


MEMORANDUM

State of Alaska

Department of Transportation & Public Facilities Design and Engineering Services - Southcoast Region Materials Section

TO: File

DATE: April 1, 2024

FROM: Travis Eckhoff, P.E.  04/01/24
Mitch McDonald
Patrick Dryer
Andrew Dyke
SR Geohazards Group

SUBJECT: SDRER0561– WRG Zimovia
Highway Milepost 11.2 Landslide;
March 2024 Monitoring Summary

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1.0 Introduction

This memo summarizes the Alaska Department of Transportation & Public Facilities' (DOT&PF) monitoring efforts at the Zimovia Highway Milepost 11.2 Landslide in Wrangell, Alaska for the monitoring period March 1, 2024 through March 31, 2024.

No significant slope movements were observed during this monitoring period. The banks of the main stream channel within the landslide path continued to erode during periods of heavy precipitation. Two weather events with 3-hour total precipitation greater than 0.3 inches occurred during the monitoring period.

2.0 Background

A catastrophic landslide occurred on Zimovia Highway near Milepost 11.2 on November 20, 2023. Since the initial emergency response DOT&PF has continued periodic monitoring of the landslide to understand the geomorphology of the landslide path and the resulting impacts to Zimovia Highway. Monitoring activities include the evaluation of precipitation data and temporal change detection using digital surface models derived from Unmanned Aerial Systems (UAS). Monitoring efforts are primarily intended to inform decision making related to road reconstruction, maintenance, and operations.

Details on the monitoring equipment and observations from previous monitoring periods are summarized in the following memoranda:

- SDRER00561 – WRG Zimovia Highway Milepost 11.2 Landslide; 11/2023 – 02/2024 Monitoring Summary

3.0 Drone Operations

Table 1 lists orthoimagery mapping missions of the full landslide path successfully completed to date. Based on previous observation, the scheduled orthoimagery mapping mission frequency was reduced to one mapping mission per month or as needed based on precipitation events. Figure 2 shows the initial orthoimagery dataset collected on 11/22/2023. Figure 3 shows the latest orthoimagery dataset collected on 3/15/2024.

Table 1 - Summary of DOT&PF Drone Mapping Missions

Date	Notes
11/22/2023	Collected during initial response. Baseline for change detection analysis.
12/06/2023	Collected during initial response. First dataset with debris removed from highway.
01/11/2024	First dataset collected with remote drone dock. Landslide path obscured by snow.
02/01/2024	Snow melted from landslide path. First dataset after End of January Storm Event.
02/07/2024	Landslide path partially obscured by snow.
02/15/2024	Landslide path partially obscured by snow.
02/20/2024	Landslide path partially obscured by snow.
03/15/2024	Headscarp and upper slope obscured by snow.

4.0 Weather Observations

Total precipitation measured at DOT&PF’s on-site weather station (Station ID WEMA2) for the month of March 2024 was 5.3 inches. Precipitation data from WEMA2 for the subject monitoring period is provided graphically in Appendix A. Precipitation data from November 17, 2023 through March 31, 2024 is also provided in Appendix A for reference.

Each figure in Appendix A provides 3-hour, 6-hour, and 24-hour total precipitation amounts. These total precipitation amounts are monitored because debris flow type landslide initiation is typically a function of soil saturation due to cumulative rainfall and the rainfall intensity immediately before landslide initiation. Table 2 below summarizes precipitation events with a 3-hour total precipitation amount greater than 0.3 inches during the subject monitoring period. Field observations during the initial landslide response and subsequent monitoring indicate that at least 0.3 inches of precipitation over a three-hour period is required to mobilize sufficient material from the landslide path for the material to collect in the highway ditch. The November 17, 2023 through November 20, 2023 precipitation data is provided for reference.

One significant weather event occurred during the March 2024 monitoring period. This weather event started on March 12, 2024 and ended on March 15, 2024. The peak of the storm occurred on March 14, 2024 with a maximum hourly rainfall rate of 0.21 inches per hour recorded at 0600H and 1.66 inches of precipitation recorded over 24 hours. The maximum 3-hour total precipitation during this storm was 0.61 inches. The storm caused erosion within the landslide path but did not impact Zimovia Highway.

