

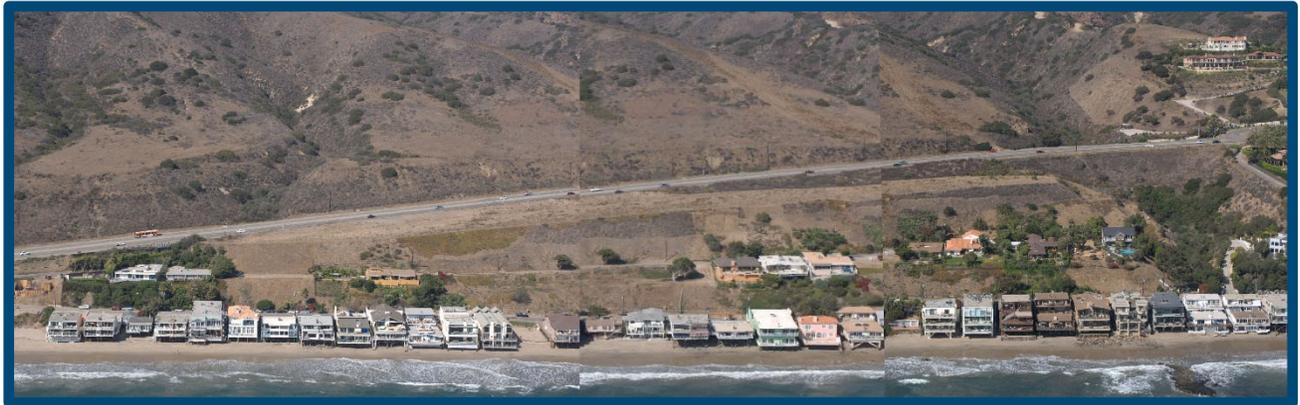
# **FY22/23 Maintenance and Monitoring**

**AD98-3, Malibu Road**

**City of Malibu, California**

Yeh Project No.: 220-278

December 22, 2023



Prepared for:

City of Malibu  
23825 Stuart Ranch Rd.  
Malibu, California 90265  
Attn: Mr. Arthur Aladjajian

Prepared by:

Yeh and Associates, Inc.  
56 East Main St., Suite 104  
Ventura, California 93001  
Phone: 805-481-9590

December 22, 2023

Project No. 220-278

City of Malibu  
23825 Stuart Ranch Rd.  
Malibu, California 90265

Attn: Mr. Arthur Aladjajian, Public Works Superintendent

**Subject: Annual Monitoring and Maintenance Report FY22/23, City of Malibu Assessment District 98-3, Malibu Road, Malibu, CA**

Dear Mr. Aladjajian:

Yeh and Associates, Inc. is pleased to submit this monitoring and maintenance report FY22/23 for the City of Malibu Assessment District AD-3, Malibu Road in Malibu, California. This report was prepared in accordance with our Agreement for Professional Services, dated June 22, 2020, between the City of Malibu and Yeh and Associates, Inc. This report provides an annual summary of monitoring and maintenance for the project over fiscal year July 1, 2022 to June 30, 2023.

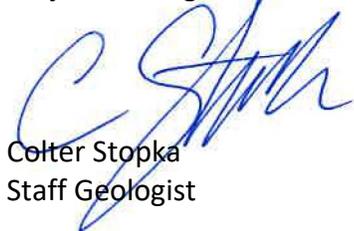
The geotechnical services consisted of monitoring and maintenance, data management, public outreach, reporting, and capital improvement planning. A map showing the location of the maintenance and monitoring facilities are provided on Plate 1. Plate 2 provides a summary of maintenance activities performed during the monitoring year.

We appreciate the opportunity to be of service. Please contact Nick Simon at 805-414-0991 or [nsimon@yeh-eng.com](mailto:nsimon@yeh-eng.com) if you have questions or require additional information.

Sincerely,  
**YEH AND ASSOCIATES, INC.**



Nick Simon  
Project Geologist



Colter Stopka  
Staff Geologist



Loree A. Berry, PE  
Senior Project Manager



## Table of Contents

<b>1. PURPOSE AND SCOPE OF STUDY.....</b>	<b>1</b>
<b>2. MONITORING .....</b>	<b>2</b>
2.1 GROUNDWATER LEVELS.....	3
2.1.1 MALIBU ROAD AREA.....	3
2.1.2 BAYSHORE DRIVE AREA.....	4
2.2 SLOPE INCLINOMETERS.....	4
2.2.1 SUMMARY OF SLOPE INCLINOMETER MONITORING EVENTS.....	4
<b>3. WATER BUDGET TRACKING .....</b>	<b>5</b>
3.1 RAINFALL DATA .....	5
3.2 DEWATERING .....	6
3.2.1 DEWATERING WELL PRODUCTION.....	6
3.3 HYDRAUGER PRODUCTION .....	6
<b>4. SEISMIC EVENTS SUMMARY .....</b>	<b>7</b>
<b>5. MAINTENANCE AND CAPITAL IMPROVEMENTS.....</b>	<b>8</b>
<b>6. ADDITIONAL OBSERVATIONS AND MONITORING.....</b>	<b>8</b>
<b>7. RECOMMENDATIONS FOR MAINTENANCE AND CAPITAL IMPROVEMENTS .....</b>	<b>9</b>
<b>8. REFERENCES .....</b>	<b>9</b>

## List of Figures

FIGURE 1: PROJECT LOCATION MAP .....	1
FIGURE 2: EPICENTER OF JANUARY 25, 2023 M4.2 EQ RELATIVE TO MALIBU ROAD LAD .....	7

## List of Tables

TABLE 1. SUMMARY OF ANNUAL MONITORING AND MAINTENANCE .....	2
TABLE 2: SUMMARY OF AVERAGE GROUNDWATER ELEVATIONS <sup>1</sup> .....	3
TABLE 3: MALIBU ROAD AREA WATER LEVEL MONITORING .....	4
TABLE 4: BAYSHORE DRIVE AREA WATER LEVEL MONITORING.....	4
TABLE 5: RESULTS OF INCLINOMETER SURVEYS .....	5
TABLE 6: SUMMARY OF MAINTENANCE AND CAPITAL IMPROVEMENTS.....	8



### List of Plates

	Plate No.
Monitoring Instrumentation and Dewatering Facilities Map .....	1
Rainfall Graph.....	2
Total Discharge – Wells and Hydraugers.....	3
Discharge vs Rainfall.....	4

### List of Appendices

	Page No.
Appendix A – Groundwater Levels	
Piezometer Information.....	A-1
Groundwater Hydrograph – Malibu Road (West End).....	A-2
Groundwater Hydrograph – Malibu Road (East End) .....	A-3
Groundwater Hydrograph – Bayshore Drive .....	A-4
Appendix B – Slope Inclinerometers	
Summary of Slope Inclinerometers .....	B-1
A/B Direction Plots for SI-1A .....	B-2 and 3
A/B Direction Plots for SI-2A .....	B-4 and 5
A/B Direction Plots for SI-4A .....	B-6 and 7
A/B Direction Plots for SI-5 .....	B-8 and 9
A/B Direction Plots for SI-6 .....	B-10 and 11
Appendix C – Dewatering Data	
Dewatering Well/Hydrauger Information.....	C-1
Dewatering Well Discharge Rate – Malibu Road .....	C-2
Dewatering Well Discharge vs Daily Rainfall Totals 22-23 Monitoring Year.....	C-2a
Dewatering Well Discharge Rate – Bayshore Drive .....	C-3
Dewatering Well Discharge vs Daily Rainfall Totals 22-23 Monitoring Year.....	C-3a
Hydrauger Discharge Rate – Malibu Road (West End) .....	C-4
Hydrauger Discharge Rate Discharge vs Daily Rainfall Totals 22-23 Monitoring Year.....	C-4a
Hydrauger Discharge Rate – Malibu Road (East End) .....	C-5
Hydrauger Discharge Rate Discharge vs Daily Rainfall Totals 22-23 Monitoring Year.....	C-5a



## 1. PURPOSE AND SCOPE OF STUDY

Yeh and Associates (Yeh) was retained by the City of Malibu (City) to perform maintenance and monitoring of the existing geotechnical instrumentation and dewatering facilities within the City of Malibu's Malibu Road Landslide Assessment District, 98-3. The project location is shown by the polygon in Figure 1. This report presents monitoring results, a maintenance summary, and facilities status for the monitoring year July 2022 through July 2023 (monitoring year). Yeh monitors groundwater levels, surveys slope inclinometers, and measures the dewatering flow from dewatering wells and horizontal drains. Yeh also oversees and maintains the function of the monitoring and dewatering facilities. Plate 1 shows the approximate locations of the specific assessment district facilities. Table 1 summarizes the equipment inventory and the approximate frequency of monitoring and maintenance over the monitoring year. Section 4.0 of this report provides a detailed summary of the maintenance activities performed during this monitoring period.

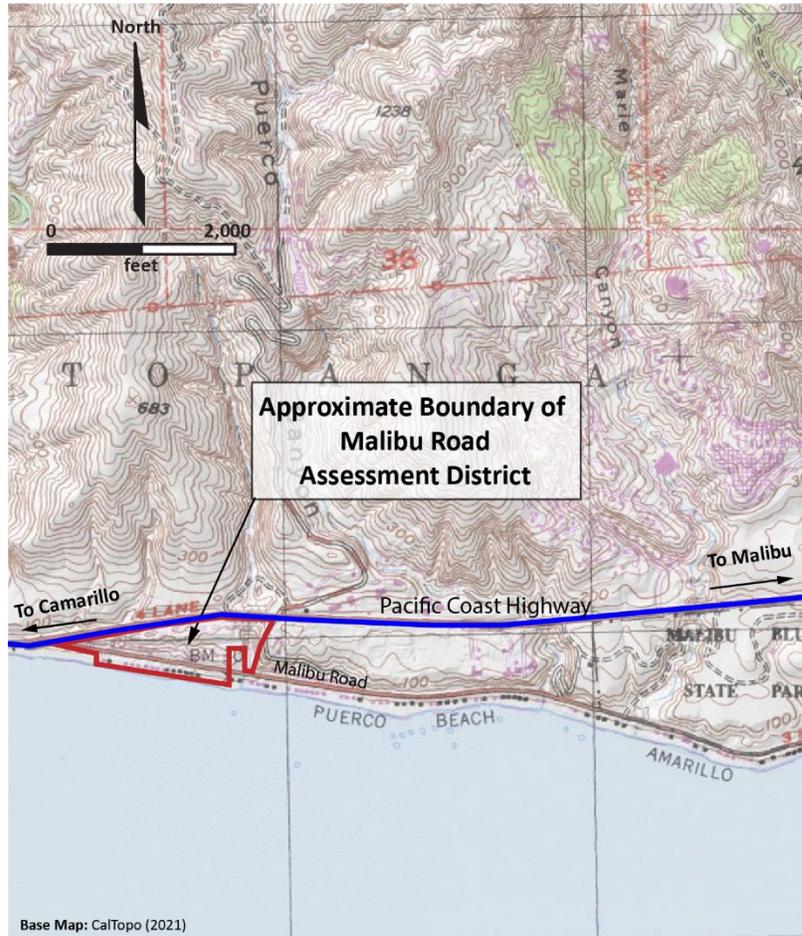


Figure 1: Project Location Map

**Table 1. Summary of Annual Monitoring and Maintenance**

Type of Monitoring Instrument or Dewatering Device	Number of Locations	Brief Description	Monitoring Frequency	Maintenance Effort <sup>2</sup>
Standpipe piezometer	8 <sup>1</sup>	2.75-inch PVC, or other casing, used to measure depth to groundwater using electric sounder or by a transducer/datalogger	monthly; hourly data from pressure transducer	low
Inclinometer survey casings	5 <sup>1</sup>	2.75-inch diameter grooved casings made of PVC, used to survey for shear displacement by an inclinometer probe	quarterly	low
Dewatering wells	14	6-inch or 12-inch diameter steel or PVC casings equipped with 0.5 to 1/3 HP submersible pump and connected to electrical controls, pumped water flows through meter and into conveyance piping to discharge	monthly	high
Horizontal Drains (hydraugers)	19	1-inch to 1.5-inch perforated PVC casings drilled slightly higher than horizontal into the slope along Malibu Road for up to 180 feet and used to drain groundwater that intercepts the casing. Flow rates are measured along Malibu Road.	monthly	medium
Big Rock Mesa Rain Gauge #1239	1	Documented Rainfall, Data obtained from Los Angeles County Public Works	monthly	N/A

Notes:

<sup>1</sup> - SI-5 and SI-6 are used as both inclinometers and standpipe piezometer.

<sup>2</sup> - maintenance effort (generalized): “high” – services monthly, “medium” – services quarterly, “low” – services annually

## 2. MONITORING

The following provides the result of water level monitoring in standpipe piezometers and the results of inclinometer surveys performed. For the purposes of discussion and context throughout the report, the monitoring results are discussed with respect to two areas within the 1978 landslide boundaries: Malibu Road and Bayshore Drive:

- Malibu Road Area:** The southern portion of landslide including Malibu Road. The toe of the 1978 landslide is mapped to the south of Malibu Road, obscured beneath shoreline development and residences. The east and west boundaries of the landslide are visible as topographic changes across Malibu Road. Active district monitoring and dewatering facilities are located on the north side of Malibu Road.
- Bayshore Drive Area:** The northern portion of the 1978 landslide that includes the headscarp still mostly visible along the north side of the vacant parcels east of 25377 Malibu Road and in the vacant parcel east of 25315 Malibu Road. Active District monitoring and dewatering facilities are located to the north of the 1978 head scarp.



## 2.1 GROUNDWATER LEVELS

Groundwater levels were measured approximately monthly in 8 standpipe piezometers shown on Plate 1. Water levels are acquired by lowering an electric probe into the standpipe to contact the groundwater surface and manually recording the depth to water. Groundwater hydrographs for individual standpipes from historic through the end of the current monitoring year are presented in Appendix A.

Pneumatic piezometers were installed with some of the inclinometers until 1998. Pneumatic piezometers were not measured during the monitoring year due to adequate coverage to obtain groundwater levels with the manually read standpipe piezometers. Appendix A includes historic pneumatic piezometer results.

Table 2 summarizes the average groundwater levels over the monitoring year for standpipe water levels within the two areas, their change from the prior monitoring year average, and their change from the historical average. The average annual groundwater elevation for the Malibu Road Area increased by 0.9 feet and the Bayshore Drive Area average groundwater elevation decreased by 1.9 feet. The decline in the Bayshore Drive Area average was due to water levels in SI-5 continuing to lower. In general, water levels in most individual standpipes in both areas increased following the December 2022 through May 2023 rainfall and are discussed by area in the following sections:

**Table 2: Summary of Average Groundwater Elevations<sup>1</sup>**

Area Averaged	Total No. of Standpipes Monitored	2022-2023 Averaged Groundwater Elevation (ft)	Change in Averaged Groundwater Elevation from Prior Monitoring Period (ft)	2022-2023 Average Annual Groundwater Elevation (ft) Vs Historical Mean Average Annual Groundwater Elevation
Malibu Road <sup>1</sup>	6	7.2	+0.9	-0.6
Bayshore Drive	2	24.6	-1.9	-0.7

Notes: <sup>1</sup> Comparison between the current and prior monitoring periods for the eight standpipe piezometers measured during the current monitoring period, except W-2A which had been dry from 2014 until January 2023 is not included

### 2.1.1 MALIBU ROAD AREA

Six standpipes along the north shoulder of Malibu Road are in use for groundwater level monitoring in the Malibu Road Area. All six of the monitored standpipes water levels were essentially static or declining through the beginning of the monitoring year and all measured increases after the December 2022 through May 2023 rainfall and had remained elevated through the end of monitoring year through June 2023. Standpipe W-2A had been dry since approximately 2014 and recorded a measurable water level beginning in January 2023. Yeh will continue to monitor to confirm the measurements in W-2A are true water levels. Statistics for individual Malibu Road Area standpipes are included on Table 3.

**Table 3: Malibu Road Area Water Level Monitoring**

Standpipe ID	Change in Groundwater Elevation between last and first measurements of monitoring year (ft)	2022-2023 Average Groundwater Elevation (ft)	Change in Average Groundwater Elevation from Prior Monitoring Year (ft)	1991-2023 Historical Mean Groundwater Elevation (ft)	2022-2023 Average Groundwater Elevation from Historical Mean Groundwater Elevation (ft)
PZ-A	+1.2	9.8	+0.6	9.4	+0.4
PZ-B	+3.5	4.1	+0.6	2.5	+1.6
PZ-C	+3.7	4.7	+0.5	3.9	+0.8
PZ-D	+2.1	5.8	+0.8	5.1	+0.7
PZ-E	+6.2	11.8	+1.7	12.4	-0.6
W-2A	Dry since 2014, measured elevation 13.1 in January 2023 and 13.4 in June 2023				

**2.1.2 BAYSHORE DRIVE AREA**

Two standpipes are in use for groundwater level monitoring in the Bayshore Drive Area. Water levels in Standpipe SI-5 had continued to decline from November 2021 until February 2023 and then approximately leveled through the end of the monitoring year. Water levels in Standpipe SI-6 during the monitoring year were static through March 2023 when they rose approximately 4.5 feet in response to rainfall. Statistics for individual Bayshore Drive Area standpipes are included on Table 4.

**Table 4: Bayshore Drive Area Water Level Monitoring**

Standpipe ID	Change in Groundwater Elevation between last and first measurements of monitoring year (ft)	2022-2023 Average Groundwater Elevation (ft)	Change in Average Groundwater Elevation from Prior Monitoring Year (ft)	1991-2023 Historical Mean Groundwater Elevation (ft)	2022-2023 Average Groundwater Elevation from Historical Mean Groundwater Elevation (ft)
SI-5	-3.2	23.4	-5.3	23.7	-0.3
SI-6	+4.8	25.8	+1.5	27.0	-1.2

**2.2 SLOPE INCLINOMETERS**

**2.2.1 SUMMARY OF SLOPE INCLINOMETER MONITORING EVENTS**

Yeh surveyed a total of five inclinometers during the monitoring year. Inclinometers are surveyed approximately quarterly or on an accelerated schedule if movement is interpreted. Inclinometers were surveyed using a vertical traversing probe that measures the tilt of the casing at 2-foot intervals. Inclinometer data were collected via Bluetooth onto a field tablet and processed by comparing each tilt measurement to previous surveys.

Inclinometer data processing and presentation utilized DigiPro2 software (Slope Indicator, 2014) and used a post Q1 2022 survey as a baseline (unless otherwise noted). Updated baselines are generally used following a change or repair to the cable and/or servicing of the inclinometer probe sensors and



carriage. Appendix B includes an inventory of District inclinometers with a summary of past movements and annotated plots of cumulative change and incremental change in the A and B directions for each inclinometer surveyed during the monitoring year.

During the current monitoring year, shear-type movement was detected in inclinometers SI-1A, -2A and 4A between the Q1 and Q2 surveys; however, no movement was recorded in SI-5 and SI-6 as presented in Table 5. After the Q2 survey, inclinometers were surveyed on an accelerated schedule and no additional movement has been detected.

**Table 5: Results of Inclinometer Surveys**

Inclinometer ID	Date of Recorded Movement	Depth of Interpreted Movement (Feet)	Amount of Interpreted Shear (Inches)	Directional Bearing of Movement (degrees)
SI-1A	Between 1/30/23 and 6/9/23 surveys	26-28	0.12	197
SI-2A	Between 1/30/23 and 6/7/23 surveys	32-34	0.20	200
SI-4A	Between 1/30/23 and 6/7/23 surveys	30-34	0.28	169
SI-5	No movement recorded	n/a	0	n/a
SI-6	No movement recorded	n/a	0	n/a

### 3. WATER BUDGET TRACKING

#### 3.1 RAINFALL DATA

Yeh obtained rainfall data for the monitoring year from the Big Rock Mesa Rain Gauge #1239 operated by the Los Angeles County Department of Public Works (LADPW). Prior to 1984, rainfall data was obtained from the Carbon Canyon Rain Gauge #447C and after 1984 from the Big Rock Mesa Rain Gauge #1239. This monitoring year Yeh also obtained complete, historical annual rainfall data from the LADPW for both gauges back to 1968 and updated missing or conflicting data and adjusted historical rainfall amounts and averages accordingly. For this report, the Big Rock Mesa Rain Gauge 40-year rainfall average replaces the previously used “Area Average”.

Plate 2 - Rainfall Graph displays historical monthly and average annual rainfall from October 1968 through September 2023. Recorded rainfall over the monitoring year totaled 31.26 inches, which is 15.12 inches above the 40-year Big Rock Mesa Rain Gauge running average of 16.14 inches and was the most annual rainfall recorded since 2005.

Plate 4 – Annual and Cumulative Deviation from Mean Rainfall vs Total Dewatering Production, shows rainfall deviation from the 40-year mean and compares rainfall amounts to total dewatering output changes. Total Discharge vs Daily Rainfall Totals compares daily rainfall amounts to dewatering output over the monitoring year.



### **3.2 DEWATERING**

Yeh tracks dewatering production for the pumping dewatering wells installed across the district and the horizontal gravity drains (hydraugers) installed in the bluff along Malibu Road. The 2022-2023 monitoring year total dewatering production averaged 1,935 gpd, which is an increase of 234-percent from the previous monitoring years' average production of 579 gpd and was the highest annual average dewatering production since the 2010-2011 monitoring year. The increase in production was a response to the above average rainfall from December 2022 through March 2023. Eighty-two percent of the total dewatering production was pumped from dewatering wells and 18-percent was from hydraugers.

#### **3.2.1 DEWATERING WELL PRODUCTION**

Yeh performed monthly monitoring for discharge rates of the 14 active district dewatering wells. Well production is measured approximately monthly for each well by reading flow totalizers that are installed along the discharge line. A summary of well status for individual wells is included on Page C-1 and graphs of historical production and of this year's annual production versus daily rainfall totals are included in Pages C-2 through C-3. A graph showing total production since 1992 is included on Plate 3.

