



California
**Department of
Conservation**
California Geological Survey

CGS Post-Earthquake Field Data Collection for the 2022 Ferndale & 2024 Cape Mendocino Earthquakes, Humboldt County, California

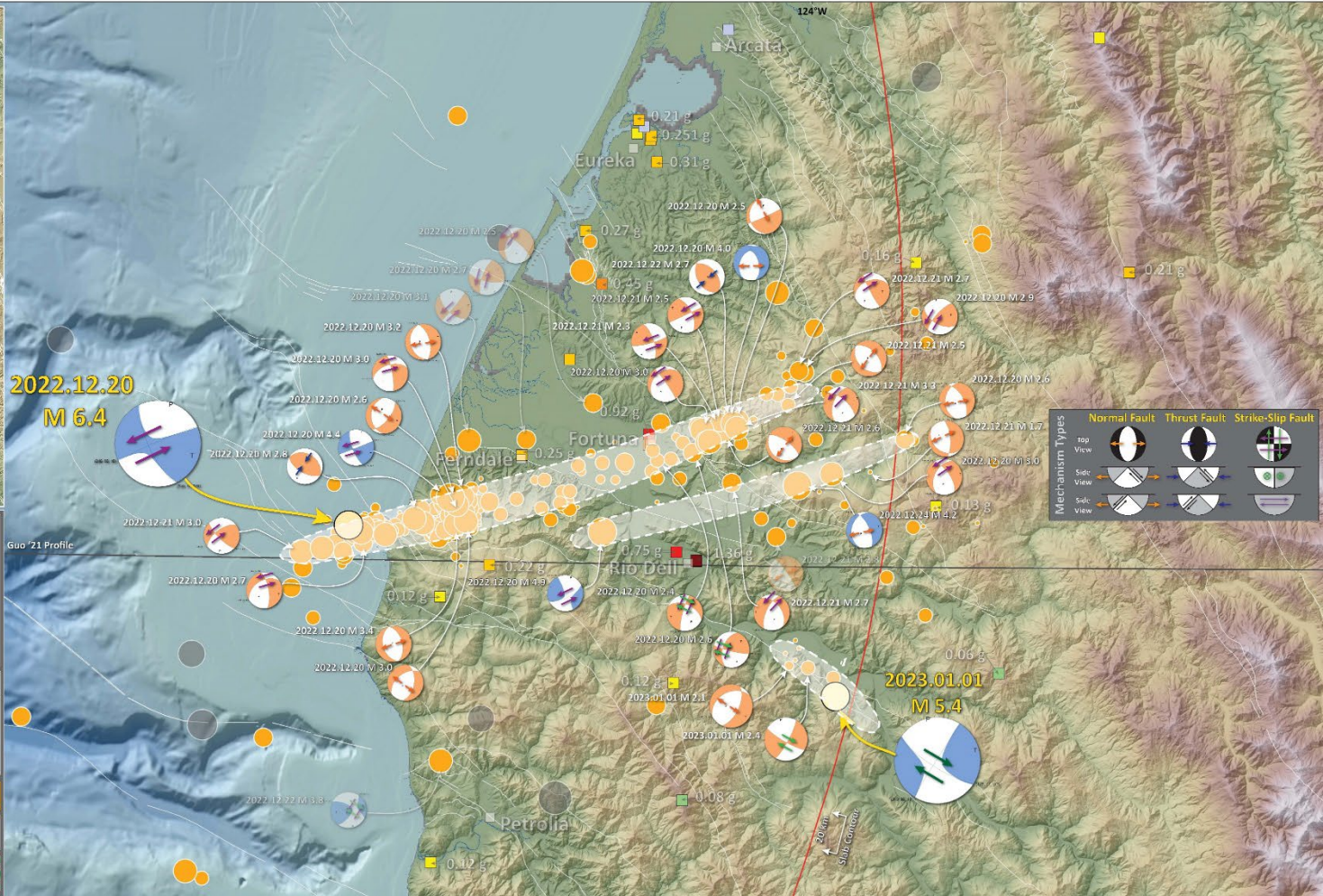
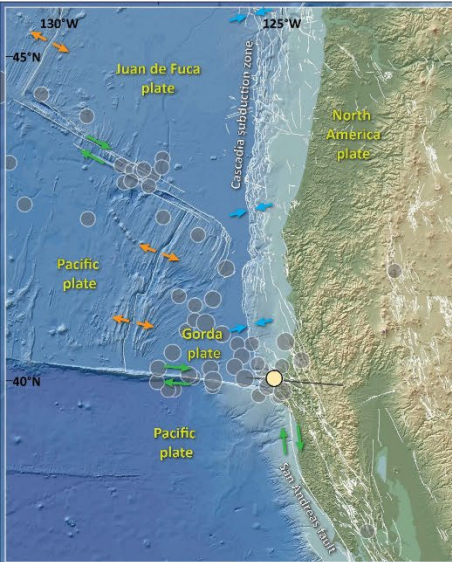
Brian Olson
Senior Engineering Geologist
California Geological Survey