Table 2 – Precipitation Events with 3-hour Total Precipitation >0.3 in., 11/27/2023 - 2/28/2024

Date	24-Hour Total Precipitation (in.)	Maximum 3-hour Total Precipitation (in.)	Maximum 6-hour Total Precipitation (in.)
11/17/2023	1.96	0.64	1.01
11/18/2023	0.64	0.36	0.89
11/20/2023 (Landslide)	2.65	0.61	1.15
03/08/2024	0.76	0.31	0.51
03/14/2024	1.66	0.61	1.06

5.0 Change Detection Analysis

No significant slope movements were observed during this monitoring period. Results of the change detection analysis between the 11/22/2023 baseline dataset and most recent 03/15/2024 dataset are provided graphically in Figure 4. This figure shows total changes in the landslide area since the

landslide occurred. Warmer red colors represent elevation loss or material erosion, and cooler blue colors represent elevation gain or material deposition. The largest area of change is located near Zimovia Highway and is due to debris removal from the roadway and property within the slide path. These areas show an elevation decrease of about three to 15 feet from the baseline dataset. The accumulation of material on the downhill side of the road is due to construction of the temporary traffic bypass.

Figure 5 provides the results of a change detection analysis between the 02/15/2024 and 03/15/2024 datasets. This figure highlights the continued erosion of the main stream channel banks within the landslide path. For example, over 5 feet of elevation change due to erosion is shown where the main stream turns west from the logging road, approximately 2,000 feet upstream from Zimovia Highway.

The island of standing trees within the landslide path causes significant noise in the data. This area is outlined in Figure 4. Most other areas showing elevation changes are due to vegetation, woody debris, and the camera's inability to photograph the ground surface through dense vegetation. Areas of movement on the margin of the slide path are mostly due to noise caused by vegetation blocking the camera's view of the ground from various angles. Some areas are showing deposition along the upper margins of the landslide due to post landslide tree fall.

Attachments:

Figure 1 – Site Map

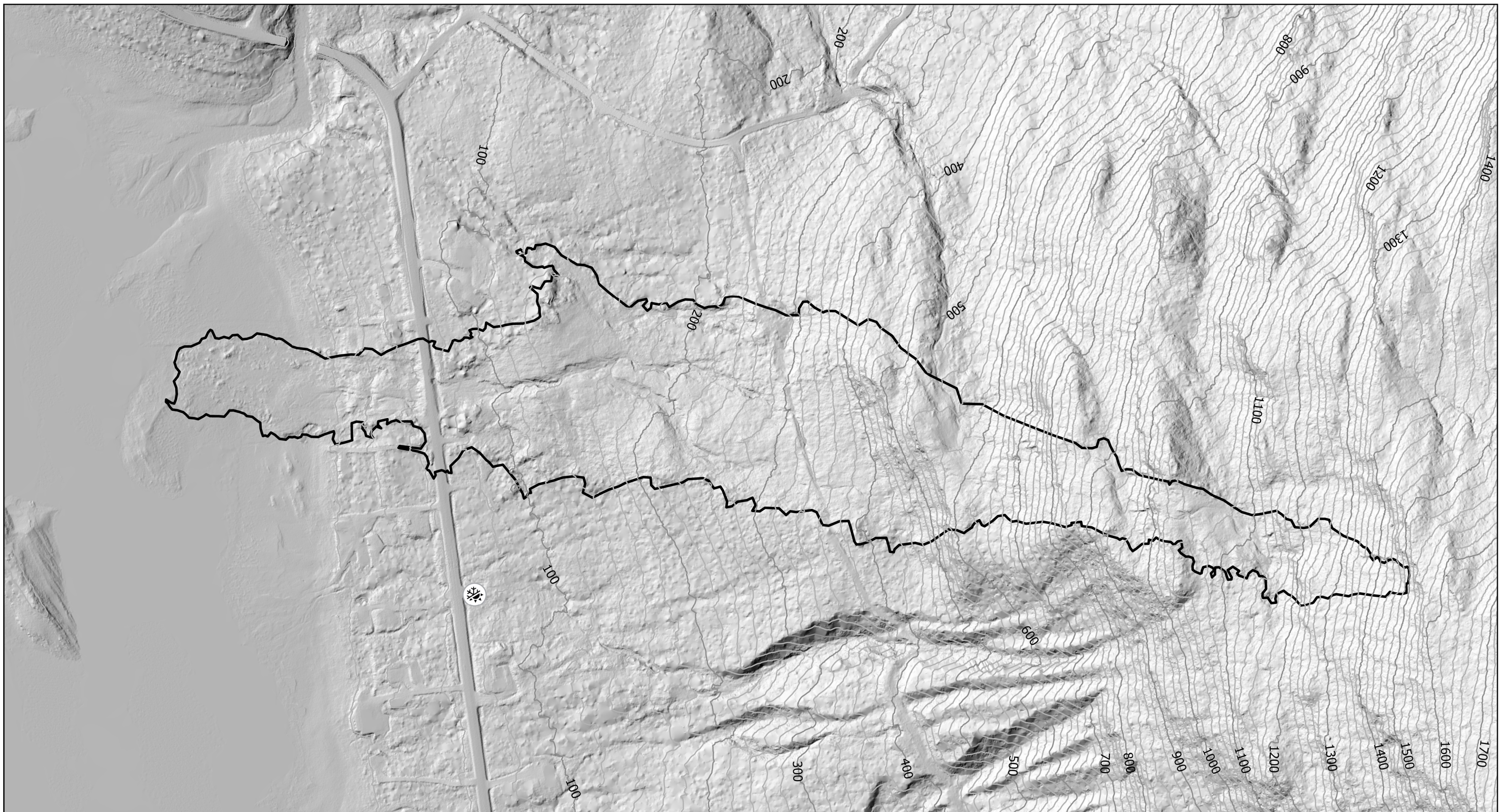
Figure 2 – November 22, 2023 Orthoimagery