During the monitoring year, the average total well production was 1,624 gpd which is 227-percent higher than last year's average production of 497 gpd, 34-percent higher than the historical production average of 1,211 gpd calculated from 1991 to present and was the highest production since the 2004-2005 monitoring year.

Plates C-2a and C-3a present data that indicate that well production typically varies in response to rainfall totals. The dewatering well production increase over this monitoring year is consistent with the high rainfall totals this monitoring year at the project.

### **3.3 HYDRAUGER PRODUCTION**

Hydrauger production is measured directly from a sampling port installed on each hydrauger. Yeh performed monthly monitoring to measure flow from 19 hydraugers, of which only two locations have recorded consistent flow in recent years. Most of the hydraugers flow intermittently in response to rainfall. An inventory and status for individual hydraugers is included in Appendix C-1 and graphs of historical production and of this year's annual production versus daily rainfall totals are included in Pages C-4 through C-5. A graph showing total hydrauger production since 1992 is included on Plate 4.

During the monitoring year, the average monthly hydrauger production was 311 gpd which is approximately 275-percent more than last year's average monthly production of 83 gpd and 59-



percent less than the historical production average of 762 gpd calculated from 1991 to present. Over the monitoring year, 89-percent of all hydrauger production was from five hydraugers with five other hydraugers producing only intermittently. Hydrauger production was highest in January in response to December 2022 and early January 2023 rainfall and remained elevated through the end of the monitoring year.

#### 4. SEISMIC EVENTS SUMMARY

One earthquake with a magnitude of 4.0 or greater was recorded within a 100-mile radius of the project area. On January 25, 2023, a M 4.2 event occurred approximately 16 kilometers south of Malibu Beach, a M 3.6 aftershock occurred approximately 3 minutes later. The epicenters were located approximately 10.2 miles south from the Malibu Road LAD boundary.

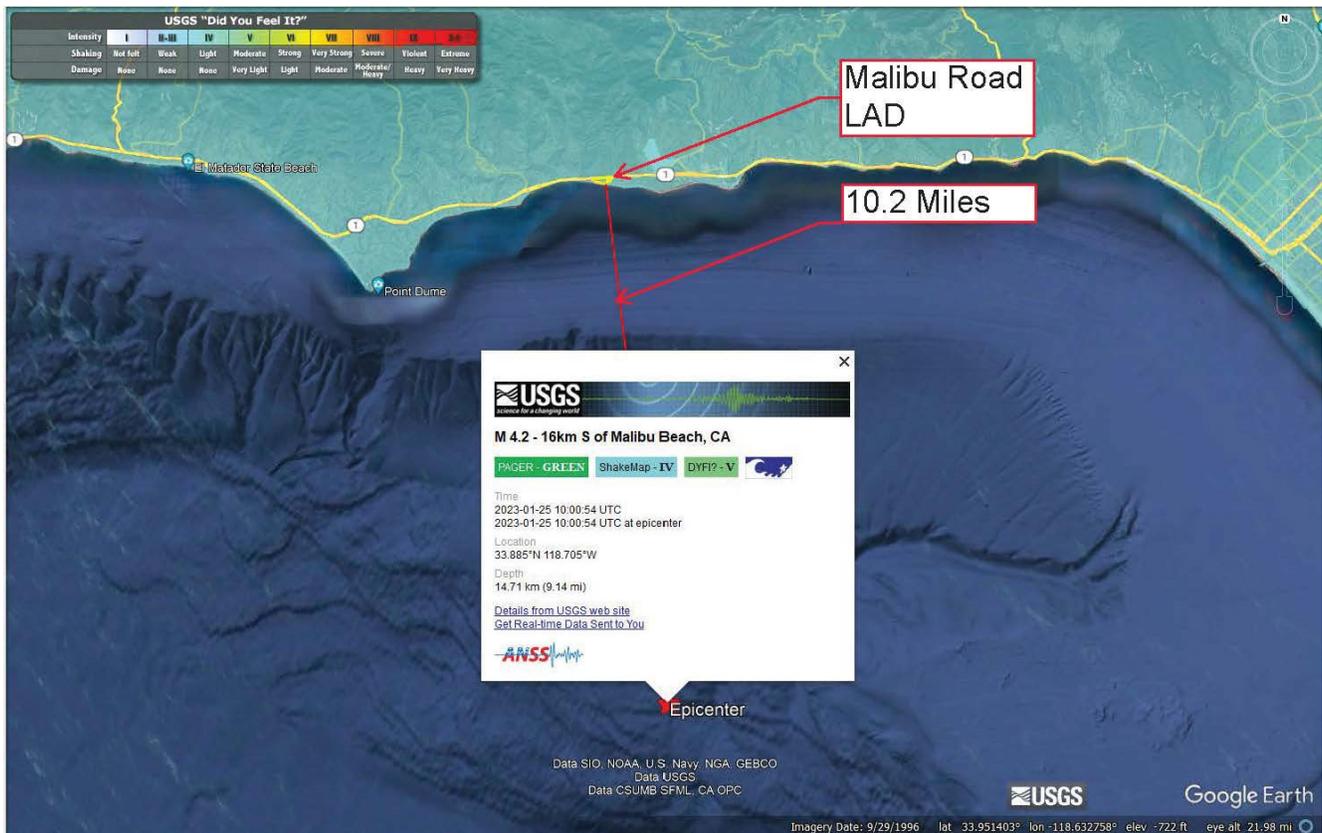


Figure 2: Epicenter of January 25, 2023 M4.2 EQ relative to Malibu Road LAD

Yeh personnel performed post-earthquake observations and surveyed inclinometers SI-1A, -2A and -4A on January 30, 2023. No movement secondary to the earthquake was interpreted on the inclinometers surveyed. Yeh staff did not observe surface displacements related to the earthquake and is unaware of any reports of damage local to the Malibu Road Landslide AD resulting from the earthquake.

## 5. MAINTENANCE AND CAPITAL IMPROVEMENTS

A summary table of the maintenance and capital improvement activities performed over this monitoring year is provided on Table 6. Typical maintenance activities to dewatering wells include assessing and replacing or repairing dewatering well pumps, well electronics and well controls; Typical maintenance to hydraugers included PVC repairs within the conveyance piping for discharge. Capital improvements include replacement and rehabilitation of existing facilities and special projects to improve the monitoring and maintenance capabilities.

**Table 6: Summary of Maintenance and Capital Improvements**

Date Noted	Maintenance Item Description	Assessment	Status
Sept 2022	All wells on Malibu Road with no production in September discovered on monthly readings	Yeh assessment find main circuit breaker on main panel is tripped. All wells on Malibu Road draw power from this panel	Circuit Breaker is turned back on 10.22.23 Yeh assessed all wells for Amps, volts and GPM. All wells appear operating normally except W-5 will require further assessment
Oct 2022	Well W-5 production drop noted during monthly production checks	10.25.22 Assessed by Yeh, pump saver recalibrated well appears to be functioning. 11.2023 intermittent production during November December. 2.2023 no production again at W-5 6.13.2023 reassessed by Yeh, motor at over 13 amps shuts off immediately. Pump/motor will need to be removed and examined.	6.14.23 CP removes pump/motor both are corroded and need to be replaced. 6.16.23 CP Installs new 10s05-9 Grundfos pump with ½ hp 230v motor, new ½ hp control box and new 233 pump saver. 1" pvc sounding tube installed. Pump returned to service
Feb 2023	Well W-6 Meter Box filling with water and spilling onto road	Assessed by Yeh and noted a broken discharge under the pavement between the meter vault and electrical vault. Pump turned off pending assessment by contractor. Both vaults are partially collapsed and need to be replaced. 6.5.23 Yeh coordinating traffic control and submitting workplans to City 6.9.23 Yeh onsite with contractor Toro for coordination assessment/estimate	6.12.23 Toro demos old meter vault and electrical vault, replumbs meter and replaces vaults with a single larger vault 6.19.23 Toro asphalt hot patch around new meter vault. Completes job.
June 2023	6.13.23 Yeh assessing W-5 for low production noted possible arcing at top of Edison pole.	6.14.23 CP notes no power at Edison meter on main breaker panel for wells along Malibu Road 6.15.23 Quest assess main panel, determines issue is at Edison pole across Malibu Road	6.15.23 Yeh create emergency Edison ticket, assessed by Edison 6.15.23 Edison makes repairs to pole and power is restored to breaker panel

## 6. ADDITIONAL OBSERVATIONS AND MONITORING

- Rainfall totals for the 2022-2023 monitoring year were the highest since the 2004-2005 monitoring year.
- No ground deformation related to the Malibu Road Landslide was noted.

- Dewatering well W-11 on Bayshore Drive was taken out of service and destroyed in April 2023 and replaced with a new well, W-11A in April 2023 re-located to approximately 20 feet north of Bayshore Drive.
- Yeh is working with staff at the Los Angeles County Department of Public Works (LACDPW) to coordinate the timing of District facility maintenance and improvements with LACDPW's repair to the existing water main.

## 7. RECOMMENDATIONS FOR MAINTENANCE AND CAPITAL IMPROVEMENTS

- A modern form of repeatable surface survey should be re-introduced and continued for the project as a consistent means to observe and evaluate potential land movement throughout the extent of the assessment district area and more specifically in-between inclinometer casing locations.
- Install datalogging radio frequency or cellular transmitting capabilities on dewatering well meters along Malibu Road.
- Install at least one in-place monitoring sensor across identified shear depths in inclinometers SI-1A, 2A or 4A.
- Plan and design for stormwater improvements to reduce stormwater and debris infiltration onto the undeveloped ground between Malibu Road and Highway 1.
- Coordinate a solution to repair or replace the obstructed and damaged storm drain on Bayshore Drive.
- Replace Inclinometer SI-3.

## 8. REFERENCES

Bing Yen and Associates, Inc. (2003), "Annual Observation & Maintenance Report for the Period July 2002 to June 2003, Malibu Road, Malibu, California," dated October.

\_\_\_\_\_ (2003), "Annual Observation & Maintenance Report for the Period July 2001 to June 2002, Malibu Road, Malibu, California" dated February.

\_\_\_\_\_ (2002), "Annual Observation & Maintenance Report for the Period July 2000 to June 2001, Malibu Road, Malibu, California," dated January.

\_\_\_\_\_ (2000), "Annual Observation & Maintenance Report for the Period April 1999 to June 2000, Malibu Road, Malibu, California," dated August.

\_\_\_\_\_ (1999), "Annual Observation & Maintenance Report for the Period April 1998 to March 1999, Malibu Road, Malibu, California," dated May.

\_\_\_\_\_ (1998), "Annual Observation & Maintenance Report for the Period July 1997 to April 1998, Malibu Road, Malibu, California," dated April.



\_\_\_\_\_ (1997), "Annual Observation & Maintenance Report for the Period July 1996 to July 1997, Malibu Road, Malibu, California," dated June.

\_\_\_\_\_ (1996), "Annual Observation & Maintenance Report for the Period July 1995 to July 1996, Malibu Road, Malibu, California," dated September.

\_\_\_\_\_ (1995), "Annual Observation & Maintenance Report for the Period July 1994 to July 1995, Malibu Road, Malibu, California," dated September.

\_\_\_\_\_ (1994), "Annual Observation & Maintenance Report for the Period July 1993 to July 1994, Malibu Road, Malibu, California," dated September.

\_\_\_\_\_ (1993), "Semi-Annual Observation & Maintenance Report for the Period July to December 1992, Malibu Road, Malibu, California," dated February.

\_\_\_\_\_ (1993), "Semi-Annual Observation & Maintenance Report for the Period January to July 1993, Malibu Road, Malibu, California," dated September.

\_\_\_\_\_ (1992), "Second Quarter Observation Report: Instrumentation and Dewatering Facilities at Calle del Barco, Puerco Beach, and Latigo Canyon Landslide Sites," dated July 9.

\_\_\_\_\_ (1992), "First Quarter Observation Report: Instrumentation and Dewatering Facilities at Calle Del Barco, Puerco Beach, and Latigo Canyon Landslide Sites," dated April 7.

\_\_\_\_\_ (1991), "Monitoring, Instrumentation, and Dewatering Facilities at Calle del Barco, Puerco Beach, Latigo Canyon, and Rambla Pacifico (2 wells) Landslide Sites," dated October 4.

David Taussig & Associates, Inc. (2019), "Annual Assessment District No. 98-3 (Malibu Road) FY 2019-2020," dated June 26.

Fugro USA Land, Inc. (2020), "Annual Report, July 2019 through June 2020 Malibu Road Landslide Assessment District, Malibu, California," dated August 2020.

\_\_\_\_\_ (2019), "Annual Report, July 2018 through June 2019 Malibu Road Landslide Assessment District, Malibu, California," dated November 2019.

\_\_\_\_\_ (2019) "Annual Report, July 2017 through June 2018 Malibu Road Landslide Assessment District, Malibu, California," dated March 2019.

\_\_\_\_\_ (2018), "Annual Report, July 2016 through June 2017 Malibu Road Landslide Assessment District, Malibu, California," dated January 2018.

Fugro Consultants, Inc. (2016), "Annual Report, July 2015 through June 2016 Malibu Road Landslide Assessment District, Malibu, California," dated November 2016.

\_\_\_\_\_ (2015b), "Annual Report, July 2014 through June 2015 Malibu Road Landslide Assessment District, Malibu, California," dated November 2015.



\_\_\_\_\_ (2015a), "Annual Report, July 2013 through June 2014 Malibu Road Landslide Assessment District, Malibu, California," dated April 2015.

\_\_\_\_\_ (2014), "Annual Report, July 2012 through June 2013 Malibu Road Landslide Assessment District, Malibu, California," dated January 2014.

\_\_\_\_\_ (2012), "Annual Report, July 2011 through June 2012 Malibu Road Landslide Assessment District, Malibu, California," dated September 2012.

\_\_\_\_\_ (2011), "Annual Report, July 2010 through June 2011 Malibu Road Landslide Assessment District, Malibu, California," dated August 2011.

\_\_\_\_\_ (2010), "Annual Report, July 2009 through June 2010 Malibu Road Landslide Assessment District, Malibu, California," dated August 2009.

\_\_\_\_\_ (2009), "Annual Report, July 2008 through June 2009 Malibu Road Landslide Assessment District, Malibu, California," dated August 2009.

\_\_\_\_\_ (2008), "Annual Report, July 2007 through June 2008 Malibu Road Landslide Assessment District, Malibu, California," dated October 2008.

\_\_\_\_\_ (2007), "Annual Report, July 2006 through June 2007 Malibu Road Landslide Assessment District, Malibu, California," dated October 2007.

\_\_\_\_\_ (2006), "Annual Report, July 2005 through June 2006 Malibu Road Landslide Assessment District, Malibu, California," dated August 2006.

\_\_\_\_\_ (2005), "Annual Report, July 2004 through June 2005 Malibu Road Landslide Assessment District, Malibu, California," dated October 2005.

\_\_\_\_\_ (2004), "Annual Report, July 2003 through June 2004 Malibu Road Landslide Assessment District, Malibu, California," dated November 2004.

Leighton and Associates, Inc. (1979), "Final Report, Geotechnical Investigation of Landslide Conditions Affecting Puerco West Area, Malibu, California," dated September 4.

Slope Indicator (2014), "DigiPro2 User Manual 50310199", dated May 29, 2014

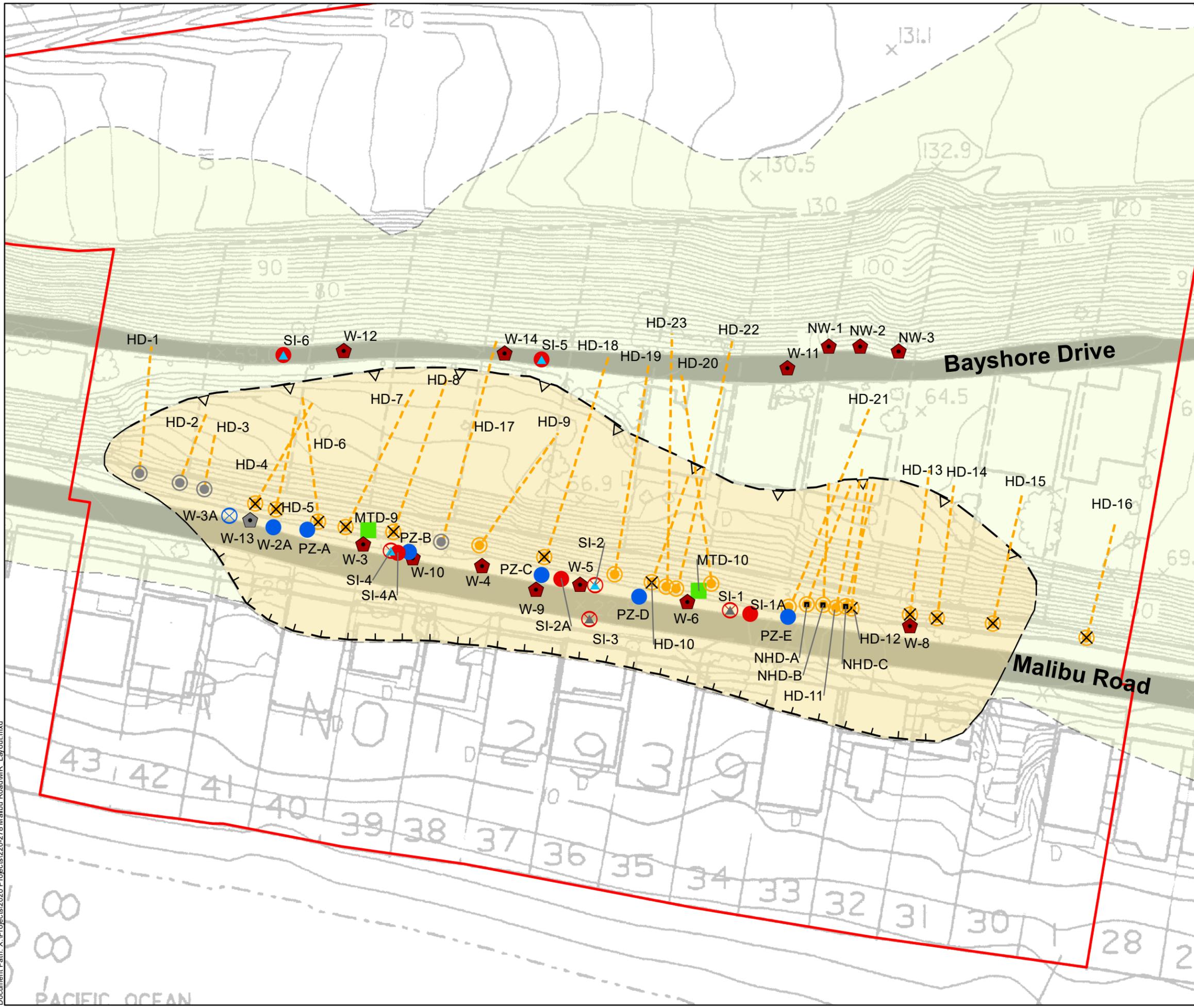
United States Geological Survey (USGS 2022). Earthquake Hazards Program. Search Earthquake Catalog. <https://earthquake.usgs.gov/earthquakes/search/>. Accessed September 2023.

Yeh and Associates, Inc. (Yeh) (2022), "Annual Report, July 2020 through June 2021, Malibu Road Landslide Assessment District, Malibu, California," dated June 2022.