Cascading Hazards Workshop
March 7, 2025 – Newport, OR

Earthquake Report: 2022.12.20

M 6.4 Northern California (& USGS Seismicity 1922-2022 M ≥ 6.0)



Seismicity (USGS - 1 century) magnitude

- 20 Dec '22 M 6.4
- 1 Jan '23 M 5.4

Seismicity (USGS - 4 week) magnitude

- 0.9 - 1.9
- 2.0 - 2.1
- 2.3 - 2.5
- 2.6 - 2.9
- 3.0 - 4.0
- 4.1 - 6.4

Strong Motion PGA

- > 1.24
- 0.66 - 1.24
- 0.35 - 0.65
- 0.19 - 0.34
- 0.10 - 0.18
- 0.05 - 0.09
- 0.02 - 0.04
- < 0.02

Guo '21 B-B' Coastline

Fault (USGS)

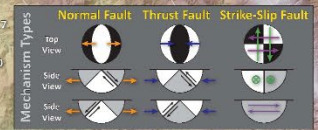
Elevation High to Low

Depth Shallow to Deep

Depth to Slab (km)

0 2.5 5 10 Miles

0 3.75 7.5 15 km



Damage Overview

Fernbridge – built 1911

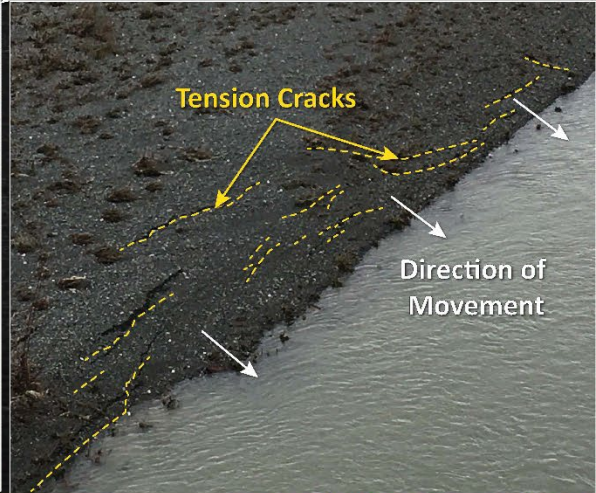
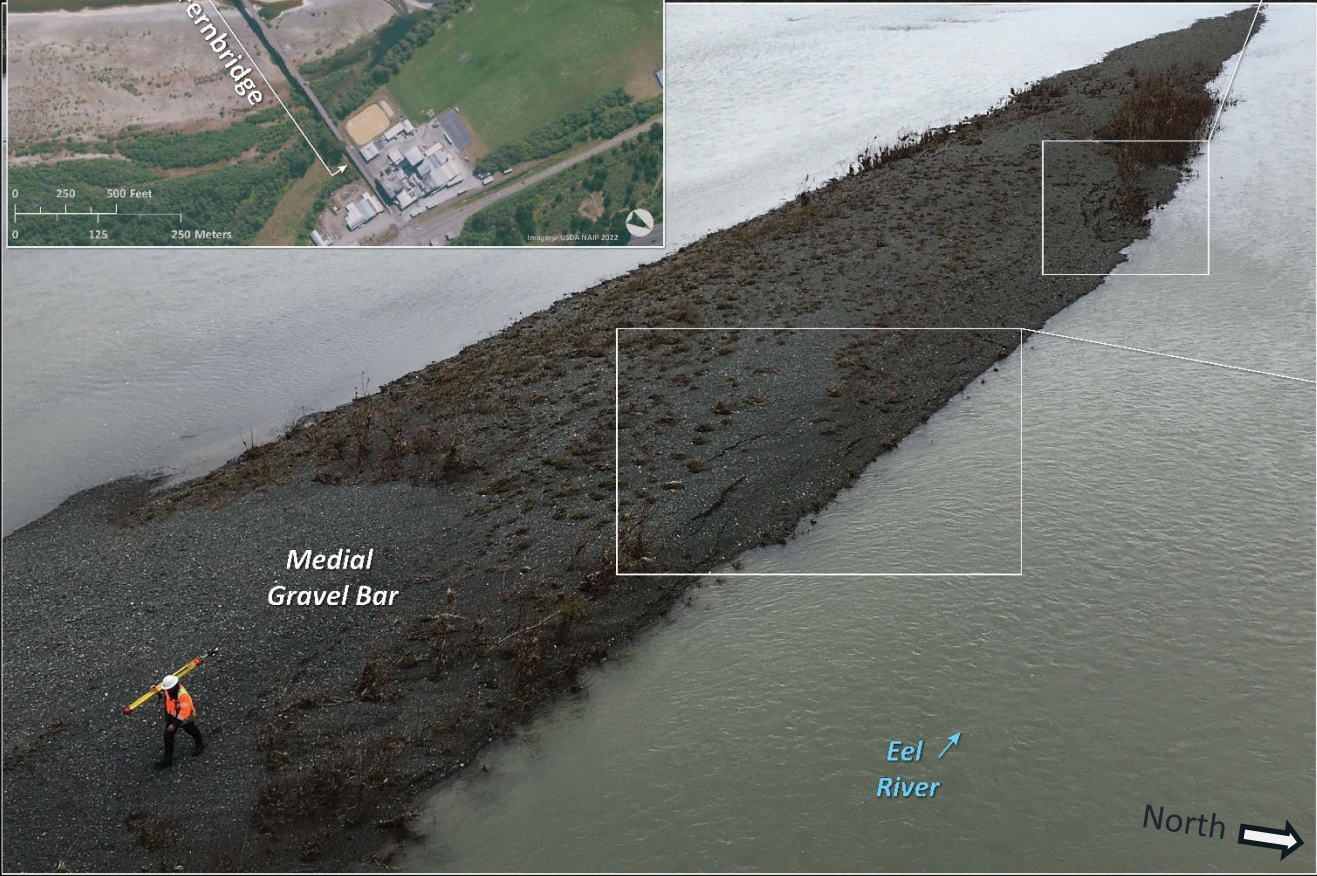
Closed for 24 hours