Figure 3 – March 15, 2024 Orthoimagery

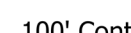



Figure 4 – 03/15/2024 vs. 11/22/2023 Change Detection

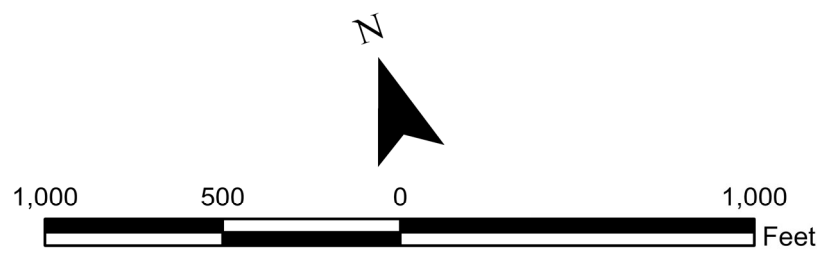
Figure 5 – 03/15/2024 vs. 02/15/2024 Change Detection

Appendix A – Graphical Weather Data




Legend

-  100' Contours Post-Landslide
-  20' Contours Post-Landslide
-  Wrangell Zimovia Hwy 11.2 Mile Landslide Boundary (Interpreted)
-  Drone Dock and Weather Station

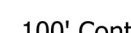





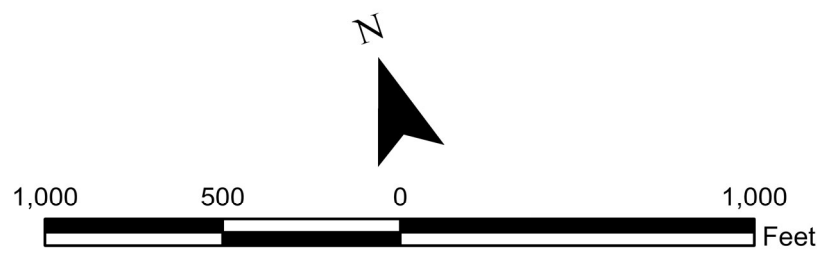
HILLSHADE BASE MAP AND CONTOURS DERIVED FROM ALASKA DGGS RDF 2024-1

SITE MAP	
<i>Wrangell Zimovia Highway MP 11.2 Landslide</i>	
	State of Alaska Department of Transportation and Public Facilities Southcoast Region
FIGURE 1	



Legend

-  100' Contours Post-Landslide
-  20' Contours Post-Landslide
-  Wrangell Zimovia Hwy 11.2 Mile Landslide Boundary (Interpreted)
-  Drone Dock and Weather Station