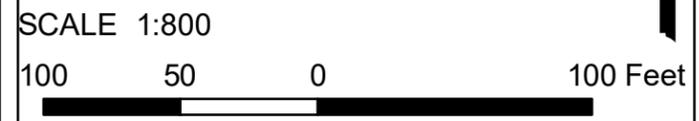


**MALIBU ROAD LANDSLIDE  
ASSESSMENT DISTRICT  
MALIBU, CALIFORNIA**

**MONITORING INSTRUMENTATION  
AND  
DEWATERING FACILITIES MAP**

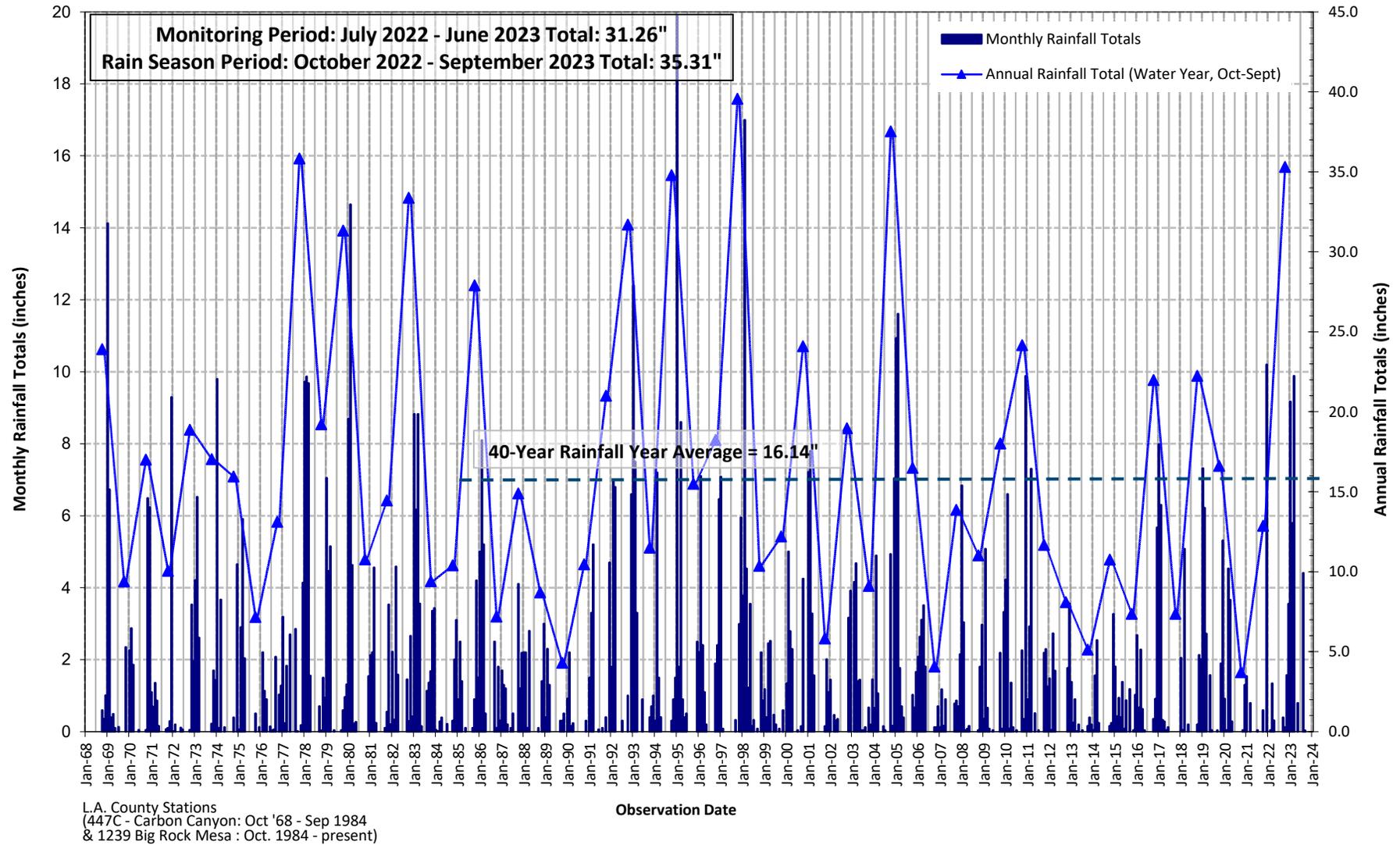


- Dewatering Well
- Dewatering Well (out of service)
- Slope Inclinator/Standpipe Piezometer
- Slope Inclinator/Standpipe Piezometer (standpipe only, not usable for inclinometer)
- Standpipe Piezometer
- Standpipe Piezometer (buried)
- Pneumatic Piezometer
- Pneumatic Piezometer (nonfunctioning)
- Nonproducing Hydrauger
- Private Hydrauger
- Producing Hydrauger
- Hydrauger (unable to locate)
- Hydrauger Installed Length
- Storm Drain Outfall
- District Boundary
- Recent Landslide of 1978 (Boundary from Leighton, 1979)
- Ancient Landslide (Boundary from Leighton, 1979)

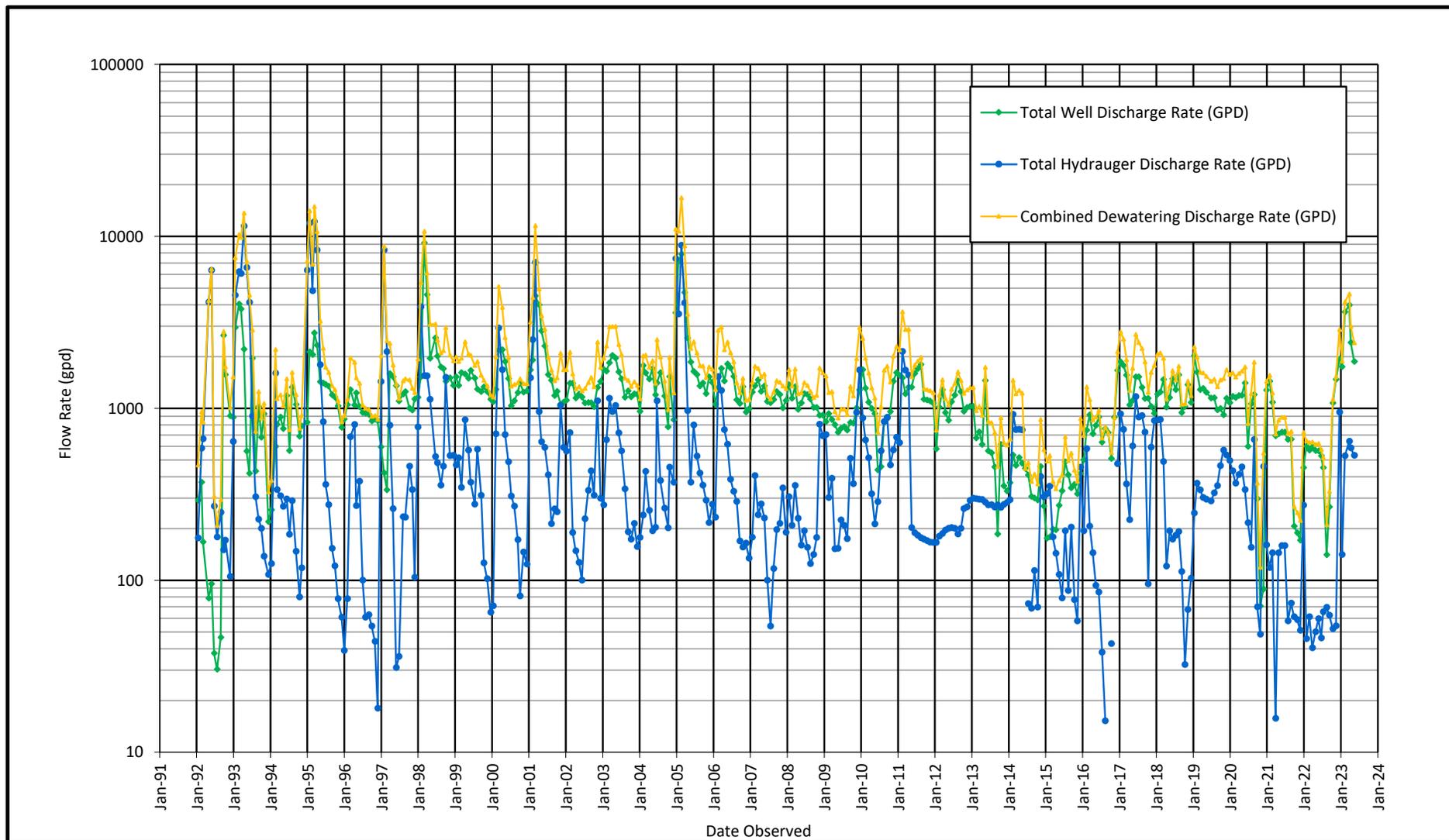


DATE: 1/26/2022	PROJECT NUMBER: 220-278	PLATE: <b>Plate-1</b>
DRAWN BY:	APPROVED BY:	

Document Path: X:\Projects\2020 Projects\220-278 Malibu Road\MR\_Layout.mxd



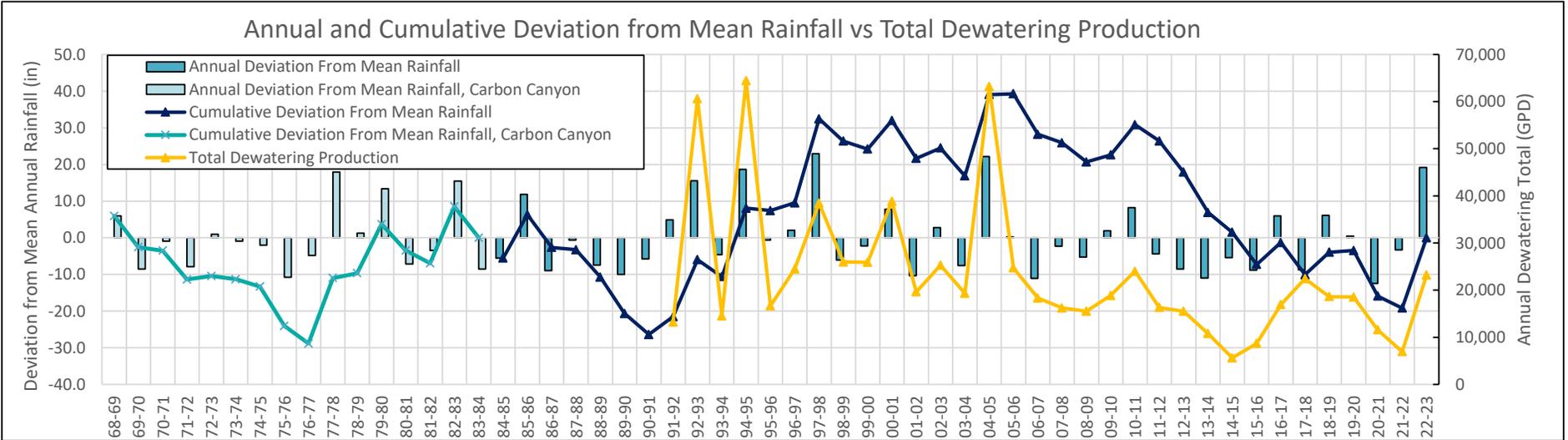
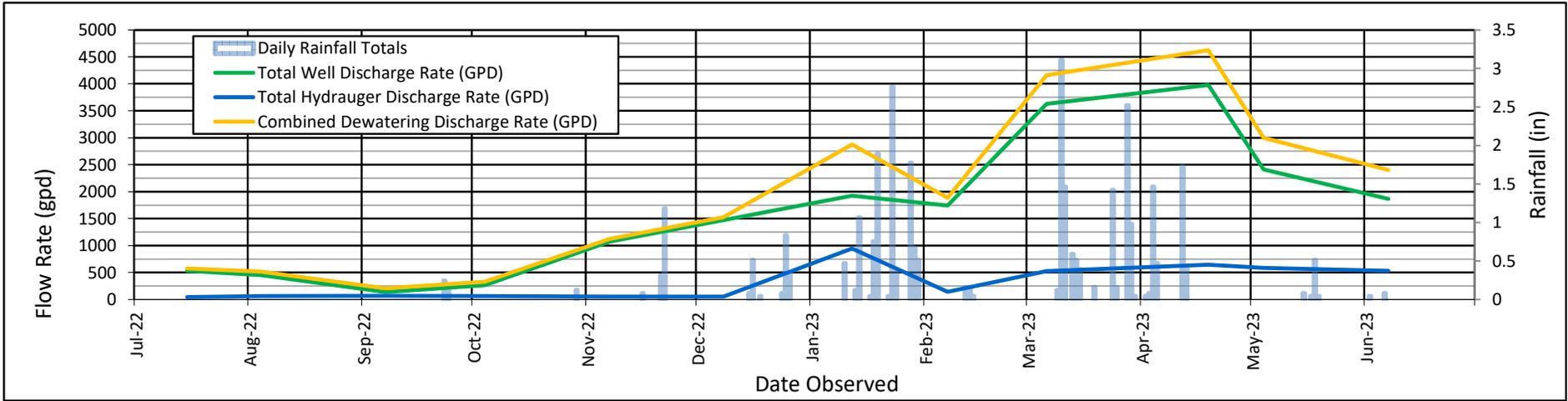
**RAINFALL GRAPH**  
 Landslide Assessment Districts  
 Malibu, California



**TOTAL DISCHARGE - WELLS AND HYDRAUGERS (HISTORIC)**

Malibu Road Landslide Assessment District

Malibu, California



**DISCHARGE VS RAINFALL**

Malibu Road Landslide Assessment District  
 Malibu, California

## APPENDIX A - GROUNDWATER LEVELS

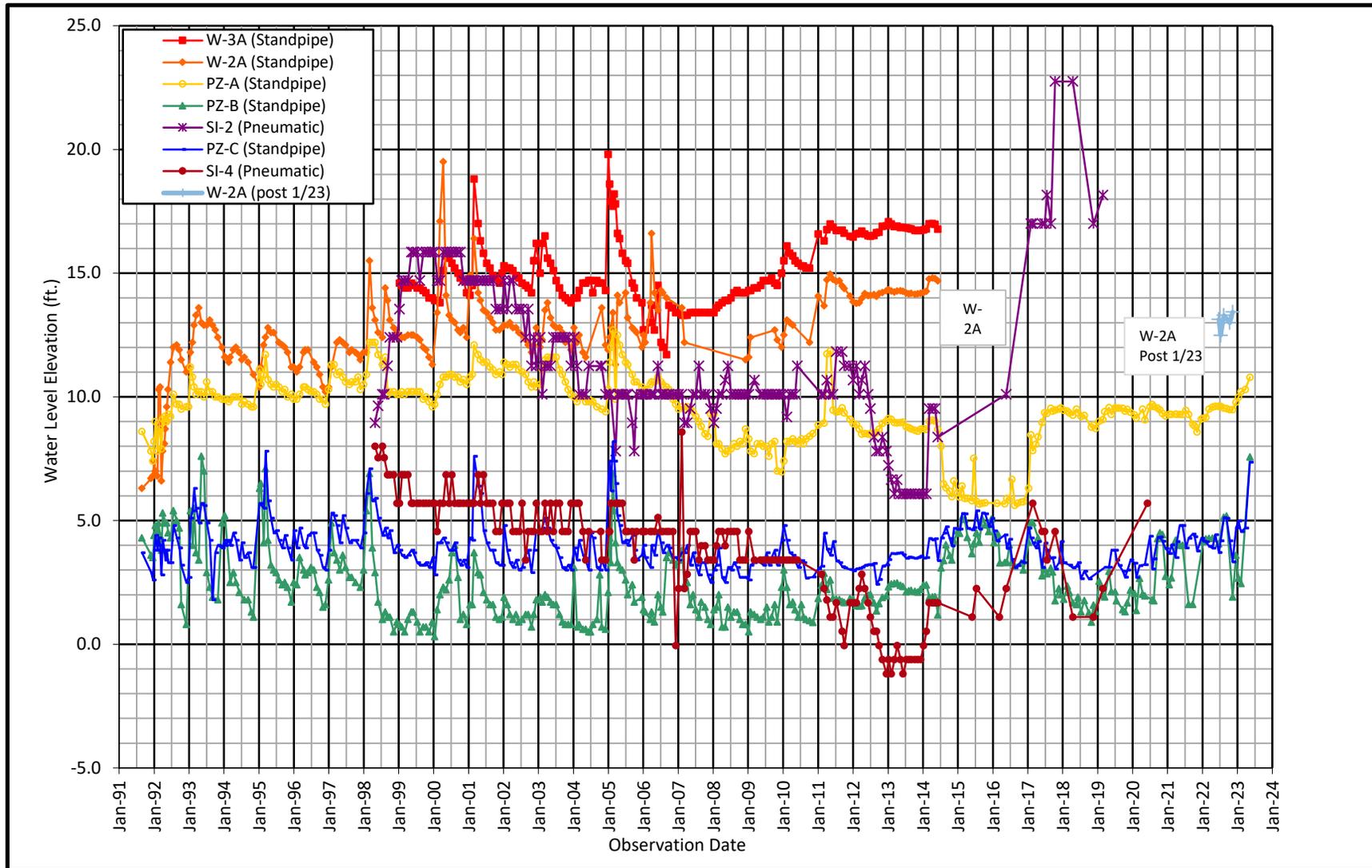
---

<b>MALIBU ROAD LAD - Standpipe Piezometer Information</b>						
Standpipe ID	Previous Reference Elevation (8/91)	Updated Reference Elevation (4/00)	Casing Depth (ft)	Perforation Interval	Installed By	Notes
W-2A	22.6	20.6	9.0	Unknown	LA COUNTY	Dry from 2014 until January 2023
W-3A	22.0	20.5	32.5	Unknown	LA COUNTY	Buried
PZ-A	20.0	19.8	17.2	Unknown	LA COUNTY	
PZ-B	20.0	19.1	27.9	Unknown	LA COUNTY	
PZ-C	20.0	19.4	29.7	Unknown	LA COUNTY	
PZ-D	20.0	19.2	24.7	Unknown	LA COUNTY	
PZ-E	20.0	21.4	15.8	Unknown	LA COUNTY	
SI-5 <sup>+</sup>	59.0	59.3	78.0	-19.0 to -14.0	BYA	
SI-6 <sup>++</sup>	57.0	58.0	78.0	-21.0 to -16.0	BYA	

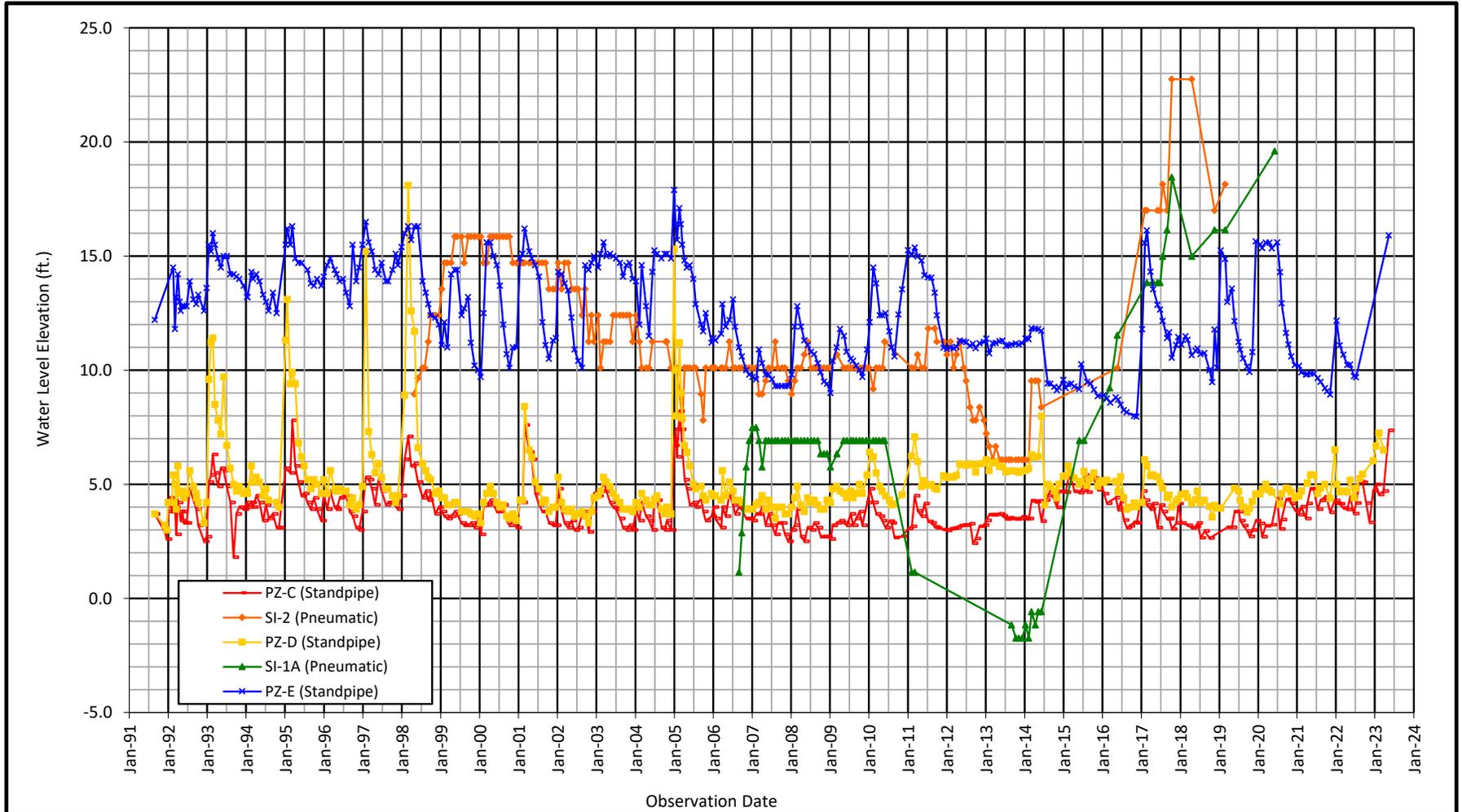
Note: + Formerly designated as MR-5  
 ++ Formerly designated as MR-6

<b>MALIBU ROAD LAD - Pneumatic Piezometer Information</b>						
Well Identification	Previous Reference Elevation (8/91)	Updated Reference Elevation (4/00)	Tip Depth (ft.)	Tip El. (ft)	Installed By	Notes
SI-1*	20.0	20.1	34.6	-14.6	BYA	leaking
SI-2	20.0	19.7	65.1	-45.1	BYA	functioning as of 2020, not measured
SI-3*	20.0	20.3	49.8	-29.8	BYA	clogged
SI-4	22.0	18.9	43.9	-21.9	BYA	functioning as of 2020, not measured
SI-5 Tip 1	59.0	59.3	60	-1	BYA	functioning as of 2020, not measured
SI-5 Tip 2	59.0	59.3	40	19	BYA	functioning as of 2020, not measured
SI-6 Tip 1	57.0	58.0	60	-3	BYA	functionality uncertain since install, not measured
SI-6 Tip 2	57.0	58.0	40	17	BYA	functioning as of 2020, not measured
SI-1A	20.0	20.0	50	-30	FUGRO	functioning as of 2020, not measured

