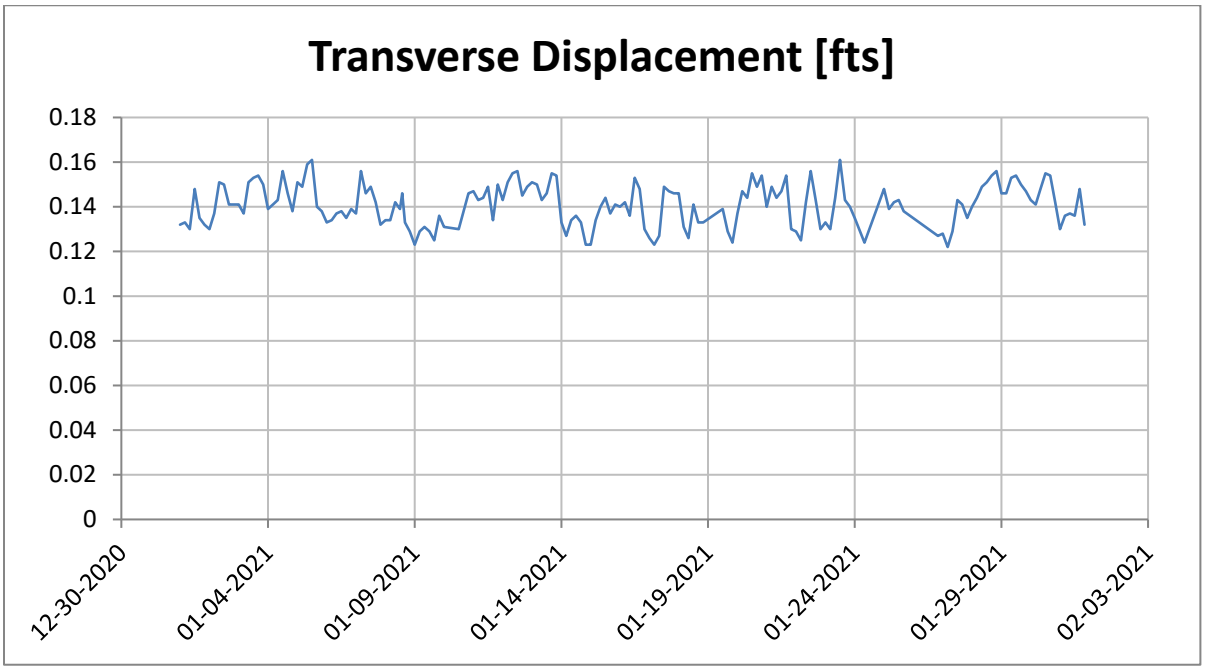
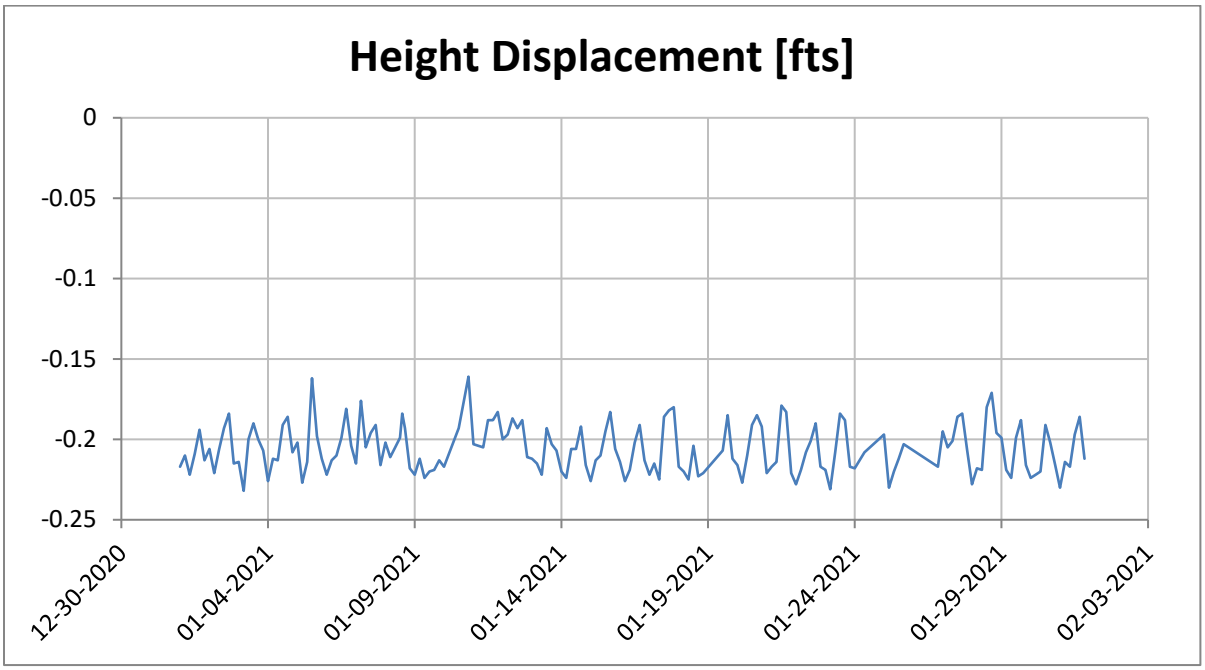
Prism NP66





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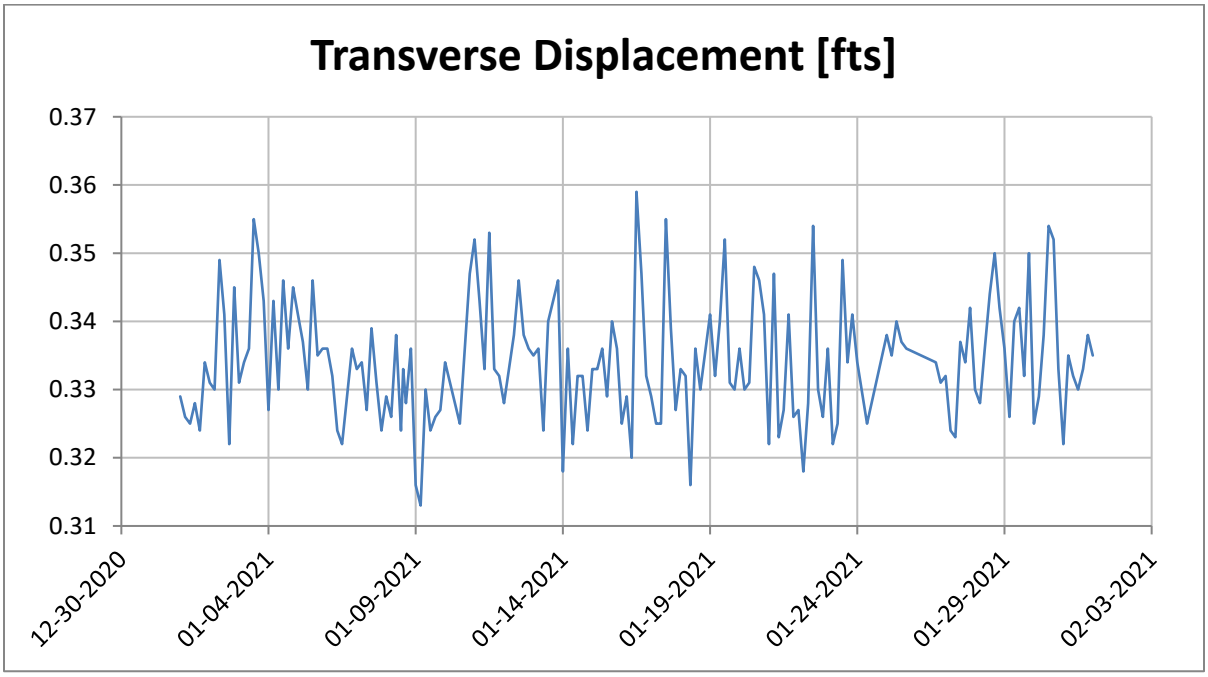
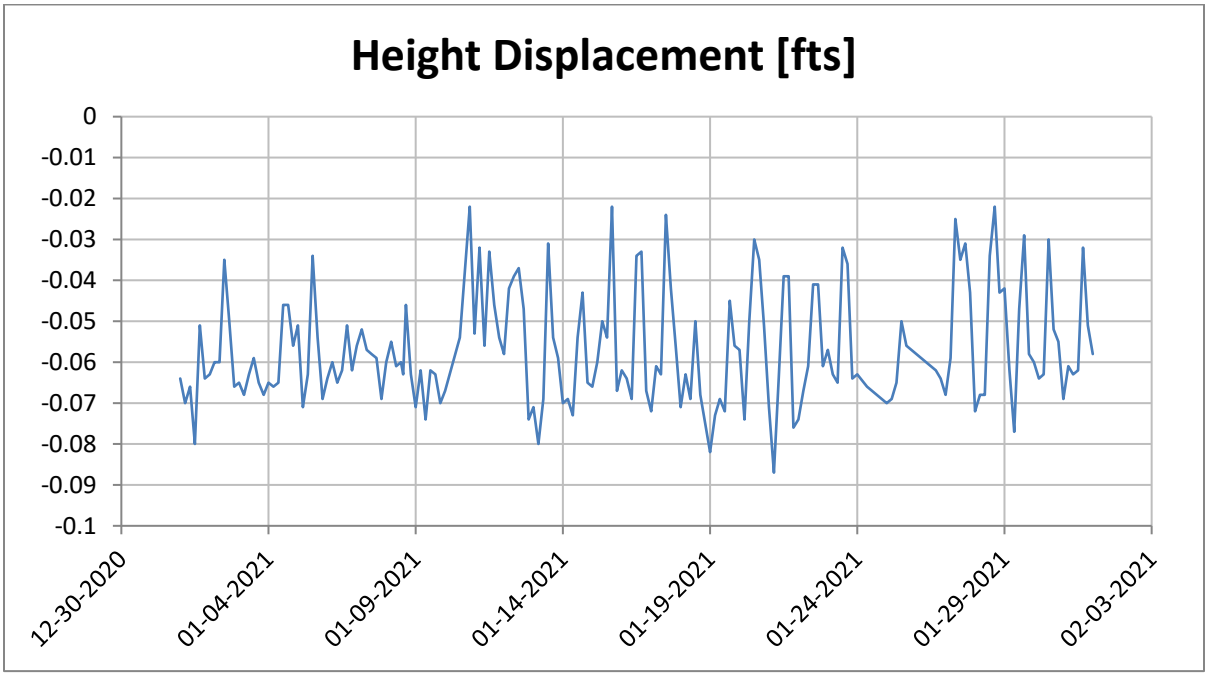
Prism P1