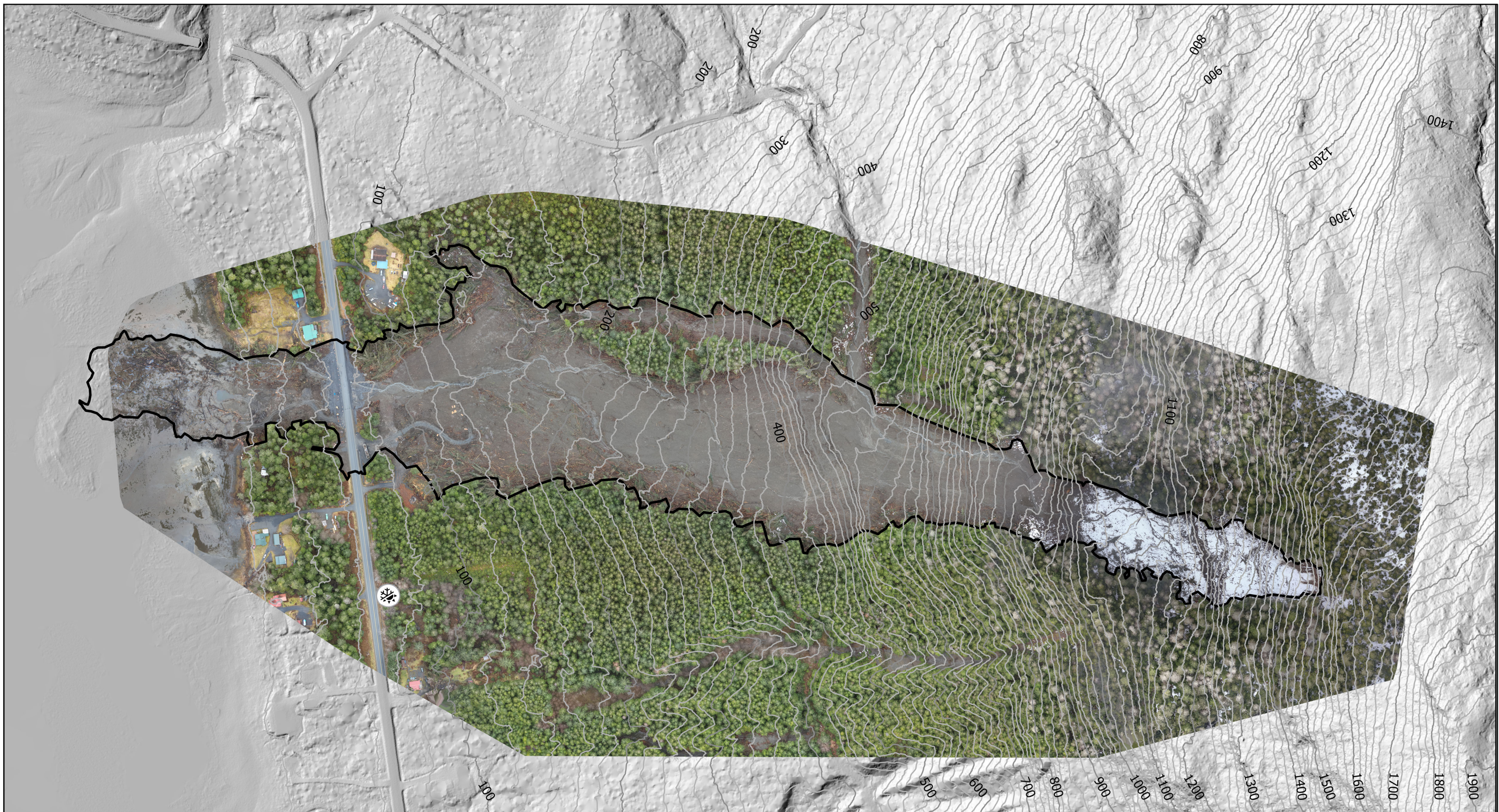
HILLSHADE BASE MAP AND CONTOURS DERIVED FROM ALASKA DGGS RDF 2024-1

NOVEMBER 22, 2023 ORTHOIMAGERY
 Wrangell Zimovia Highway
 MP 11.2 Landslide

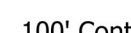





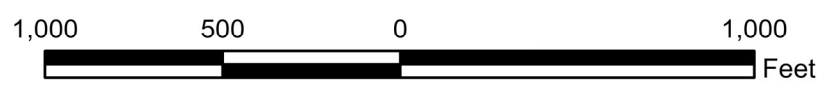
State of Alaska
 Department of Transportation
 and Public Facilities
 Southcoast Region

FIGURE 2



Legend

-  100' Contours Post-Landslide
-  20' Contours Post-Landslide
-  Wrangell Zimovia Hwy 11.2 Mile Landslide Boundary (Interpreted)
-  Drone Dock and Weather Station