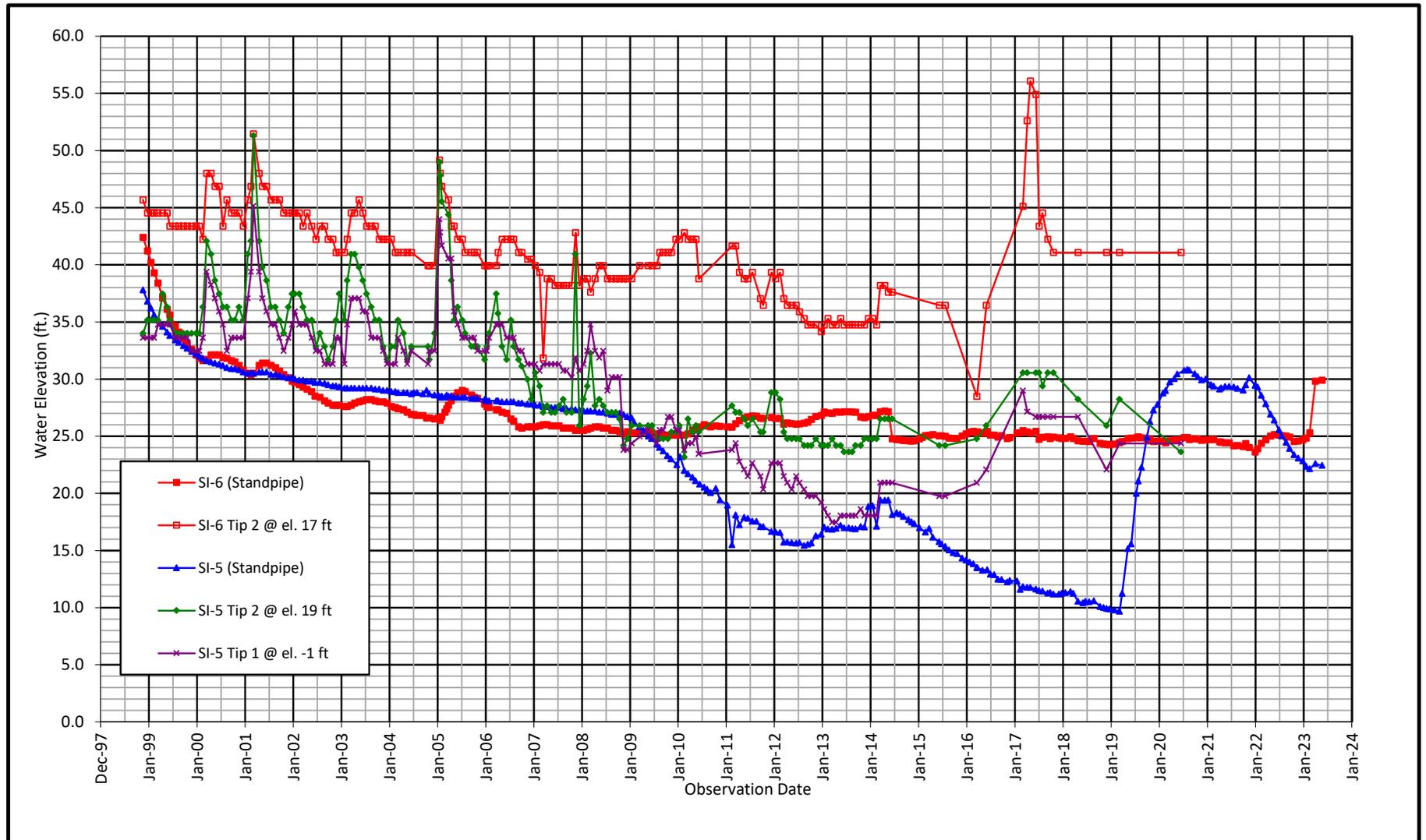
Note: SI-1 thru SI-4 were previously designated MR98-1 thru MR98-4  
 SI-5 and SI-6 were previously designated MR-5 and MR-6  
 \* Piezometer not functioning



**GROUNDWATER HYDROGRAPH**  
 Malibu Road (West End)  
 Malibu Road Landslide Assessment District  
 Malibu, California



**GROUNDWATER HYDROGRAPH**  
**Malibu Road (East End)**  
Malibu Road Landslide Assessment District  
Malibu, California



**GROUNDWATER HYDROGRAPH**  
**Bayshore Drive**  
Malibu Road Landslide Assessment District  
Malibu, California

## APPENDIX B - SLOPE INCLINOMETERS

---

<b>MALIBU ROAD LAD - Slope Incliner Interpretation Summary</b>									
	<b>SI-1 (MR98-1)</b>	<b>SI-1A</b>	<b>SI-2 (MR98-2)</b>	<b>SI-2A</b>	<b>SI-3 (MR98-3)</b>	<b>SI-4 (MR98-4)</b>	<b>SI-4A</b>	<b>SI-5</b>	<b>SI-6</b>
<b>Installation Details</b>									
Previous Ref.Elev.(8/91)	20.0	20.0	20.0	20.0	20.0	22.0	N/A	59.0	57.0
Updated Ref.Elev.(4/00)	20.1	20.0	19.7	19.7	20.3	18.9	18.9	59.3	58.0
Depth (ft.)	34	50	64	64	49	43	50	78	78
Install Date	Apr-98	Aug-06	Apr-98	Sep-10	Apr-98	Apr-98	Aug-12	Apr-98	Apr-98
A+ Axis orientation (deg)	184	197	201	200	190	204	204	176	186
Casing	RST	SI	RST	RST	RST	RST	SI	SI	SI
Installer	BYA	Fugro	BYA	Fugro	BYA	BYA	Fugro	BYA	BYA
Interpreted Rupture Depth (ft)	30-32	23-30	28-32	28-34	35-38	32-34	32-34	unknown	unknown
Status	D	F	D	F	D	D	F	F	F
Reading Interval	Quaterly	Quaterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quaterly	Quarterly
<b>Interpretation Movement (inches)</b>									
2022-2023	NR	0.12	NR	0.20	NR	NR	0.28	--	--
2021-2022	NR	--	NR	--	NR	NR	--	--	--
2020-2021	NR	--	NR	--	NR	NR	--	--	--
2019-2020	NR	--	NR	--	NR	NR	--	--	--
2018-2019	NR	--	NR	--	NR	NR	--	--	--
2017-2018	NR	--	NR	--	NR	NR	--	--	--
2016-2017	NR	0.1	NR	0.15	NR	NR	0.15	--	--
2015-2016	NR	--	NR	--	NR	NR	--	--	--
2014-2015	NR	<0.1	NR	--	NR	NR	--	--	--
2013-2014	NR	0.1	NR	--	NR	NR	--	--	--
2012-2013	NR	<0.1	NR	<0.1	NR	NR	--	0.1	0.1
2011-2012	NR	<0.1	NR	--	NR	--	NR	--	<0.1
2010-2011	NR	<0.1	NR	--	NR	0.6	NR	--	<0.1
2009-2010	NR	<0.1	NR	--	NR	--	NR	--	<0.1
2008-2009	NR	<0.1	<0.1 (4)	NR	NR	--	NR	--	<0.1
2007-2008	NR	<0.1	--	NR	NR	--	NR	--	<0.1
2006-2007	NR	NR	--	NR	NR	--	NR	--	0.1
2004-2005	0.5 (3)	NR	0.4	NR	>1(3)	0.4 to 0.5	NR	~ 0.2 *	--
2003-2004 (1)	--	NR	--	NR	--	--	NR	--	--
2002-2003	~ 0.2 *	NR	~ 0.1 *	NR	--	--	NR	--	--
2001-2002	--	NR	--	NR	--	--	NR	--	--
2000-2001	0.5	NR	0.4	NR	0.3	0.6	NR	--	--
1999-2000	--	NR	--	NR	--	--	NR	--	--
1998-1999	3.1	NR	1.5	NR	4.1	1.3 (2)	NR	--	--

**NOTES:**

**D** Destroyed

**F** Functioning

**NI** No information

(1) Readings only through March 2004

(2) Readings are through 2000, although majority of movement occurred in 1998

(3) Inclinerometer sheared off in January, 2005.

(4) Inclinerometer sheared off winter of 2009.

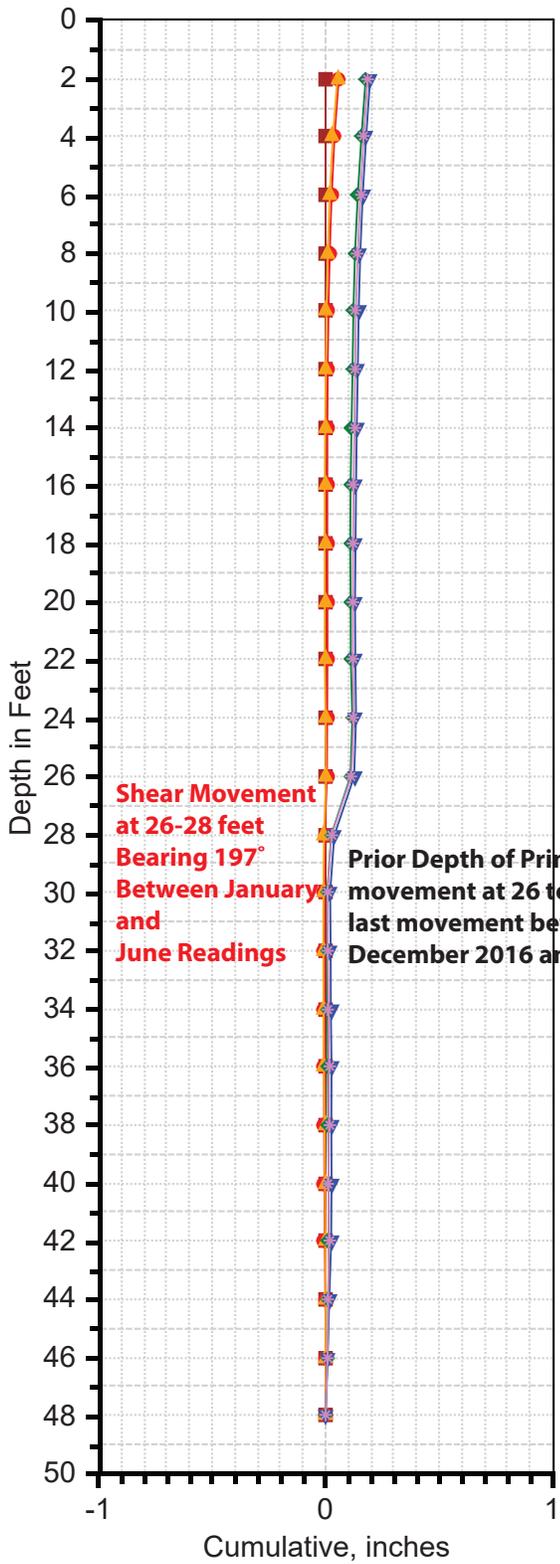
**NR** No reading

-- No clearly defined interpreted movement.

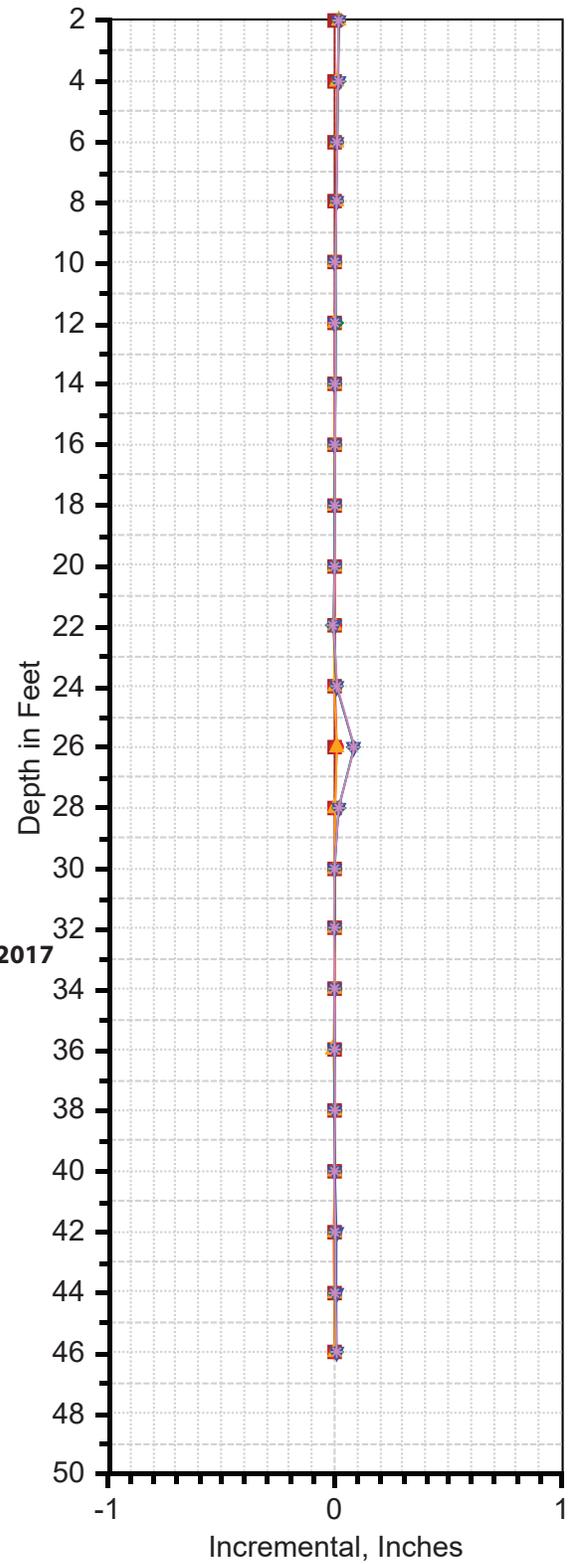
~ 0.1 \* Indicated displacement is less than reliable instrument accuracy. Interpreted movement is theoretical.

**SUMMARY OF SLOPE INCLINOMETERS**  
**Malibu Road Landslide Assessment District**  
**Malibu, California**

A-17°



A+197°



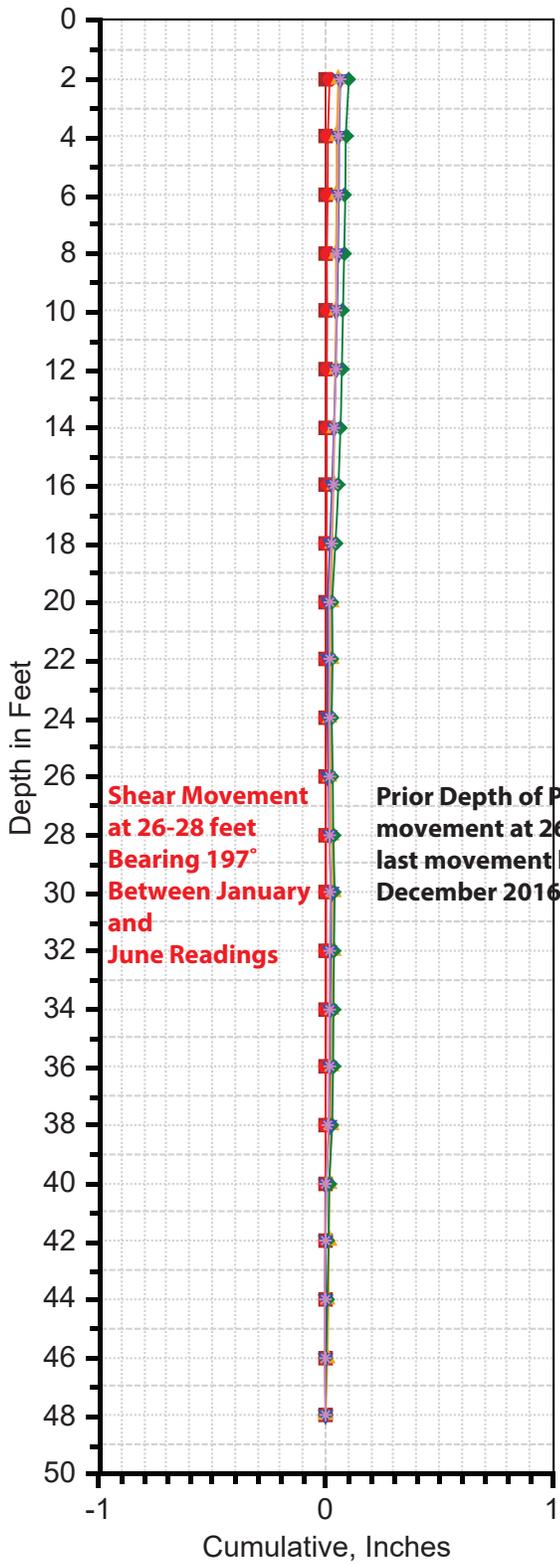
■ 5/4/2021    ● 1/18/2023    ▲ 1/30/2023  
◆ 6/9/2023    ▼ 6/15/2023    ✦ 7/7/2023

■ 5/4/2021    ● 1/18/2023    ▲ 1/30/2023  
◆ 6/9/2023    ▼ 6/15/2023    ✦ 7/7/2023

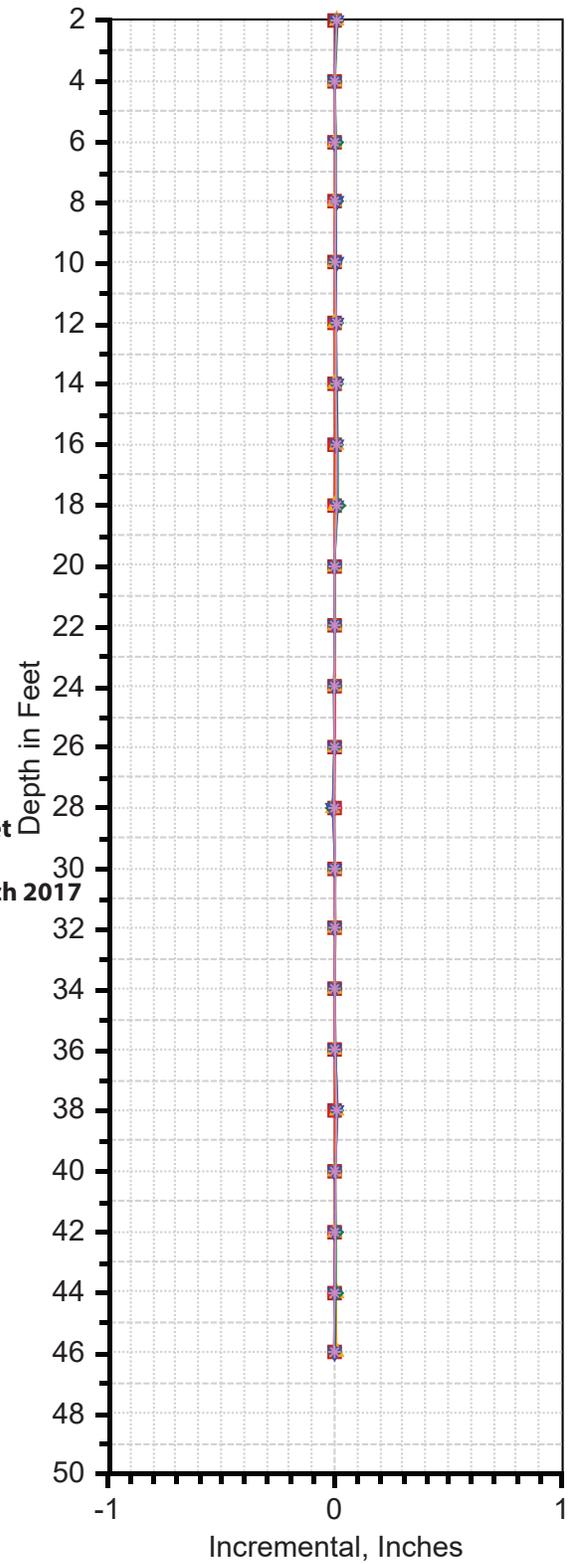
Plot of Slope Inclinometer  
**SI-1A**

Plot Type: Cumulative and Incremental		Plot Direction: A-Direction	
Depth of Survey (ft): 46		Baseline Date: 5/04/2021	
Install Date: 8/2006		Corrections: None	
Installed Depth (ft): 50	Interpreted Movement Since Baseline (in): 0.12	Interpreted Movement Monitoring Year (in): 0.12	

B-  
107°



B+  
287°

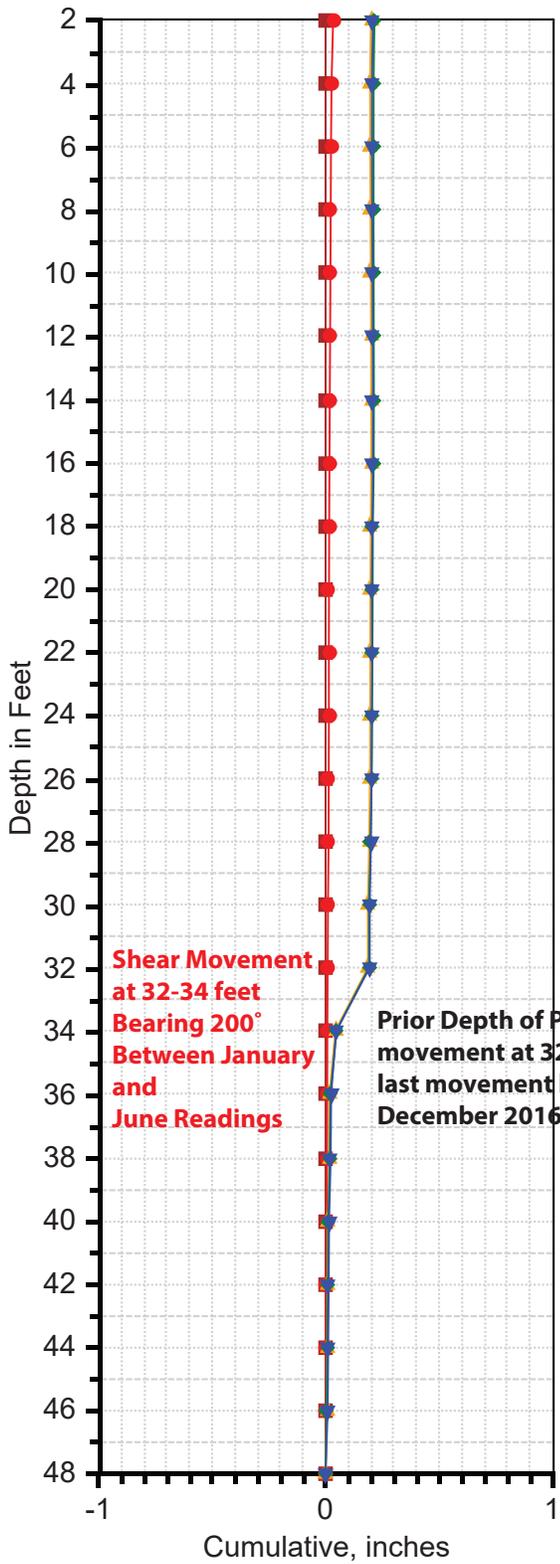


- 5/4/2021
- 1/18/2023
- ▲ 1/30/2023
- ◆ 6/9/2023
- ▼ 6/15/2023
- ✦ 7/7/2023

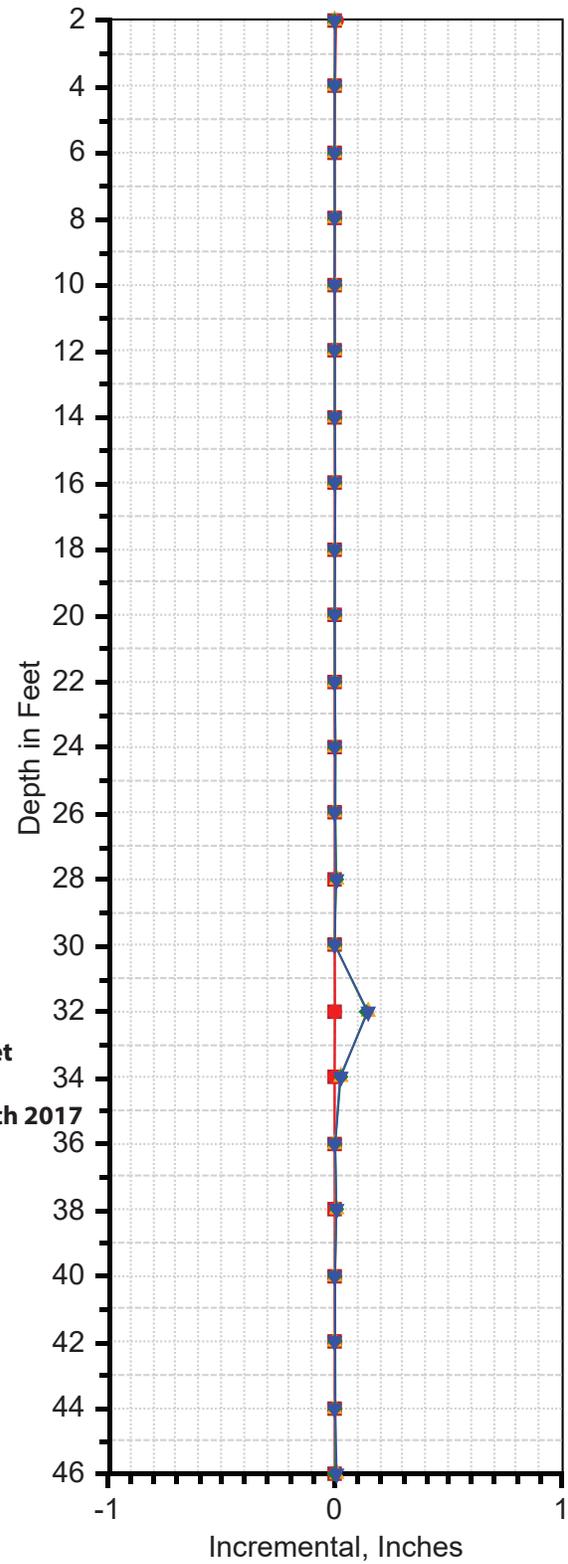
- 5/4/2021
- 1/18/2023
- ▲ 1/30/2023
- ◆ 6/9/2023
- ▼ 6/15/2023
- ✦ 7/7/2023