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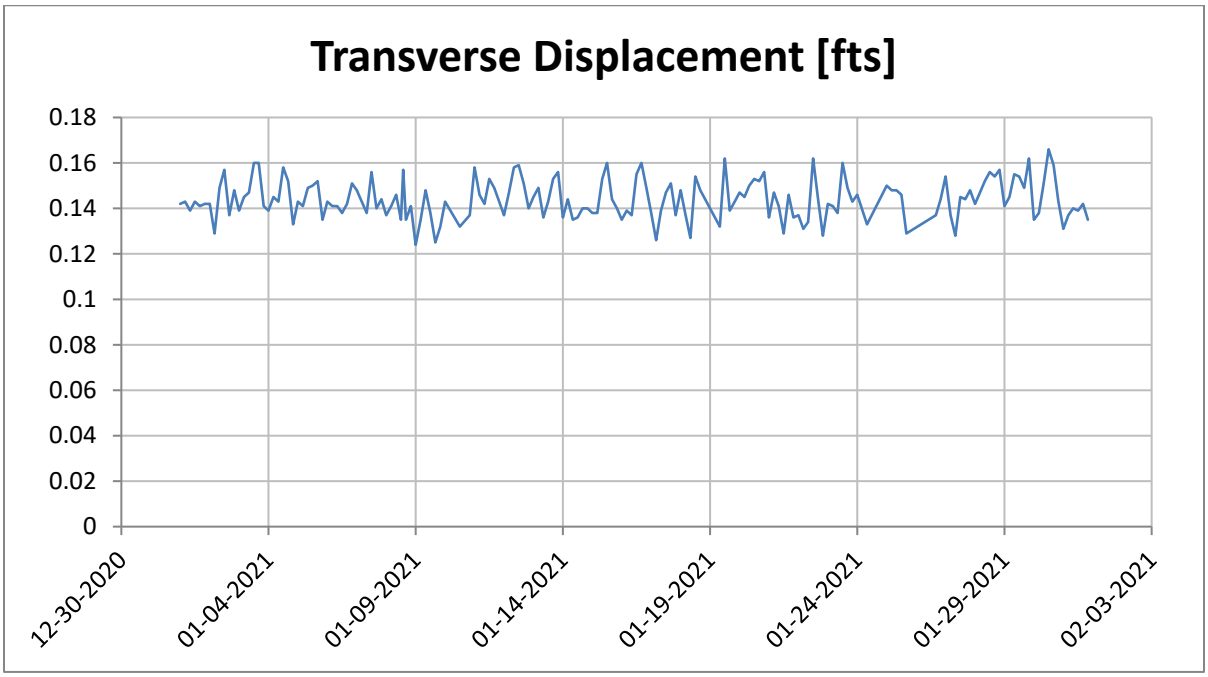
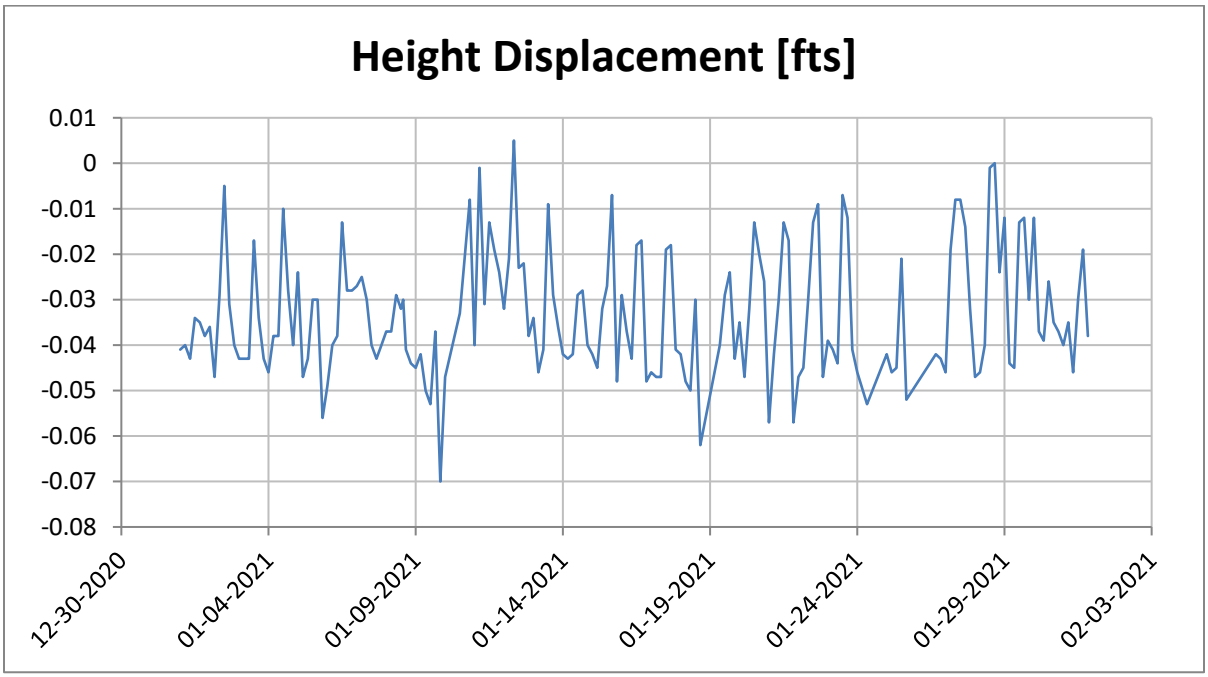
Prism P2

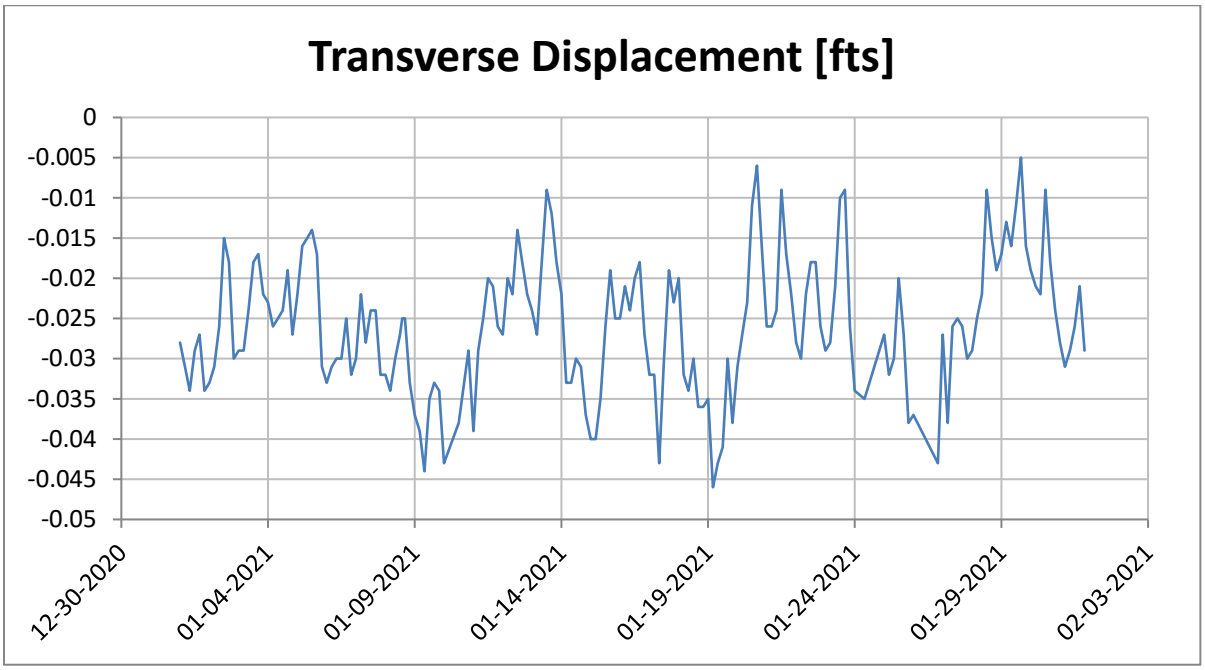


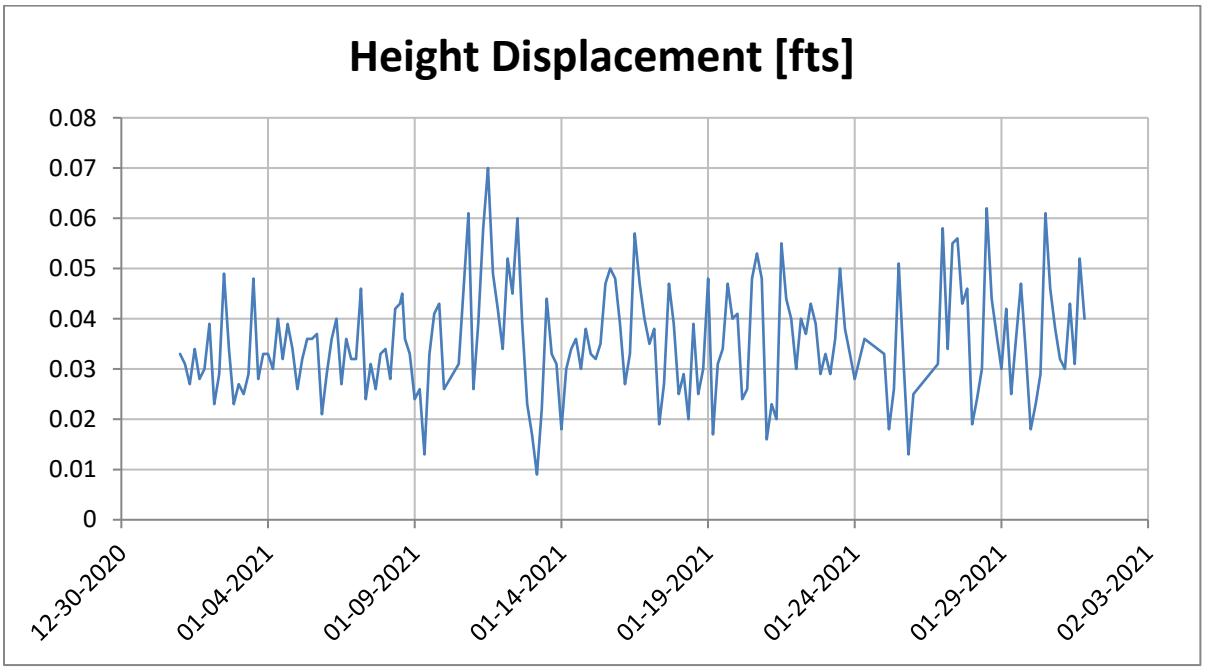


Notes:

1. Survey accuracy is +/-0.016 feet.
2. Alarm threshold is +/-0.35 feet.
3. Transverse displacement is in the horizontal direction. Positive direction means closer to the robotic station.
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism P25

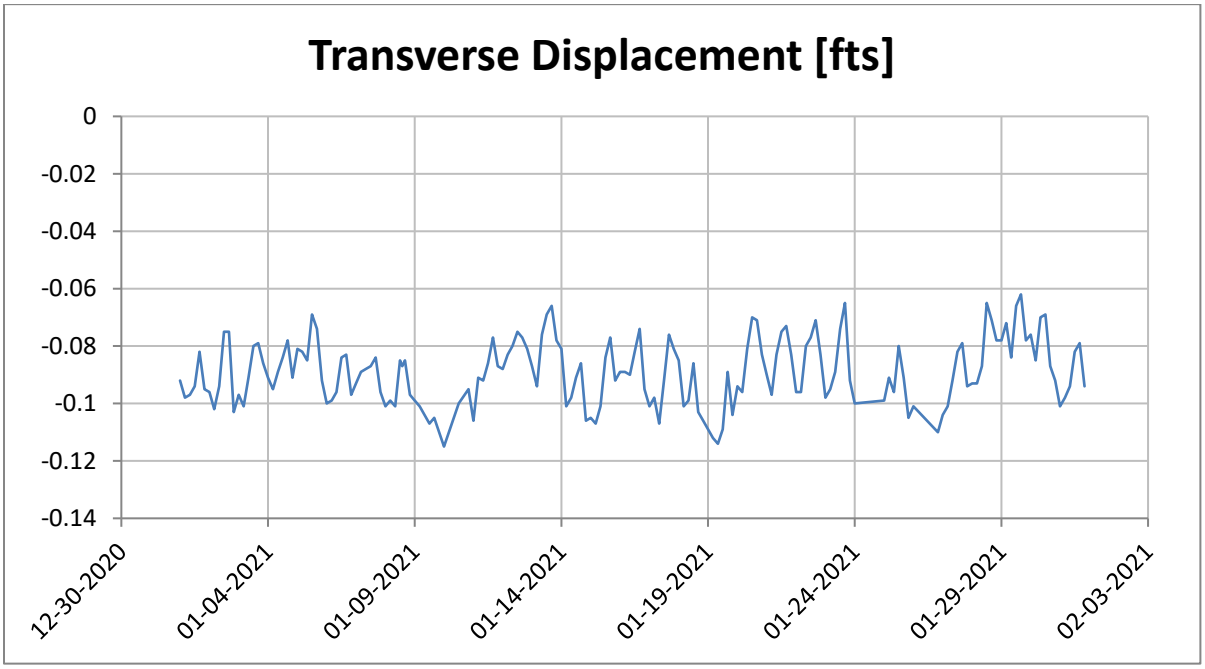


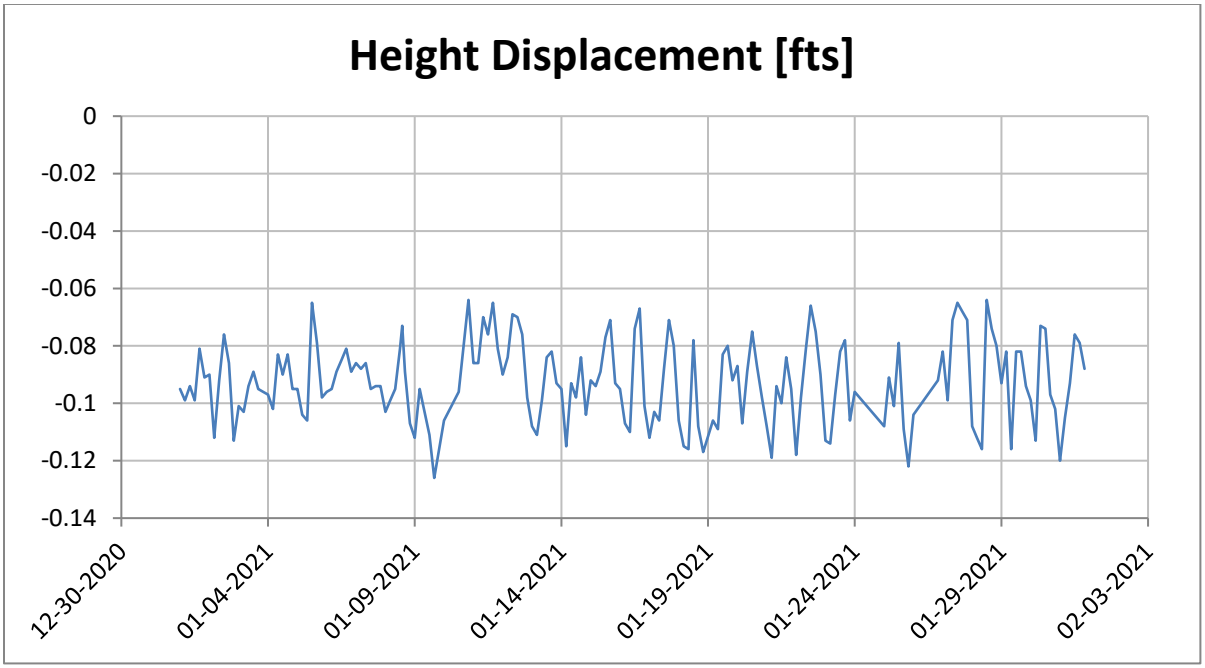


Notes:

1. Survey accuracy is +/-0.016 feet.
2. Alarm threshold is +/-0.35 feet.
3. Transverse displacement is in the horizontal direction. Positive direction means closer to the robotic station.
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism P32

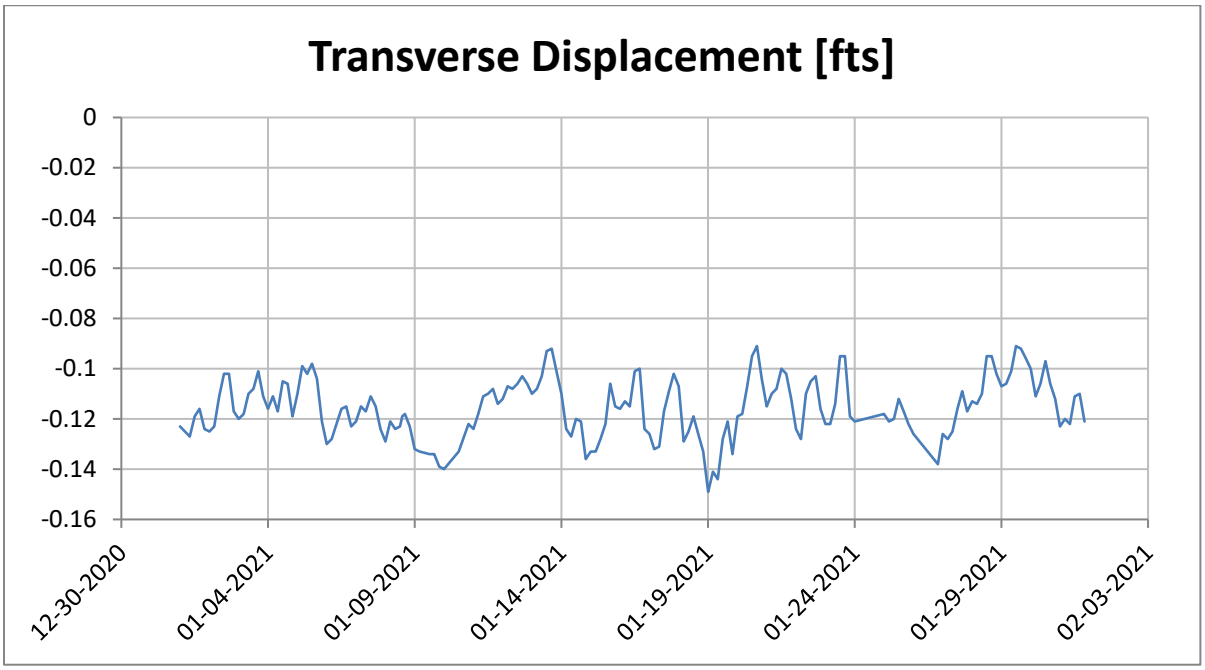


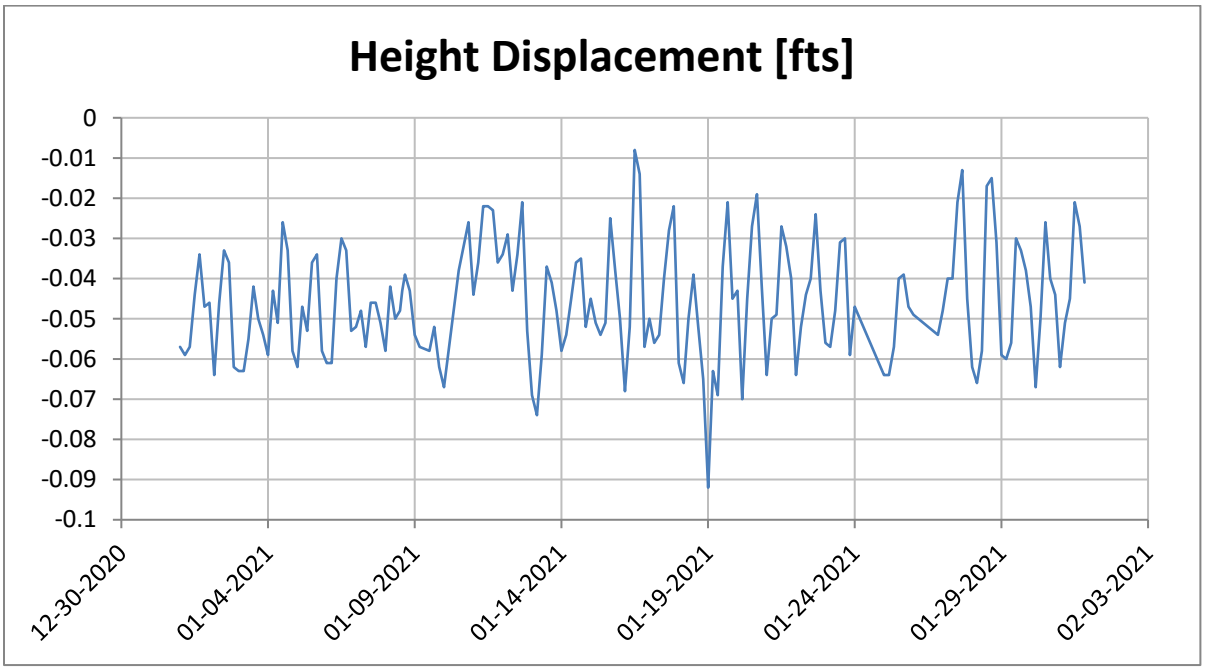


Notes:

1. Survey accuracy is +/-0.016 feet.
2. Alarm threshold is +/-0.35 feet.
3. Transverse displacement is in the horizontal direction. Positive direction means closer to the robotic station.
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism P33

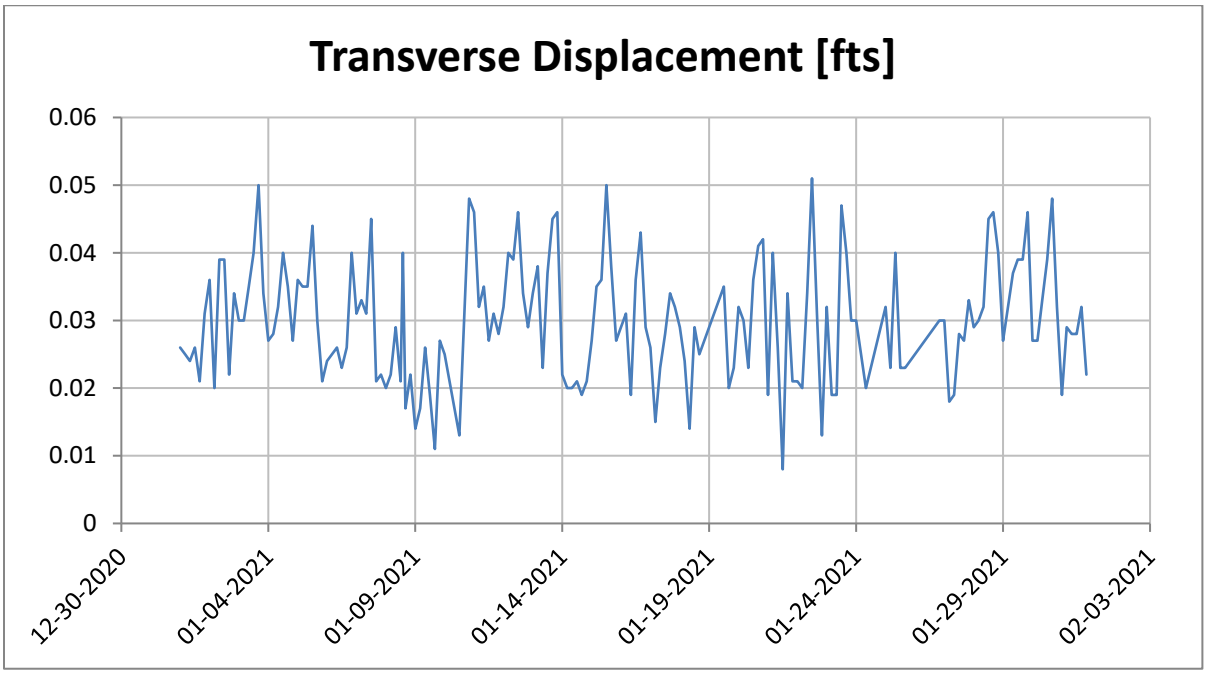


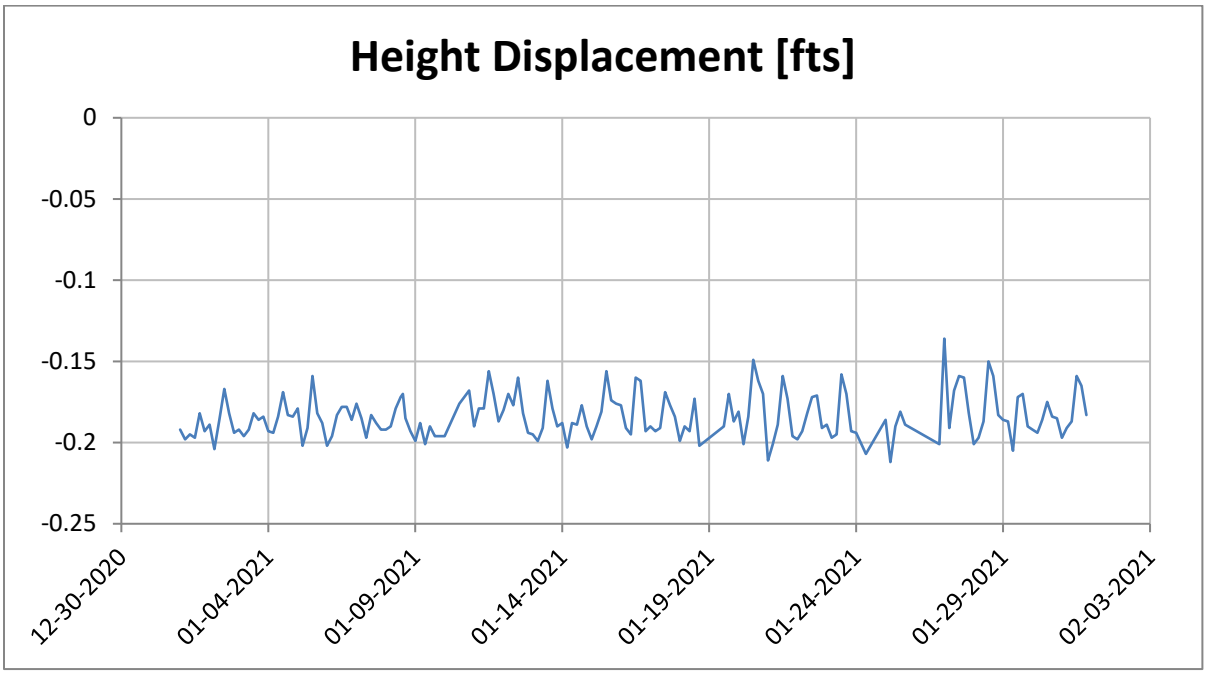


Notes:

1. Survey accuracy is +/-0.016 feet.
2. Alarm threshold is +/-0.35 feet.
3. Transverse displacement is in the horizontal direction. Positive direction means closer to the robotic station.
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism P35

