

To: Jerald Schnabel From: Paul Kos  
Continental Materials Corp. Denver, CO 80222  
File: February 28, 2021 Monitoring Summary Date: March 31, 2021

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**Reference: February 2021 Geotechnical Monitoring Summary Pikeview Quarry**

## 1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) has prepared this February 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 February 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 February 2021 uninterrupted. Visual inspections of the slopes were performed by Stantec engineers.

### 1.1 PURPOSE

The purpose of this report is to summarize the February 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:

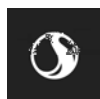
- Meet corporate risk management requirements,
- Provide ongoing slope monitoring and advance warning of any changed conditions that could pose a hazard to workers or to the public,
- Document the geotechnical performance of the slope, and
- Document monthly site grading activities and construction quality 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 <sup>3</sup> (min.)



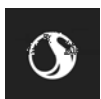
## 2.0 VISUAL INSPECTIONS

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 February 2021 resulted in the operator visual inspections being limited to stockpiles.

Stantec conducted visual inspections of the Pikeview Quarry slopes on February 23, 2021. 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.

- Observed a new crack on the road on the north side of the quarry. The crack runs parallel to a fill slope and is likely the result of loose fill settling. The crack is not in the vicinity of the landslide and runs perpendicular to the landslide; therefore, it is not related to the landslide. (Note 2)
- Walked to the new 3 new prisms installed at the toe. (Note 5)
- The area upstream of the culvert has been excavated to clear the pipe for storm water. (Note 1)
- 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.
- Gullies and Rills: Gullies and rills have formed on the slopes above the slide area as well as in the burn areas above the quarry. (Note 8)
- 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 7)
- 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 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. (Note 3)
- 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.



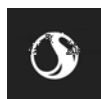
### 3.0 PRISM SURVEY

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. There are currently 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, and the proposed prism locations are shown on the reclamation topography in Figure 4. Both figures are included in Appendix B.

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. On February 5, the site power was cut by a nearby, but offsite, construction project. The power was restored and readings resumed on February 8. On February 10, two alarms were received based on prism TOE2. The station recorded a reading of -0.687 feet followed by a reading of +1.369 feet. CMC made sure that there were no workers in the area before inspecting the slope. No signs of movement were observed. Stantec and CMC know that the station has previously recorded "movements" that were immediately followed by "movements" in the opposite direction. Following each alarm, CMC clears the area of concern until the data can be reviewed and the slope can be inspected. These "movements" are considered erroneous, and the readings collected throughout the month provide the actual long-term movements at prisms TOE2. All other alarms were determined to be caused by snow, fog, or frost. There were no alarms caused by slope movements.

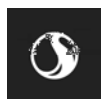
**Table 2 Alarm Summary**

Date	Notes	Actions taken	Issue Resolved
02/05/2021	Multiple prisms missing after multiple scans	Power Cut	02/08/2021
02/06/2021	Multiple prisms missing after multiple scans	Power Cut	02/08/2021
02/07/2021	Multiple prisms missing after multiple scans	Power Cut	02/08/2021
02/08/2021	Multiple prisms missing after multiple scans	Snow and Fog	02/08/2021
02/09/2021	Multiple prisms missing after multiple scans	Frost	02/09/2021
02/10/2021	Multiple prisms missing after multiple scans	Heavy Fog	02/10/2021
02/10/2021	TOE2 regression limits exceeded	Area cleared of workers. Believed to be erroneous data.	02/11/2021
02/11/2021	Multiple prisms missing after multiple scans	Snow and Frost	02/11/2021



02/12/2021	Multiple prisms missing after multiple scans	Snow and Frost	02/12/2021
02/13/2021	Multiple prisms missing after multiple scans	Snow and Frost	02/13/2021
02/14/2021	Multiple prisms missing after multiple scans	Snow and Frost	02/14/2021
02/15/2021	Multiple prisms missing after multiple scans	Snow and Frost	02/15/2021
02/17/2021	Multiple prisms missing after multiple scans	Snow and Fog	02/17/2021
02/18/2021	Multiple prisms missing after multiple scans	Snow and Fog	02/18/2021
02/21/2021	Multiple prisms missing after multiple scans	Frost	02/21/2021
02/24/2021	Multiple prisms missing after multiple scans	Snow	02/24/2021
02/25/2021	Multiple prisms missing after multiple scans	Snow and Cloud cover	02/25/2021
02/26/2021	Multiple prisms missing after multiple scans	Frost	02/26/2021

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. Prism P69 was moved on June 20, 2020, and the displacements included in Table 3 are the displacements since that date. According to Leica documentation, the survey accuracy is  $\pm 4 \text{ mm} + 1.5 \text{ ppm}$  for prisms located greater than 500m from the station; these equates to an accuracy of  $\pm 0.016 \text{ ft}$ . The data show stable conditions with no movement for 16 of 17 prisms with recorded displacements limited to data scatter and not actual movements. Prism P63 is located at the toe of the landslide, and this location shows slope creep movements at slow velocities ( $< 0.001 \text{ feet per day}$ ). Plots of the transverse and height displacements for each prism are included in Appendix B.



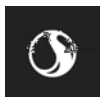


**Table 3 Prism Summary**

<b>Prism ID</b>	<b>Cumulative Transverse Displacement (ft)</b>	<b>Cumulative Height Displacement (ft)</b>	<b>Monthly Delta (ft)</b>	<b>Cumulative Delta (ft)</b>	<b>Needs / Recommendations</b>
CP1	0.000	-0.027	-0.0012	0.0304	
CP2	-0.075	-0.016	0.0050	0.3955	
CP3	0.266	-0.235	0.0146	0.3569	
NP1	0.027	-0.013	-0.0195	0.0372	
NP2	-0.023	-0.090	0.0083	0.1069	
NP66	0.135	-0.228	0.0078	0.3132	
P1	0.339	-0.079	0.0079	0.3481	
P2	0.141	-0.042	-0.0031	0.1970	
P25	-0.038	0.020	0.0018	0.1484	
P32	-0.104	-0.111	0.0139	0.2969	
P33	-0.131	-0.061	0.0181	0.2285	
P35	0.036	-0.196	0.0016	0.4185	
P4	0.351	-0.139	0.0027	0.4612	
P5	0.383	-0.166	-0.0032	0.5950	
P63	15.264	-6.259	0.0137	16.4976	Prism at toe of slide. Movements are within expected range.
P69	-0.068	-0.038	-0.0096	1.9795	
P70	0.339	-0.323	0.0069	0.5717	
TOE1	-0.002	0.021	-0.0091	0.0211	
TOE2	-0.004	-0.014	0.0013	0.0146	
TOE3	0.040	0.016	0.0020	0.0484	

## 4.0 DRONE SURVEY

The site was flown for aerial imagery using an unmanned aircraft system (UAS or 'drone') on February 10, 2020. 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 January topography was also compared to the February topography to identify changes in the site topography. Comparison of the two surveys showed that approximately 2,242 yd<sup>3</sup> 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

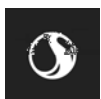
No fill was permanently placed at the quarry in February. Once fill placement starts, the fill will be placed in one-foot thick lifts, moisture conditioned as necessary, and compacted. Compaction testing will commence at the rate of at least one test per 5,000 yd<sup>3</sup> placed.

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 February 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.

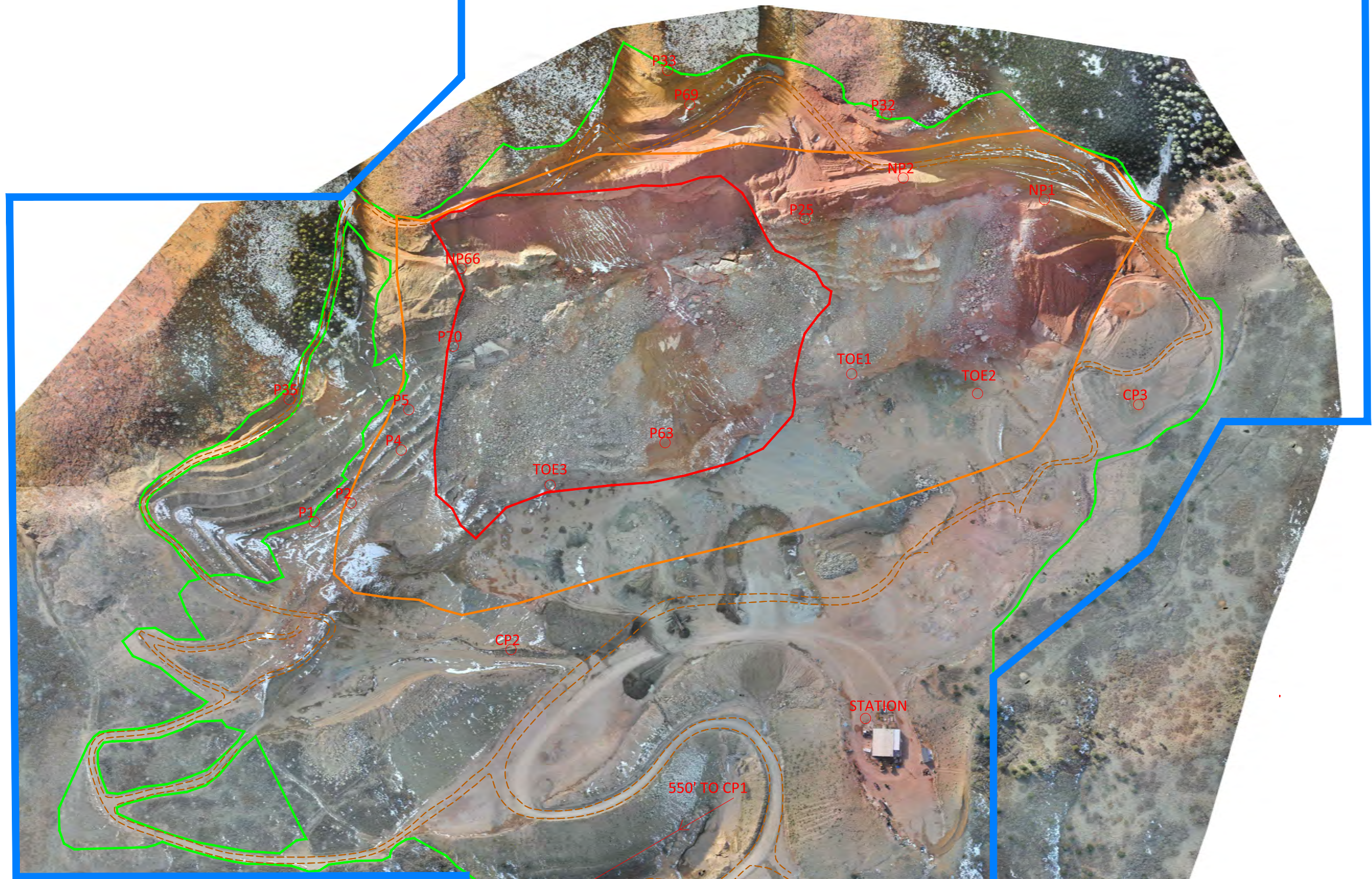
- Restricted access to the ungraded landslide slopes should continue.
- All monitoring should continue at current frequencies.
- All alarms shall continue to be taken seriously even if data errors are suspected.





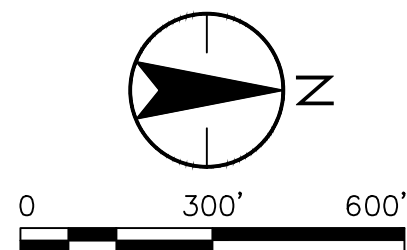
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Stantec Consulting Services Inc.  
2000 South Colorado Boulevard Suite 2-300  
Denver CO 80222-7933  
Tel: (303) 758-4058  
www.stantec.com

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



Client/Project  
CONTINENTAL MATERIALS  
CORP.  
PIKEVIEW QUARRY SLOPE  
MONITORING

Project No.  
227419041

Title  
SITE MAP

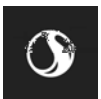
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Drawn By  
PK

Date  
2021.03.31  
Figure No.  
1



# Appendix A

## Visual Inspections



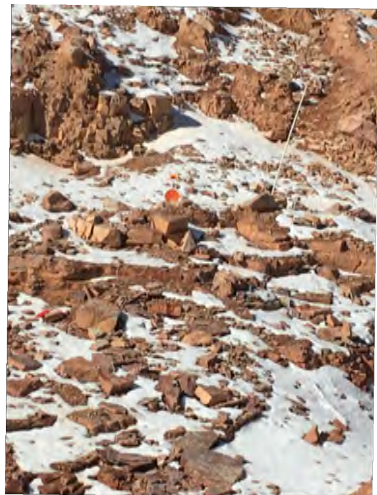


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6. AREA ABOVE THE SLIDE



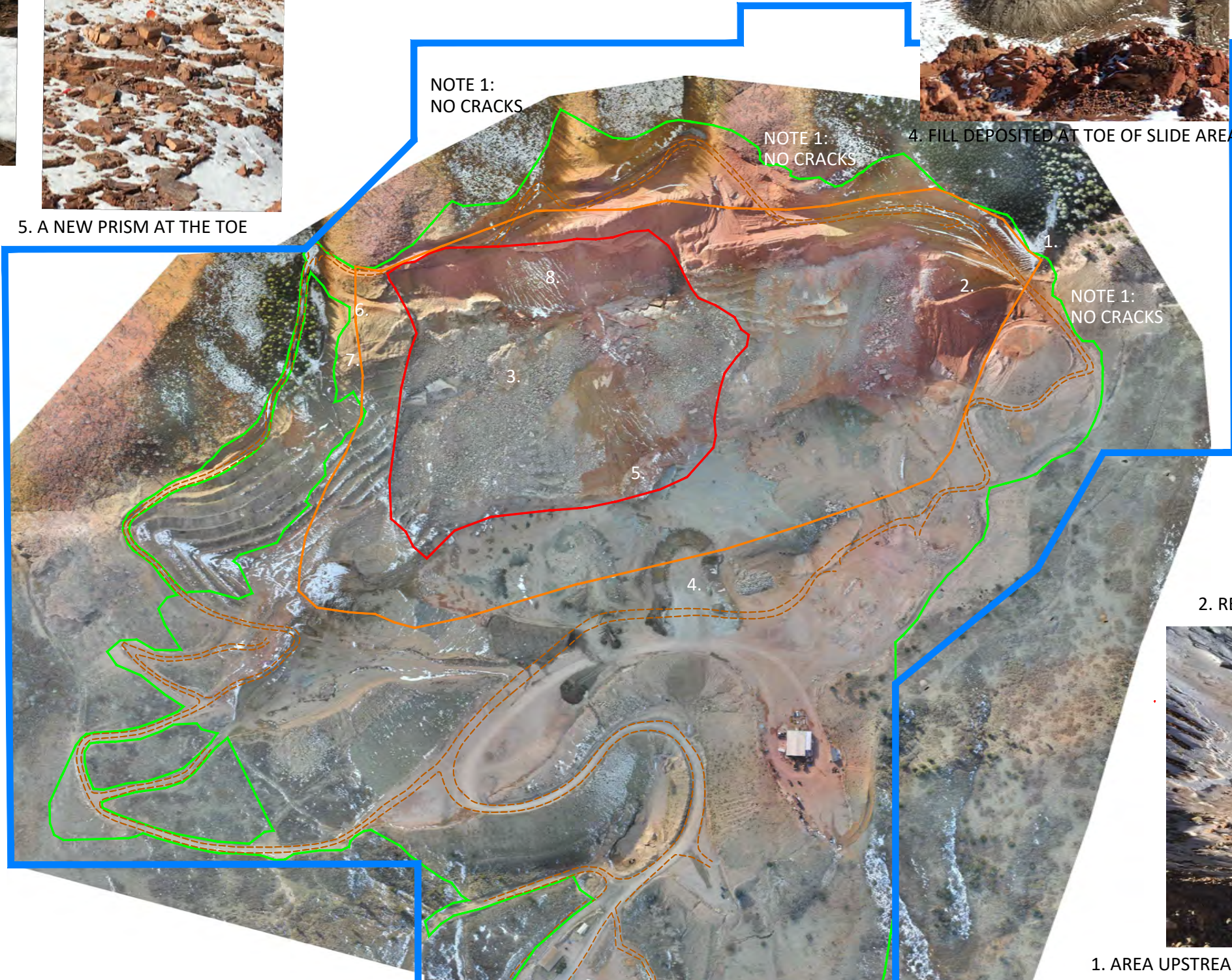
5. A NEW PRISM AT THE TOE



7. HISTORIC CRACK PARALLEL TO SLIDE



8. RILLS ON SLOPE UNDER PEAK



4. FILL DEPOSITED AT TOE OF SLIDE AREA



3. LARGE PIECES OF THE SLIDE BREAKING UP



2. RECENT CRACKING LIKELY FROM SETTLEMENT



1. AREA UPSTREAM OF CULVERT GETTING CLEARED OF DEBRIS



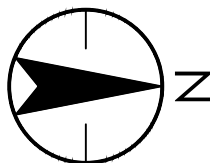
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LEGEND

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

NOTES

1. NO CRACKS OBSERVED IN THIS AREA.
2. ALL PHOTOS TAKEN FEBRUARY 23, 2020.



Client/Project

CONTINENTAL MATERIALS  
CORP.  
PIKEVIEW QUARRY SLOPE  
MONITORING

Project No.