<b>Plot of Slope Inclinometer</b>  <h1 style="margin: 0;">SI-1A</h1>	Plot Type: Cumulative and Incremental		Plot Direction: B-Direction
	Depth of Survey (ft): 46	Baseline Date: 5/04/2021	
	Install Date: 8/2006	Installed Depth (ft): 50	Interpreted Movement Since Baseline (in): 0.12
		Interpreted Movement Monitoring Year (in): 0.12	

A-20°



A+200°

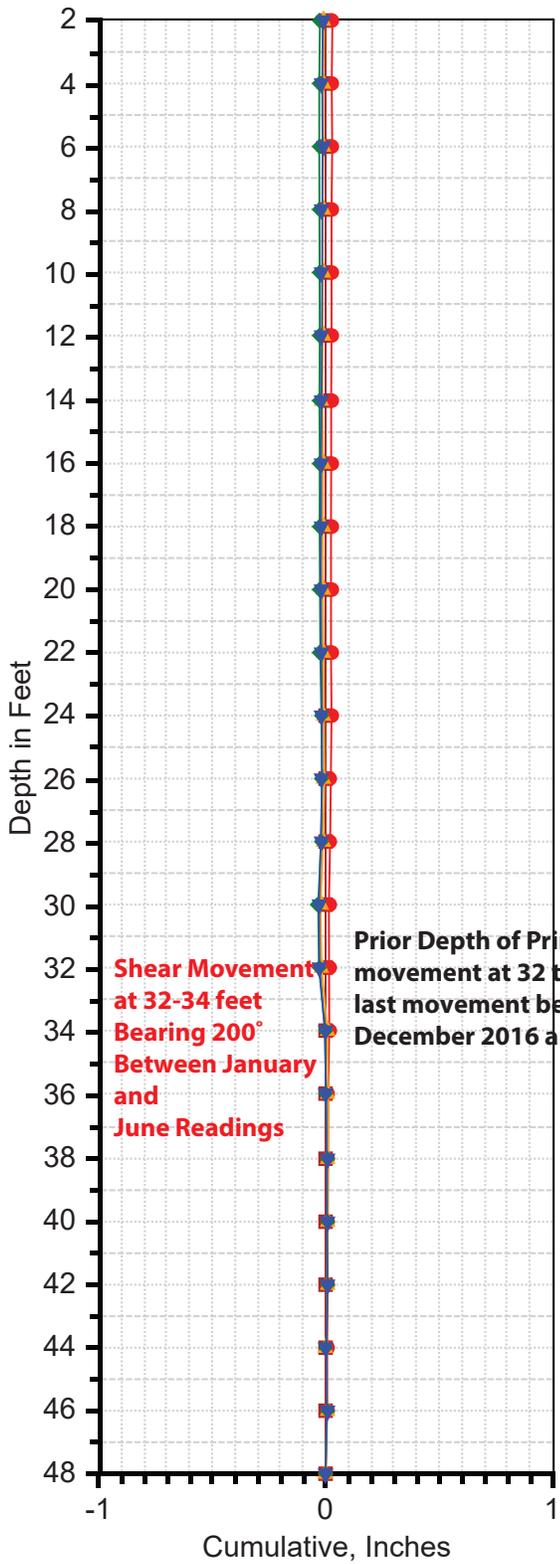


■ 8/13/2021    ● 1/30/2023    ▲ 6/7/2023  
◆ 6/15/2023    ▼ 7/7/2023

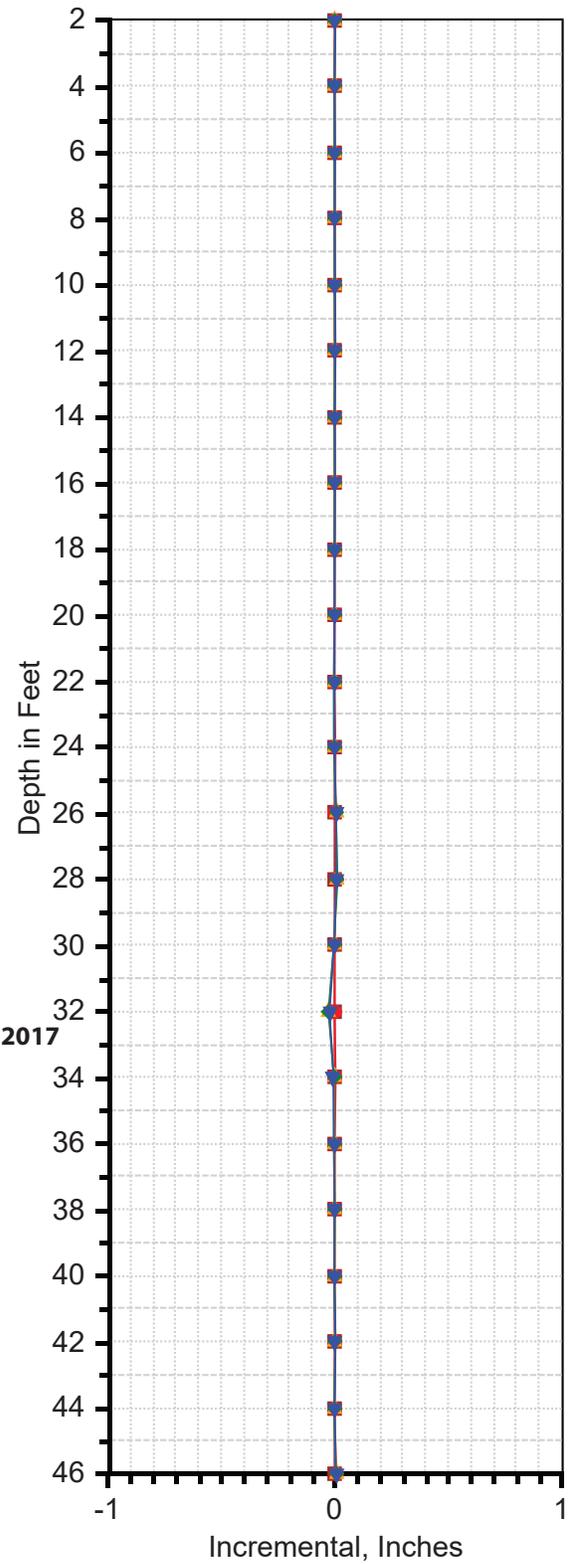
■ 8/13/2021    ● 1/30/2023    ▲ 6/7/2023  
◆ 6/15/2023    ▼ 7/7/2023

Plot of Slope Inclinometer  <h2 style="margin: 0;">SI-2A</h2>	Plot Type: Cumulative and Incremental		Plot Direction: A-Direction
	Depth of Survey (ft):	48	Baseline Date: 8/13/2021
	Install Date: 9/2010	Installed Depth (ft): 64	Interpreted Movement Since Baseline (in): 0.20
			Corrections: None

B-110°



B+290°

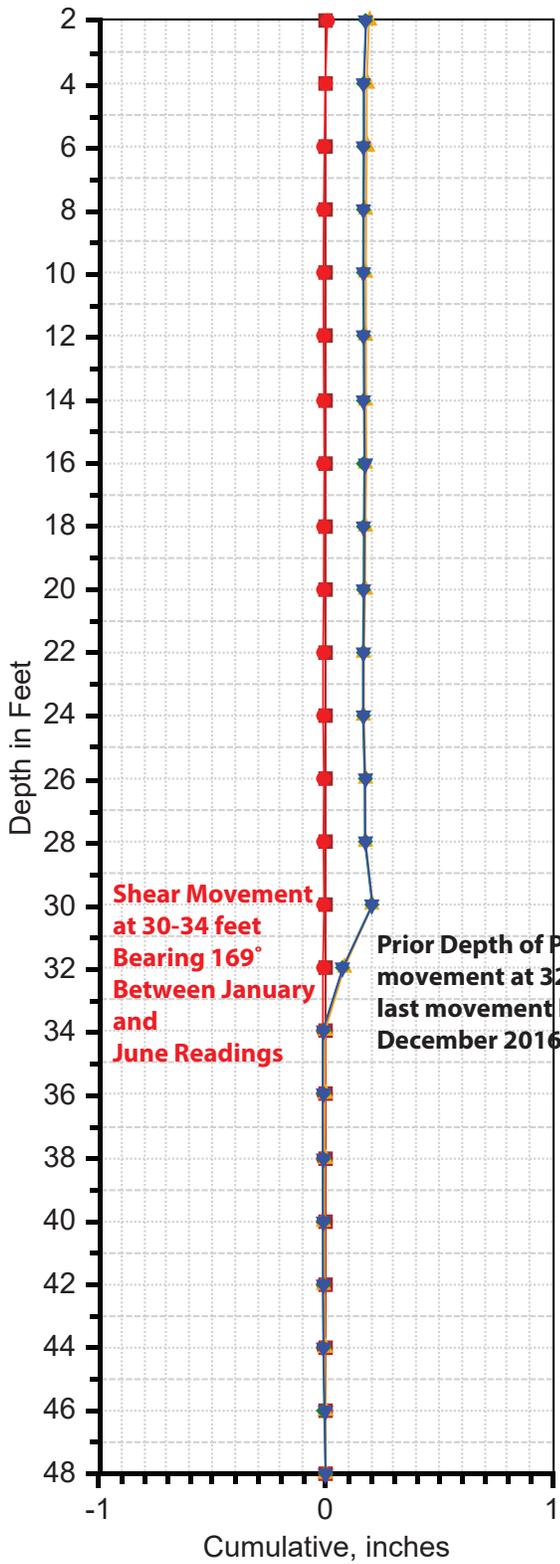


■ 8/13/2021    ● 1/30/2023    ▲ 6/7/2023  
◆ 6/15/2023    ▼ 7/7/2023

■ 8/13/2021    ● 1/30/2023    ▲ 6/7/2023  
◆ 6/15/2023    ▼ 7/7/2023

Plot of Slope Inclinometer  <b>SI-2A</b>	Plot Type: Cumulative and Incremental		Plot Direction: B-Direction
	Depth of Survey (ft): 48	Baseline Date: 8/13/2021	Corrections: None
	Install Date: 9/2010	Installed Depth (ft): 64	Interpreted Movement Since Baseline (in): 0.20
			Interpreted Movement Monitoring Year (in): 0.20

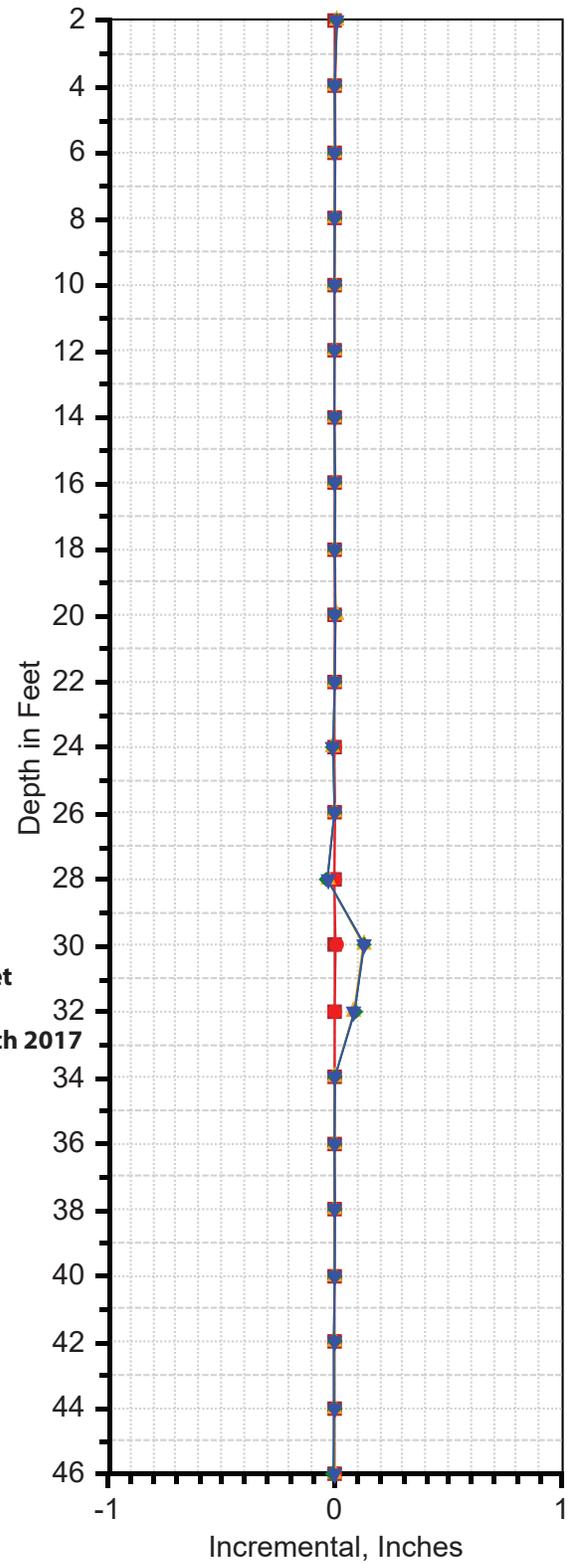
A-24°



Shear Movement at 30-34 feet Bearing 169° Between January and June Readings

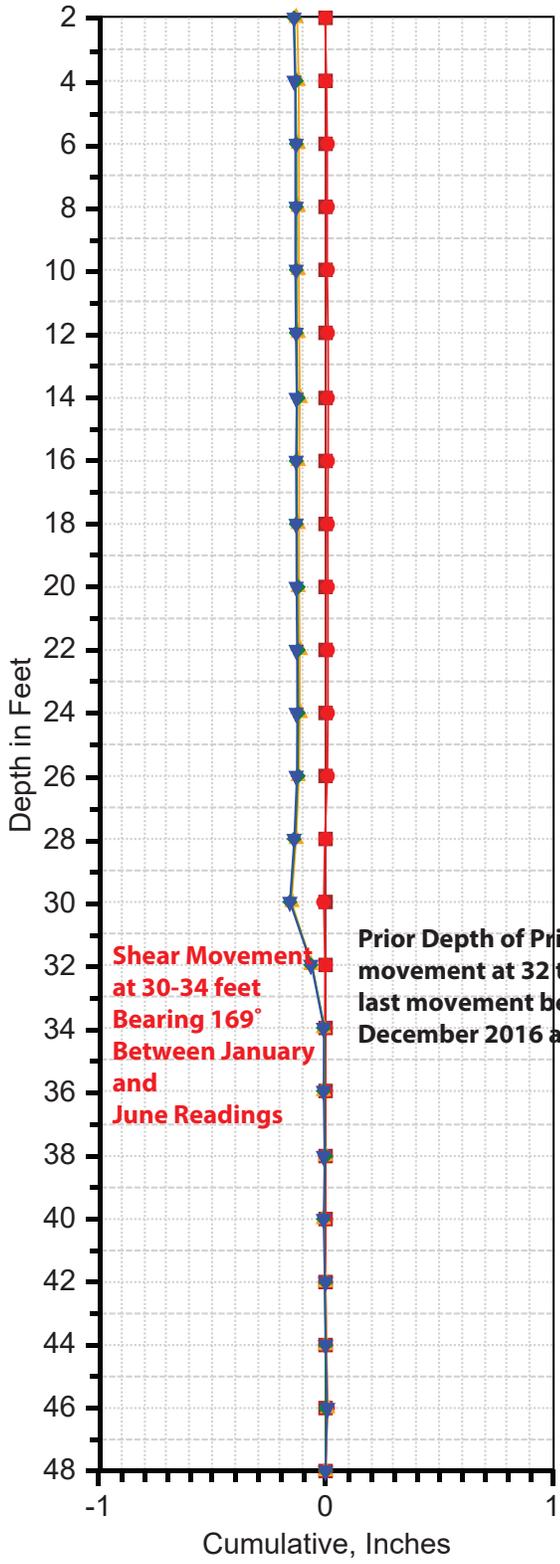
Prior Depth of Primary movement at 32 to 34 feet last movement between December 2016 and March 2017

A+204°

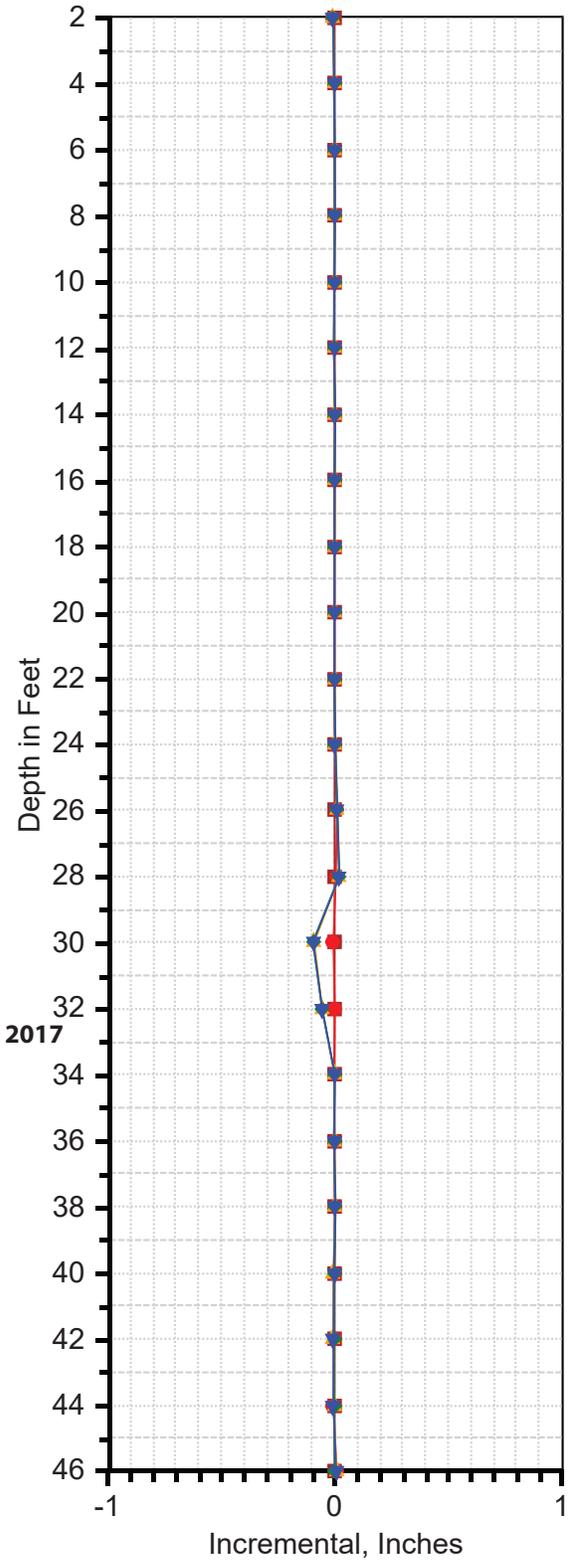


Plot of Slope Inclinometer  <b>SI-4A</b>	Plot Type: Cumulative and Incremental		Plot Direction: A-Direction	
	Depth of Survey (ft): 48		Baseline Date: 8/06/2021	
	Install Date: 8/2012	Installed Depth (ft): 50	Interpreted Movement Since Baseline (in): 0.28	Interpreted Movement Monitoring Year (in): 0.28