Nearby stations recorded PGAs ranging from 0.26g – 0.30g



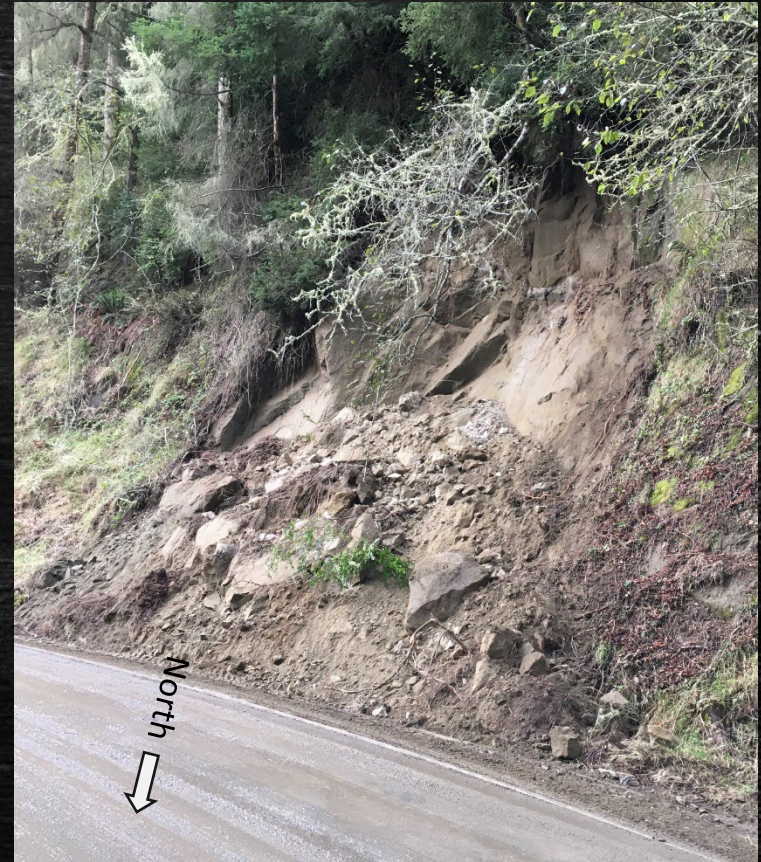
Photo: CalTrans District 1

Eel River Gravel Bar (Downstream of Fernbridge)