227419041

Title

OBSERVATIONS FROM  
FEBRUARY INSPECTION

Revision

#

Drawn By

PK

Date

2021.03.31

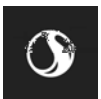
Figure No.

2



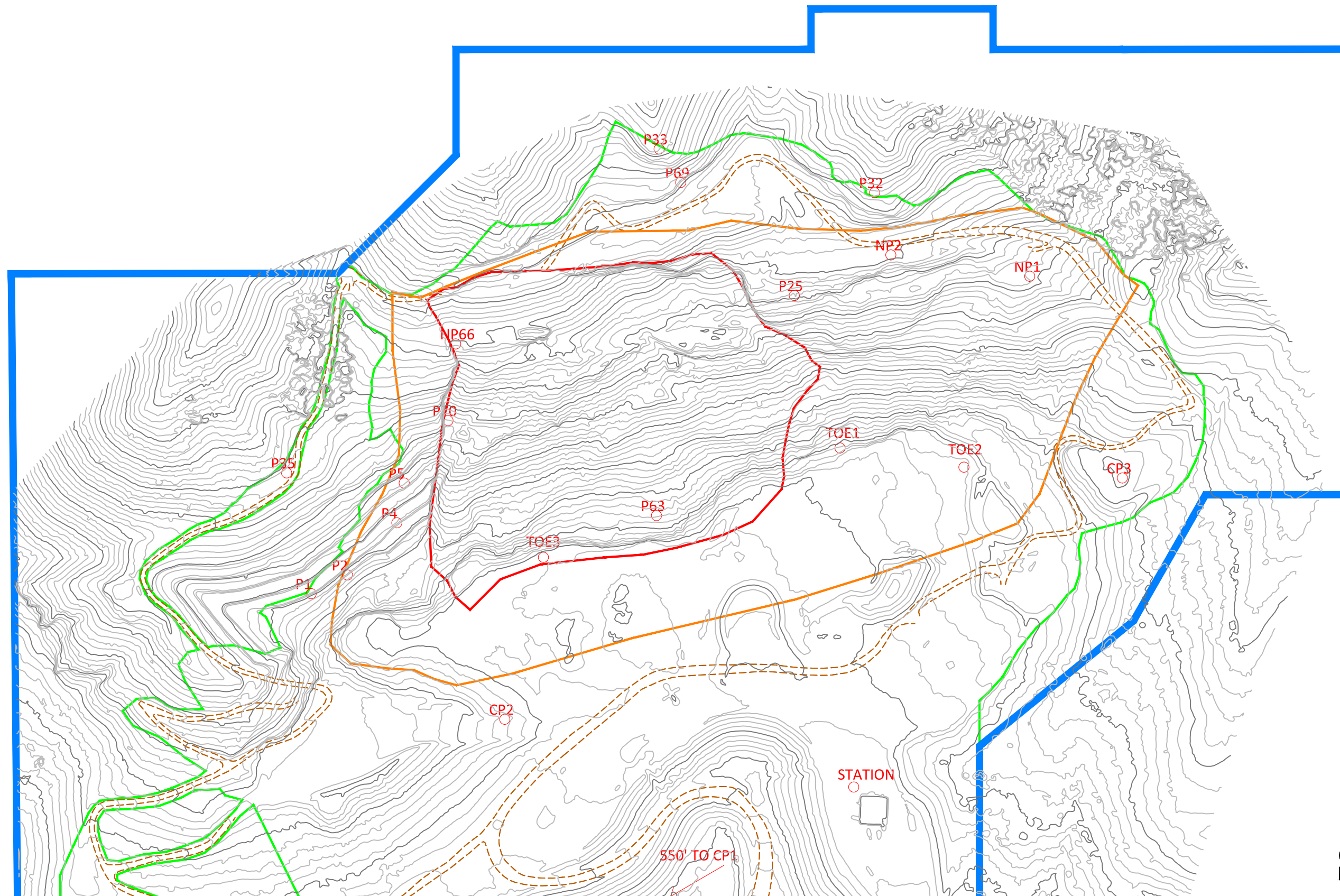
# Appendix B

## Prism Survey



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Denver CO 80222-7933  
Tel: (303) 758-4058  
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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 FEBRUARY 10, 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  
#

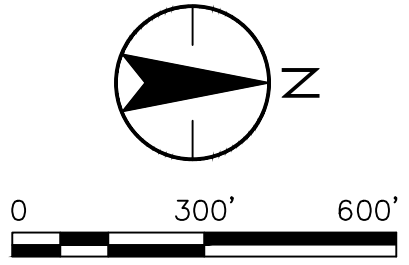
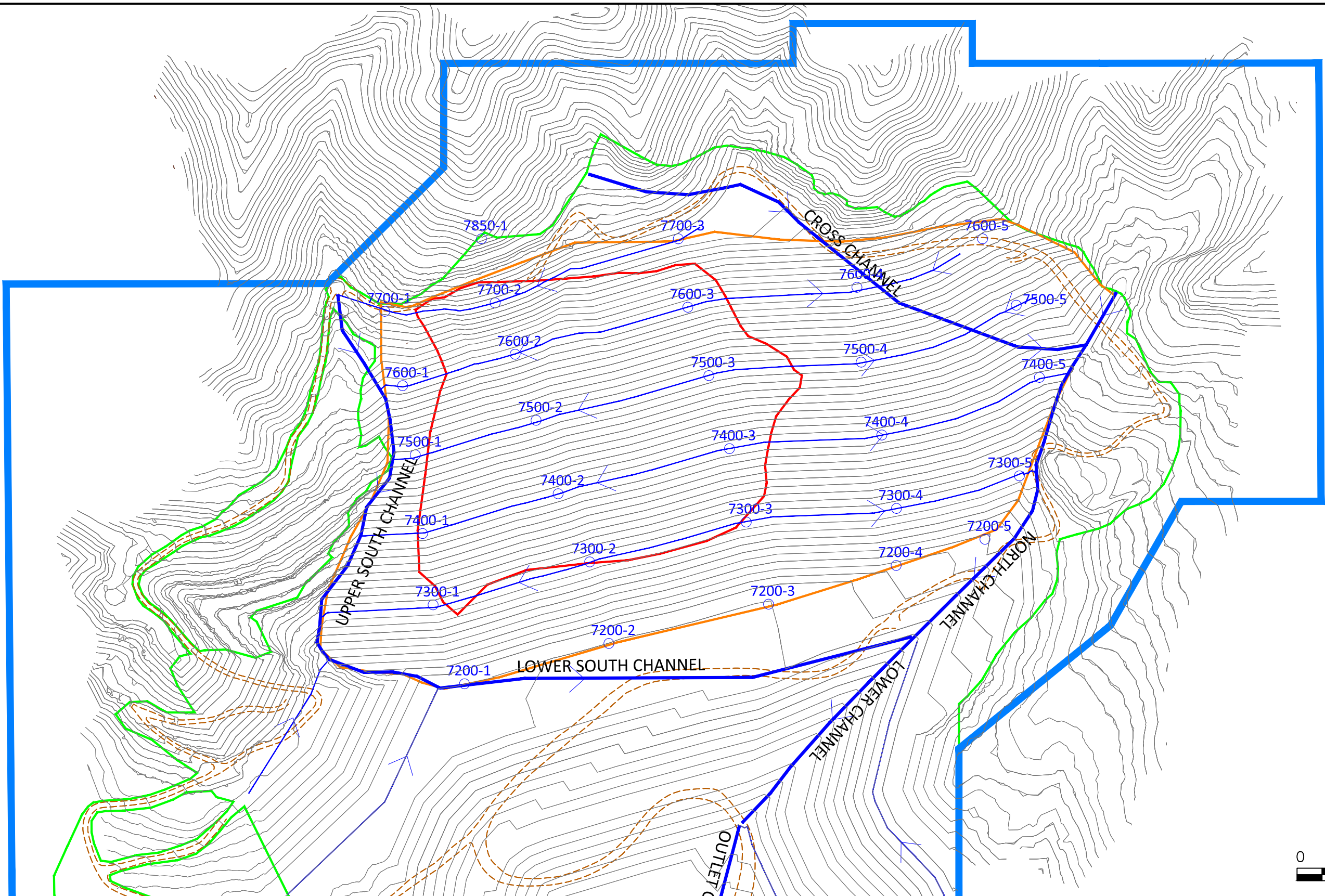
Drawn By  
PK

Date  
2021.03.31

Figure No.  
3



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**Stantec**

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2000 South Colorado Boulevard Suite 2-300  
Denver CO 80222-7933  
Tel: (303) 758-4058  
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- LEGEND
- Permit/Affected Lands Boundary
  - Proposed Disturbance Limit
  - Landslide Extent
  - - - Buttress Fill Extent
  - Proposed Prism

- NOTES
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.

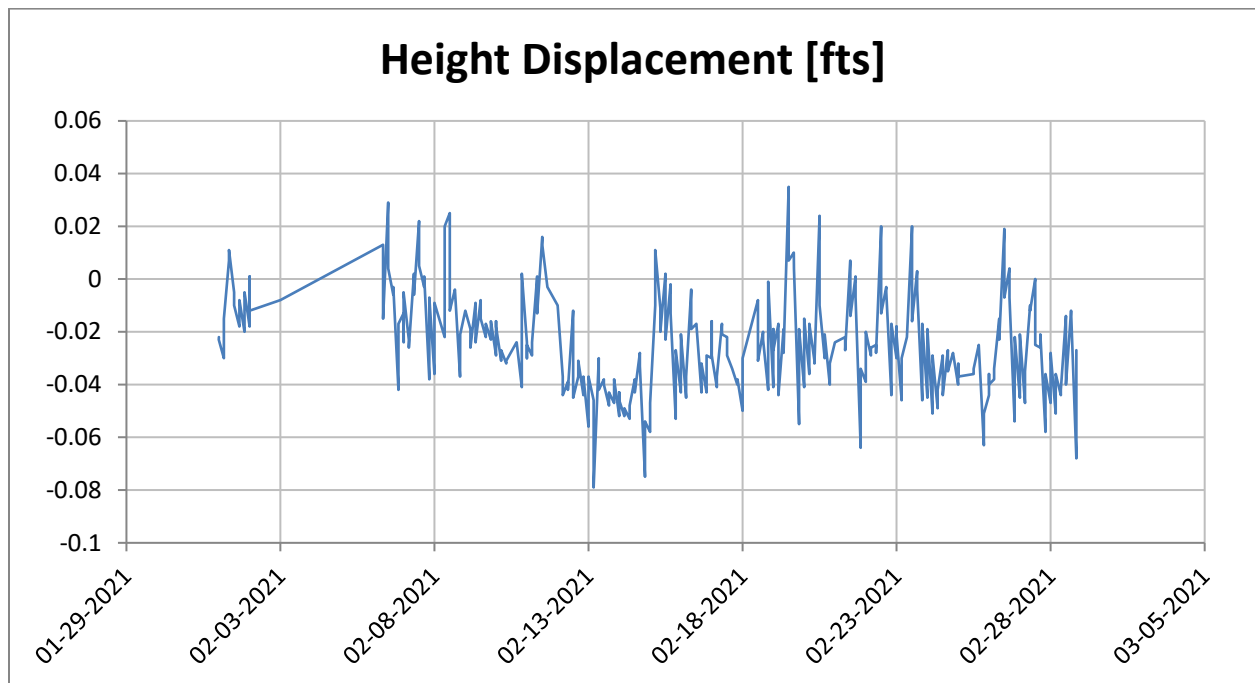
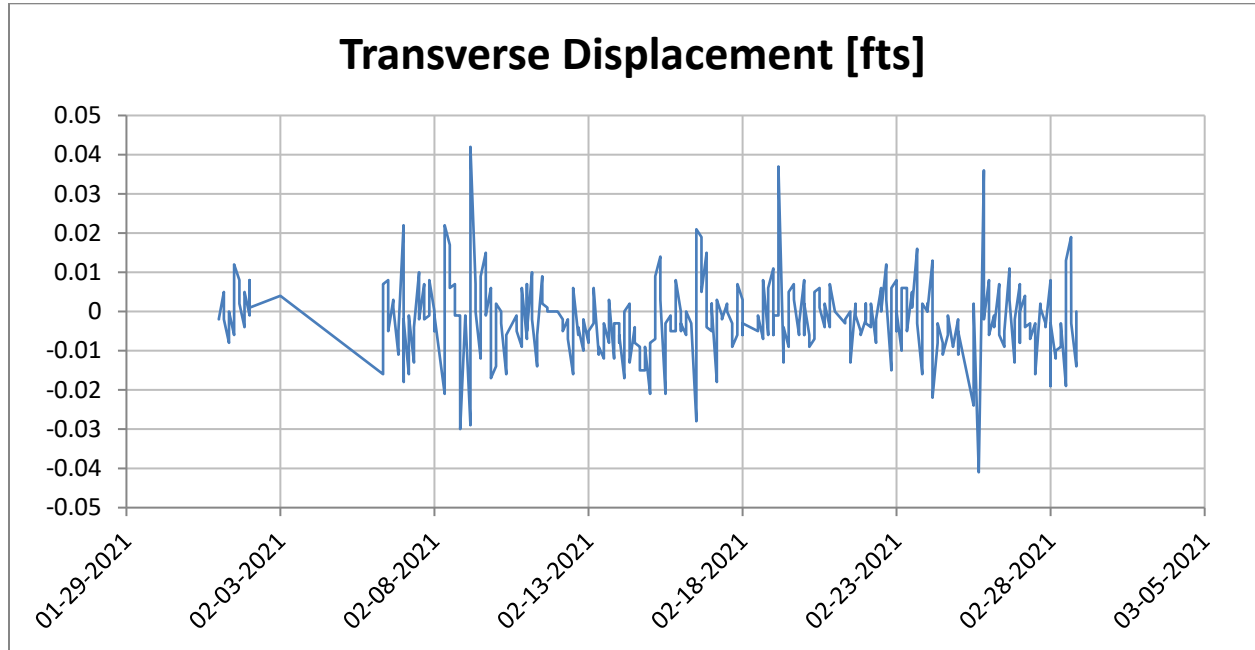
Client/Project  
**CONTINENTAL MATERIALS CORP.  
PIKEVIEW QUARRY SLOPE MONITORING**

Project No.  
227419041

Title	
PROPOSED PRISMS WITH RECLAMATION SURFACE	
Revision #	Date
	2021.03.31
Drawn By PK	Figure No. 4