B-  
114°

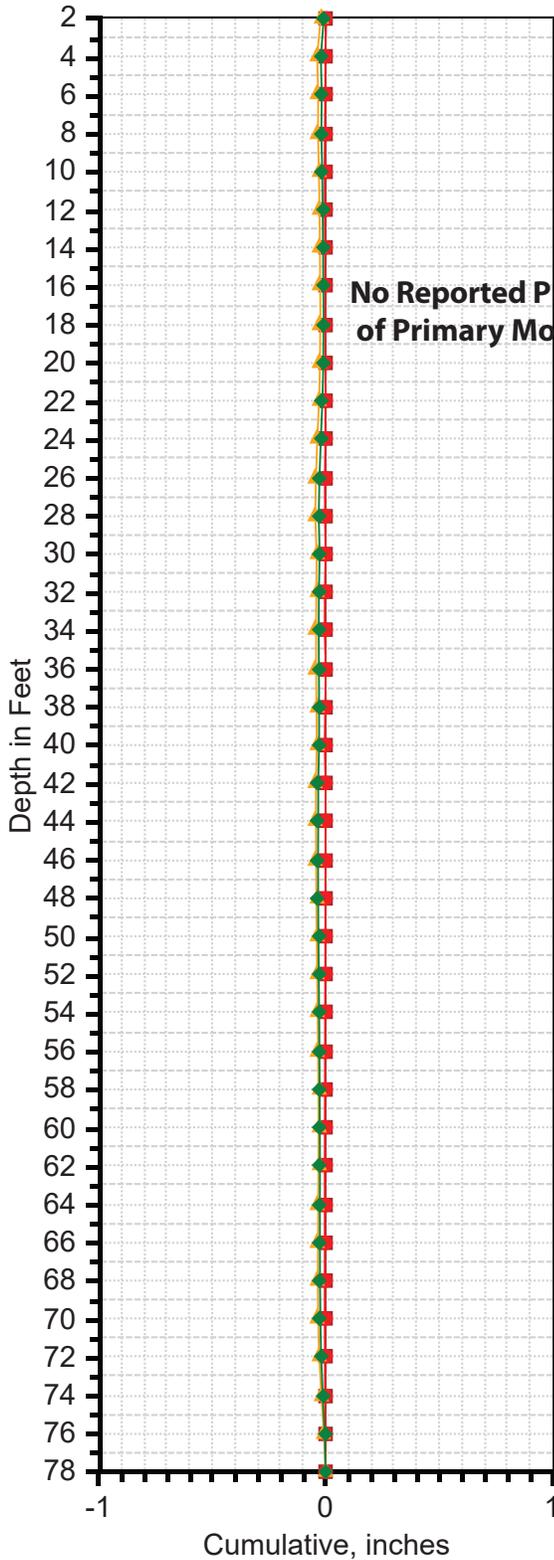


B+  
294°

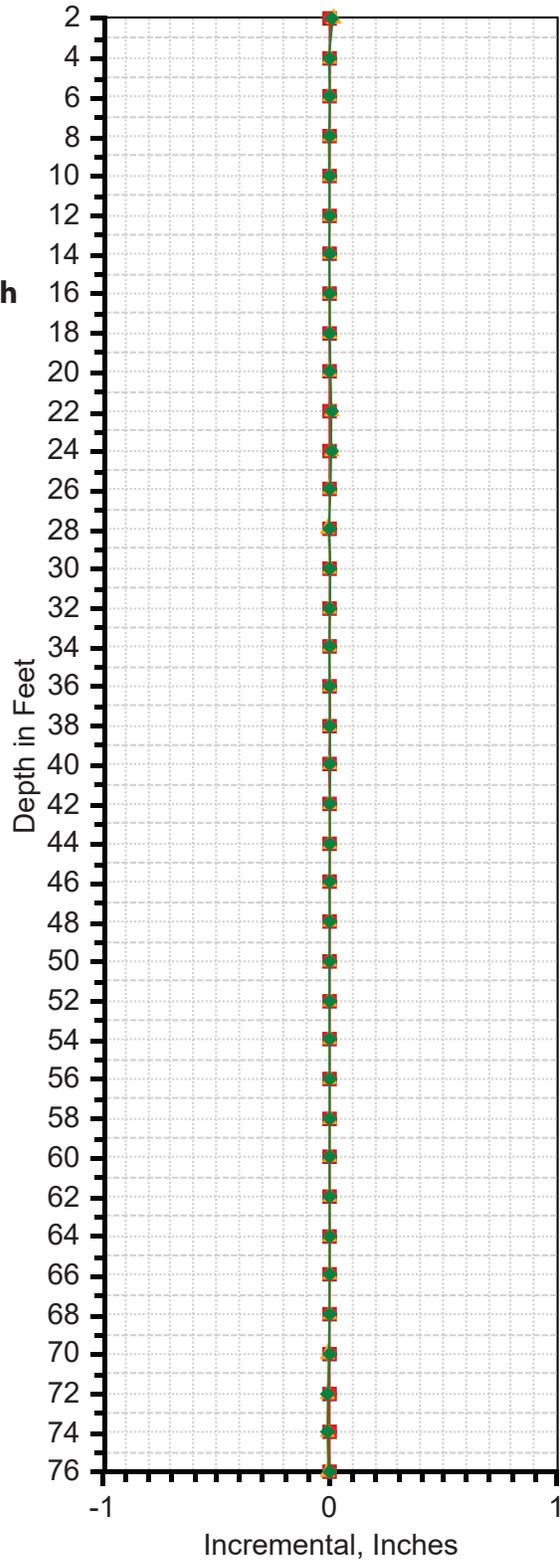


<b>Plot of Slope Inclinometer</b>  <b>SI-4A</b>	Plot Type: Cumulative and Incremental		Plot Direction: B-Direction
	Depth of Survey (ft): 48	Baseline Date: 8/6/2021	Corrections: None
	Install Date: 8/2012	Installed Depth (ft): 50	Interpreted Movement Since Baseline (in): 0.28
			Interpreted Movement Monitoring Year (in): 0.28

A-  
356°



A+  
176°



■ 5/3/2021    ● 1/18/2023  
▲ 6/6/2023    ◆ 7/6/2023

■ 5/3/2021    ● 1/18/2023  
▲ 6/6/2023    ◆ 7/6/2023

Plot of Slope Inclinometer

SI-5

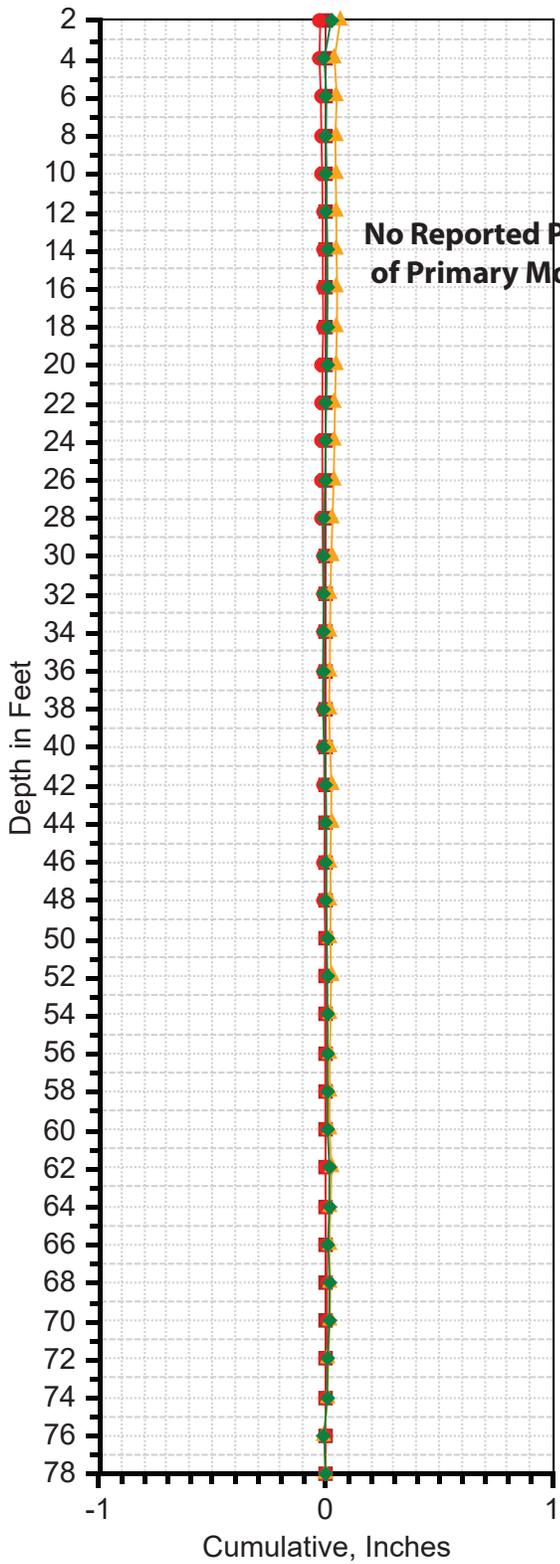
Plot Type: Cumulative and Incremental		Plot Direction: A-Direction	
Depth of Survey (ft): 78		Baseline Date: 5/3/2021	
Install Date: 4/1998		Corrections: None	
Installed Depth (ft): 78	Interpreted Movement Since Baseline (in): 0	Interpreted Movement Monitoring Year (in): 0	



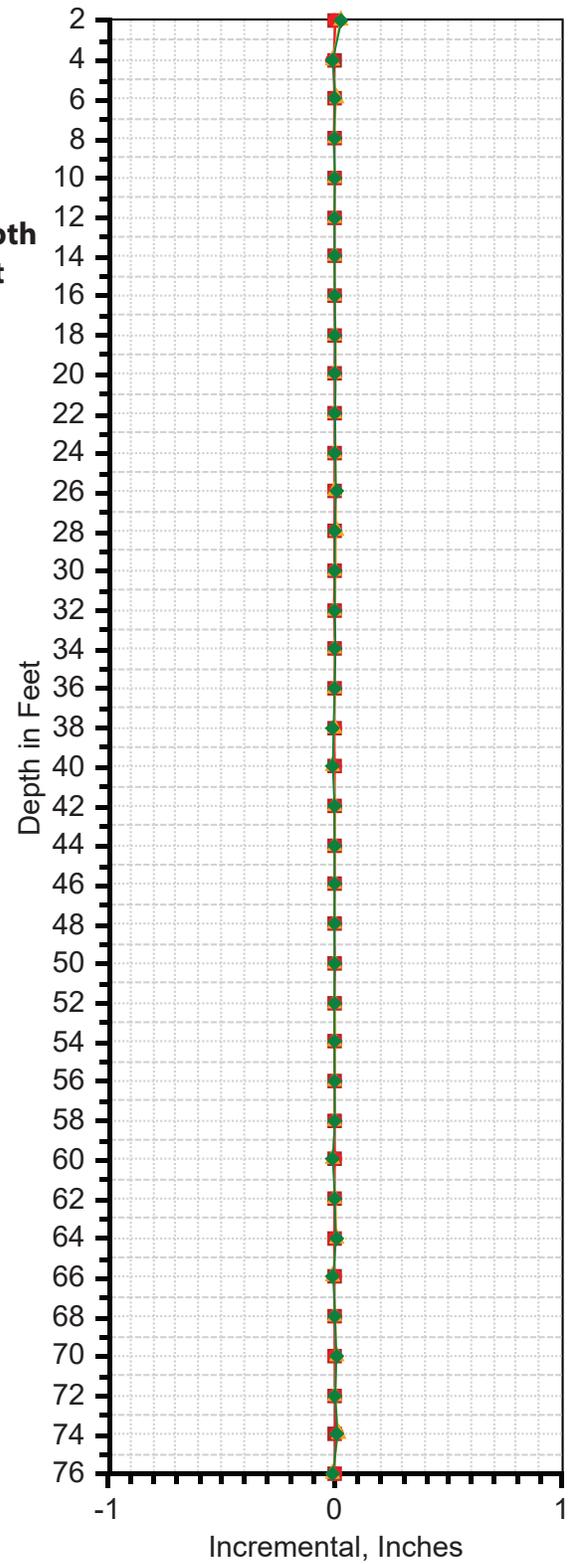
**Yeh and Associates, Inc.**  
Geotechnical • Geological • Construction Services

PROJECT:	<b>Malibu Road LAD</b> Malibu, CA	PROJECT NUMBER:	<b>220-278</b>
REVISION DATE:	8/7/2023		Plate B-8

B-  
86°



B+  
266°

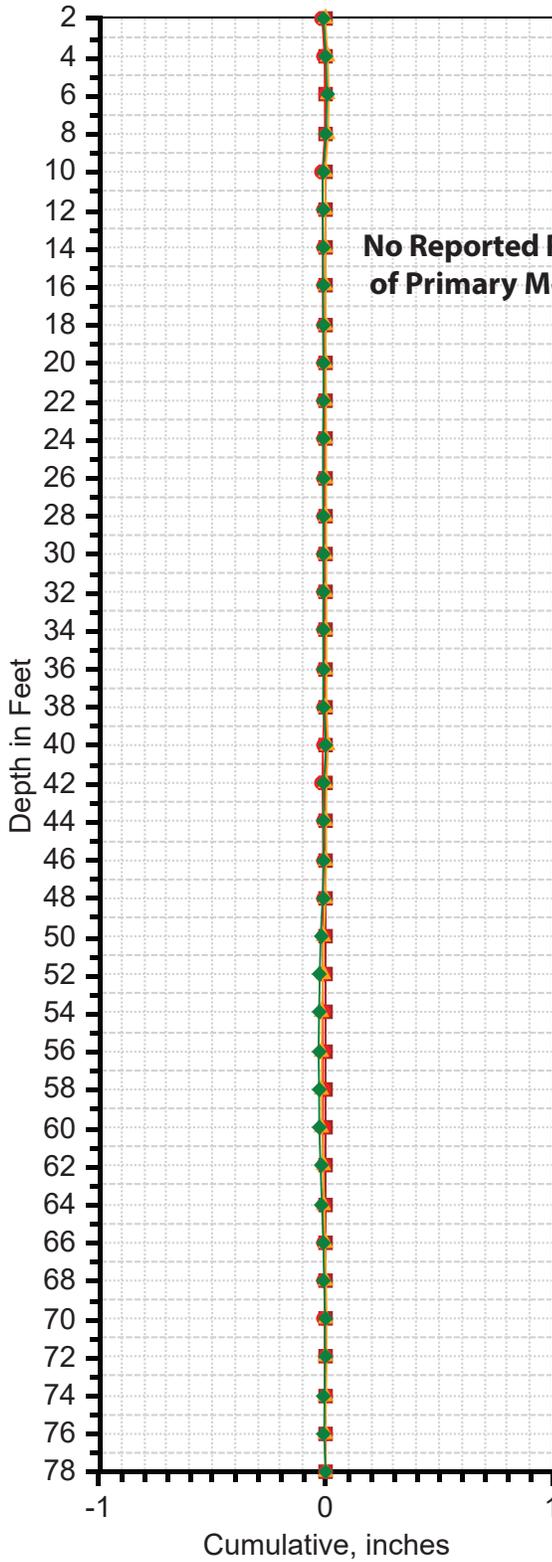


■ 5/3/2021    ● 1/18/2023  
▲ 6/6/2023    ◆ 7/6/2023

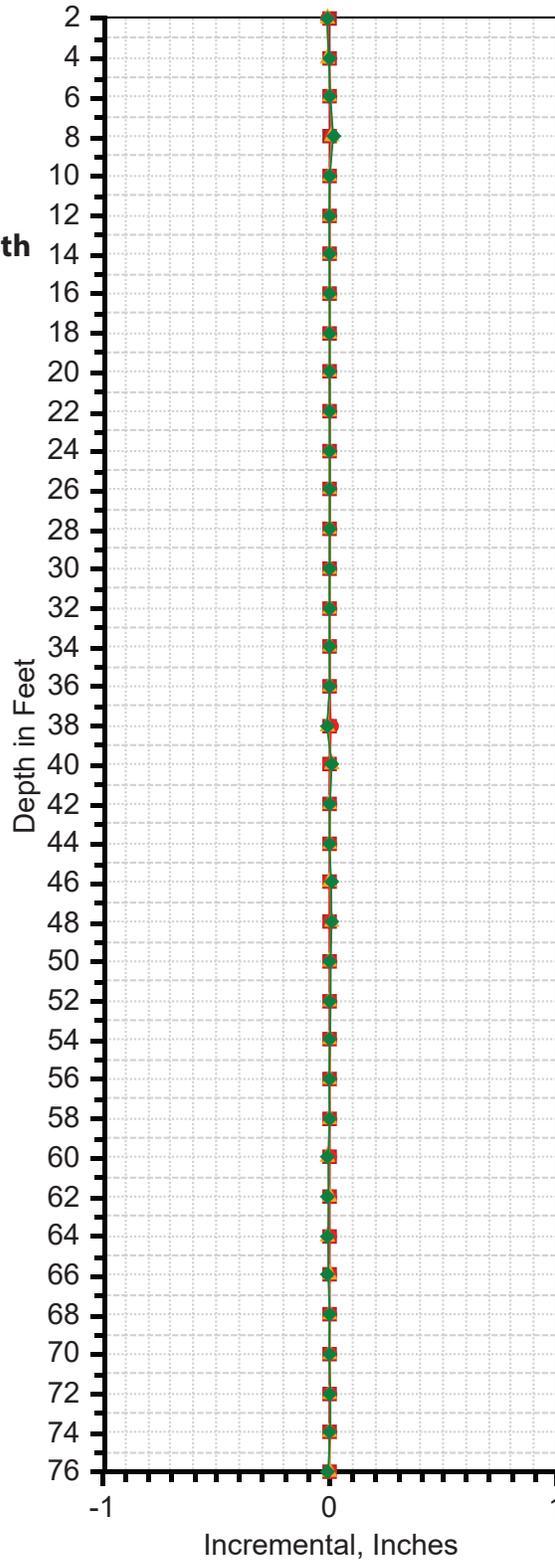
■ 5/3/2021    ● 1/18/2023  
▲ 6/6/2023    ◆ 7/6/2023

Plot of Slope Inclinometer  <b>SI-5</b>	Plot Type: Cumulative and Incremental		Plot Direction: B-Direction
	Depth of Survey (ft): 78	Baseline Date: 5/3/2021	Corrections: None
	Install Date: 4/1998	Installed Depth (ft): 78	Interpreted Movement Since Baseline (in): 0
		Interpreted Movement Monitoring Year (in): 0	

A-  
6°



A+  
186°



■ 5/3/2021    ● 1/18/2023  
▲ 6/6/2023    ◆ 7/6/2023

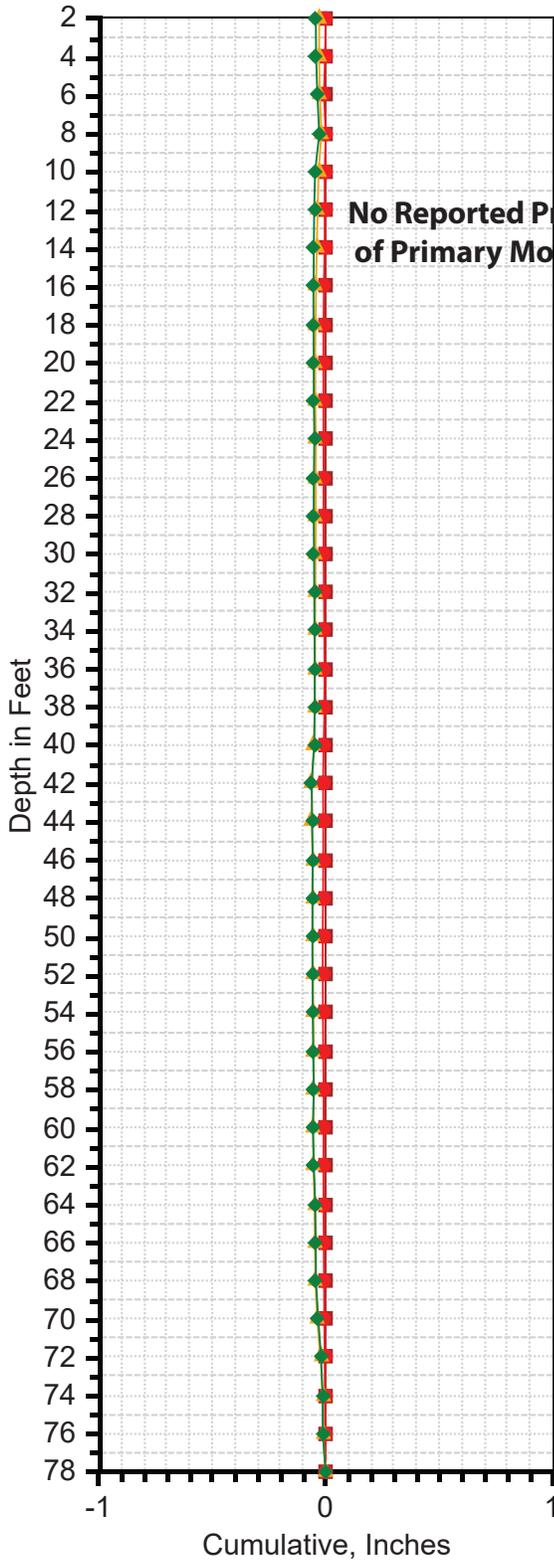
■ 5/3/2021    ● 1/18/2023  
▲ 6/6/2023    ◆ 7/6/2023