**Mattole Road
(south of Ferndale)
Road cut landslides**

Nearby stations
recorded PGAs of
about 0.12g



Scotia Bluffs
Cliff failures/rock topples

Nearby stations recorded PGAs ranging from 1.36g – 1.46g



Structural Damage to Chimneys and Raised-Floor Foundations

Nearby stations recorded PGAs ranging from 1.36g – 1.46g



**Structural Damage to
Unreinforced
Masonry Buildings
(Loleta Creamery)**

Built 1893

Closed 2010

Torn down 2023

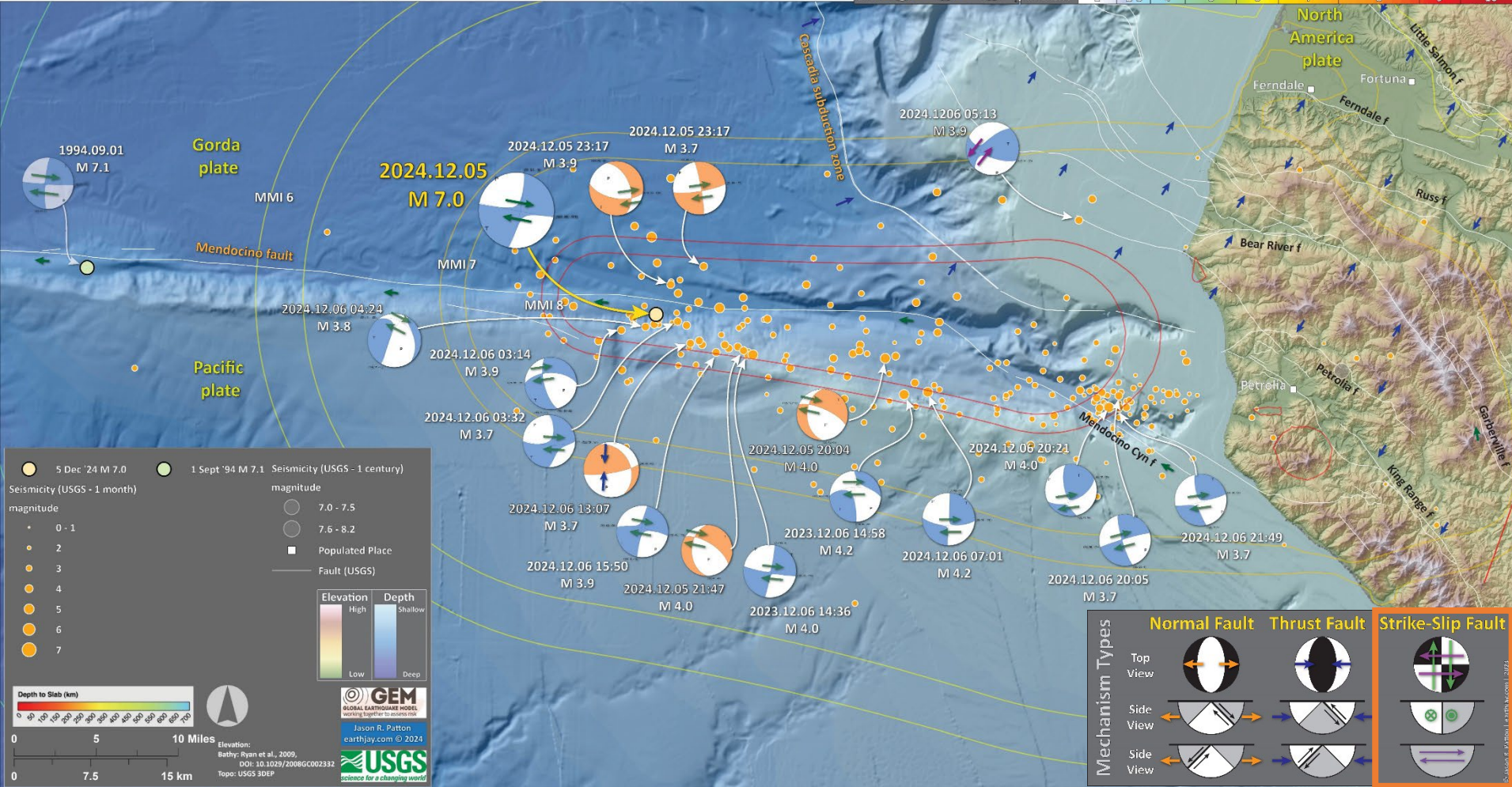
Nearby stations
recorded PGAs
ranging from
1.36g – 1.46g



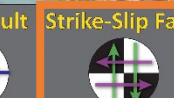
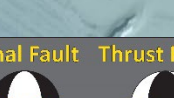
Earthquake Report: 2024.12.05

M 7.0 California (& USGS Seismicity)

Shaking Intensity	1	2-3	4	5	6	7	8	9	10
SHAKING	Not Felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme
DAMAGE	Note	None	None	Very Light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PGA (%g)	<0.05	0.3	2.76	6.2	11.5	21.5	40.1	74.7	>139
PGV (cm/s)	<0.02	0.13	1.41	4.65	9.64	20	41.4	85.8	>178



2024.12.05
M 7.0



● 5 Dec '24 M 7.0 ● 1 Sept '94 M 7.1 Seismicity (USGS - 1 century)
● Seismicity (USGS - 1 month)
● magnitude
● 0 - 1
● 2
● 3
● 4
● 5
● 6
● 7

○ 7.0 - 7.5
○ 7.6 - 8.2
■ Populated Place
 Fault (USGS)

Elevation High
 Depth Shallow
 Low
 Deep

GLOBAL EARTHQUAKE MODEL
 Jason R. Patton
earthjay.com © 2024

USGS
 science for a changing world

Elevation: Bathy: Ryan et al., 2009; NCH 10.1029/2008GC002332
 Topo: USGS 3DEP

Depth to Slab (km)

0 5 10 Miles
 0 7.5 15 km

Mechanism Types

	Normal Fault	Thrust Fault	Strike-Slip Fault
Top View			
Side View			
Side View			

CGS_USGS Point Observations (view only)

- Fault Rupture
- ◆ Liquefaction
- ▲ Slope Movement
- Damage
- No Deformation

Clearinghouse Point Observations (view only)