## Prism CP1

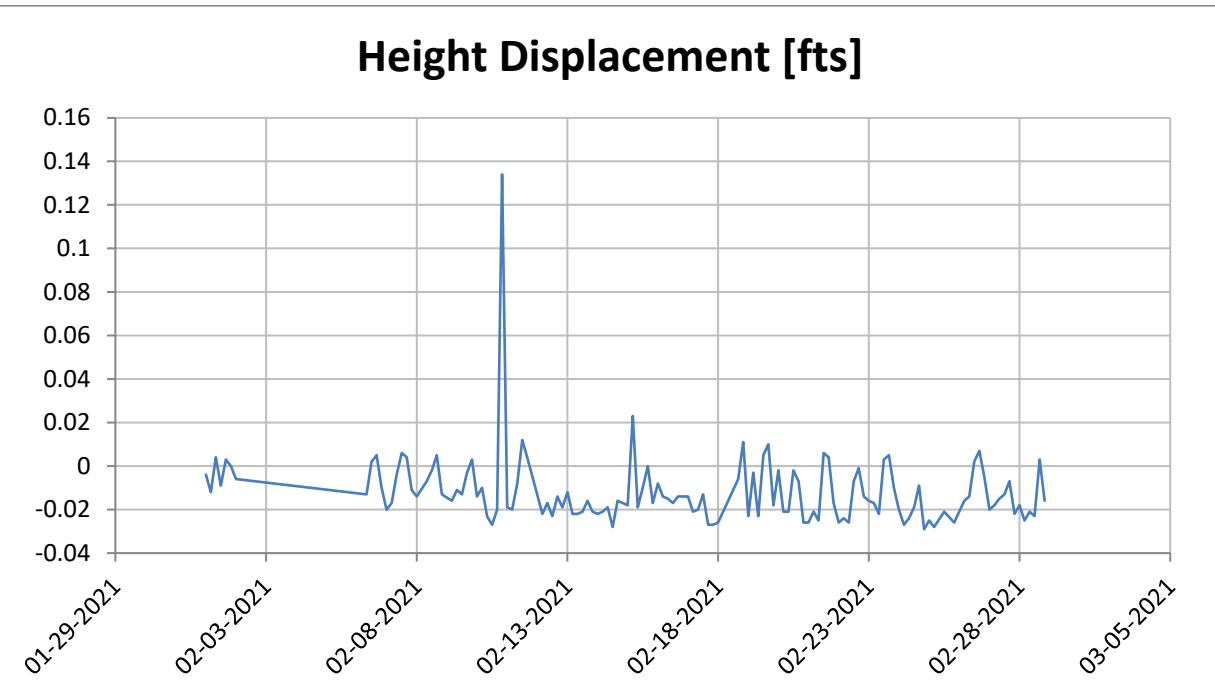
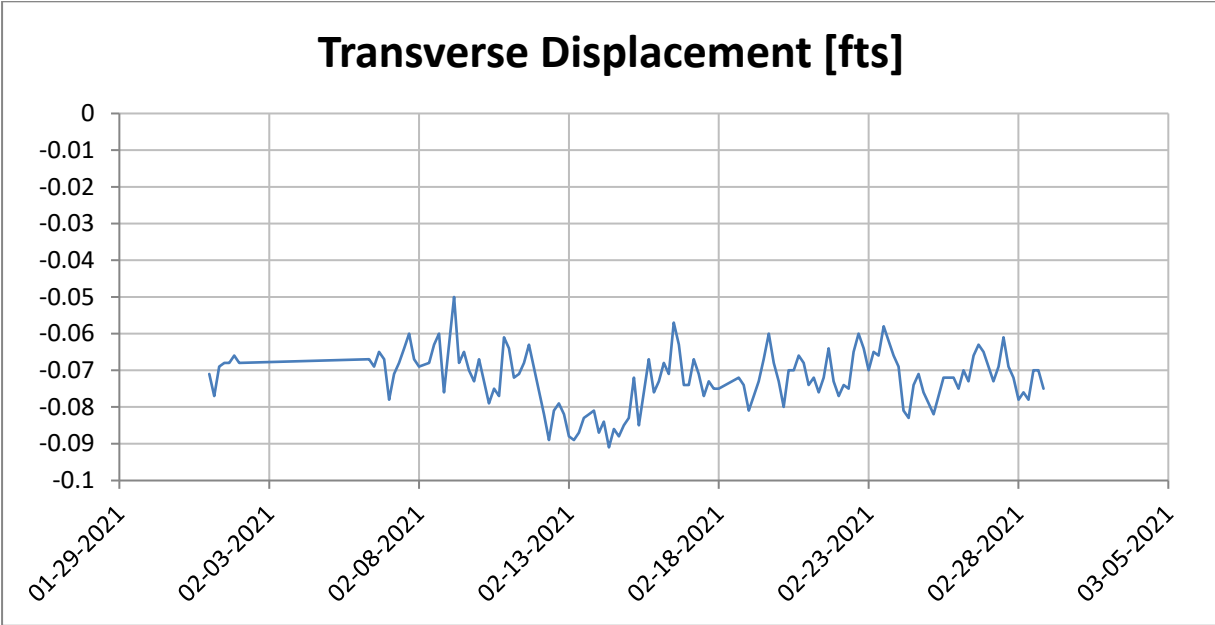


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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

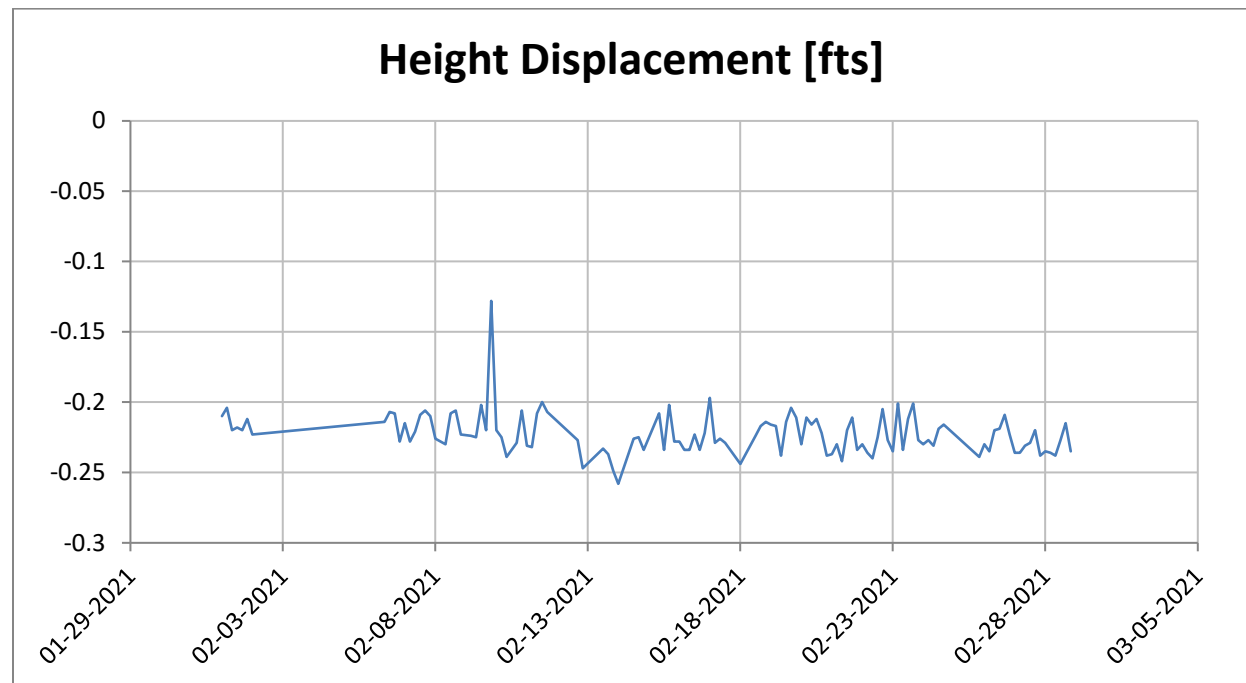
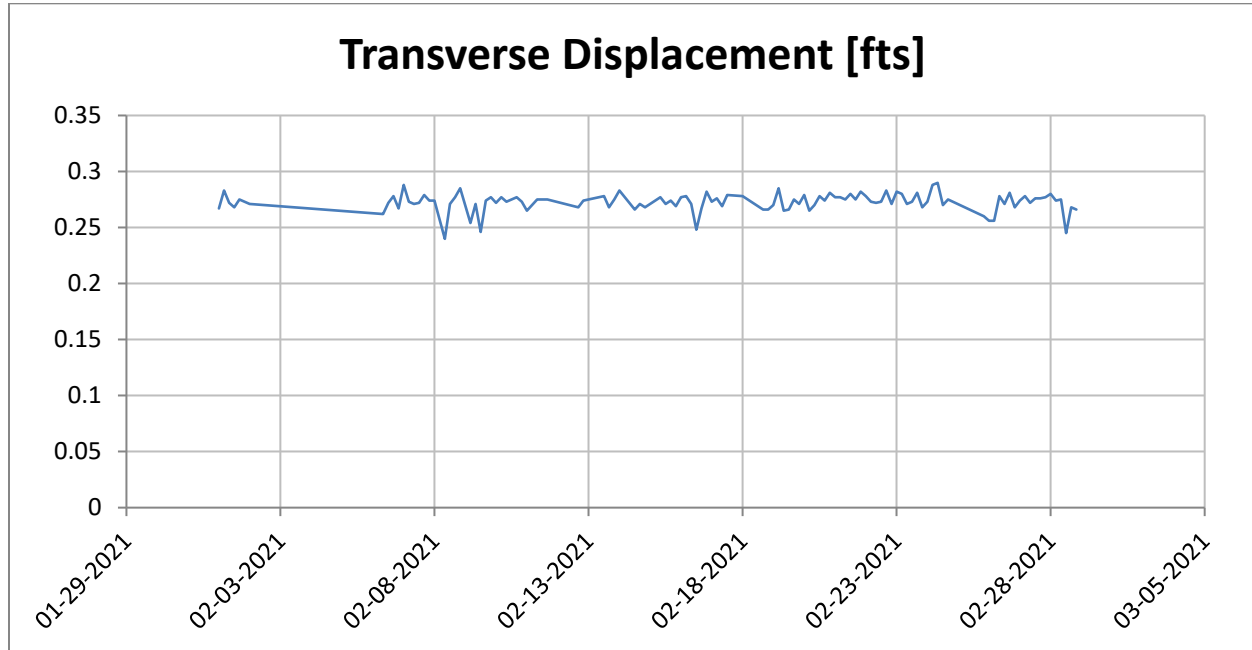


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## Prism CP3

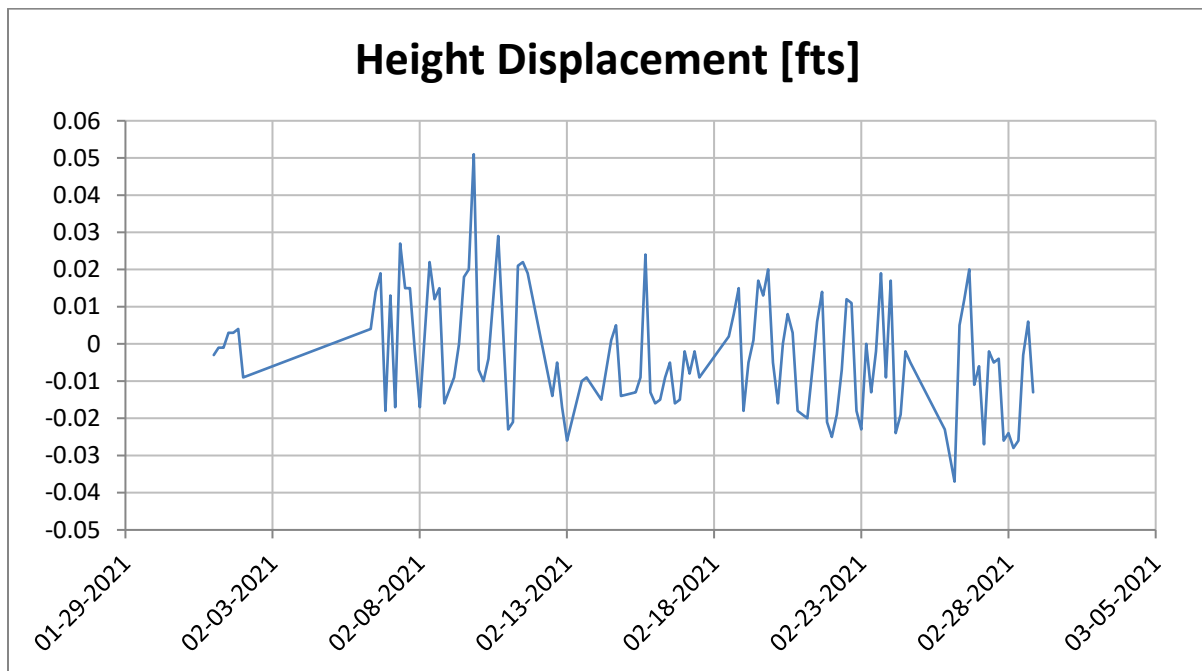
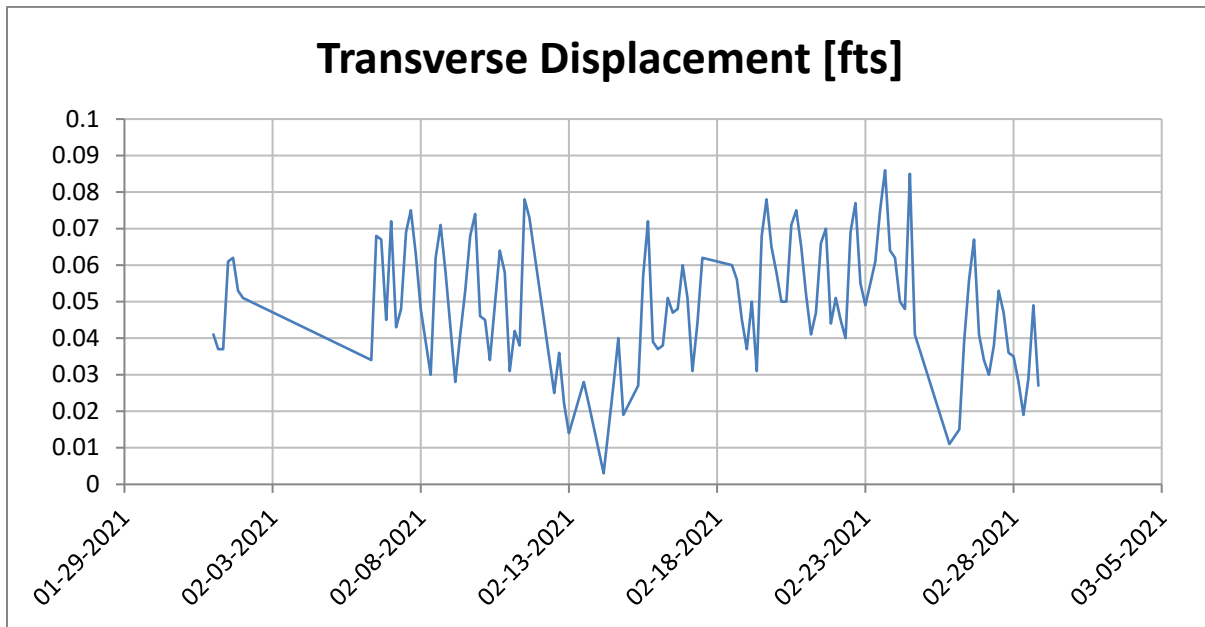


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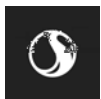


## Prism NP1

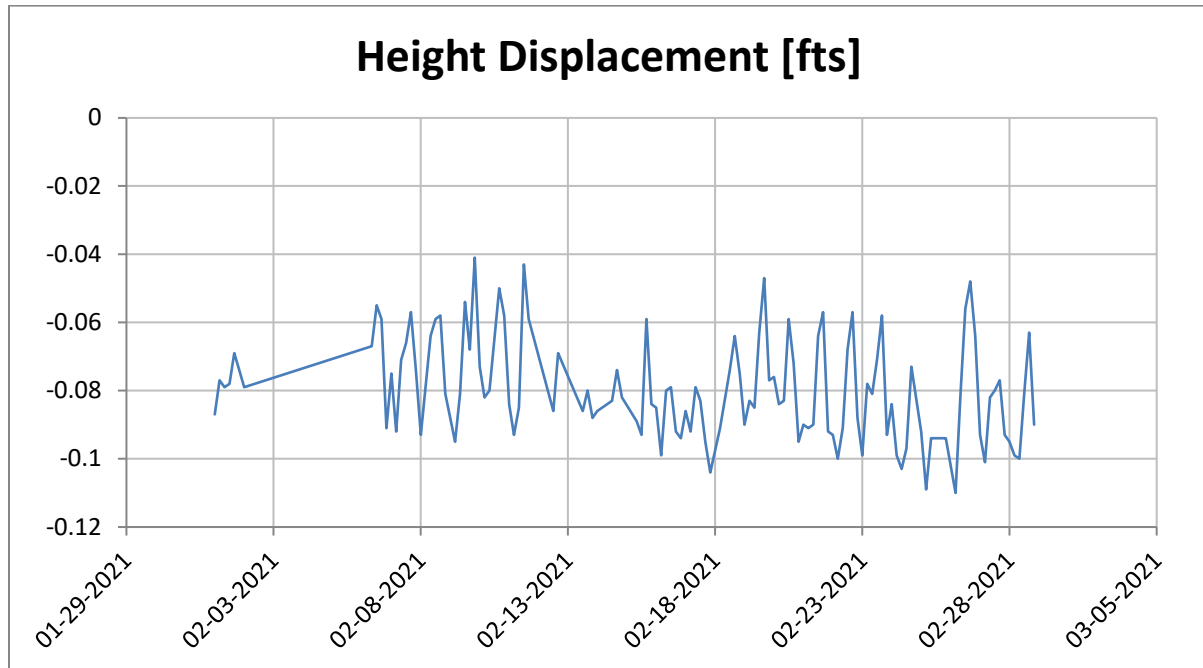
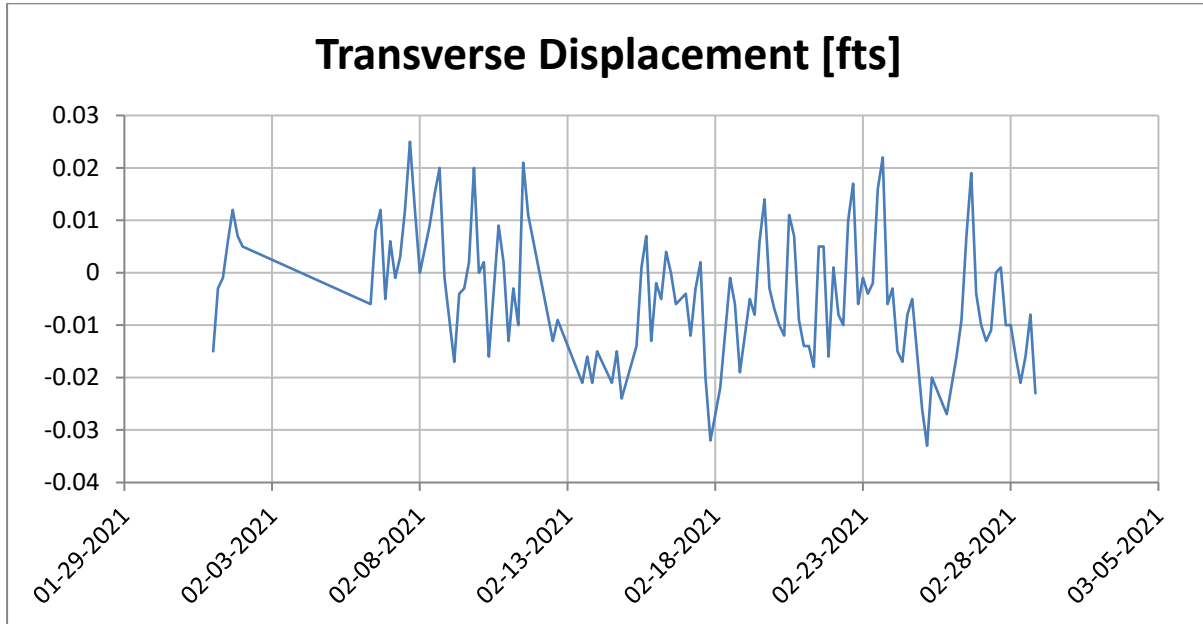