HILLSHADE BASE MAP AND CONTOURS DERIVED FROM ALASKA DGGS RDF 2024-1

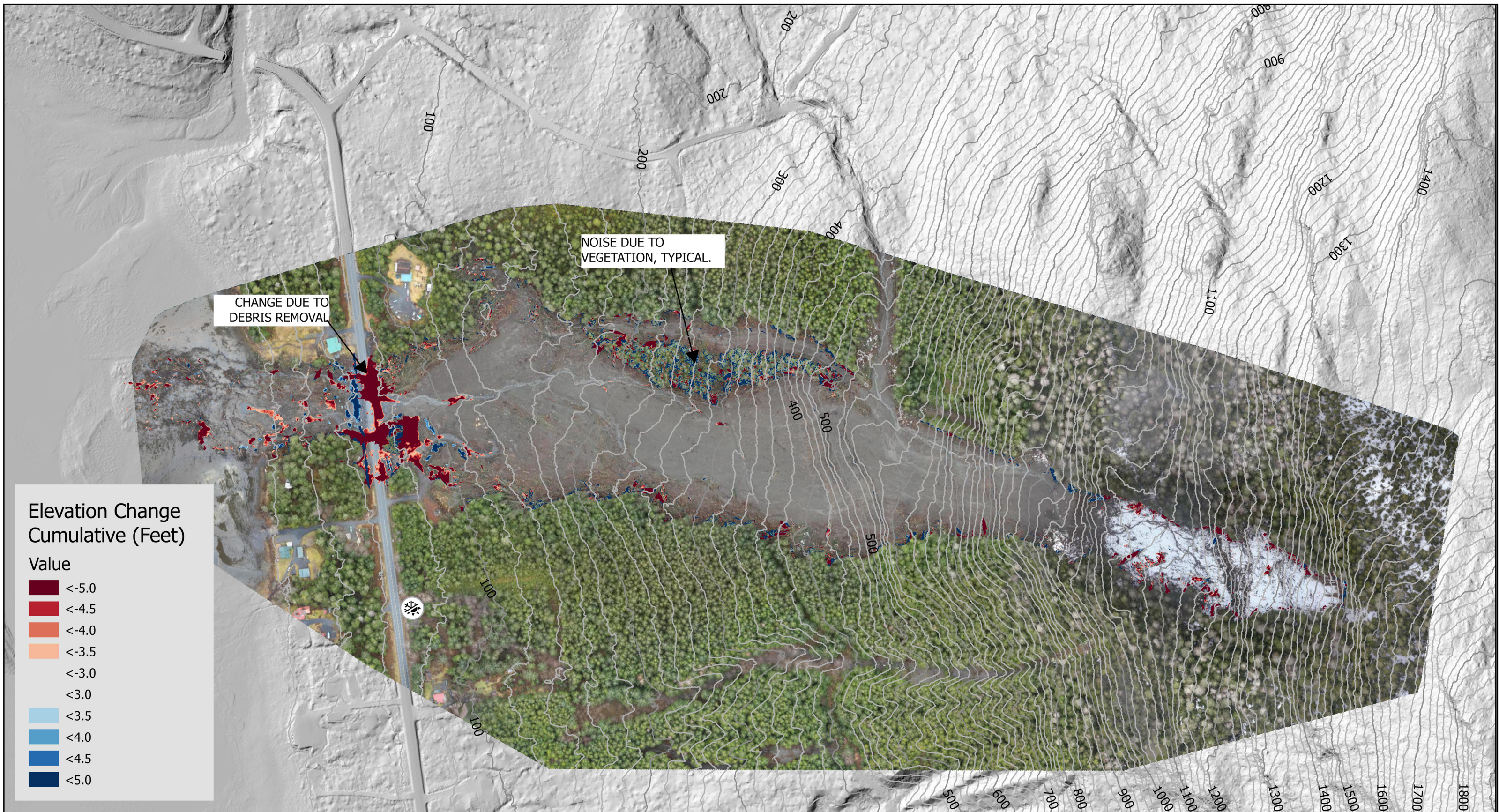
MARCH 15, 2024 ORTHOIMAGERY

*Wrangell Zimovia Highway
MP 11.2 Landslide*



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FIGURE 3



Elevation Change Cumulative (Feet)

Value

- <-5.0
- <-4.5
- <-4.0
- <-3.5
- <-3.0
- <3.0
- <3.5
- <4.0
- <4.5
- <5.0

Legend

- 100' Contours Post-Landslide
- 20' Contours Post-Landslide
- Drone Dock and Weather Station