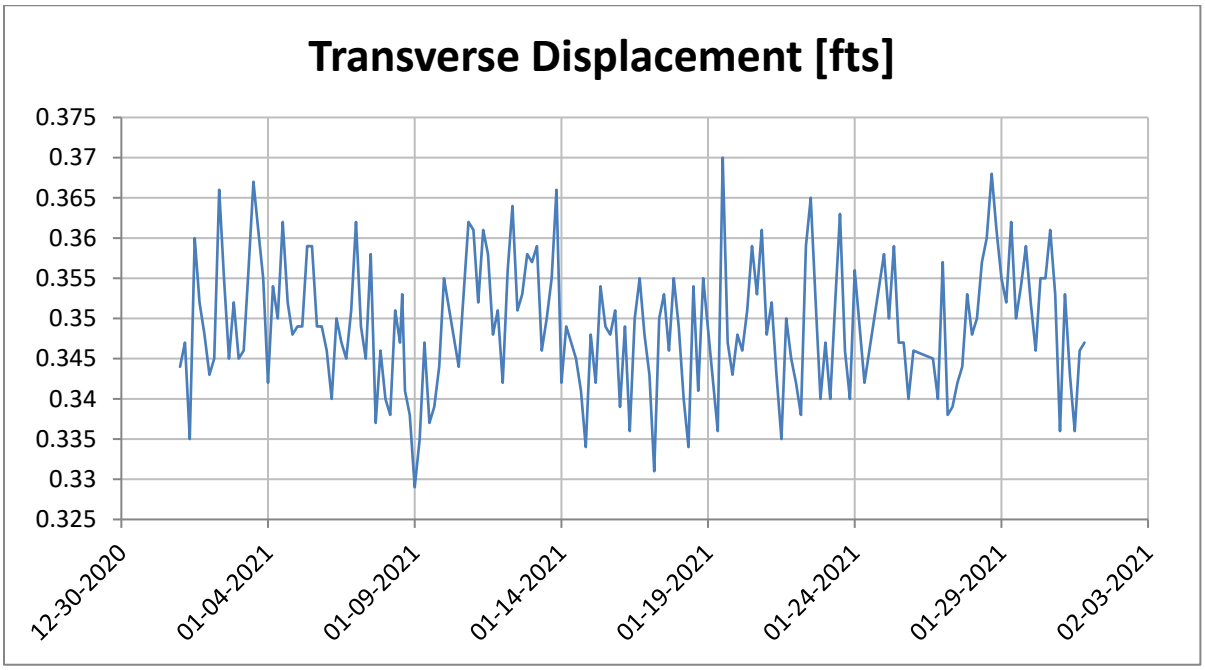


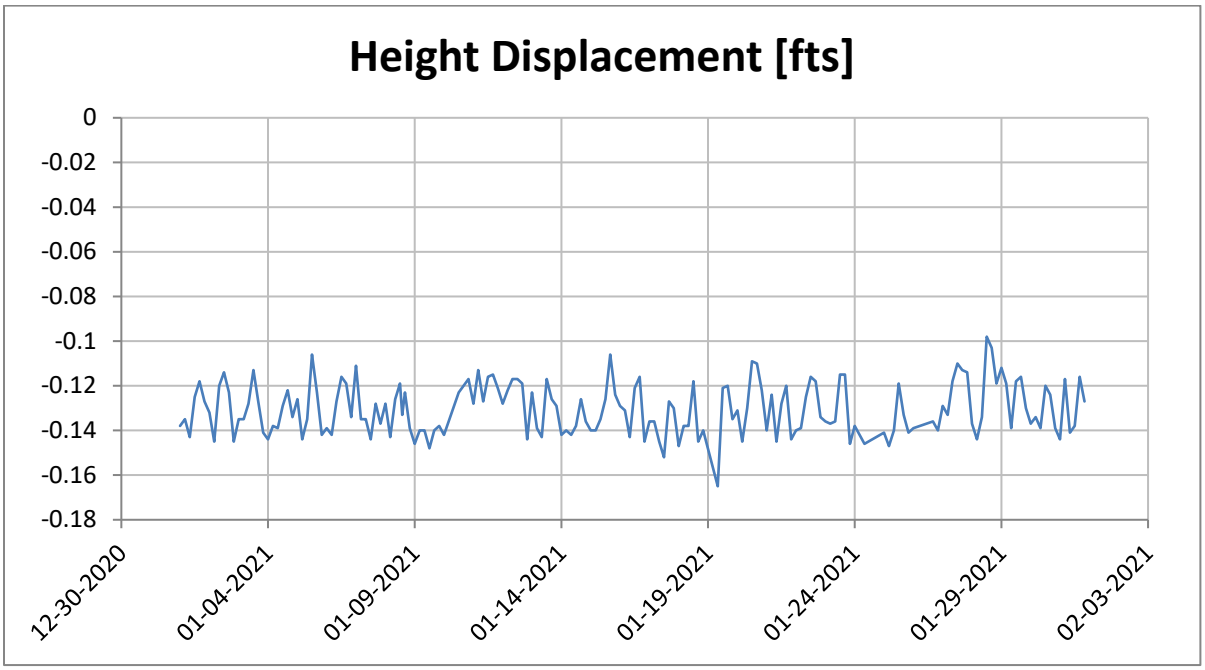


Notes:

1. Survey accuracy is +/-0.016 feet.
2. Alarm threshold is +/-0.35 feet.
3. Transverse displacement is in the horizontal direction. Positive direction means closer to the robotic station.
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism P4

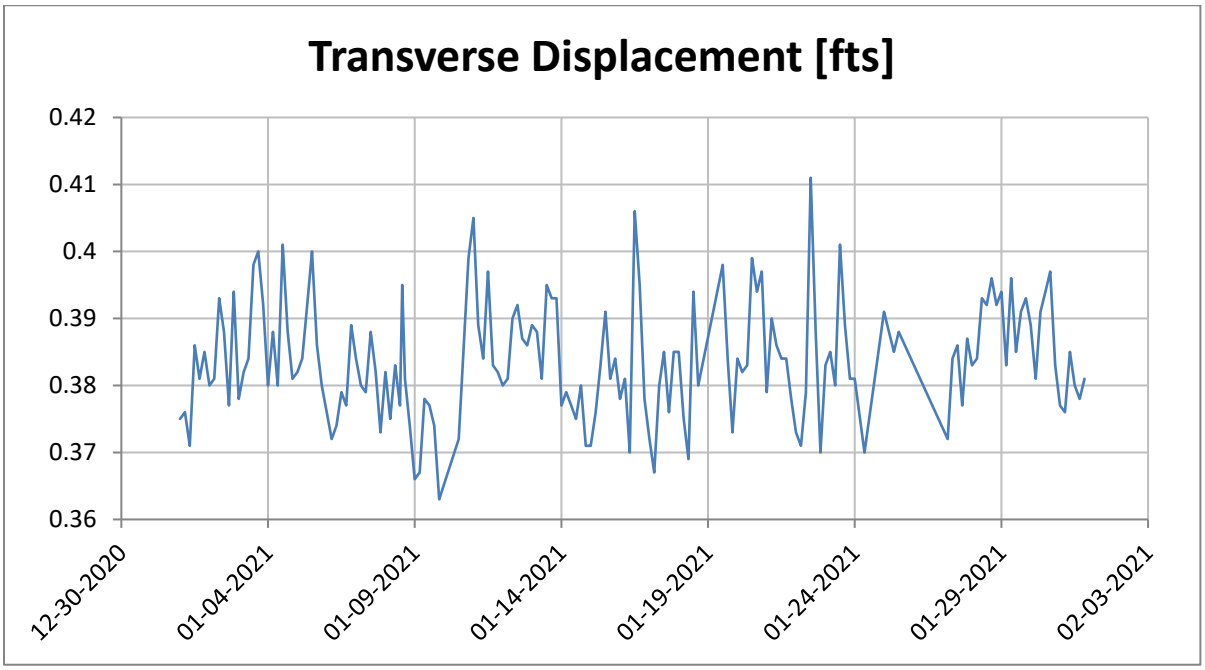


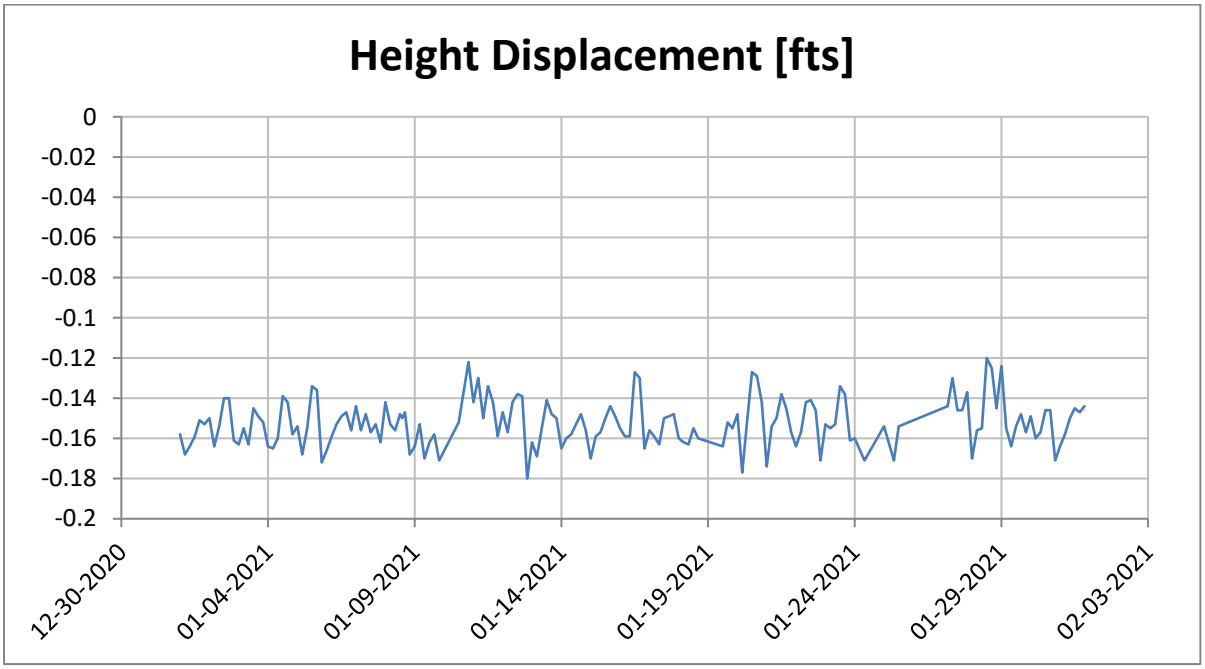


Notes:

1. Survey accuracy is +/-0.016 feet.
2. Alarm threshold is +/-0.35 feet.
3. Transverse displacement is in the horizontal direction. Positive direction means closer to the robotic station.
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism P5