#### Notes:

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## Prism NP2

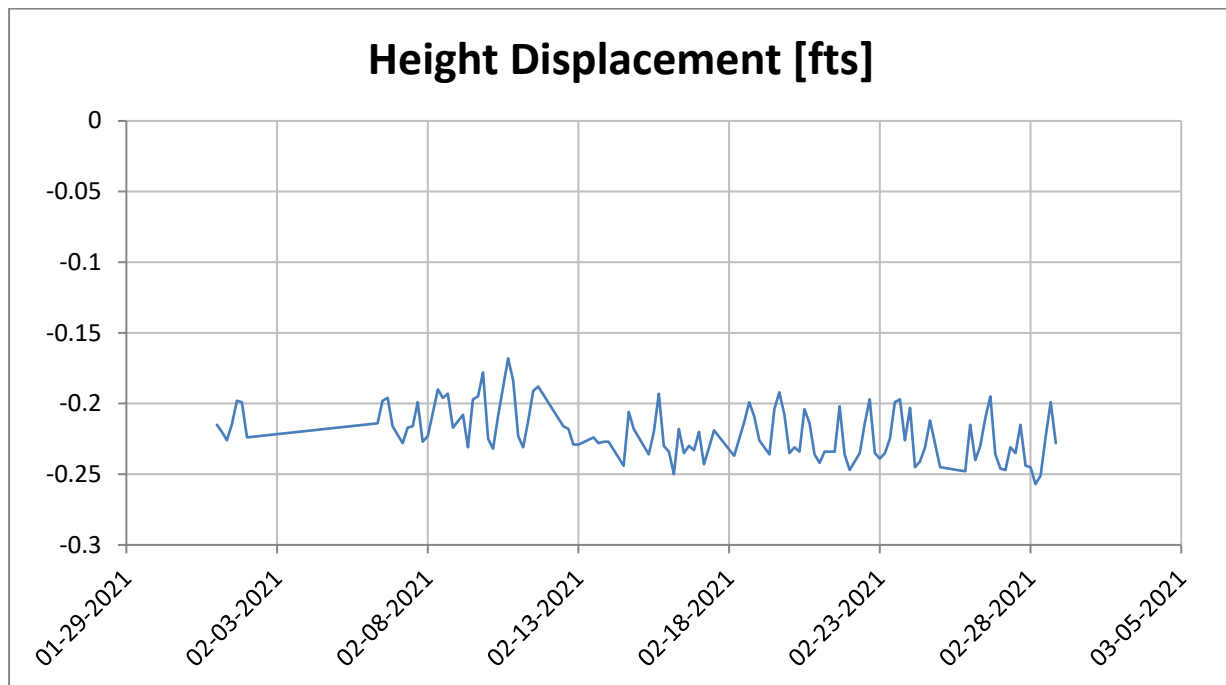
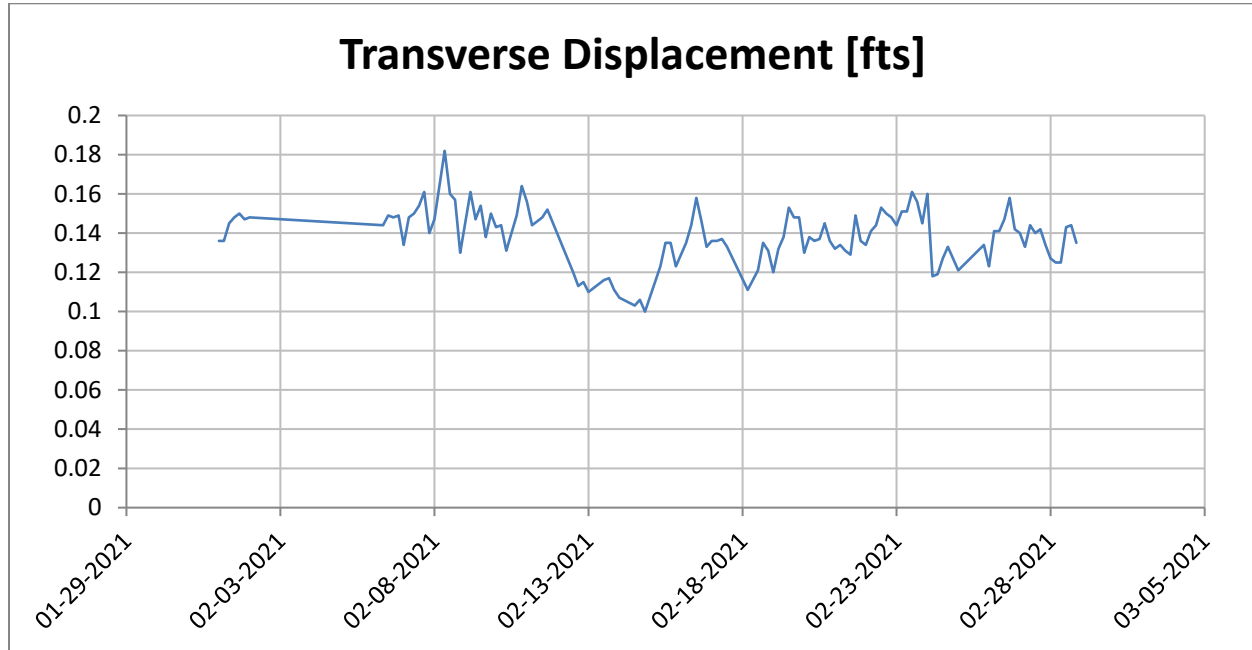


#### Notes:

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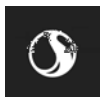


## Prism NP66

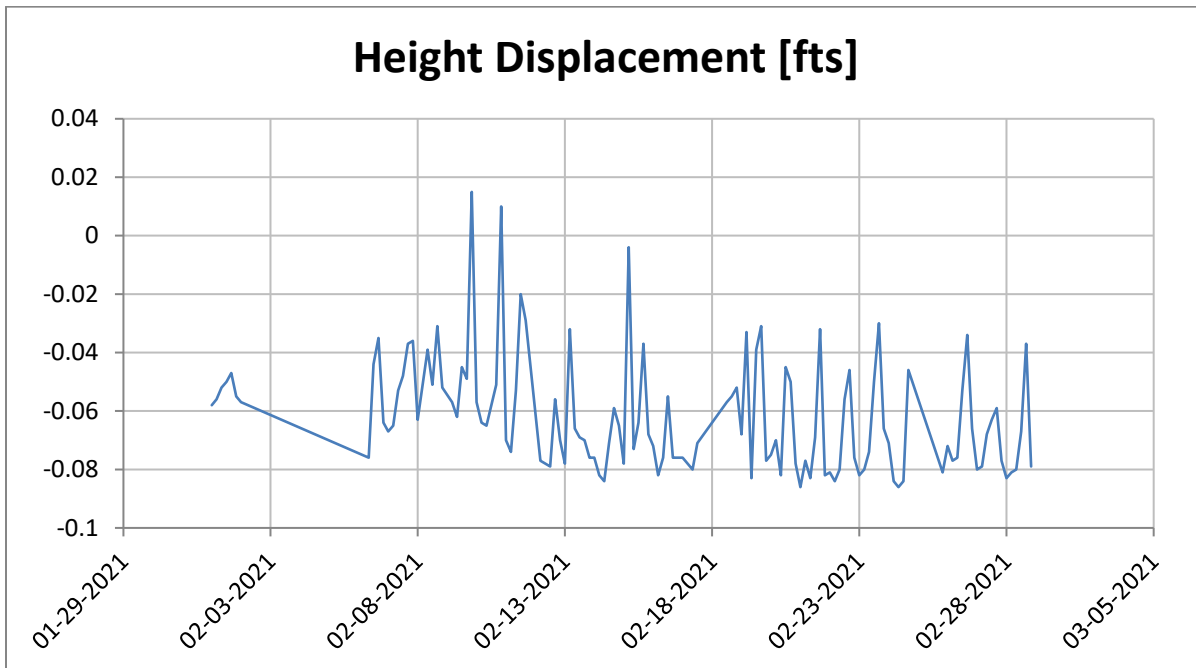
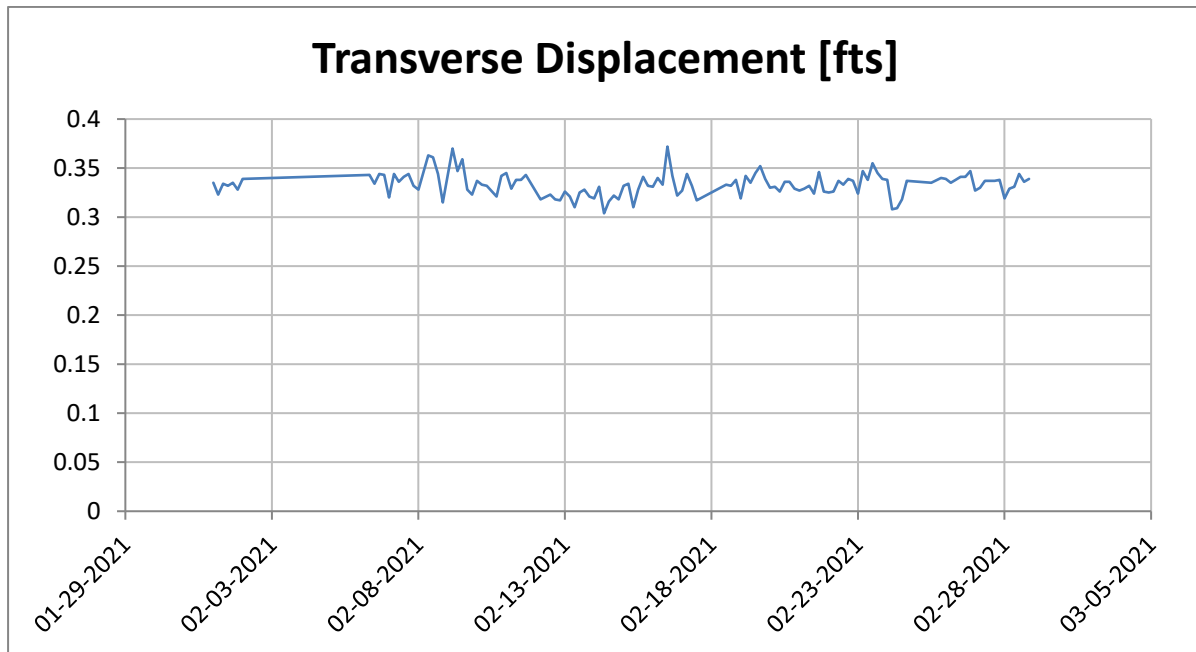


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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.

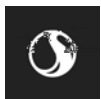


## Prism P1

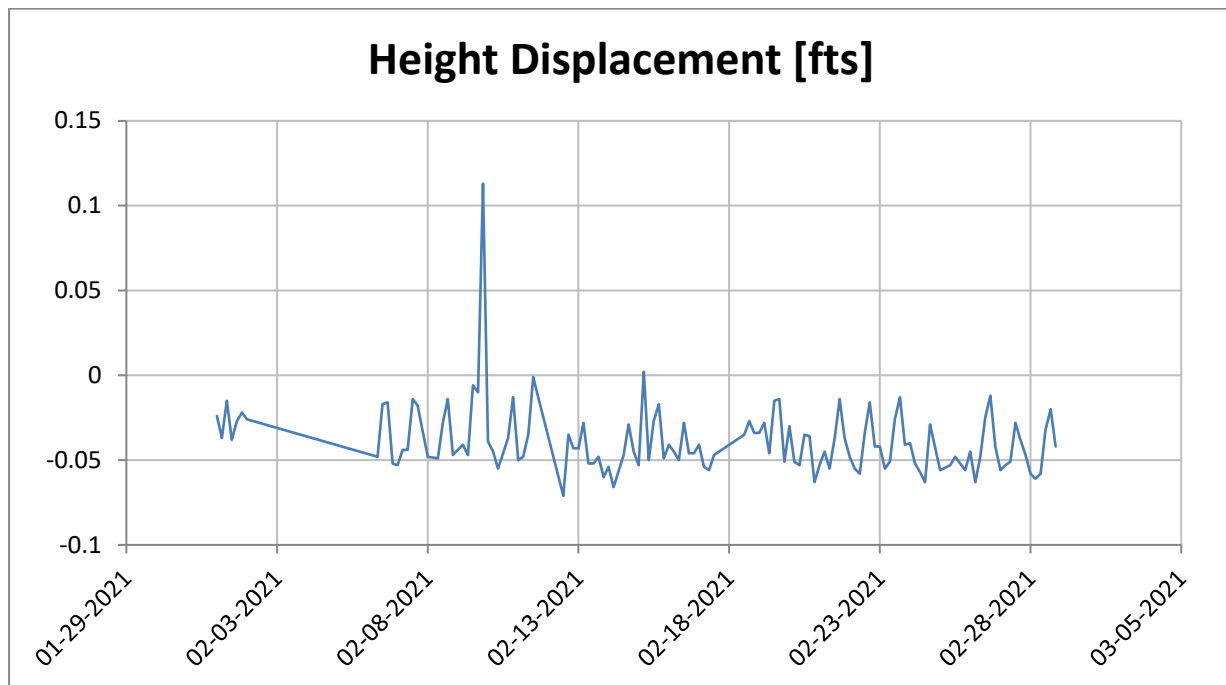
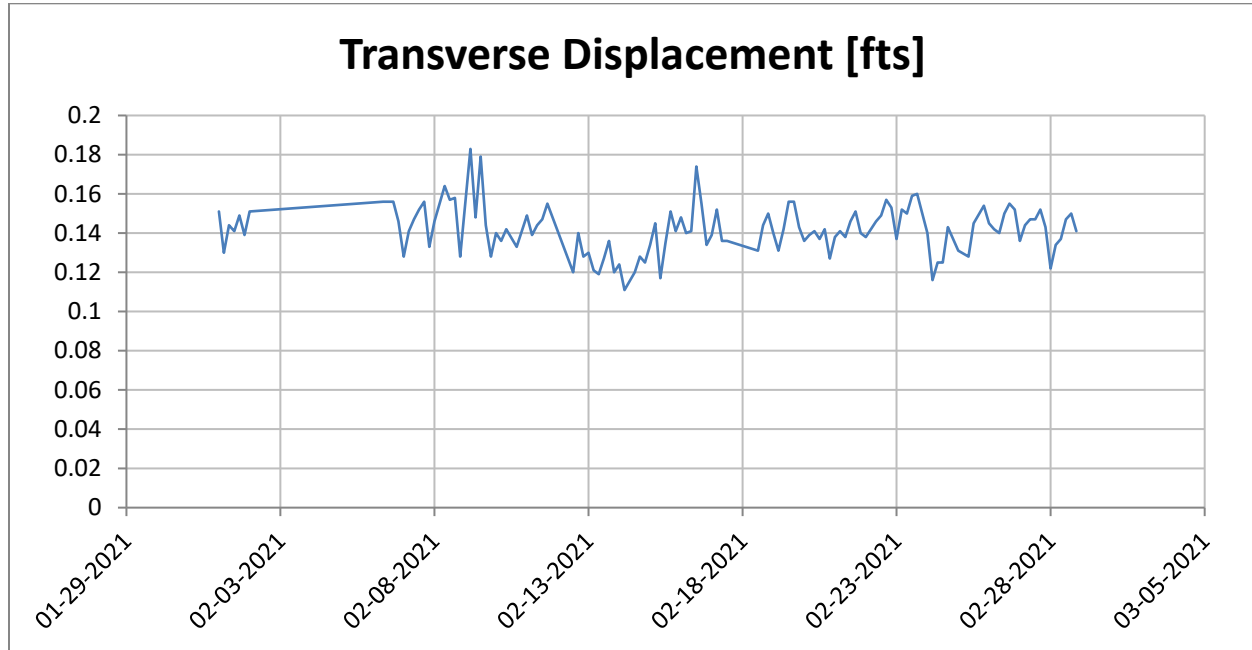


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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 P2