Plot of Slope Inclinometer

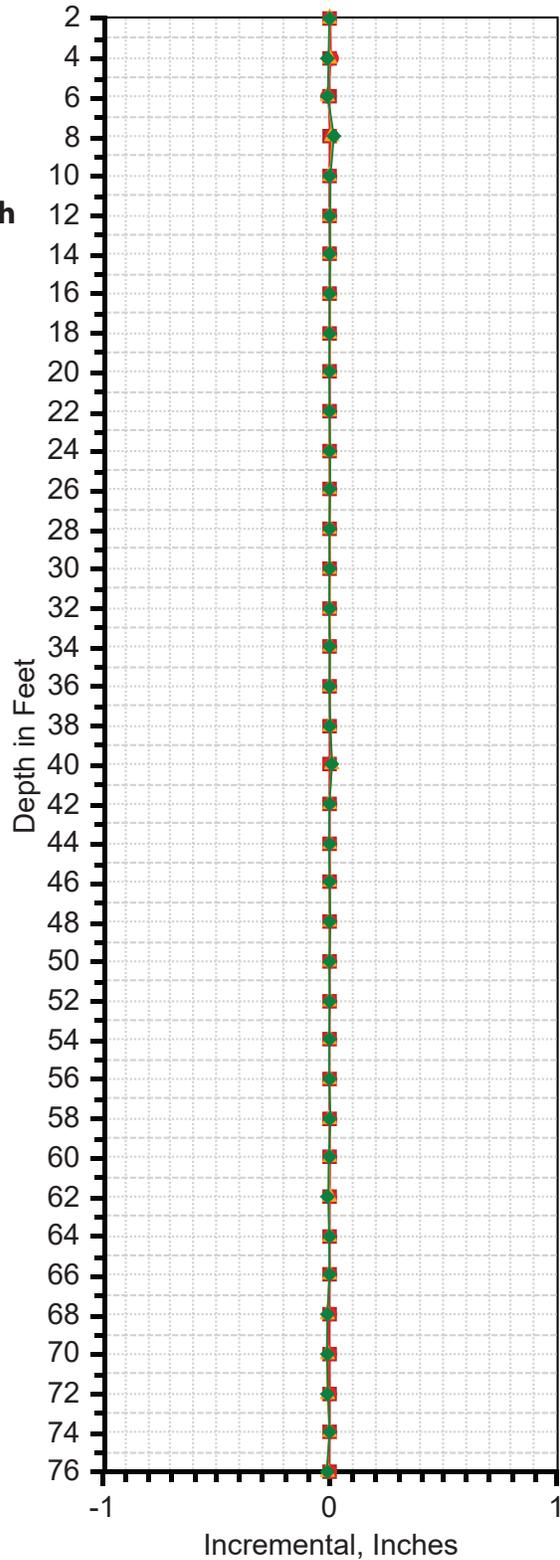
SI-6

Plot Type: Cumulative and Incremental		Plot Direction: A-Direction
Depth of Survey (ft): 78	Baseline Date: 5/3/2021	Corrections: None
Install Date: 4/1998	Installed Depth (ft): 78	Interpreted Movement Since Baseline (in): 0
		Interpreted Movement Monitoring Year (in): 0

B-  
96°



B+  
276°



■ 5/3/2021    ● 1/18/2023  
▲ 6/6/2023    ◆ 7/6/2023

■ 5/3/2021    ● 1/18/2023  
▲ 6/6/2023    ◆ 7/6/2023

Plot of Slope Inclinometer

SI-6

Plot Type: Cumulative and Incremental		Plot Direction: B-Direction
Depth of Survey (ft): 78	Baseline Date: 5/3/2021	Corrections: None
Install Date: 4/1998	Installed Depth (ft): 78	Interpreted Movement Since Baseline (in): 0
		Interpreted Movement Monitoring Year (in): 0

**APPENDIX C - DEWATERING**

---

<b>MALIBU ROAD LAD - Dewatering Well Information</b>							
Well ID	Vault Elevation (ft.)	Bottom Elevation (ft.)	Pump Elevation (ft.)	Pump Size (hp)	2022-2023 Mean Pumping Rate (gpd)	% of Total Well Production	Installed By
W-3	19.5	-4.0	Unknown	1/2	437	31%	LA Co.
W-4	20.0	-9.0	-4.0	1/2	0	0%	LA Co.
W-5	19.0	-9.5	Unknown	1/2	130	9%	LA Co.
W-6	20.0	-4.5	0.0	1/2	18	1%	LA Co.
W-8	27.5	11.0	Unknown	1/2	8	1%	LA Co.
W-9	20.0	-40.0	-35.0	1/3	11	1%	LA Co.
W-10	19.0	-26.0	-21.0	1/3	85	6%	LA Co.
W-11	61.0	1.0	13.0	1/3	46	3%	BYA
W-12	58.0	-2.0	8.0	1/3	401	28%	BYA
W-13	20.0	-28.0	N/A	N/A	0	0%	Fugro
W-14	60.0	-20.0	Unknown	1/3	220	15%	Fugro
NW-1	Unknown	Unknown	Unknown	Unknown	5	0%	Homeowner
NW-2	Unknown	Unknown	Unknown	Unknown	56	4%	Homeowner
NW-3	Unknown	Unknown	Unknown	Unknown	2	0%	Homeowner

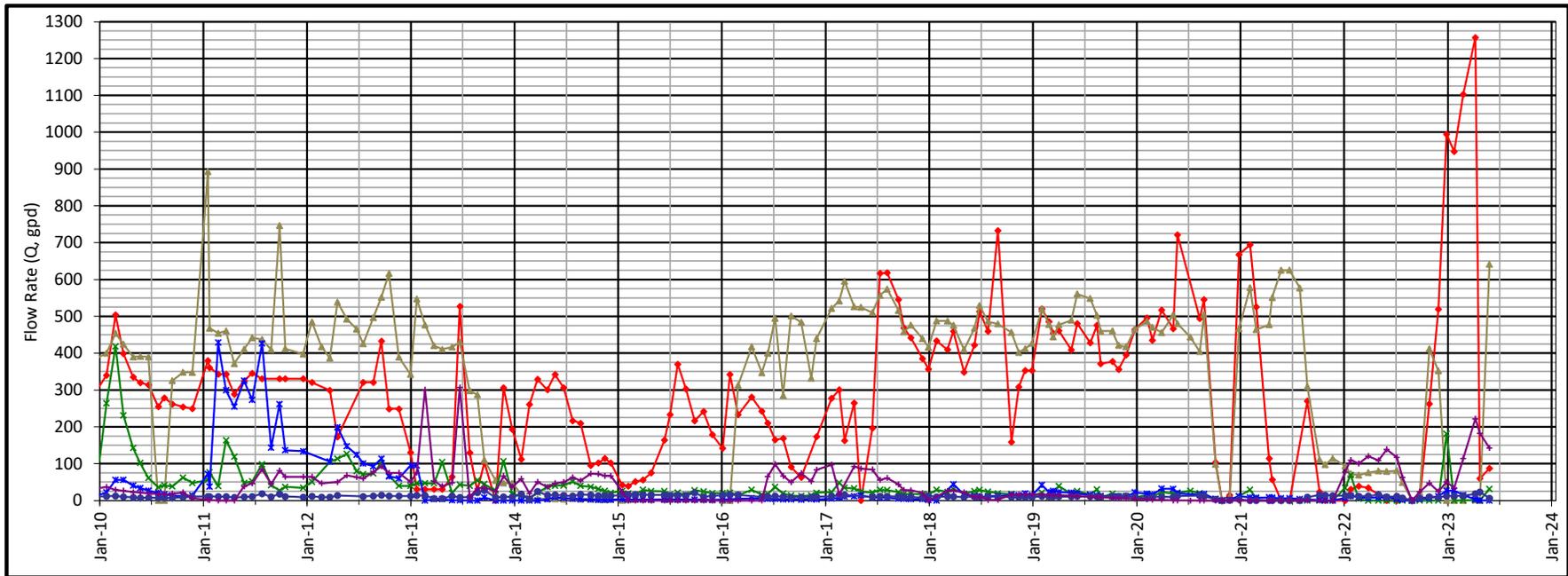
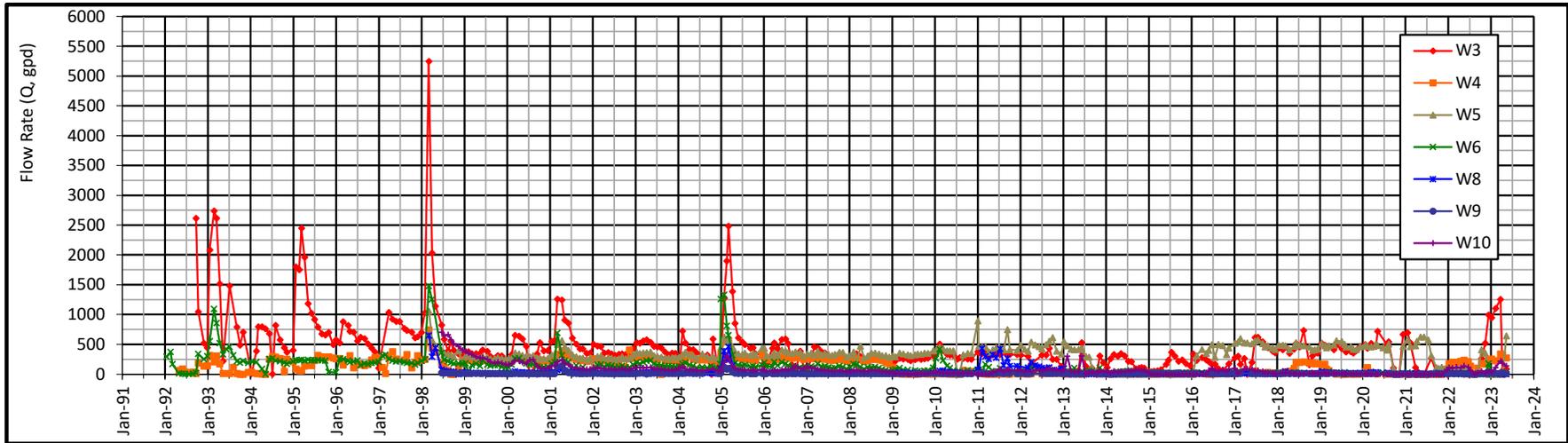
<b>MALIBU ROAD LAD- Hydrauger Information</b>						
Hydrauger ID	Installed Length (ft.)	Bearing	Functional Length* (ft)	2022-2023 Mean Flow Rate (gpd)	% of Total Production	Installed By
HD-1**	Unknown	N05E	74	0	0%	LA County
HD-2**	Unknown	N21E	34	0	0%	LA County
HD-3**	Unknown	N06E	13	0	0%	LA County
HD-4	Unknown	N29E	53	0	0%	LA County
HD-5A	Unknown	N13E	41	55	18%	LA County
HD-6	Unknown	N08W	55	0	0%	LA County
HD-7	Unknown	N26E	87	14	5%	LA County
HD-8	Unknown	N19E	92	0	0%	LA County
HD-8A	Unknown	Unknown	Unknown	48	16%	Unknown
HD-9	Unknown	N34E	76	0	0%	LA County
HD-10	Unknown	N19E	55	0	0%	LA County
HD-11	Unknown	N11E	78	11	4%	LA County
HD-12	Unknown	N08E	70	0	0%	LA County
HD-13	Unknown	N09E	79	0	0%	LA County
HD-14	Unknown	N08E	80	0	0%	LA County
HD-15	Unknown	N14E	82	0	0%	LA County
HD-16	Unknown	N15E	69	0	0%	LA County
HD-17**	150	N15E	150	0	0%	BYA
HD-18	150	N18E	150	2	1%	BYA
HD-19	150	N10E	150	17	6%	BYA
HD-20	150	N09W	150	48	16%	BYA
HD-21	150	N22E	150	38	13%	BYA
HD-22	180	N13E	180	0	0%	Fugro West
HD-23	160	N01E	160	65	22%	Fugro West

Note: \* Measured on 4/1/98 (except HD-22 and HD-23 installed 1/22/05)

\*\* buried/unable to locate

**DEWATERING WELL / HYDRAUGER INFORMATION**

Malibu Road Landslide Assessment District  
 Malibu, California

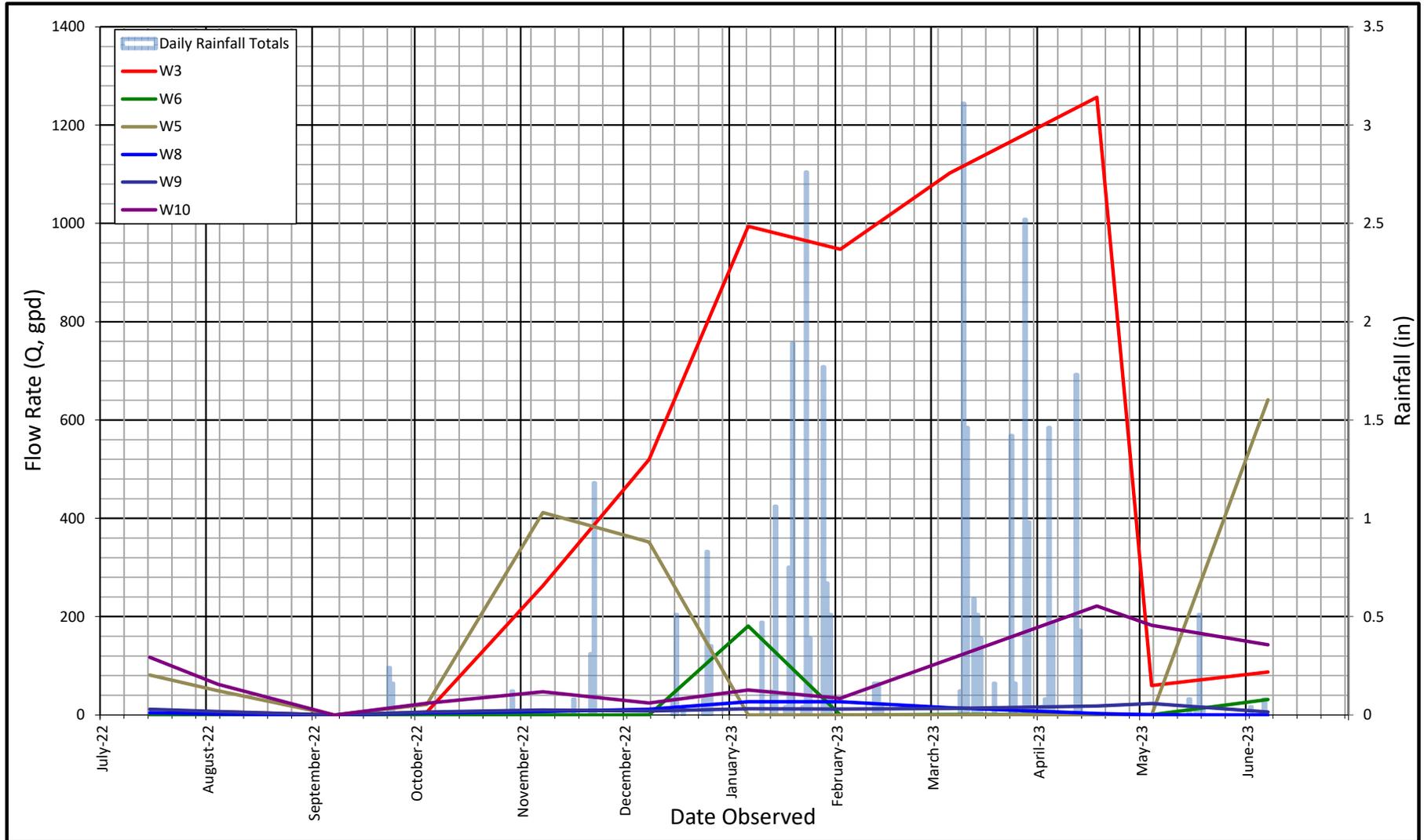


**DEWATERING WELL DISCHARGE RATE GRAPH (HISTORIC)**

**Malibu Road**

Malibu Road Landslide Assessment District

Malibu, California

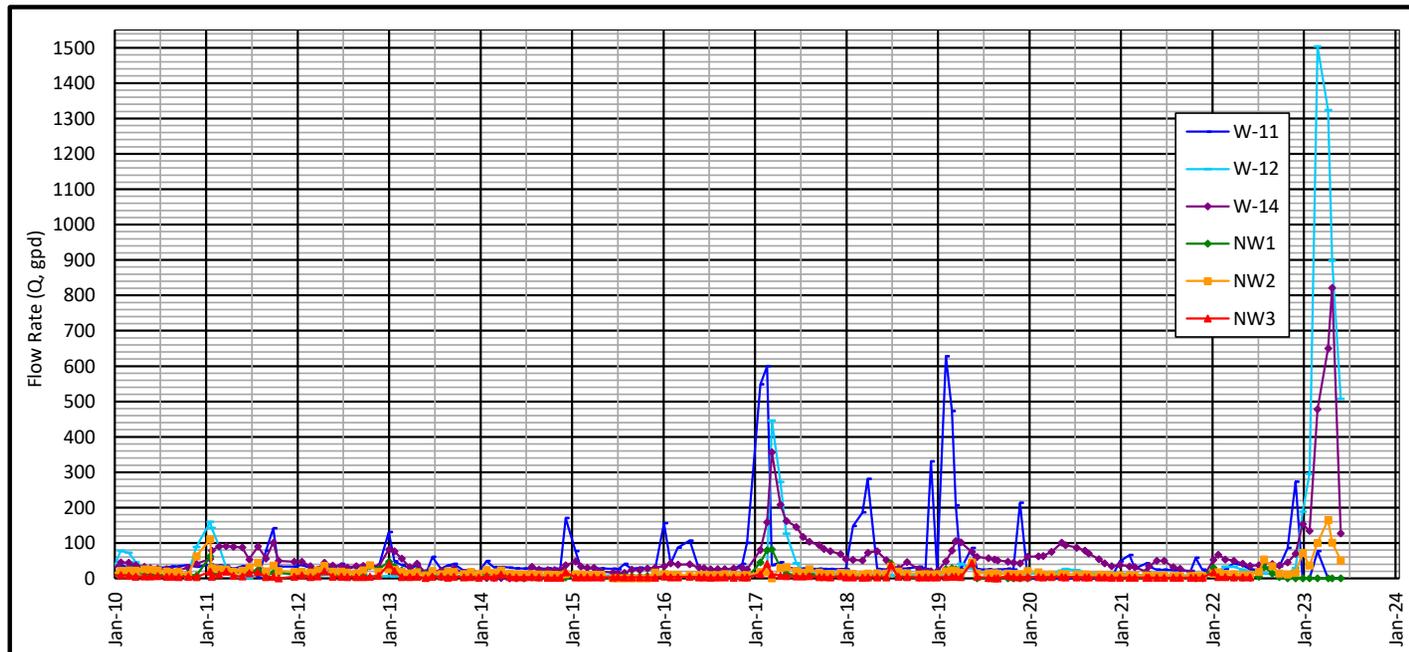
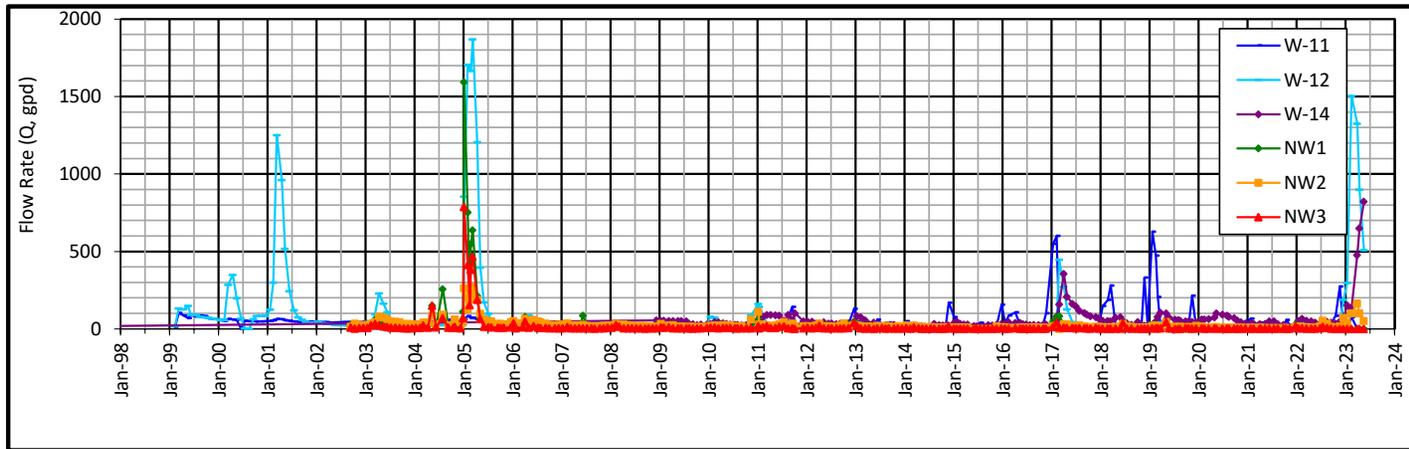