N
 1,000 500 0 1,000 Feet

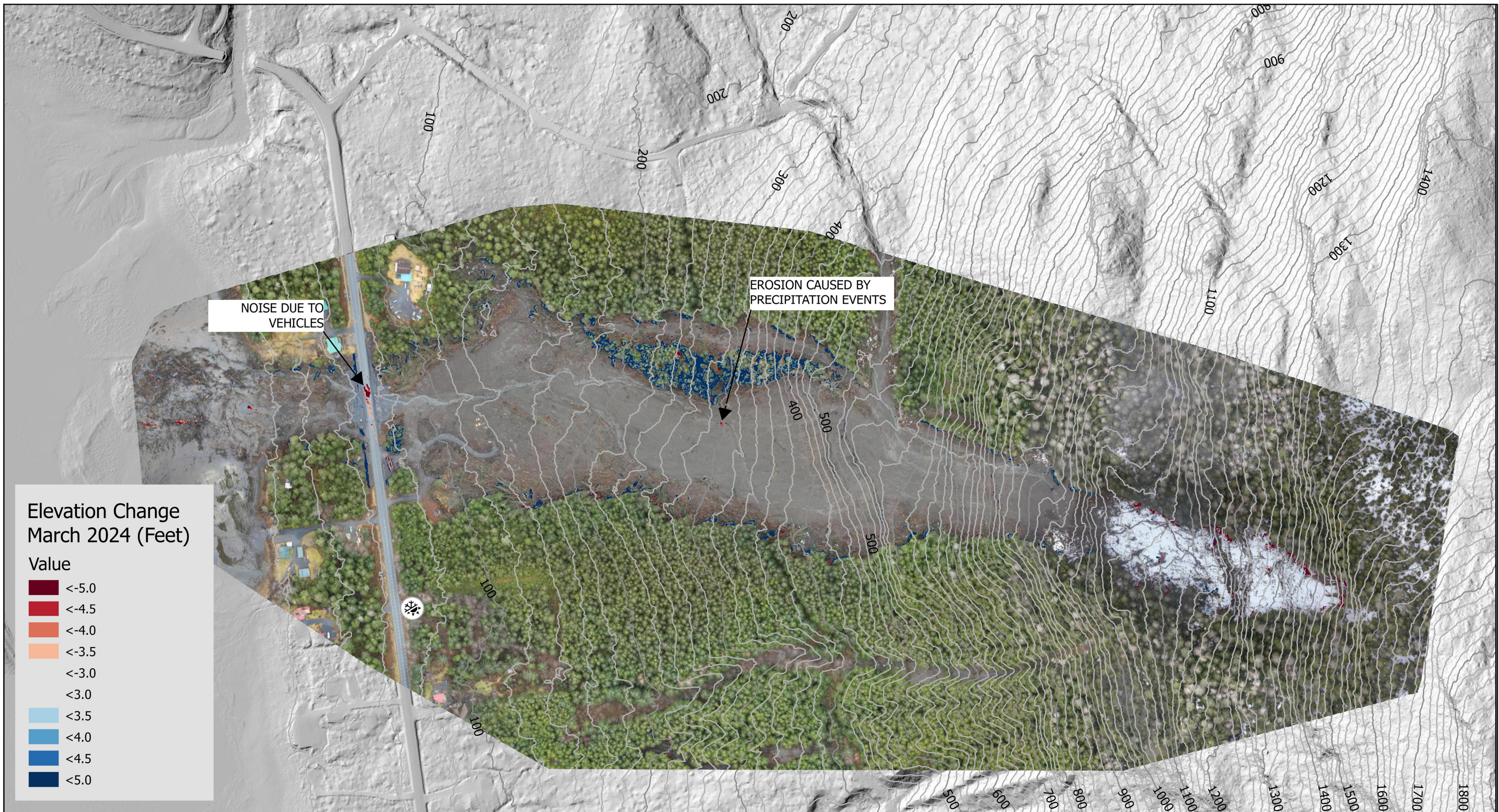
HILLSHADE BASE MAP AND CONTOURS DERIVED FROM ALASKA DGGS RDF 2024-1

03/15/2024 VS. 11/22/2023 CHANGE DETECTION

*Wrangell Zimovia Highway
MP 11.2 Landslide*

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FIGURE 4



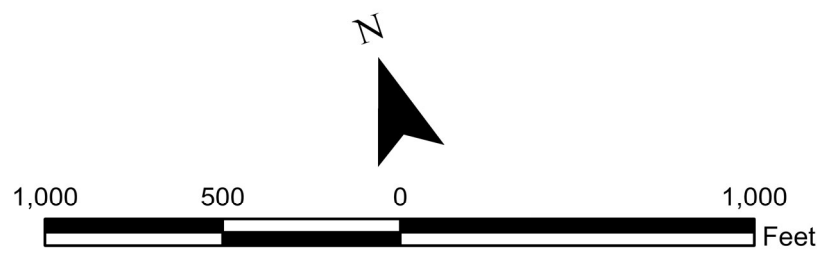
**Elevation Change
March 2024 (Feet)**

Value


<-5.0
<-4.5
<-4.0
<-3.5
<-3.0
<3.0
<3.5
<4.0
<4.5
<5.0

Legend

- 100' Contours Post-Landslide
- 20' Contours Post-Landslide
- Drone Dock and Weather Station