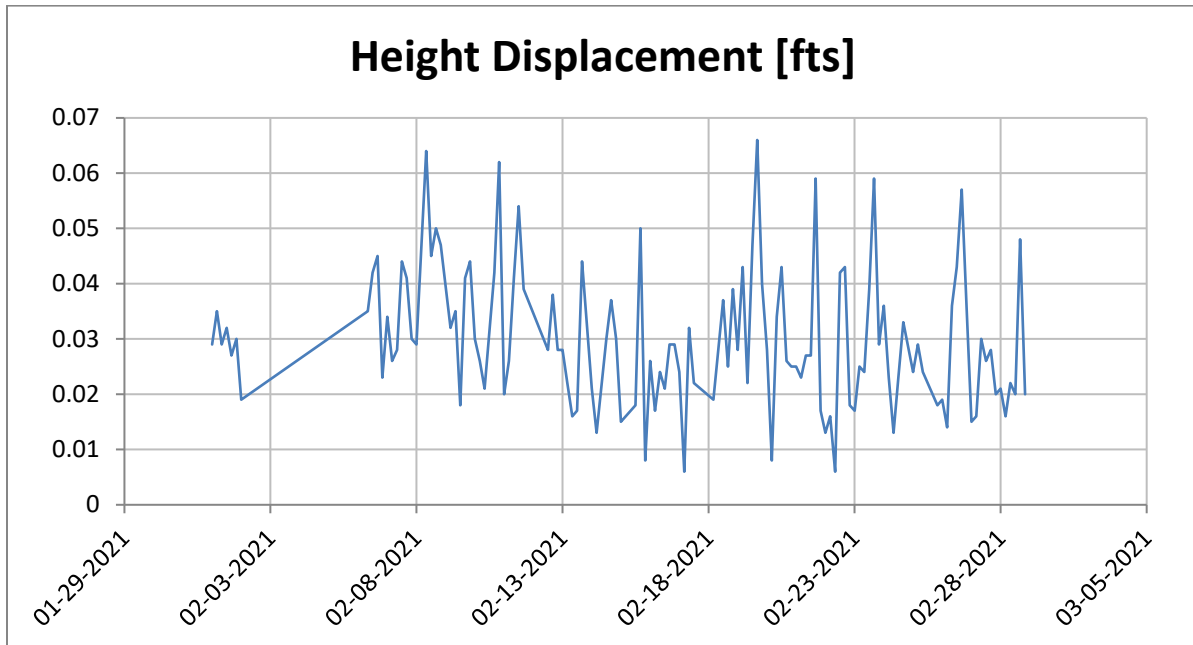
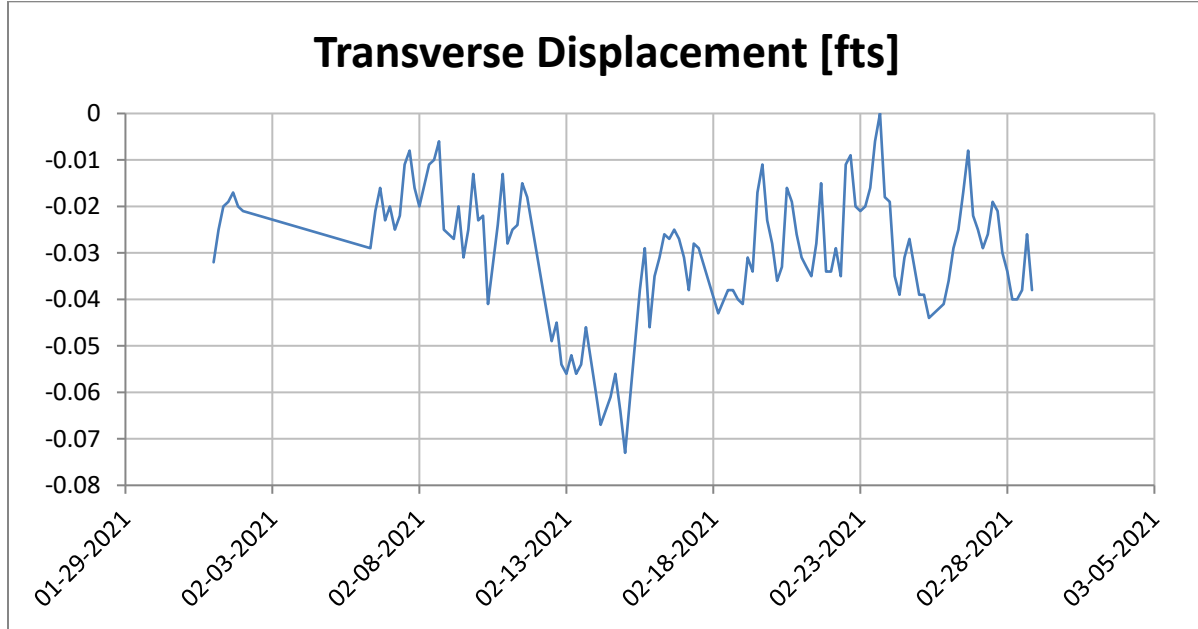
#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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

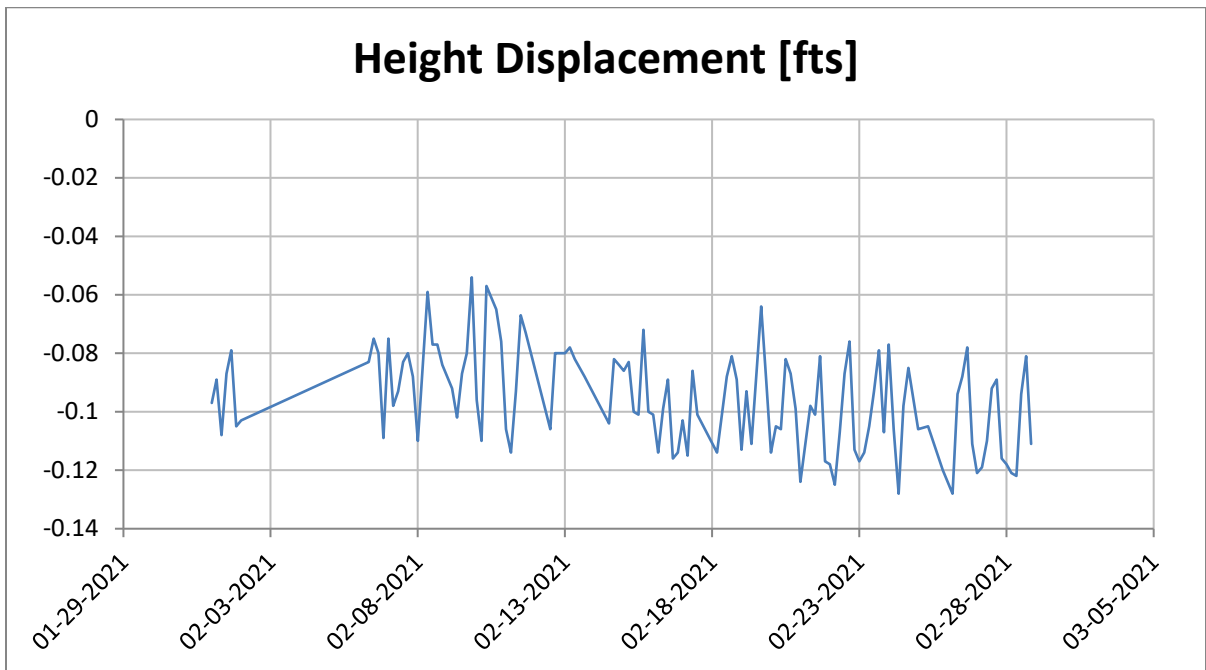
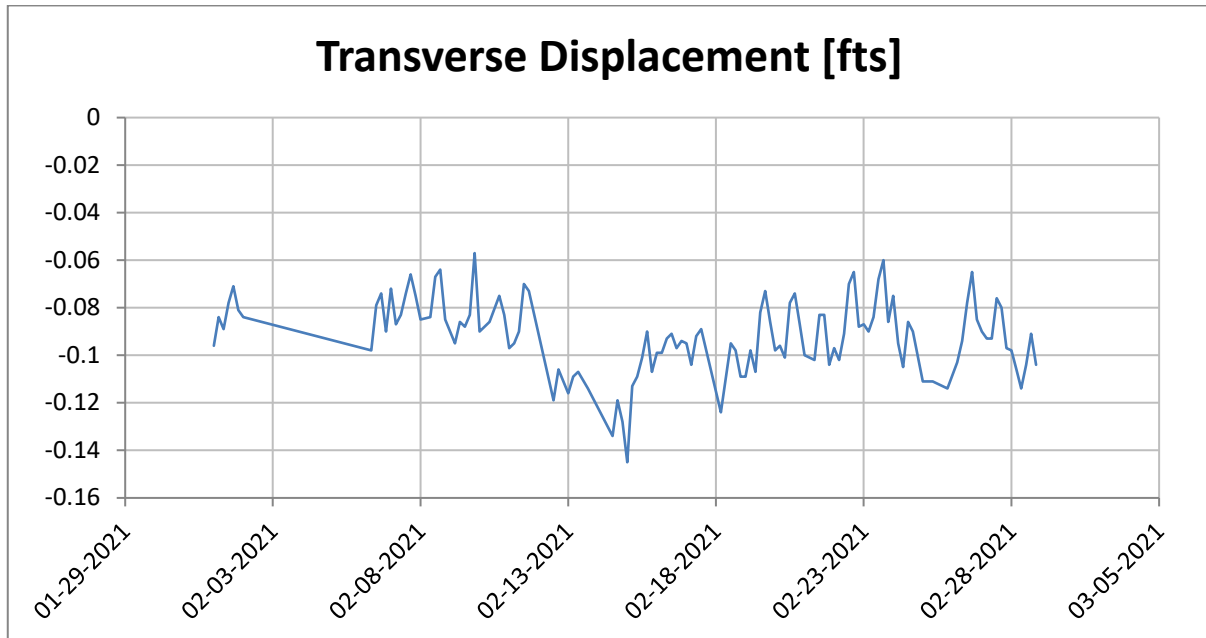


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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.

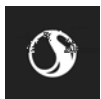


## Prism P32

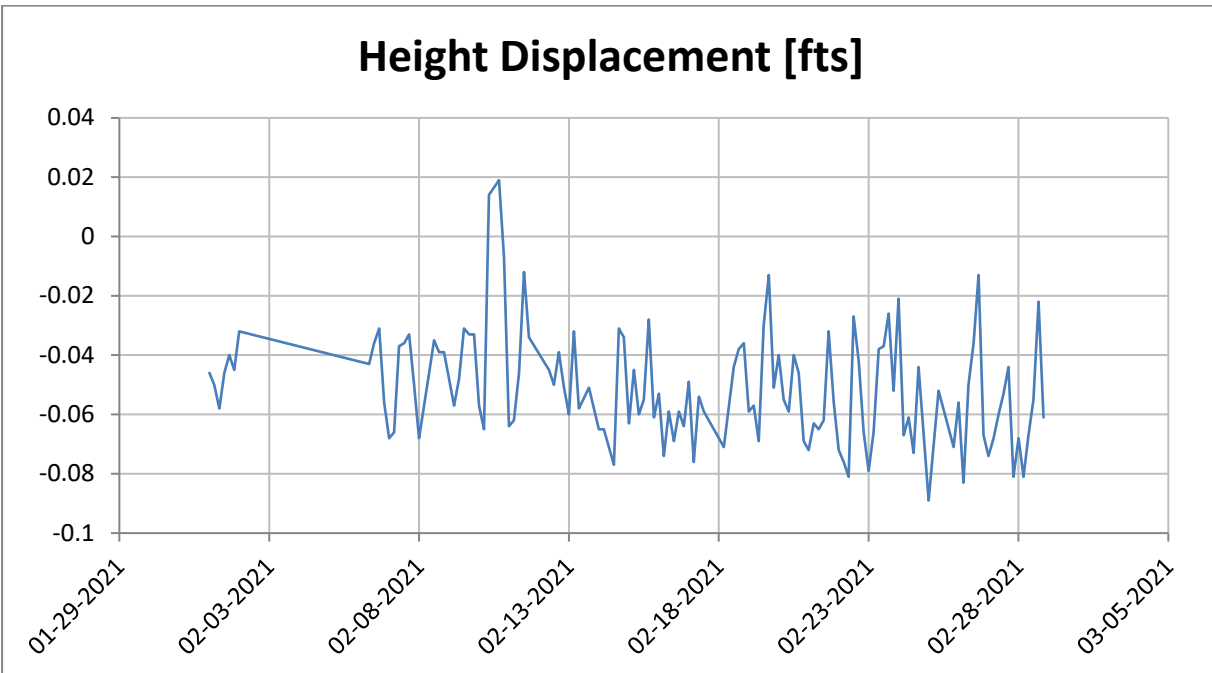
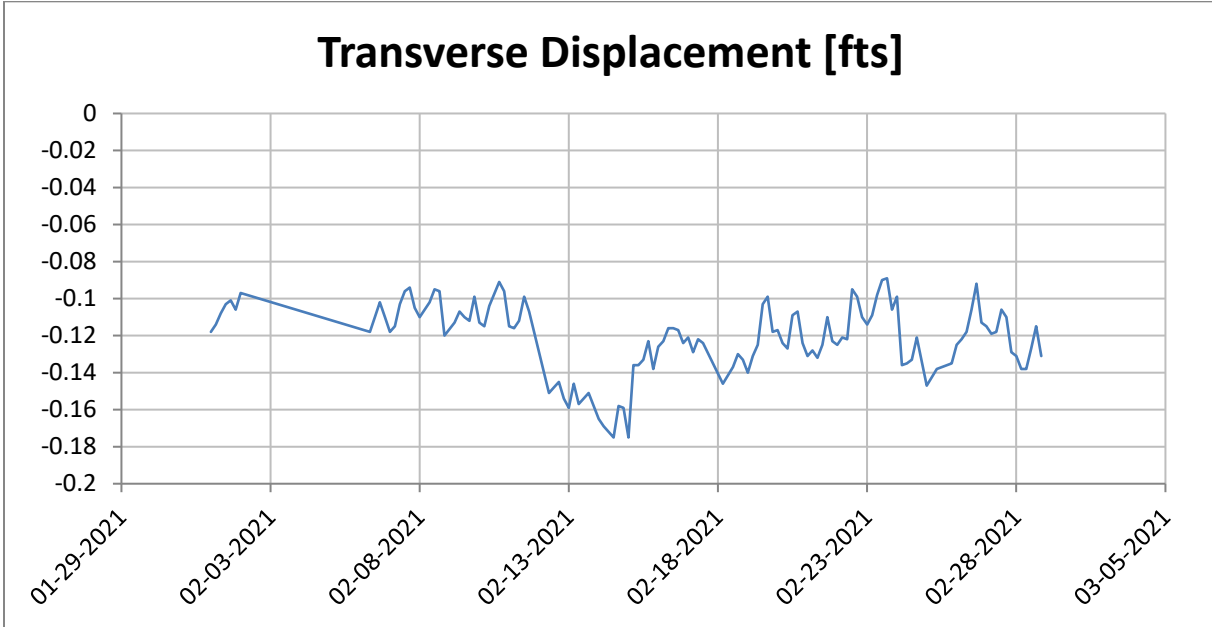


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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