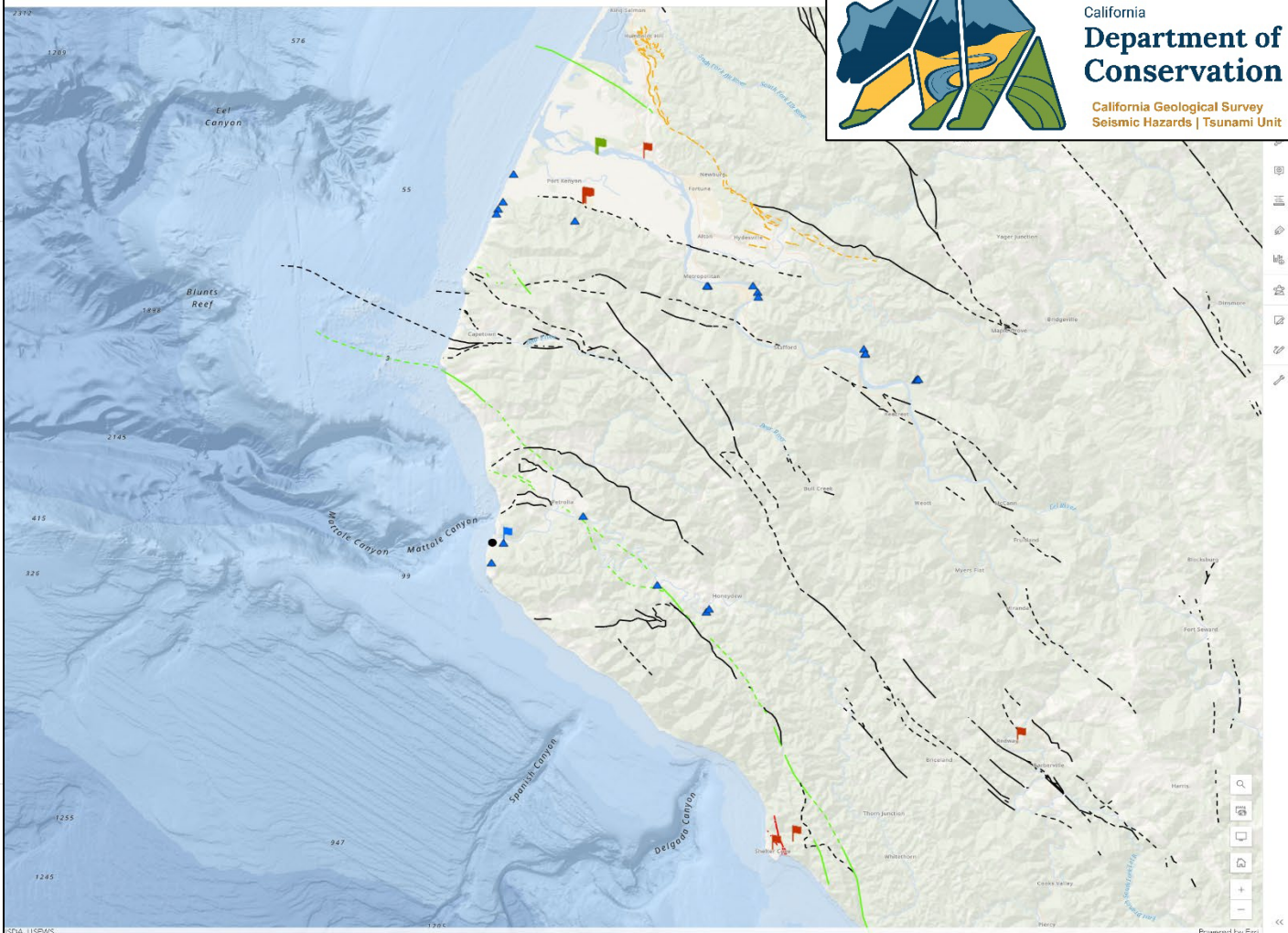
- Fault Rupture
- ◆ Liquefaction
- ▲ Slope Movement
- Damage
- No Deformation