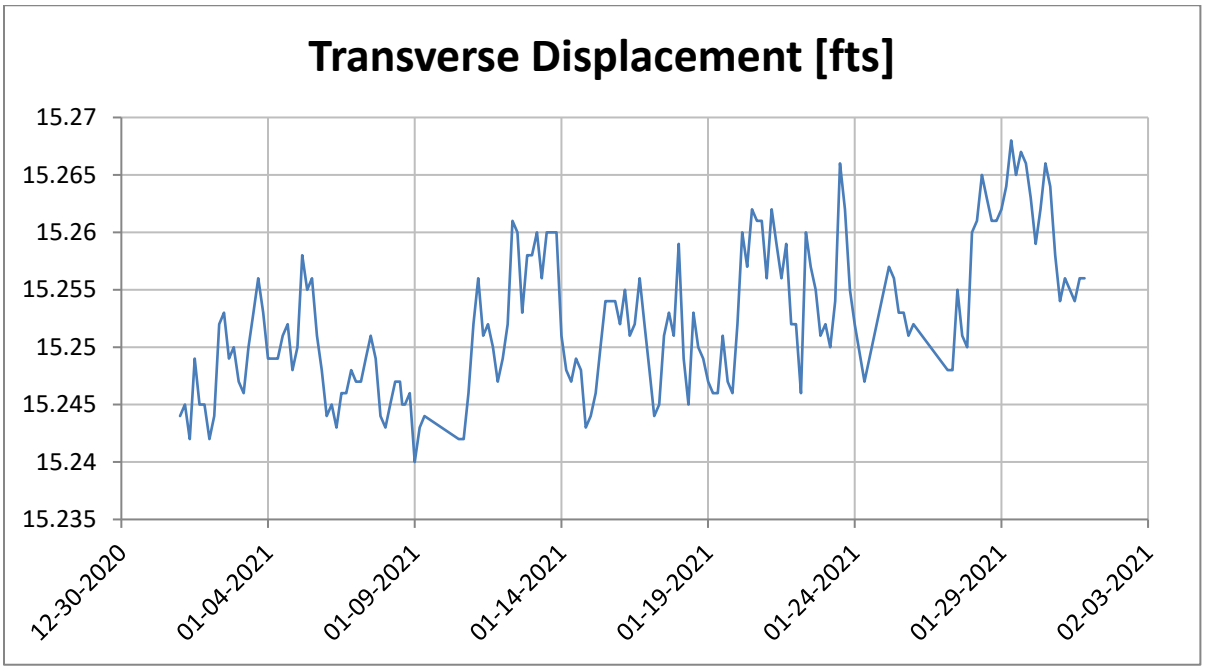


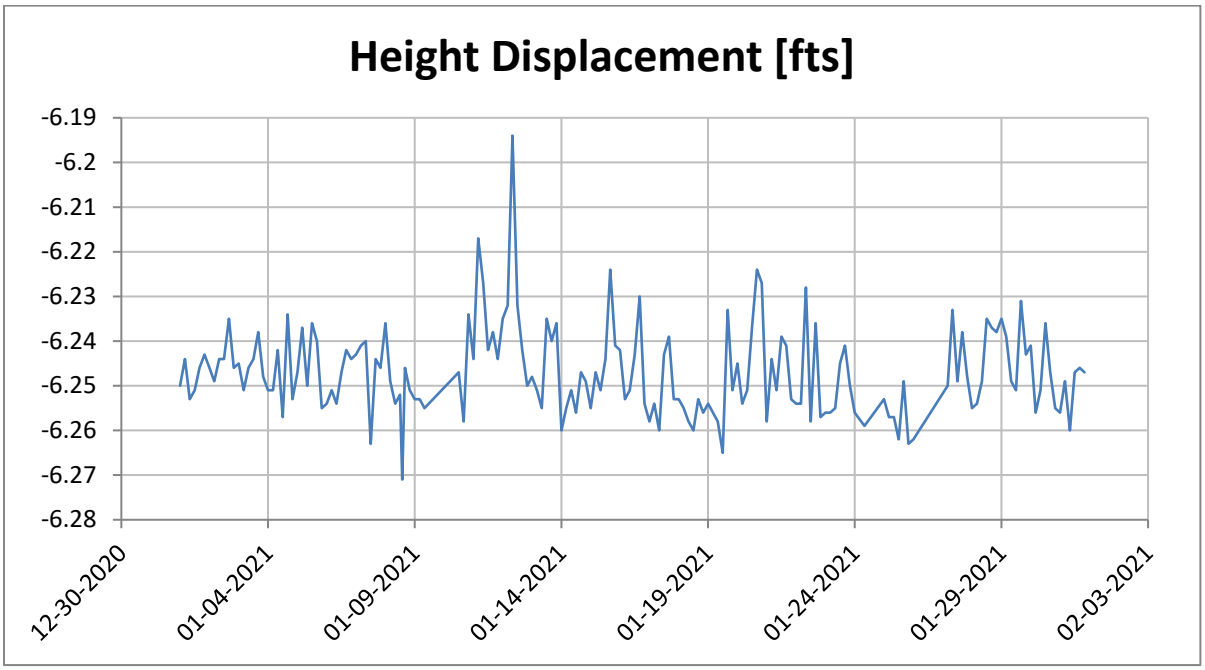


Notes:

1. Survey accuracy is +/-0.016 feet.
2. Alarm threshold is +/-0.35 feet.
3. Transverse displacement is in the horizontal direction. Positive direction means closer to the robotic station.
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism P63

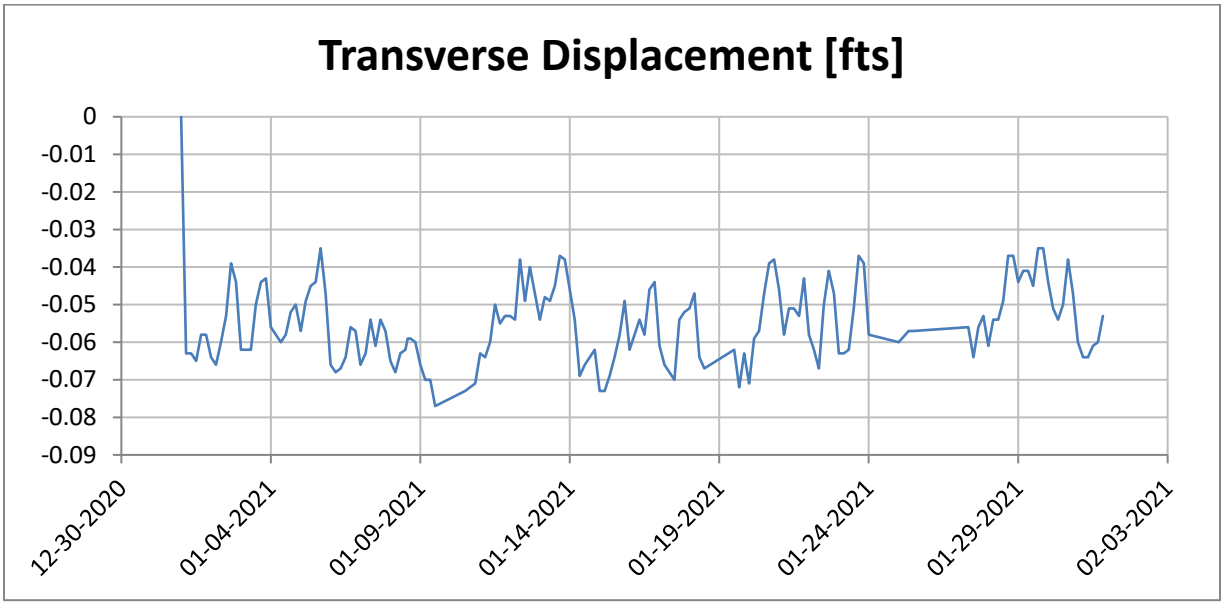


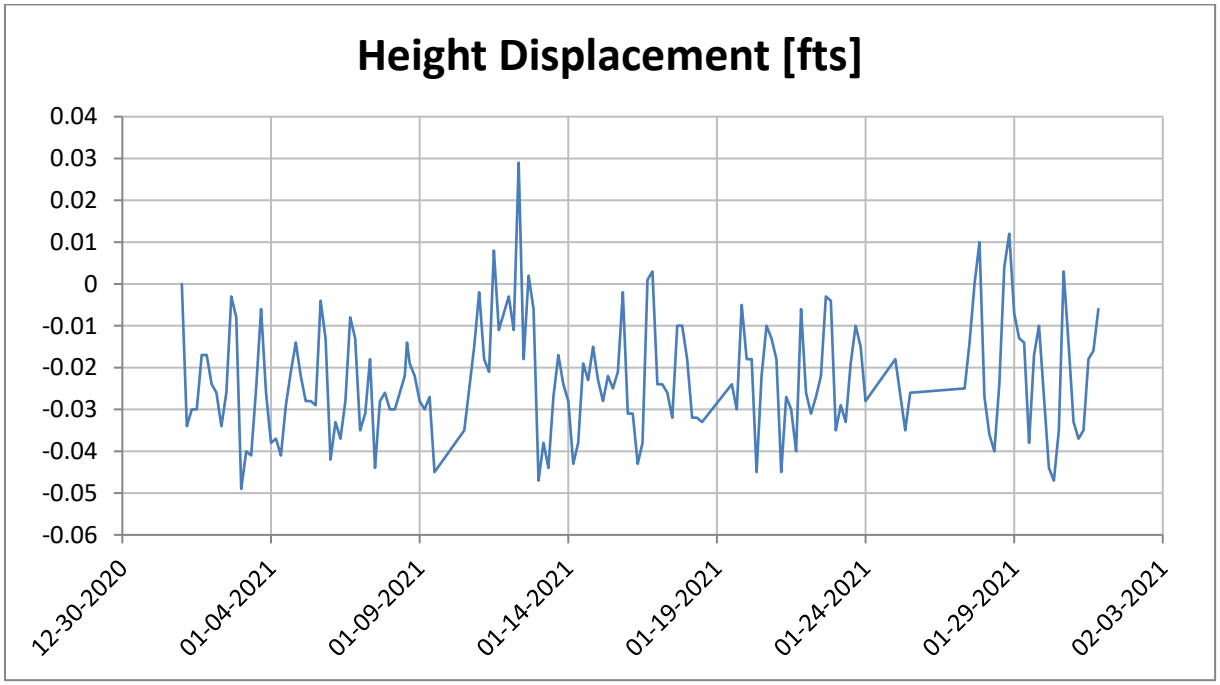


Notes:

1. Survey accuracy is +/-0.016 feet.
2. Alarm threshold is +/-0.35 feet.
3. Transverse displacement is in the horizontal direction. Positive direction means closer to the robotic station.
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism P69