**DEWATERING WELL DISCHARGE RATE GRAPH (MONITORING YEAR)**

**Malibu Road**

Malibu Road Landslide Assessment District

Malibu, California

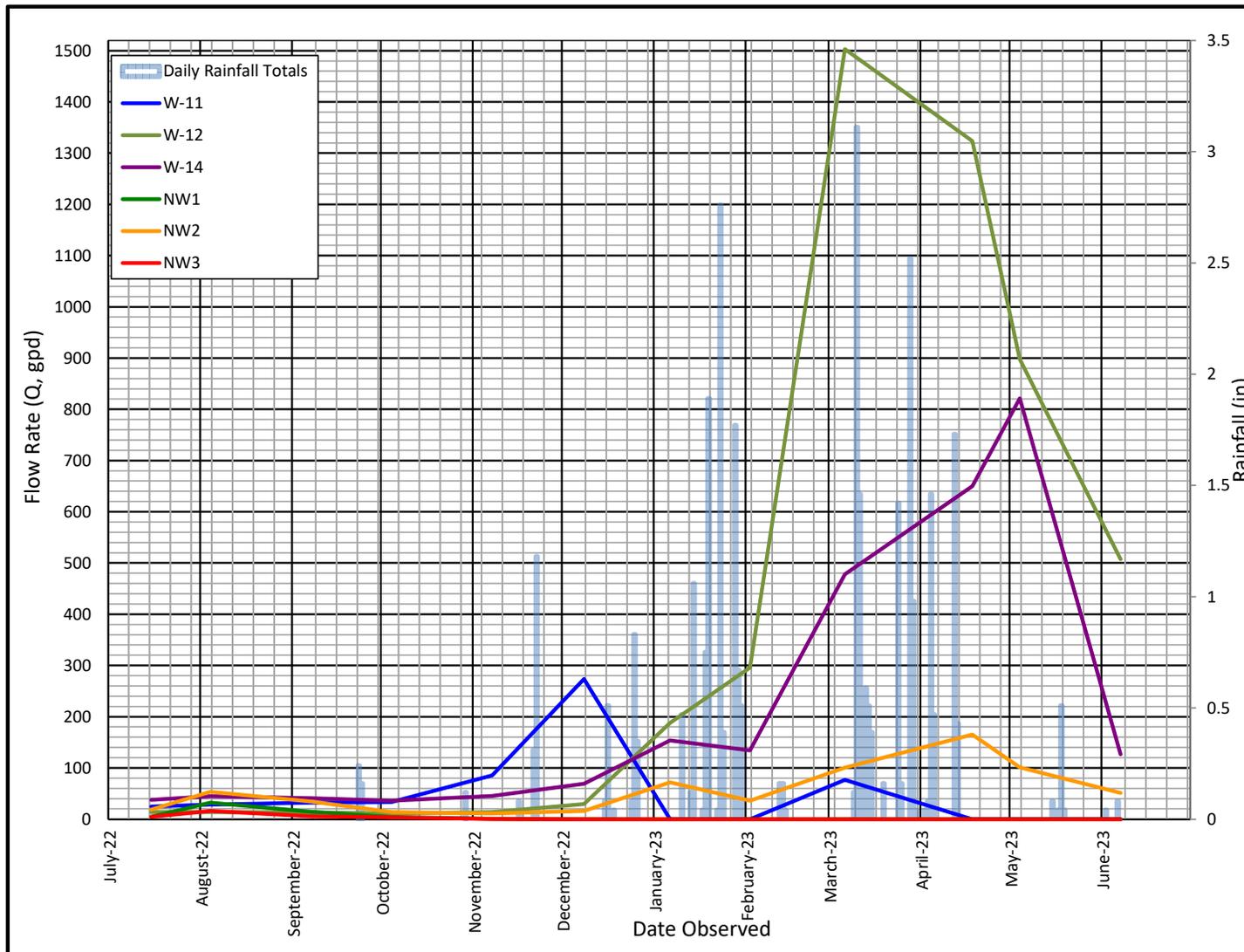


**DEWATERING WELL DISCHARGE RATE GRAPH (HISTORIC)**

**Bayshore Drive**

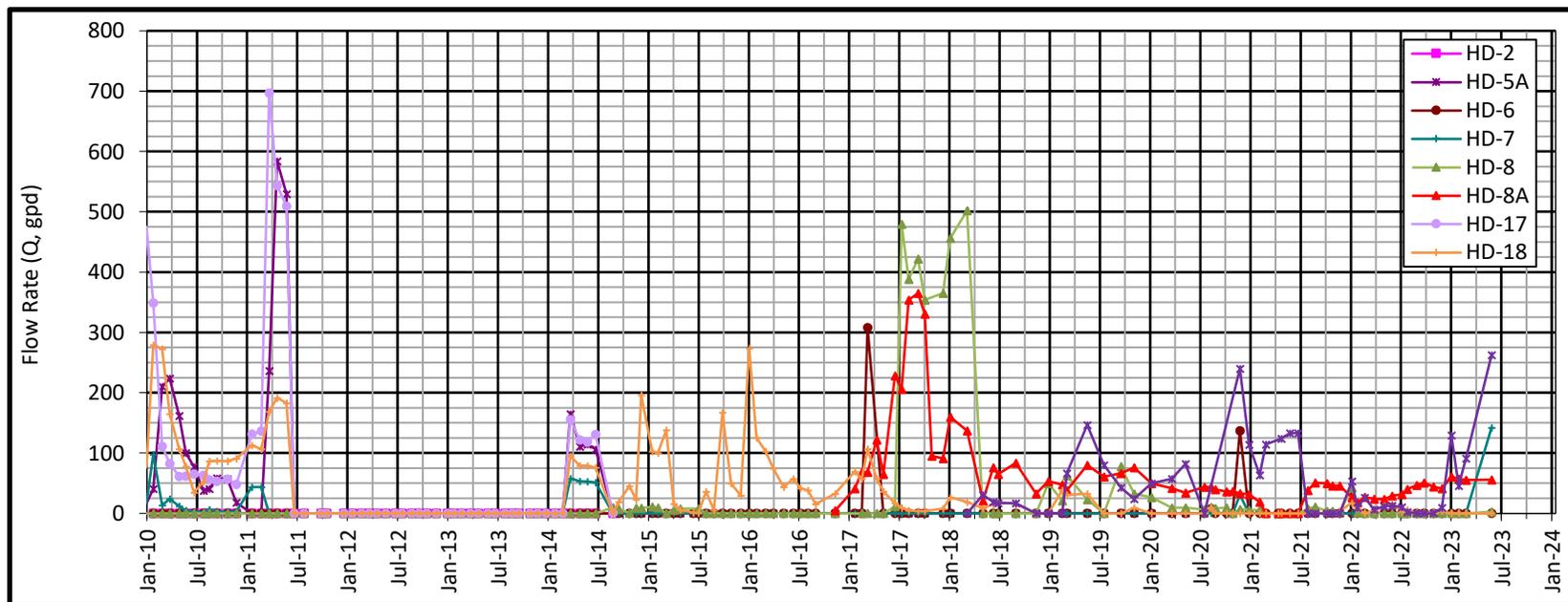
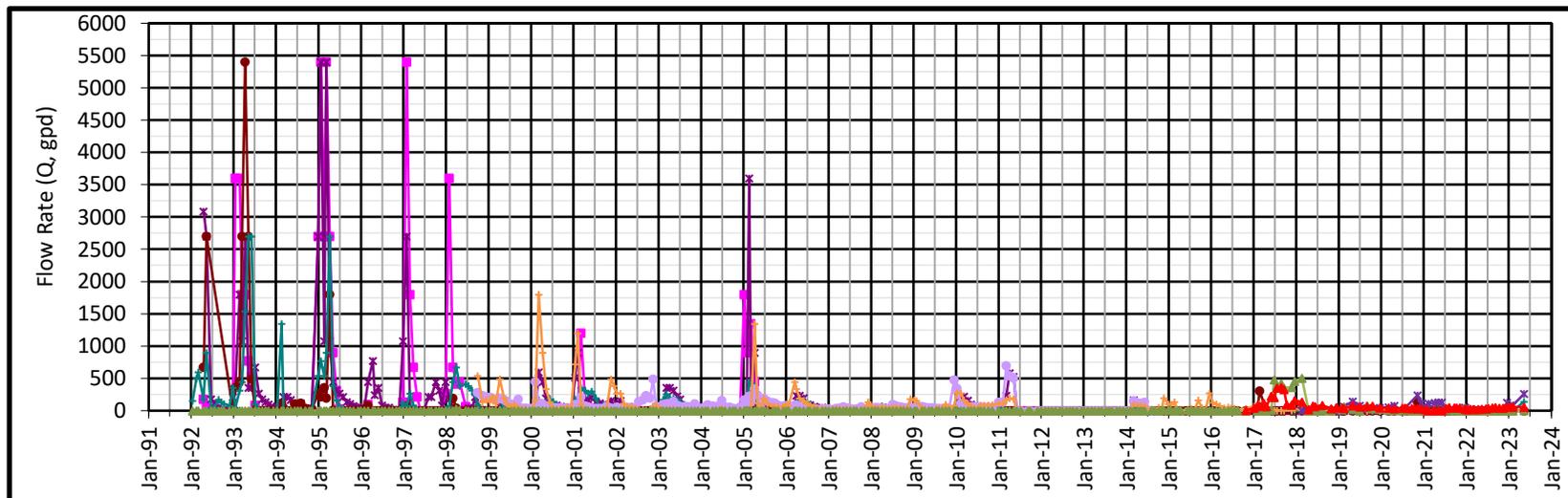
Malibu Road Landslide Assessment District

Malibu, California



**DEWATERING WELL DISCHARGE RATE GRAPH (MONITORING YEAR)**

**Bayshore Drive**  
 Malibu Road Landslide Assessment District  
 Malibu, California

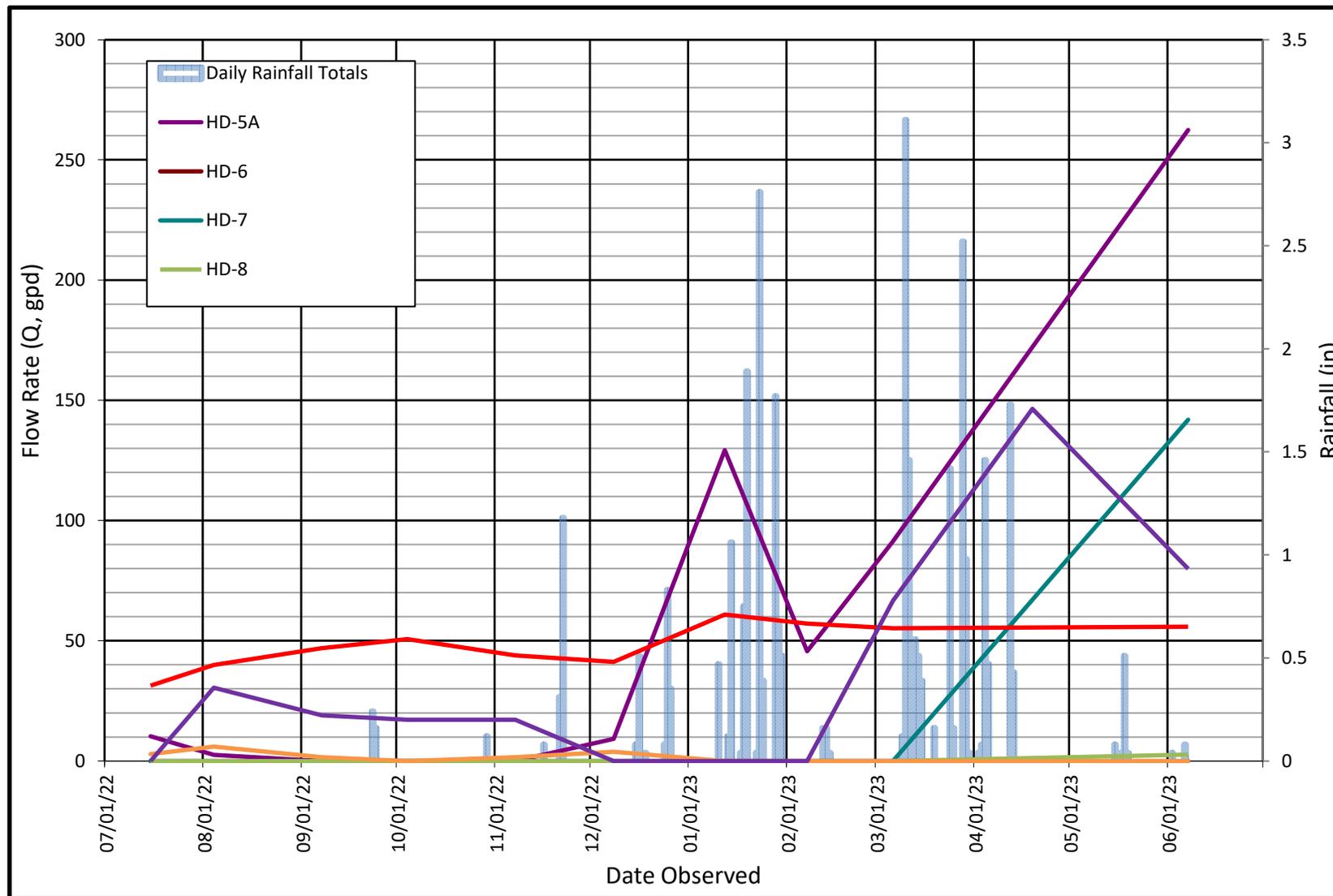


**HYDRAUGER DISCHARGE RATE GRAPH (HISTORIC)**

**Malibu Road (West End)**

Malibu Road Landslide Assessment District

Malibu, California

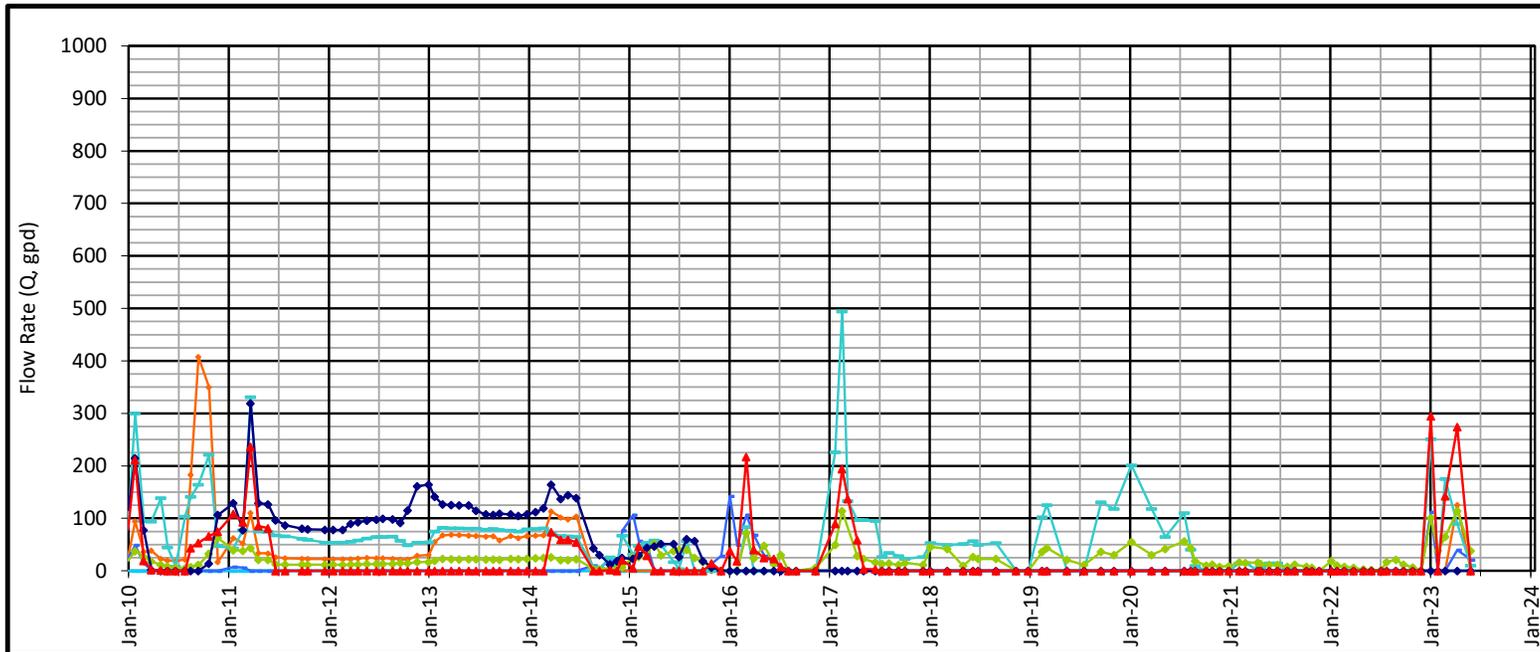
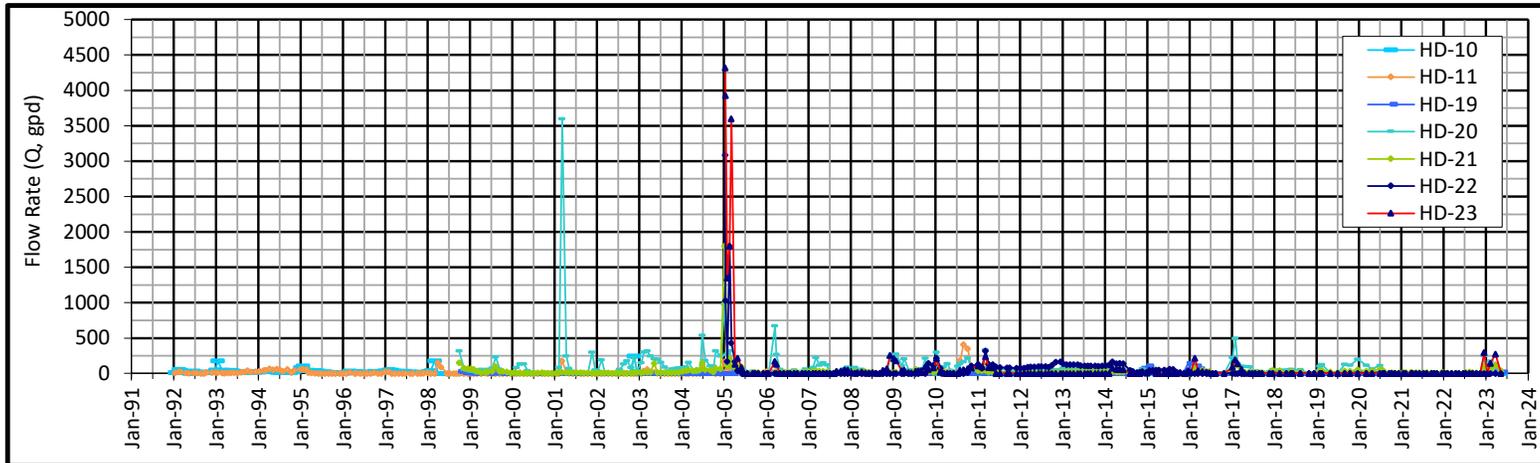


**HYDRAUGER DISCHARGE RATE GRAPH (MONITORING YEAR)**

**Malibu Road (West End)**

Malibu Road Landslide Assessment District

Malibu, California

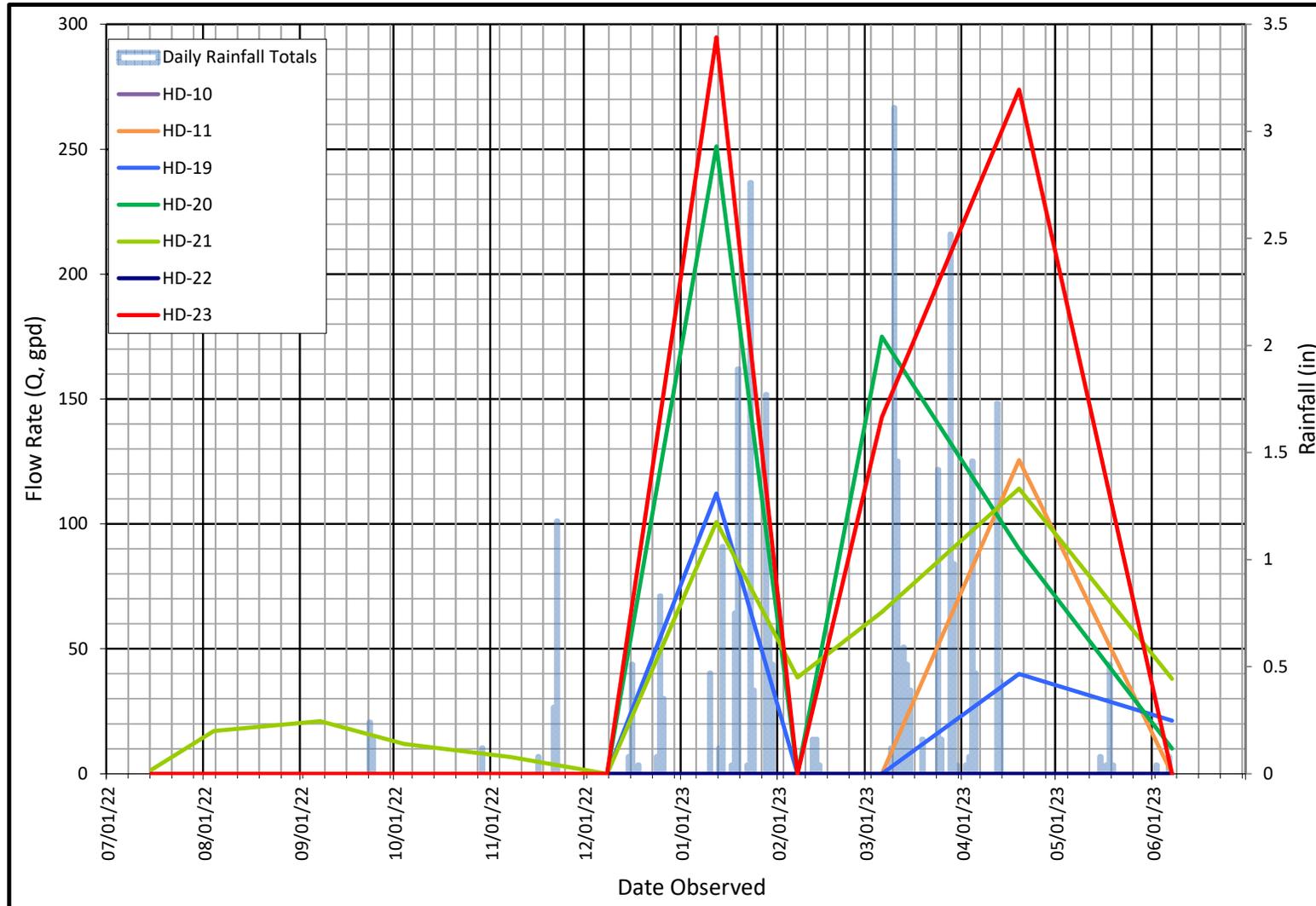


**HYDRAUGER DISCHARGE RATE GRAPH (HISTORIC)**

**Malibu Road (East End)**

Malibu Road Landslide Assessment District

Malibu, California



**HYDRAUGER DISCHARGE RATE GRAPH (HISTORIC)**

**Malibu Road (East End)**

Malibu Road Landslide Assessment District  
 Malibu, California