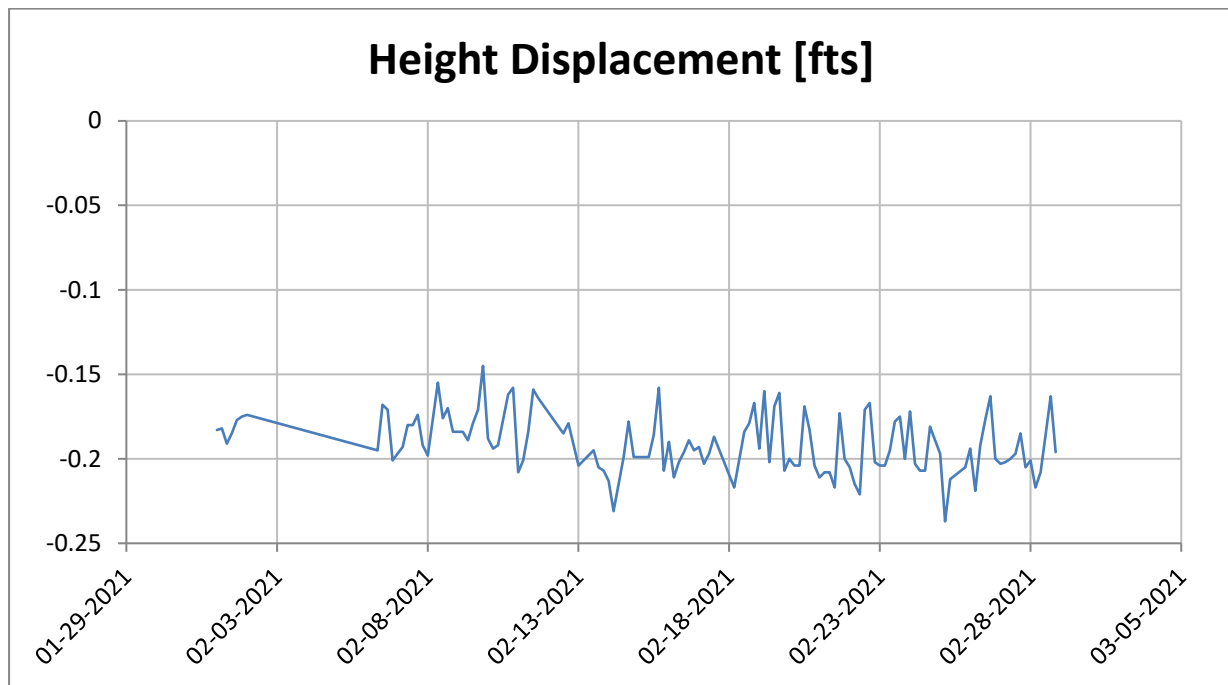
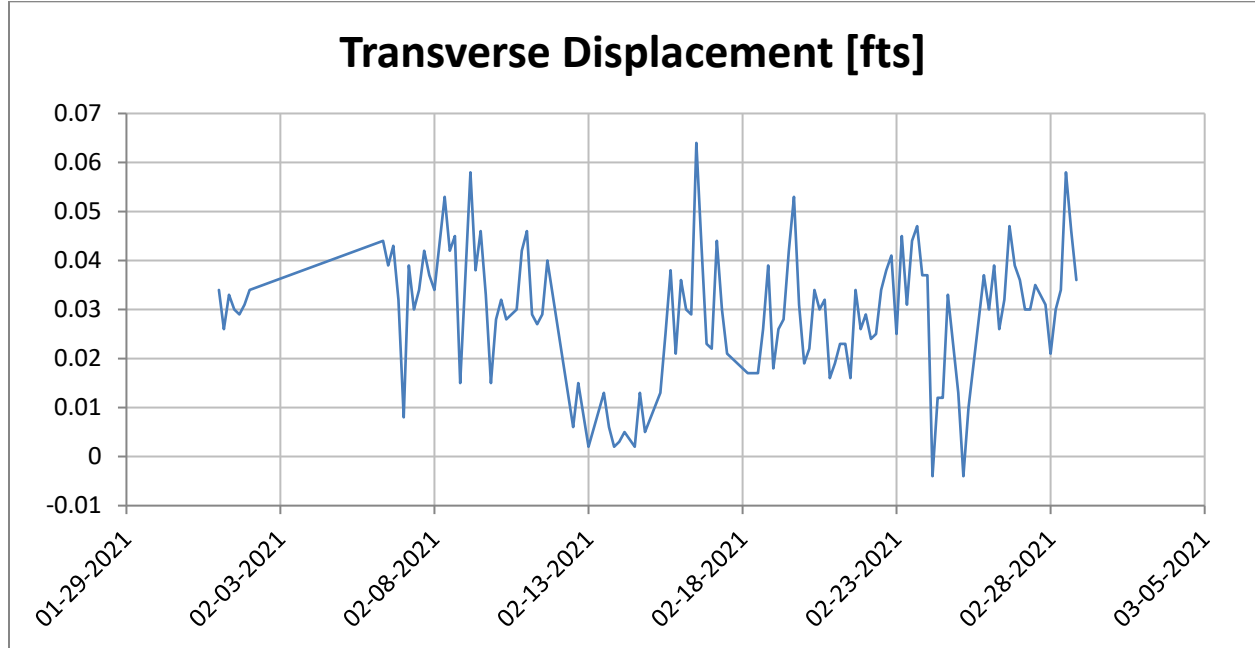


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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

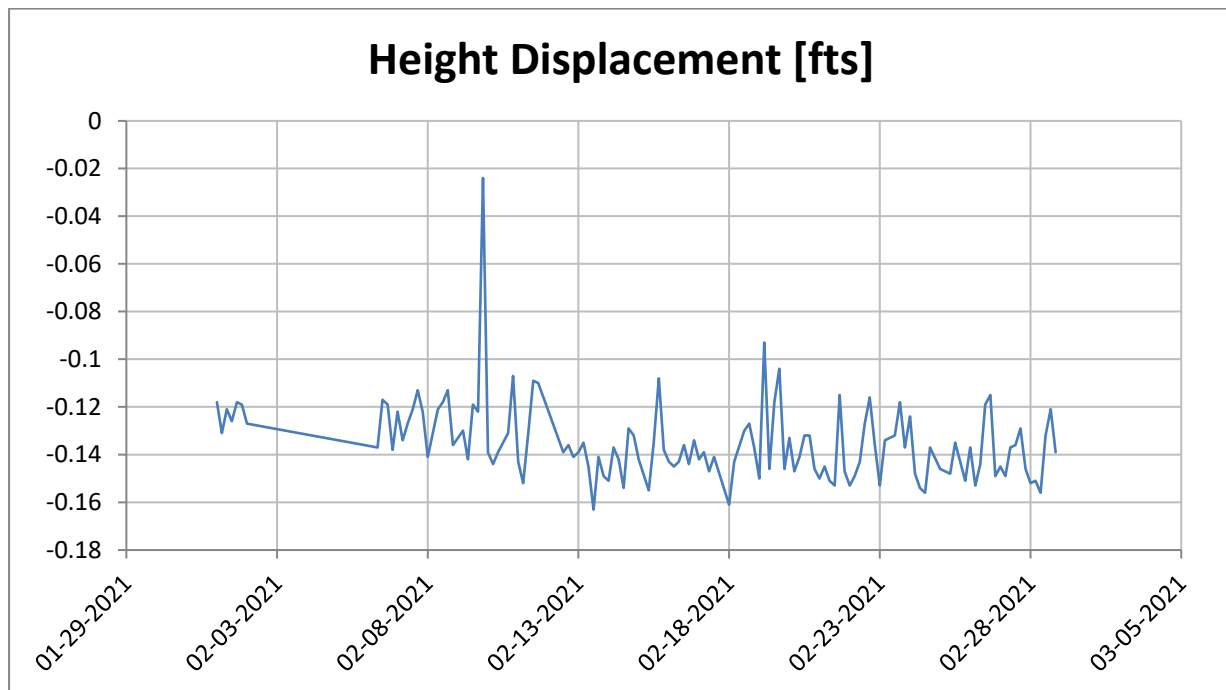
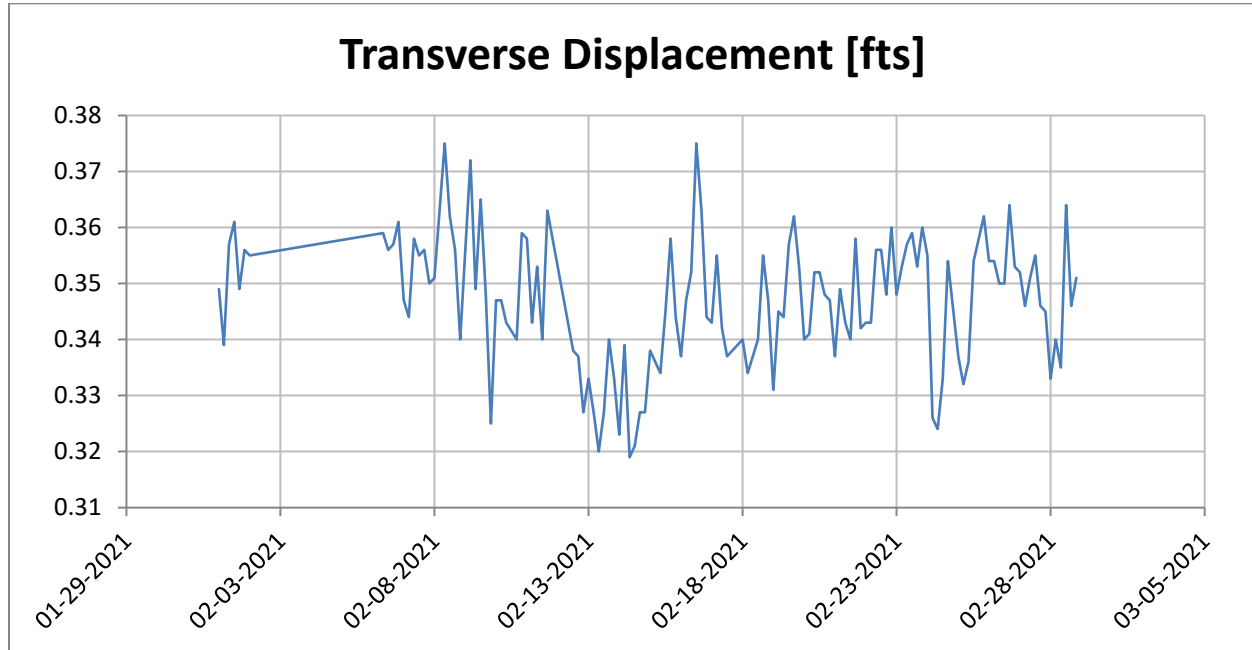


#### Notes:

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.

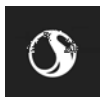


## Prism P4

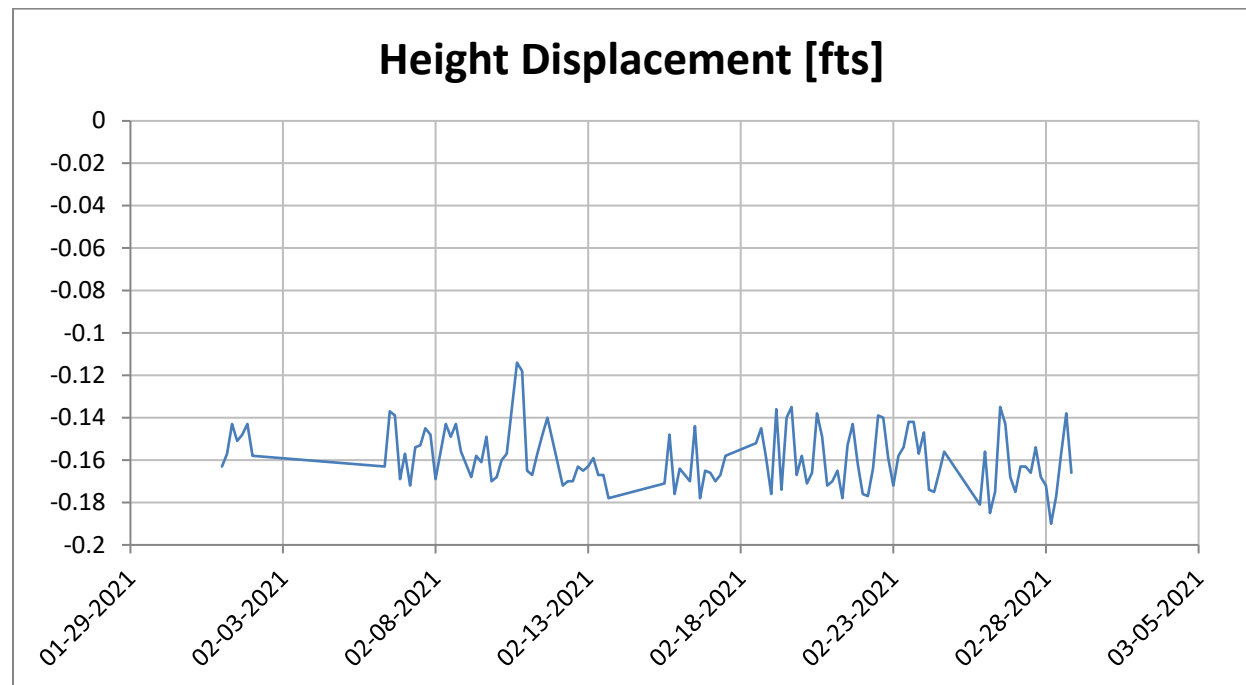
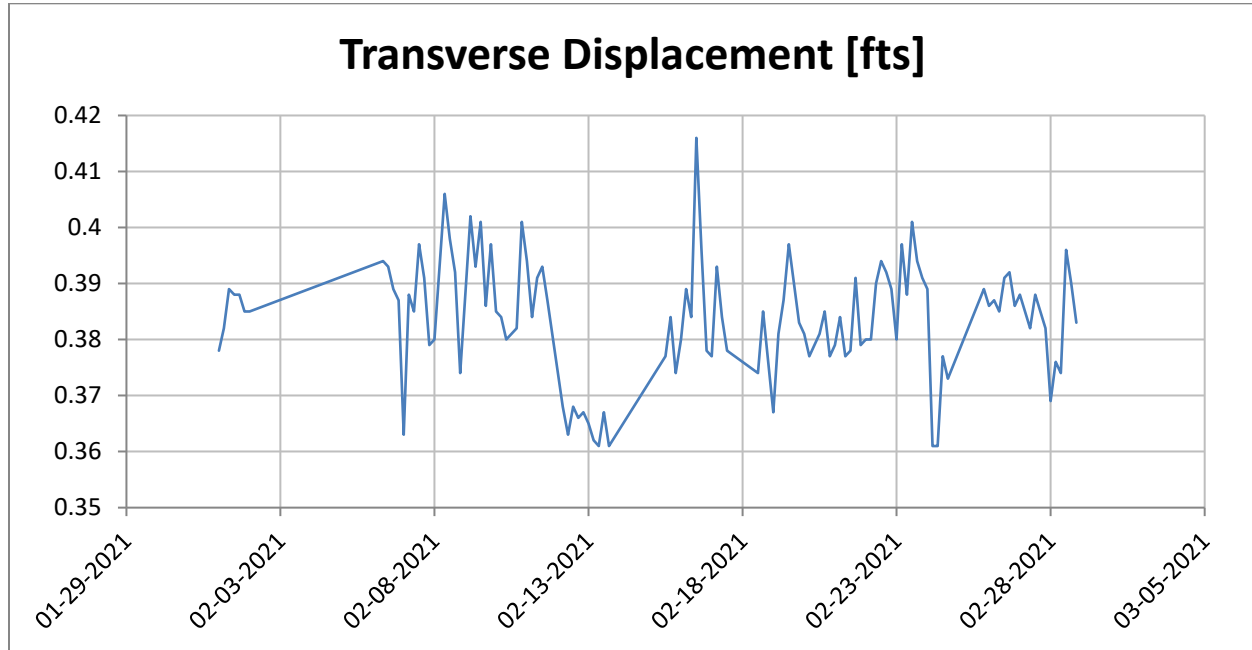


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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

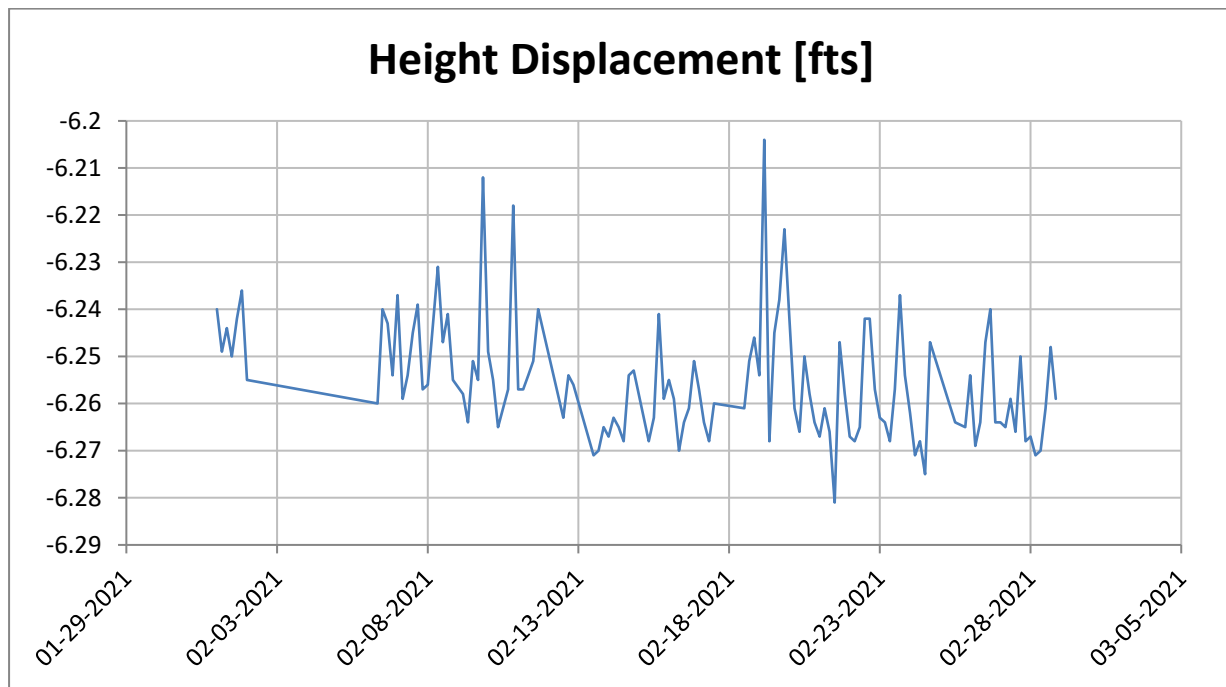
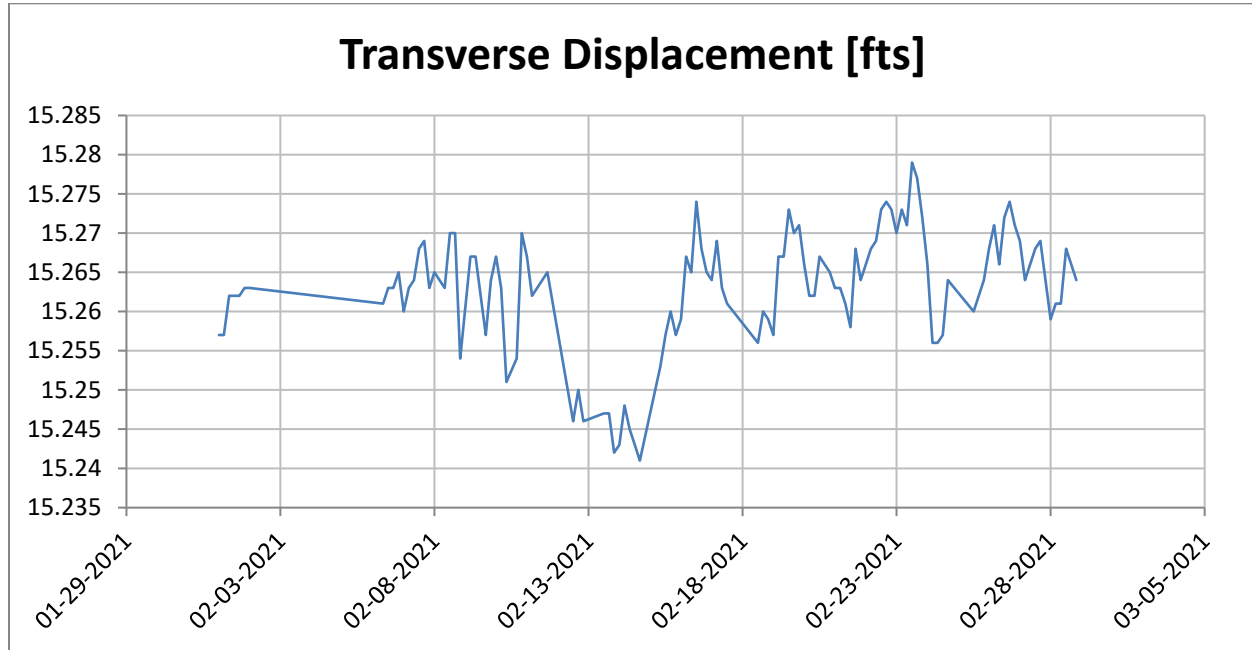


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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.