Social Media Collection

- Fault Rupture
- Liquefaction
- Slope Movement
- Damage
- No Deformation

CM24_basemap_v20241210_14_15pst

Epicenter





Nearby station
recorded PGAs of
about 0.24g

**Shivley Road
(south of Rio Dell)
Road shoulder
landslides**

Nearby stations
recorded PGAs ranging
from 0.13g – 0.17g

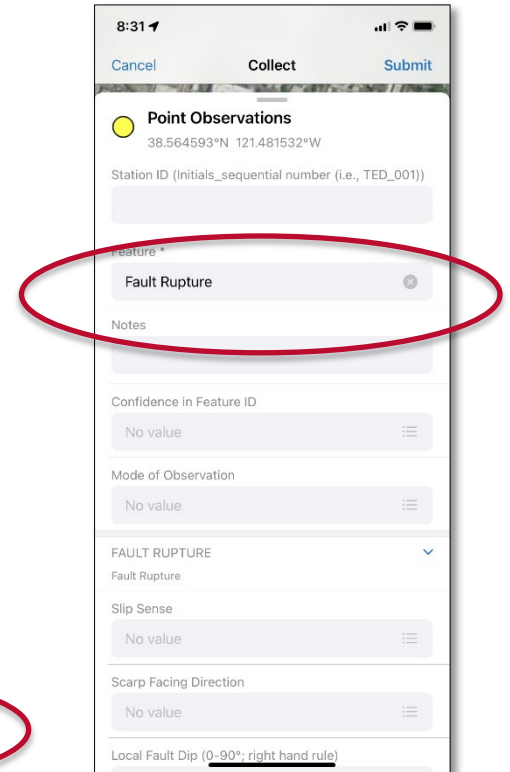
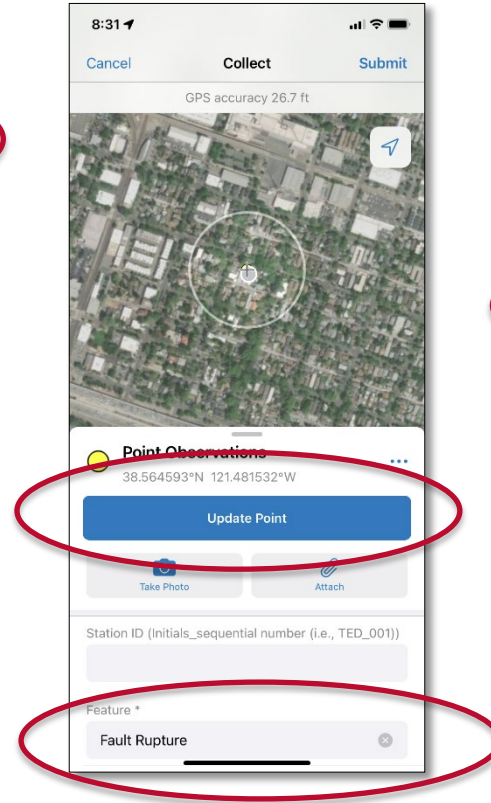
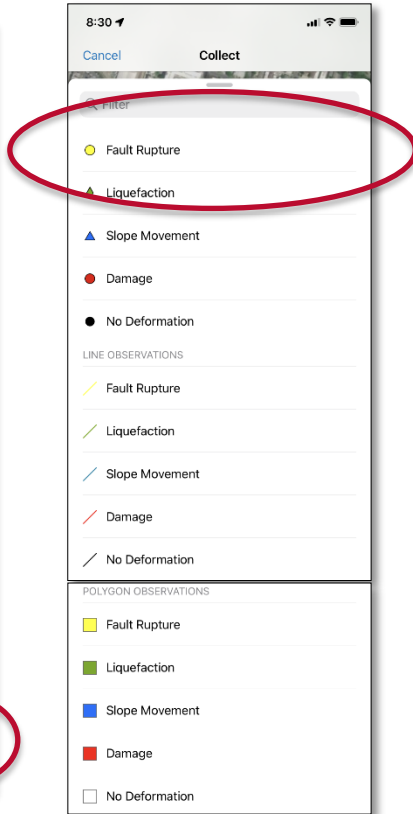
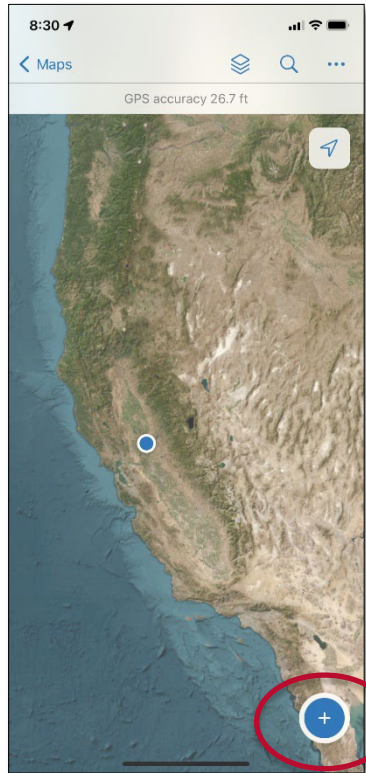