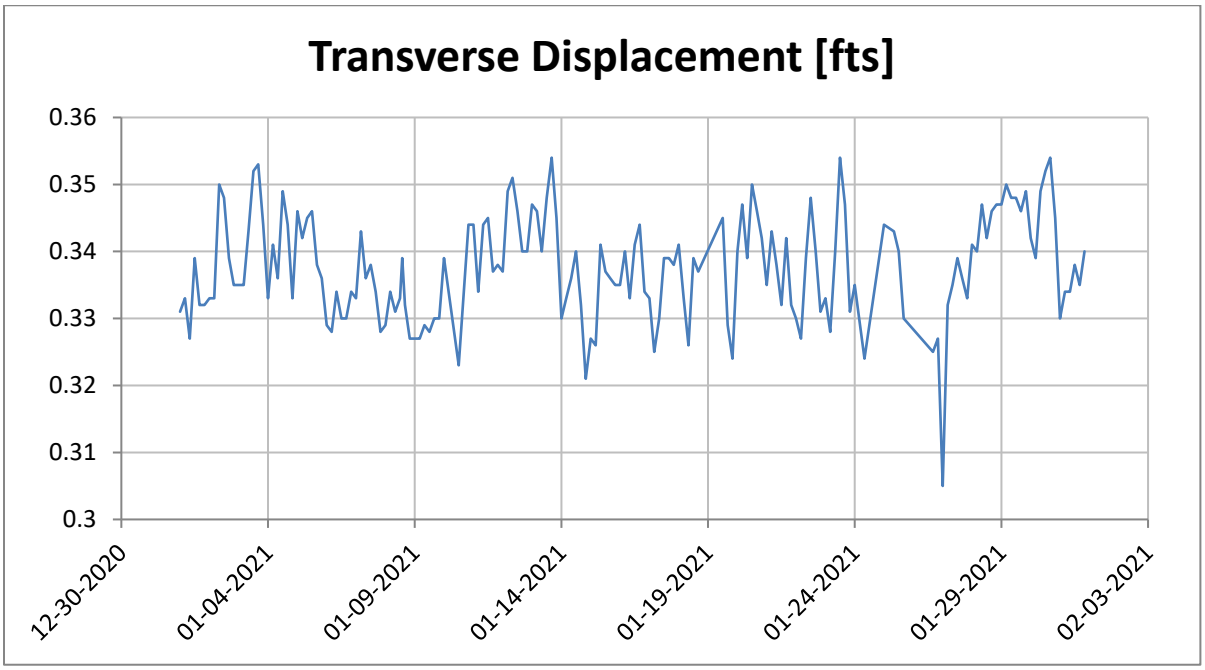


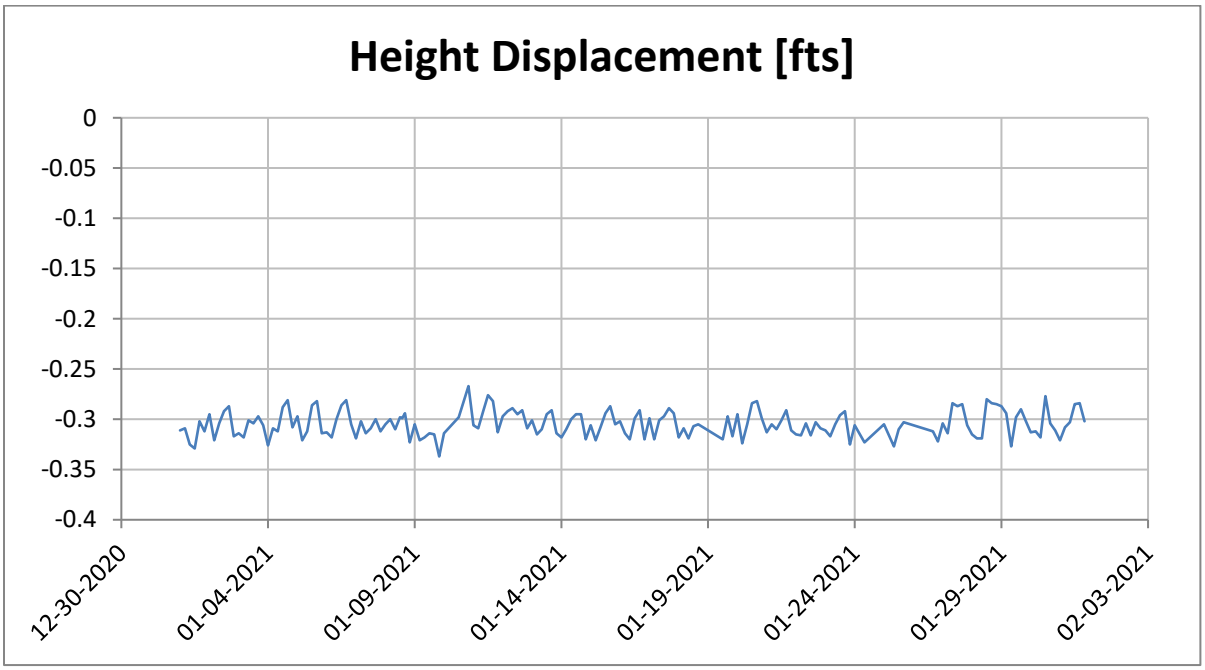


Notes:

1. Survey accuracy is +/-0.016 feet.
2. Alarm threshold is +/-0.35 feet.
3. Transverse displacement is in the horizontal direction. Positive direction means closer to the robotic station.
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism P70

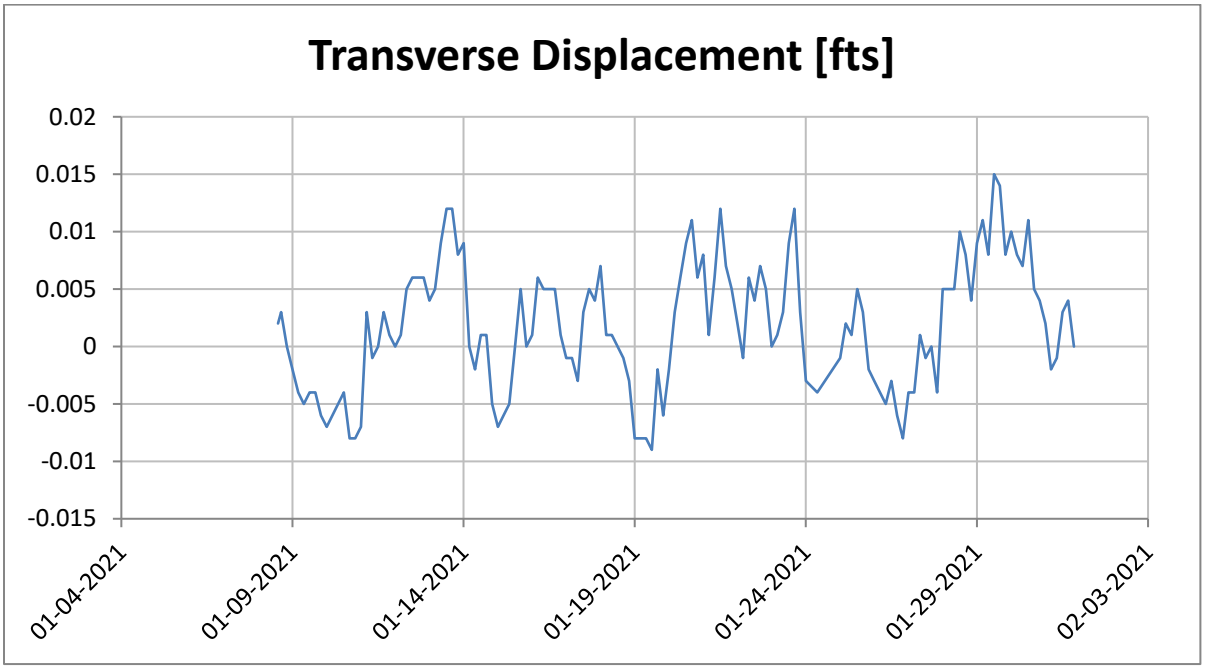


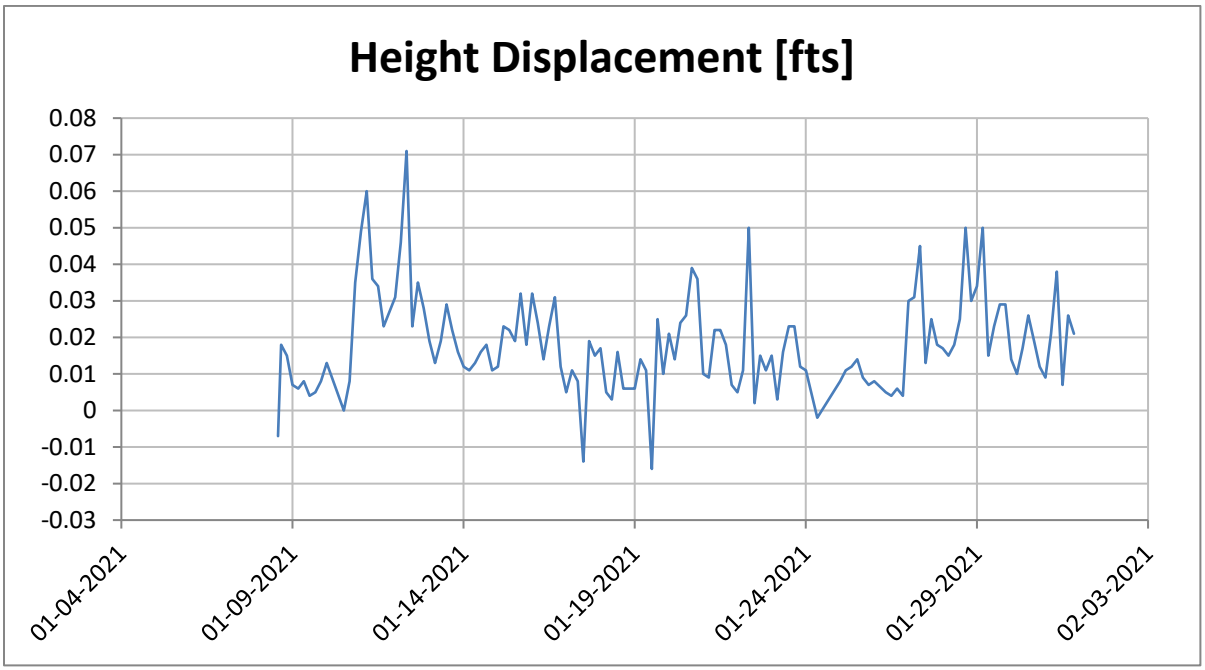


Notes:

1. Survey accuracy is +/-0.016 feet.
2. Alarm threshold is +/-0.35 feet.
3. Transverse displacement is in the horizontal direction. Positive direction means closer to the robotic station.
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism TOE1





Notes:

1. Survey accuracy is +/-0.016 feet.
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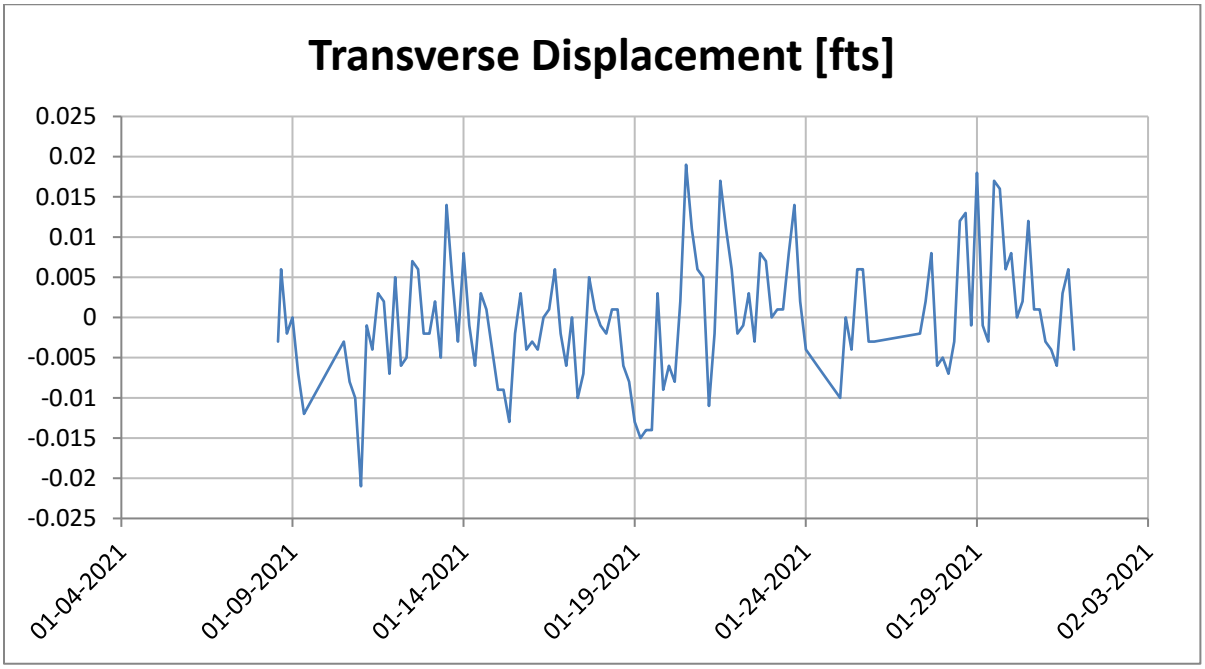
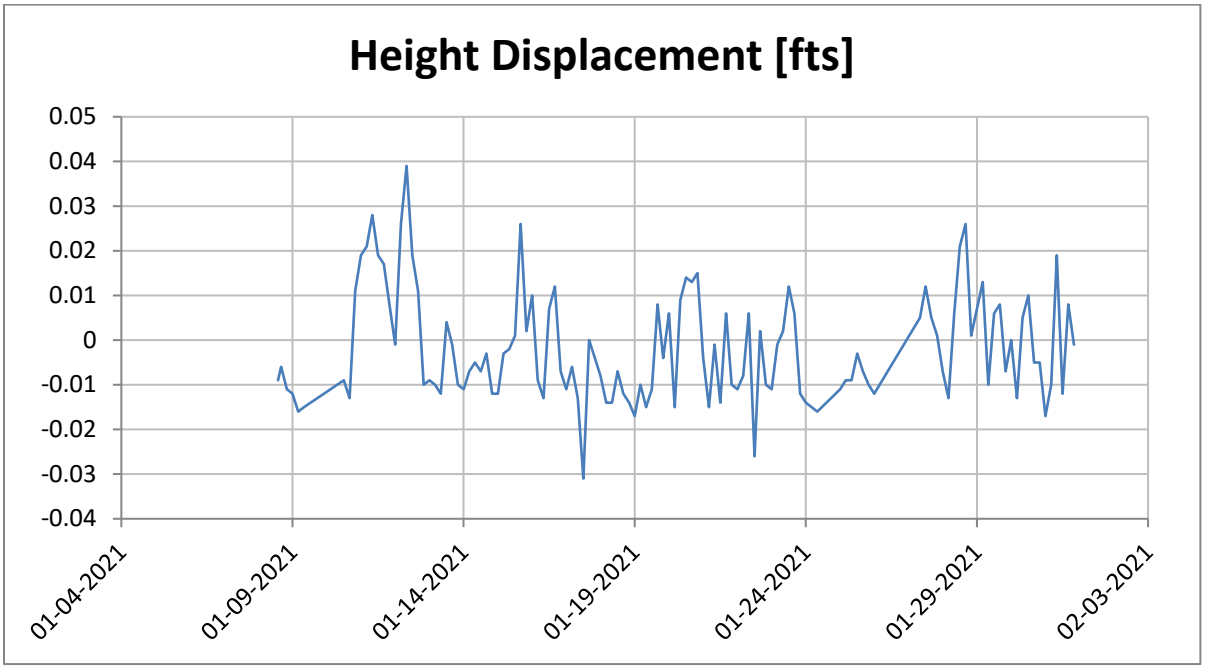
4. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism TOE2

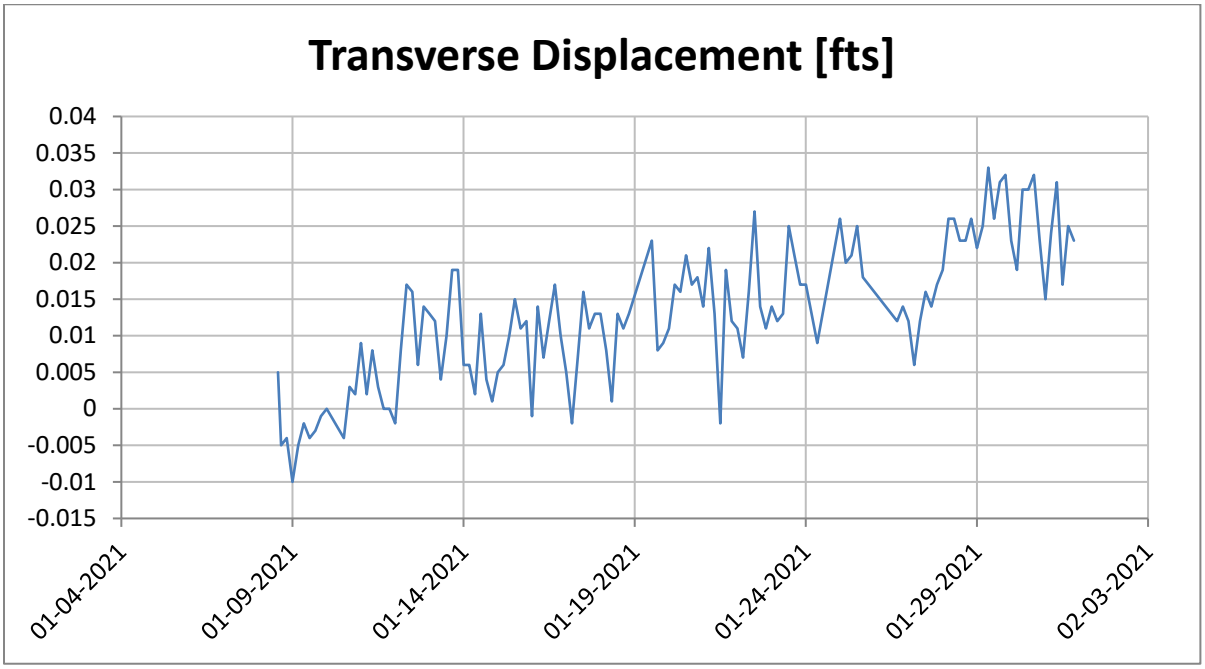


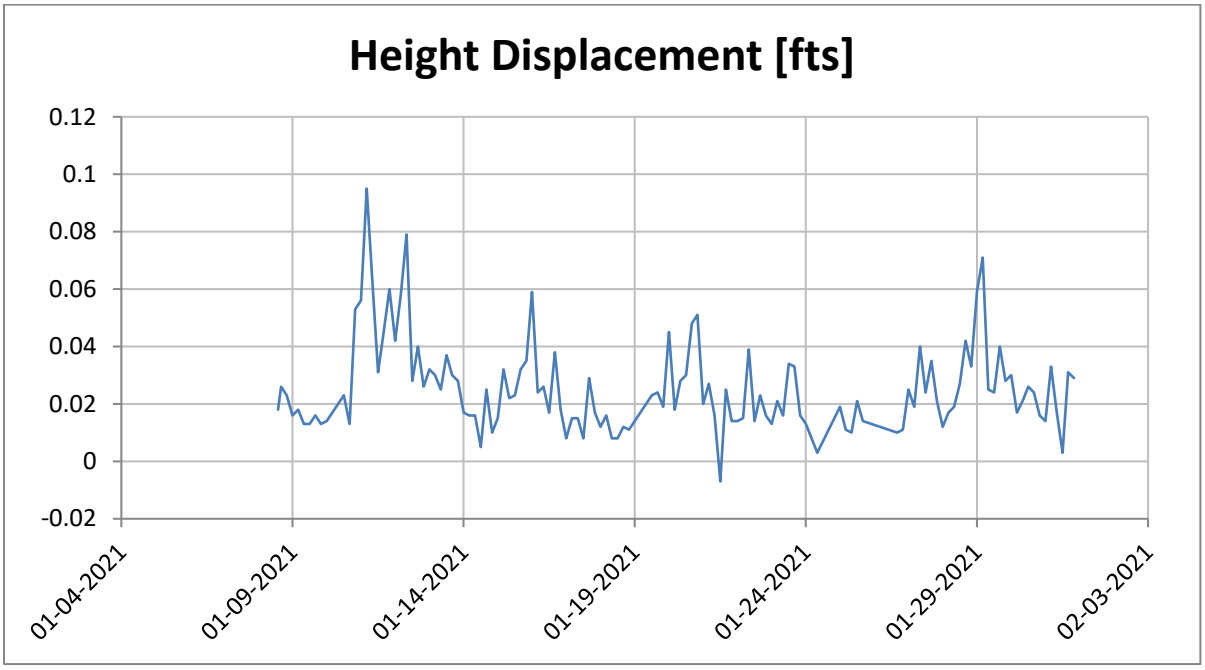


Notes:

5. Survey accuracy is +/-0.016 feet.
6. Alarm threshold is +/-0.35 feet.
7. Transverse displacement is in the horizontal direction. Positive direction means closer to the robotic station.
8. Height displacement is in the vertical direction. Positive direction means higher in elevation.

Prism TOE3





Notes:

1. Survey accuracy is +/-0.016 feet.
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Appendix C

Drone Survey

MATERIAL TEMPORARILY STOCKPILED.

MATERIAL VOLUME DECREASE IN MULCH PILE.

MATERIAL ADDED TO GROWTH MEDIA PILE

N

0 300' 600'

Stantec

Stantec Consulting Services Inc.
2000 South Colorado Boulevard Suite 2-300
Denver CO 80222-7933
Tel: (303) 758-4058
www.stantec.com

LEGEND

- Permit/Affected Lands Boundary
- Proposed Disturbance Limit
- Landslide Extent
- Buttress Fill Extent
- Comparison Contour. Increase in elevation. (CI=2')
- Comparison Contour. Decrease in elevation. (CI=2')

1. COMPARISON OF DRONE FLIGHTS FROM 12/17/21 and 01/16/2021.

Client/Project
CONTINENTAL MATERIALS CORP.
PIKEVIEW QUARRY SLOPE MONITORING

Project No.
227419041

Title
EXISTING PRISMS WITH CURRENT SURFACE

Revision
#

Date
2021.02.28

Drawn By
PK

Figure No.
5