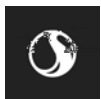


## Prism P63

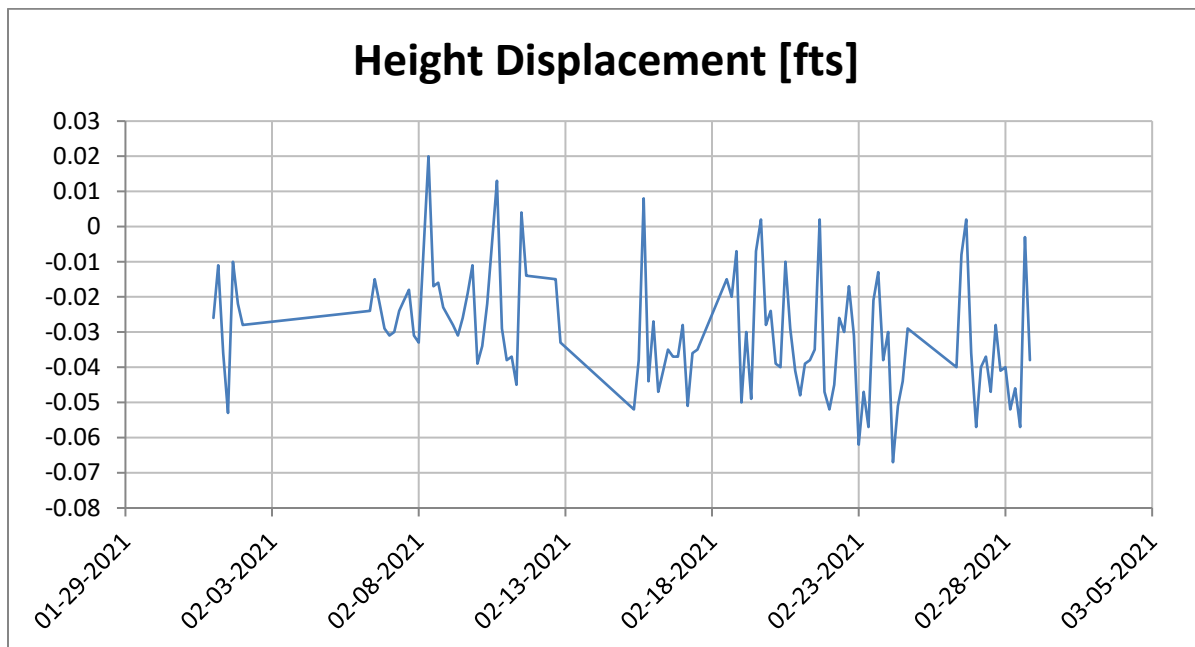
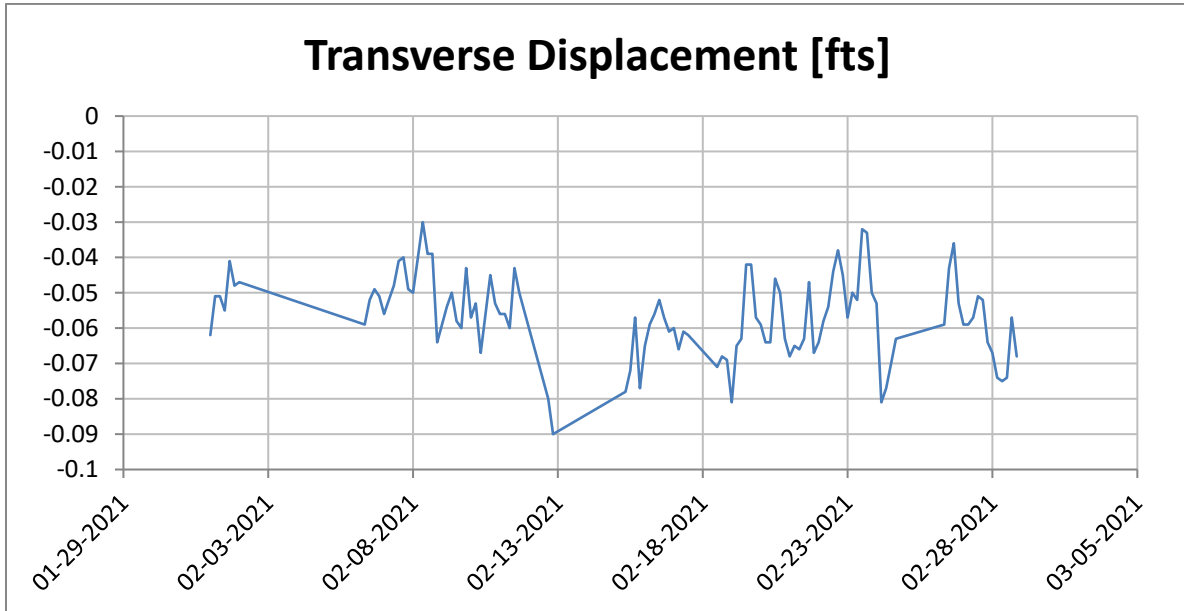


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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



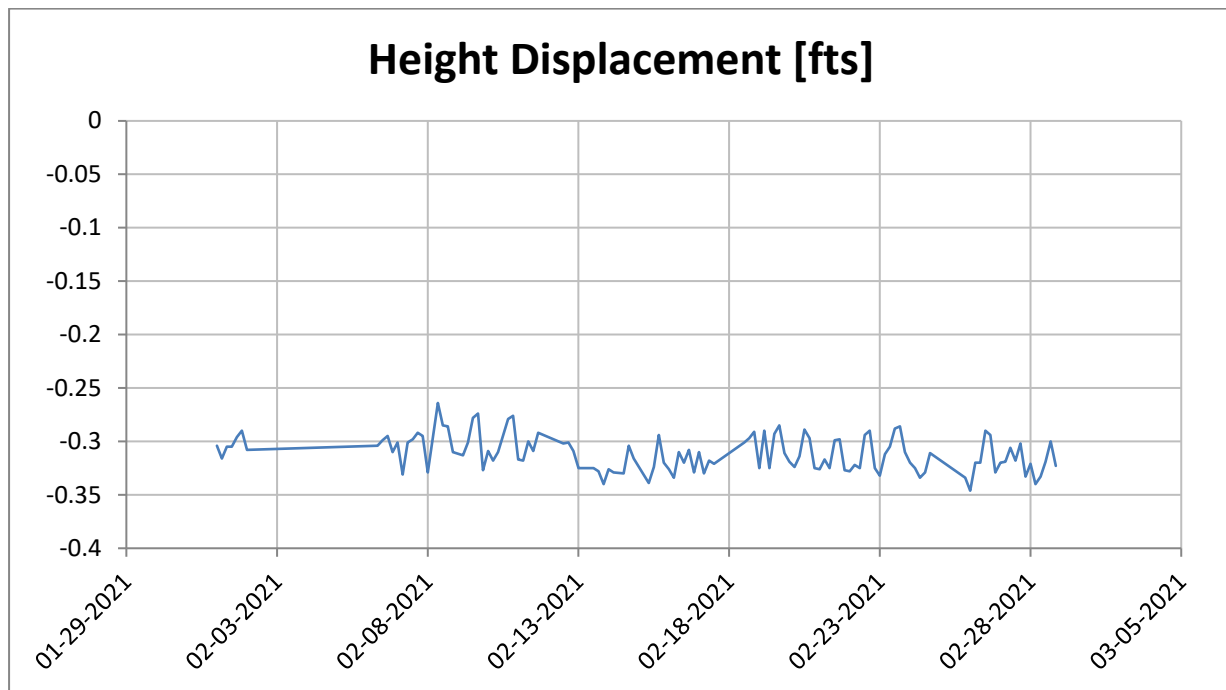
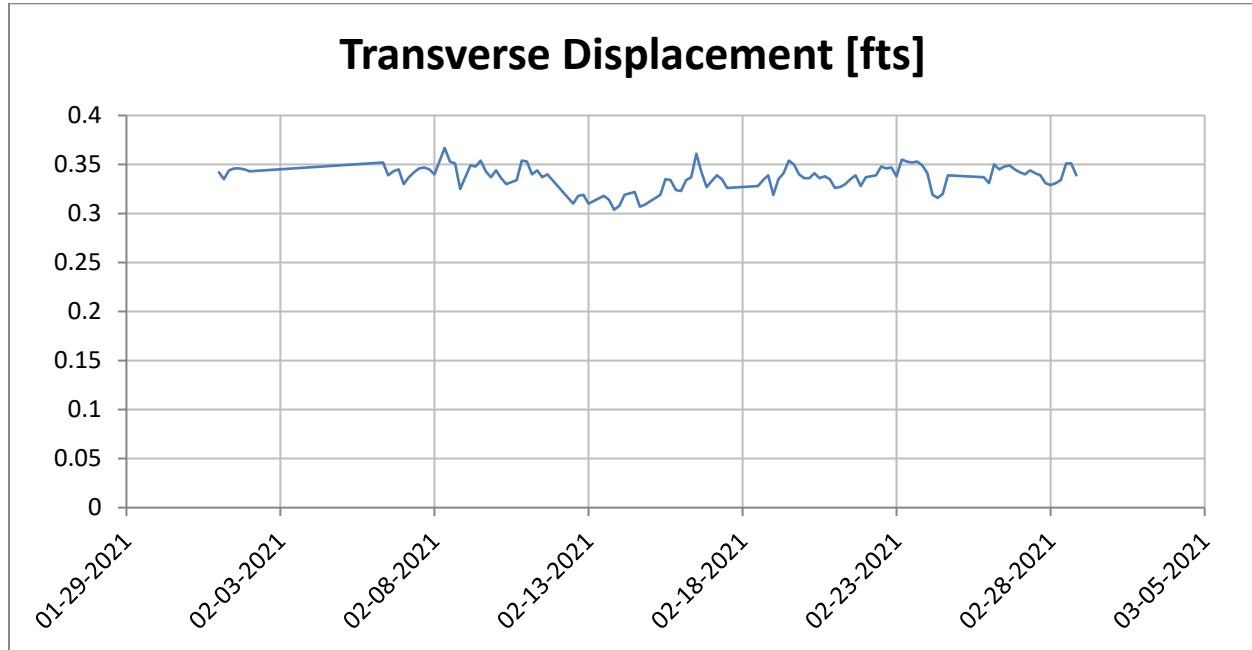
#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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.



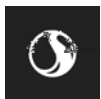


## Prism P70

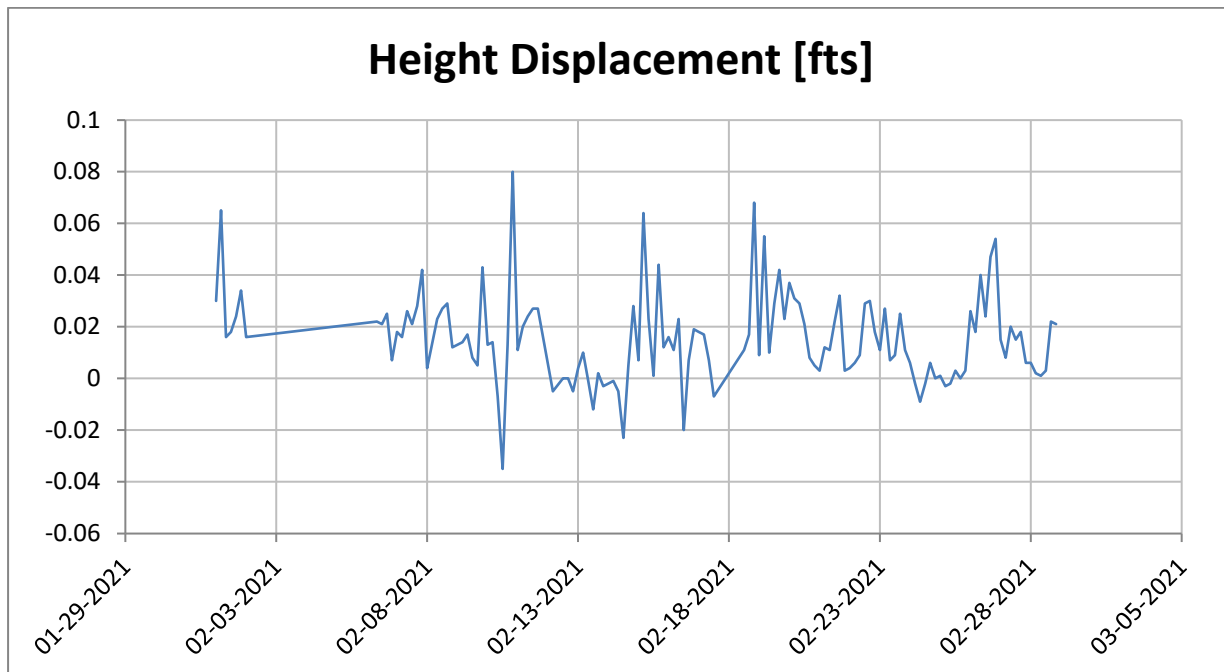
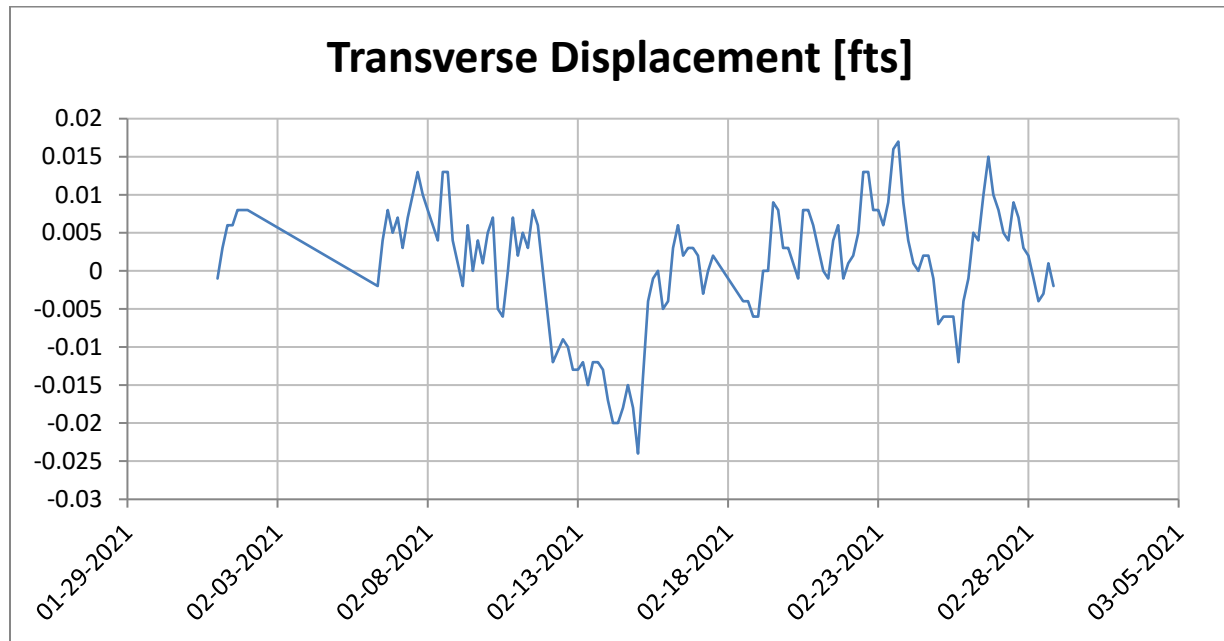


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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.