**Lost Coast headlands
(Bluff failure onto
the beach)**

Nearby stations
recorded PGAs of
about 0.48g

Data Acquisition – ESRI Field Maps



Clearinghouse Communications and Data Dissemination



Ferndale 12/20/2022 Data Response Dashboard

Observations in Map View

- Damage Iblair_geoplatform
- Damage SGallagher_cadoc
- Damage mlking_cadoc

Attachments in Map View

Point Observations: SG1



Observation Details

Point Observations: SG1

Adjacent Features	
Date of Movement (YYYYMMDD,Time)	
Depth	
Diameter (m)	
Displacement Amount	
Estimate Direction of Slope Movement	
Estimated Max Drop in Elevation (ft)	
Estimated Maximum Vertical Movement (m)	
Facility Affected	Bridge
Facility Cause of Damage	Shaking
Facility Damage Severity	Severe (Red Tag)
Fault Slip	
Feature_Origin	Damage
Heave (cm)	
Heave_Max(cm)	
Heave_Min(cm)	
Height of material (m)	
Horizontal Separation Max (cm)	
Horizontal Separation Min (cm)	
Horizontal Separation (cm)	
Landslide Feature	
Length Exposed Downslope	
Liquefaction Area Affected (sq. meters)	
Liquefaction Facility affected	
Local Fault Azimuth (0.360°)	
Local Fault Dip (0.00° Right hand rule)	
Material Type	
Net Slip Max (cm)	
Net Slip Min (cm)	
Net Slip Preferred (cm)	
No Deformation Comments	
Notes	Fermbidge
Observational Accuracy	



Station ID

SG1	Fermbidge
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Notes

Last update: 1 second ago

Obs by Observer Point Observations Table Polyline Table Polygon Table

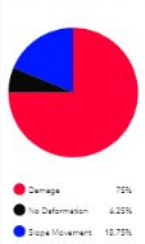
Total Point Observations

64

Point Observations, Past 24 Hrs

0

Feature Origin Distribution



LEGEND

Data Acquisition Layers

Point Observations

- Fault Rupture
- Liquefaction
- ▲ Slope Movement
- Damage
- No Deformation

Line Observations

- Fault Rupture
- Liquefaction
- Slope Movement
- Damage
- No Deformation

Polygon Observations

- Fault Rupture
- Liquefaction
- Slope Movement
- Damage
- No Deformation

Social Media Collection

- Fault Rupture
- Liquefaction
- Slope Movement
- Damage
- No Deformation

Mainhook

★

USGS O'faults

Historic (< 150 years), well constrained location



California

**Department of
Conservation**

California Geological Survey

THANK YOU

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@CAGeoSurvey



Thank you

Social Media

Not all Twitter is science-based

Science communication during a major earthquake is IMPORTANT!!