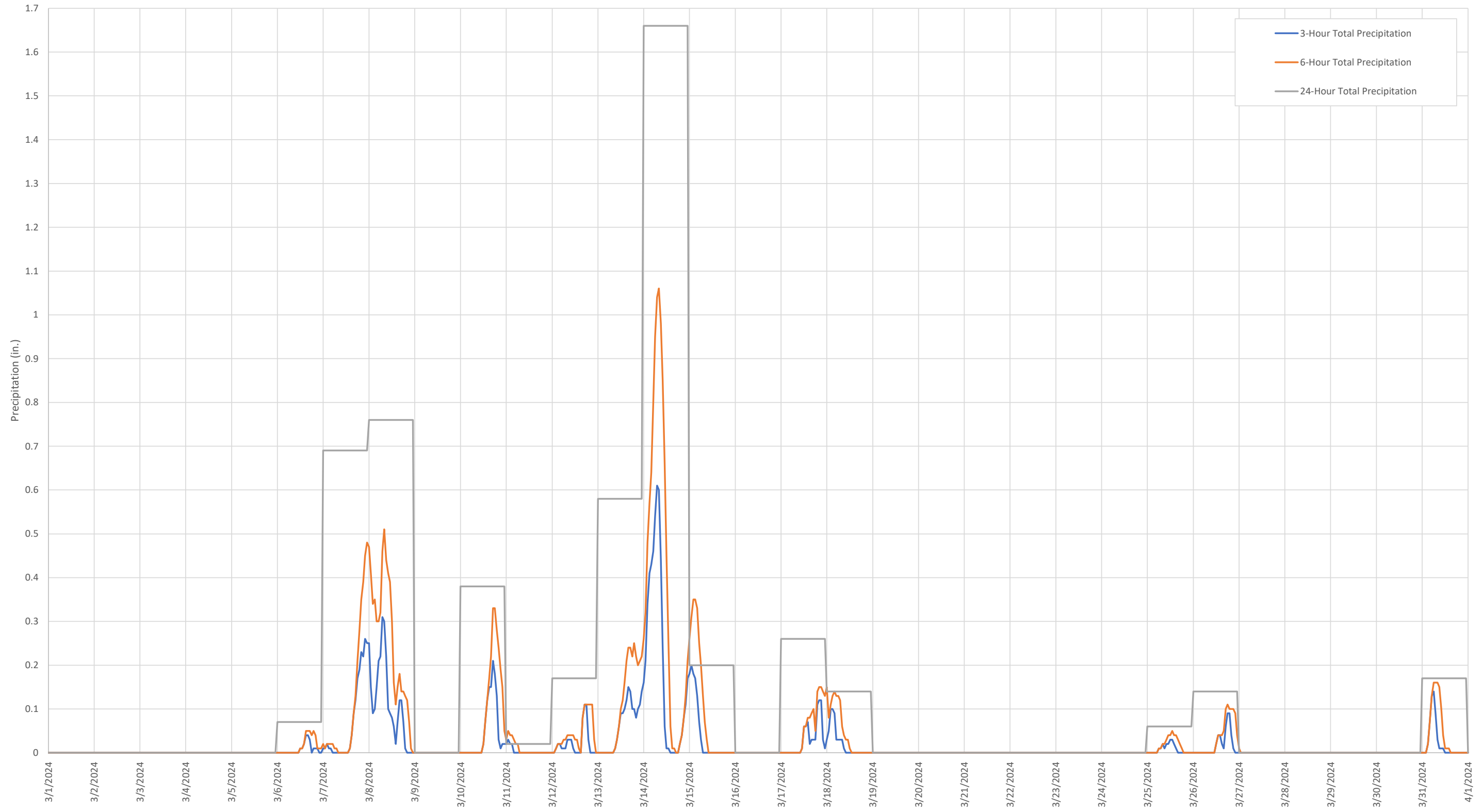


HILLSHADE BASE MAP AND CONTOURS DERIVED FROM ALASKA DGGS RDF 2024-1

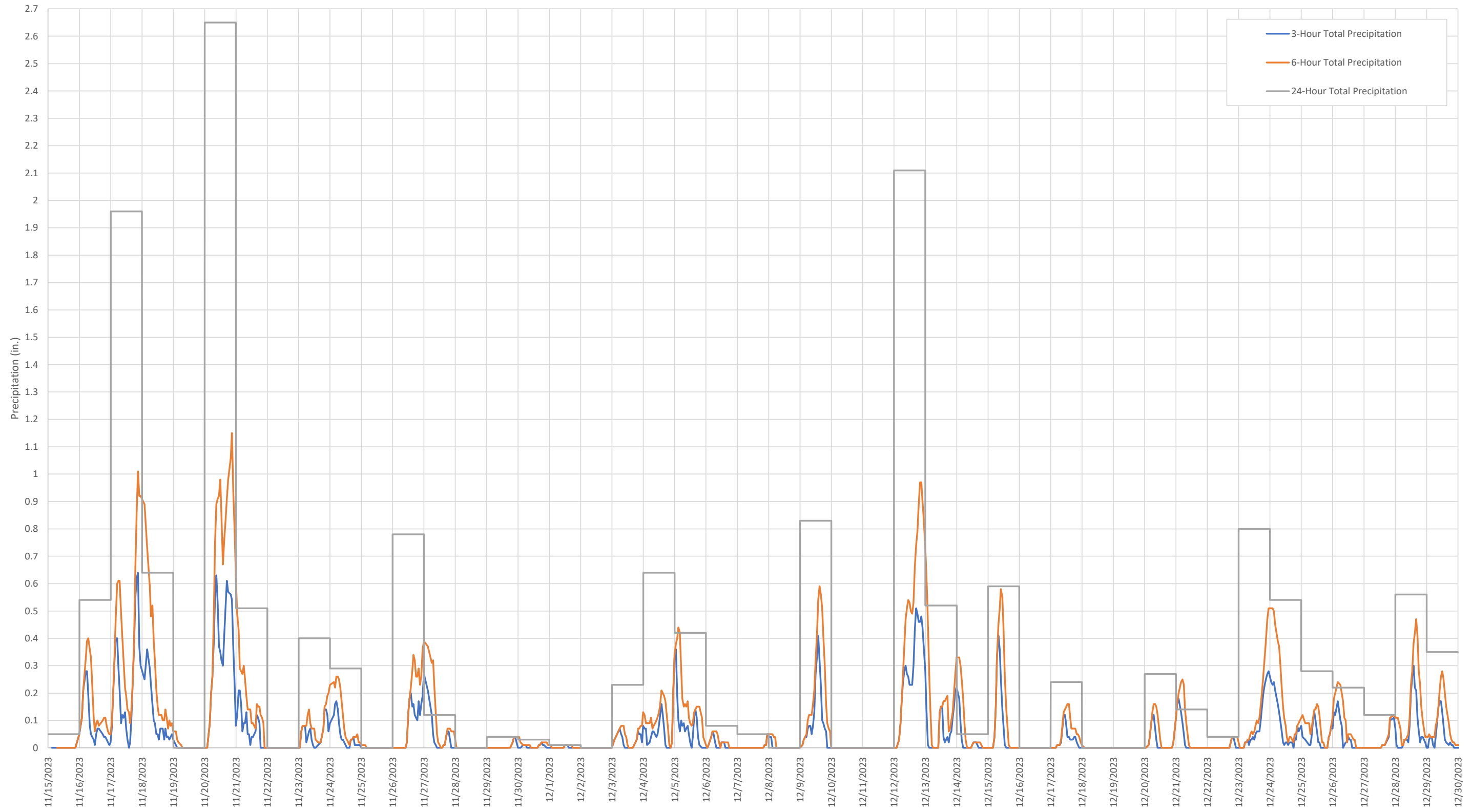
03/15/2024 VS. 02/15/2024 CHANGE DETECTION	
<i>Wrangell Zimovia Highway MP 11.2 Landslide</i>	
	State of Alaska Department of Transportation and Public Facilities Southcoast Region
FIGURE 5	

APPENDIX A – GRAPHICAL WEATHER DATA

Wrangell Zimovia Hwy MP 11.2 Landslide - Drone Dock Weather Station (WEMA2) Precipitation Data 03/01/2024 - 03/31/2024



Wrangell Zimovia Hwy MP 11.2 Landslide - Airport Weather Station (PAWG) Precipitation Data 11/15/2023 - 12/31/2023



Wrangell Zimovia Hwy MP 11.2 Landslide - Drone Dock Weather Station (WEMA2) Precipitation Data 01/15/2024 - 03/31/2024