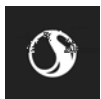


## Prism Toe 1

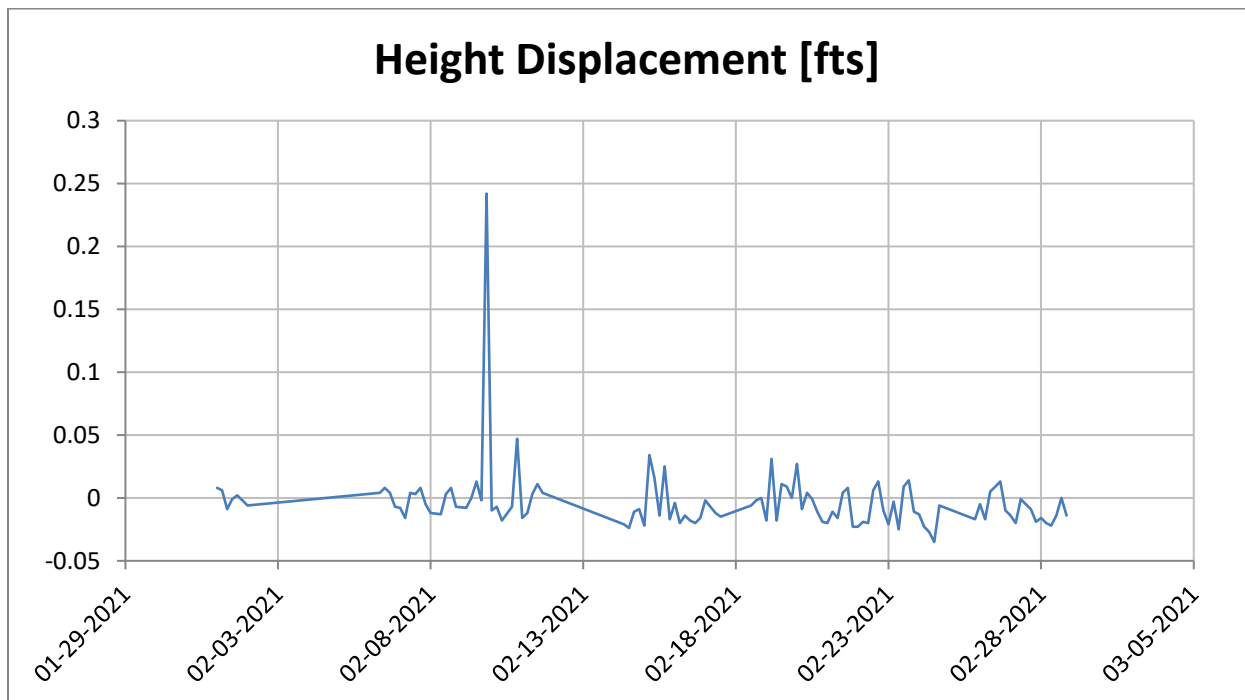
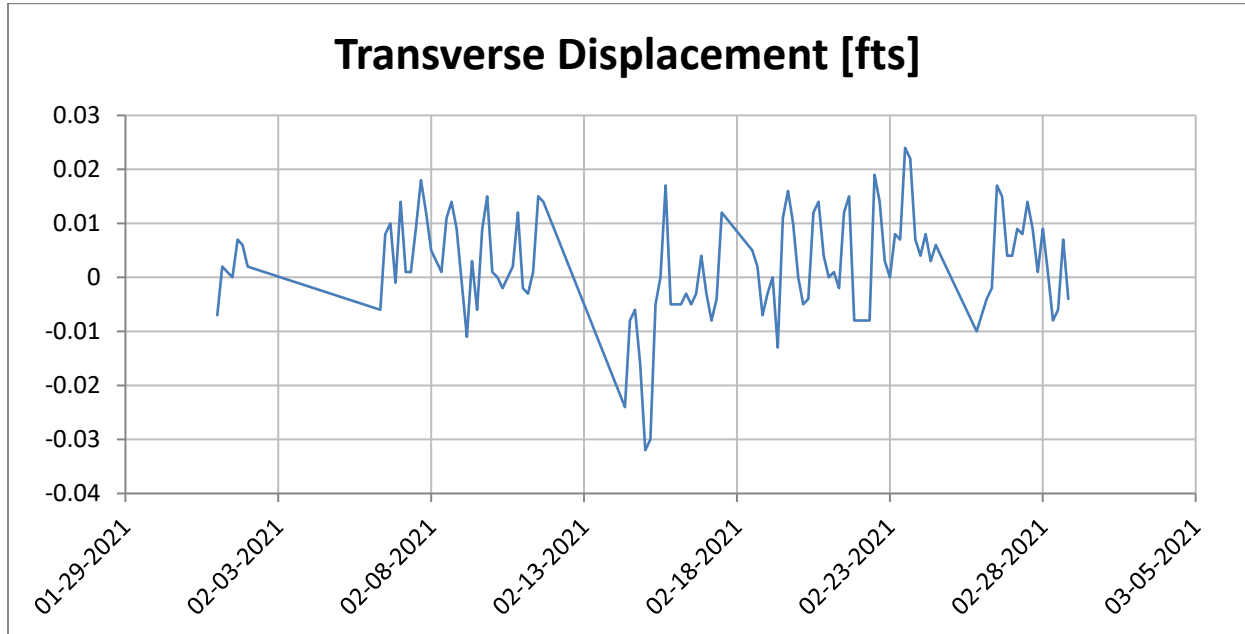


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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 Toe 2

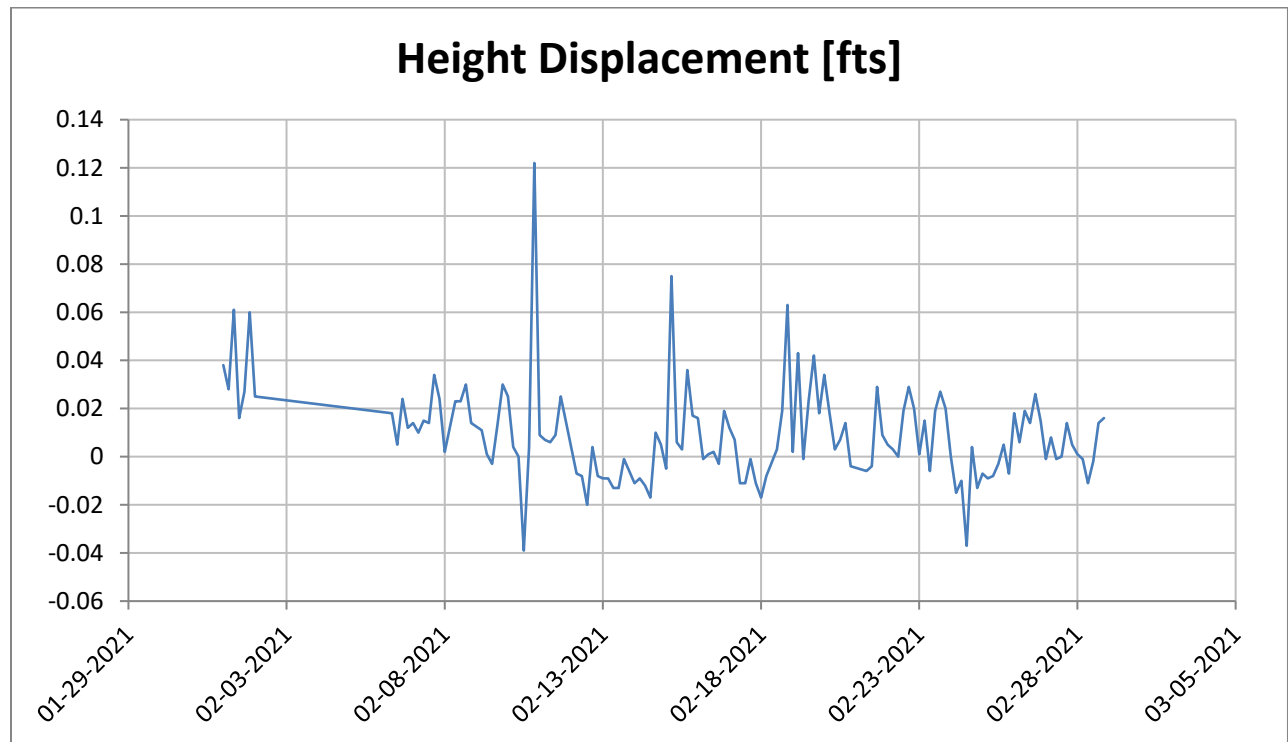
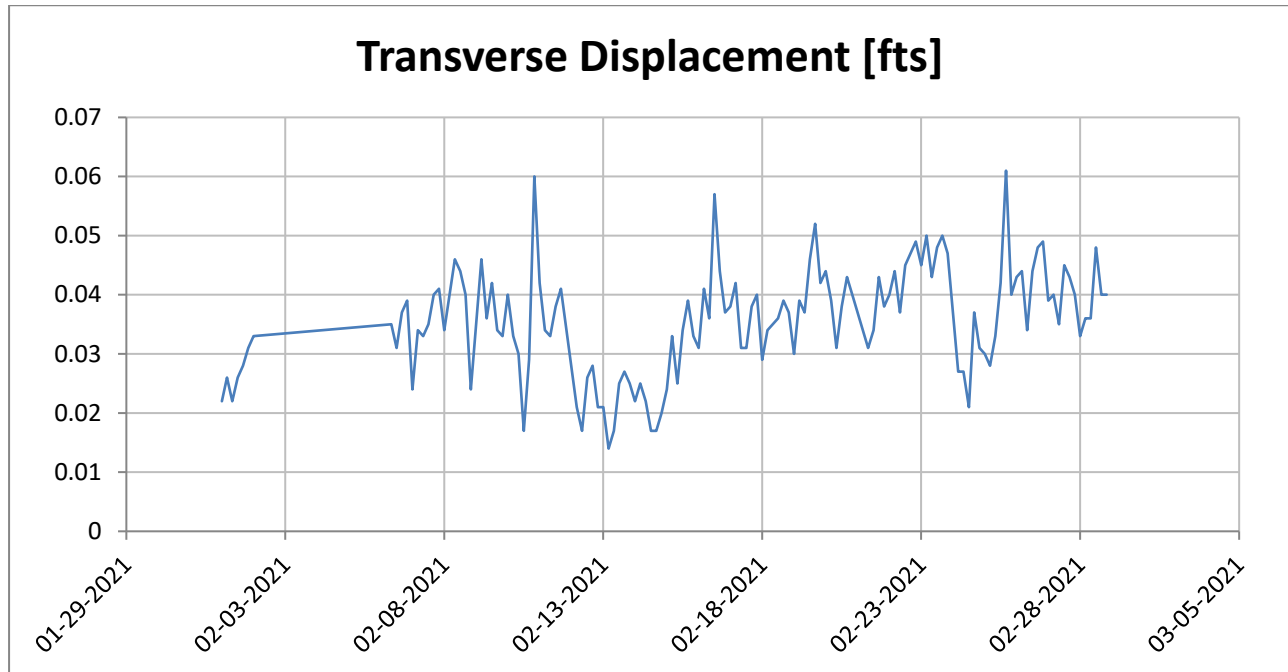


#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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.

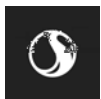


## Prism Toe 3



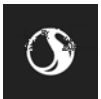
#### Notes:

1. Survey accuracy is  $\pm 0.016$  feet.
2. Alarm threshold is  $\pm 0.35$  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.



# Appendix C

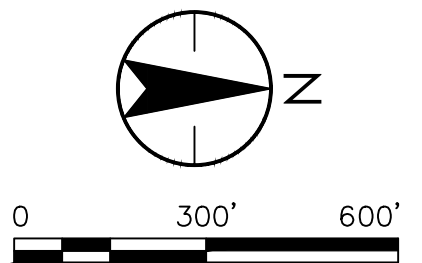
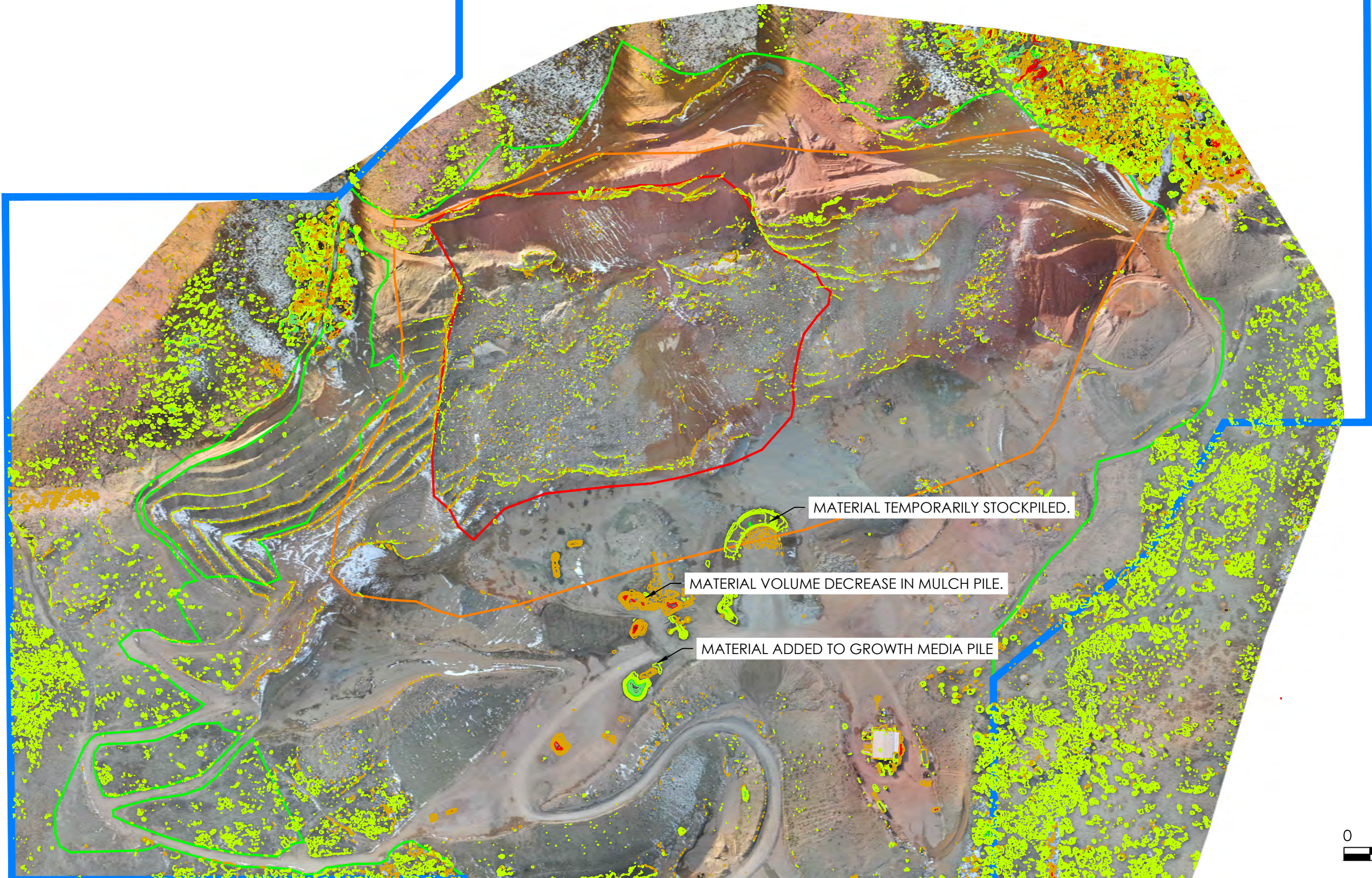
## Drone Survey





\\us0321-ppfss01\workgroup\2274\active\227419041\disc\monitoring\2021-02\dwg\pikeview prisms\_12mar2021

2021.04.09 10:07:40 AM



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

LEGEND

- Blue line: Permit/Affected Lands Boundary
- Green line: Proposed Disturbance Limit
- Red line: Landslide Extent
- Orange line: Buttress Fill Extent
- Yellow/Green points: Comparison Contour. Increase in elevation. (CI=2')
- Red/Pink points: Comparison Contour. Decrease in elevation. (CI=2')

1. COMPARISON OF DRONE FLIGHTS FROM 1/16/21 and 02/10/2021.

Client/Project  
CONTINENTAL MATERIALS  
CORP.  
PIKEVIEW QUARRY SLOPE  
MONITORING

Project No.  
227419041

Title  
EXISTING PRISMS WITH  
CURRENT SURFACE

Revision #	Date 2021.03.31
Drawn By PK	Figure No. 5