



SMAC Report – Fall 2023

Dylan Esquivel
NCPA Reservoir Engineer
November 16, 2023

Lake County Wastewater Recycling System

A partnership of
Northern California Power Agency
Lake County Sanitation District
Calpine Corporation

- First phase operational 1997; second phase 2001
- Communities supplying effluent: 10
- Total countywide effluent recycled: 85%
- Effluent pipeline length: 50 miles
- Average flow rate: 5800 gpm
- Solar powered treatment & pumping: 3.4 MW
- Effluent-based geothermal power: 100 MW
- Avoided global warming CO₂ emissions: 8 billion lbs. (Jan. 08)



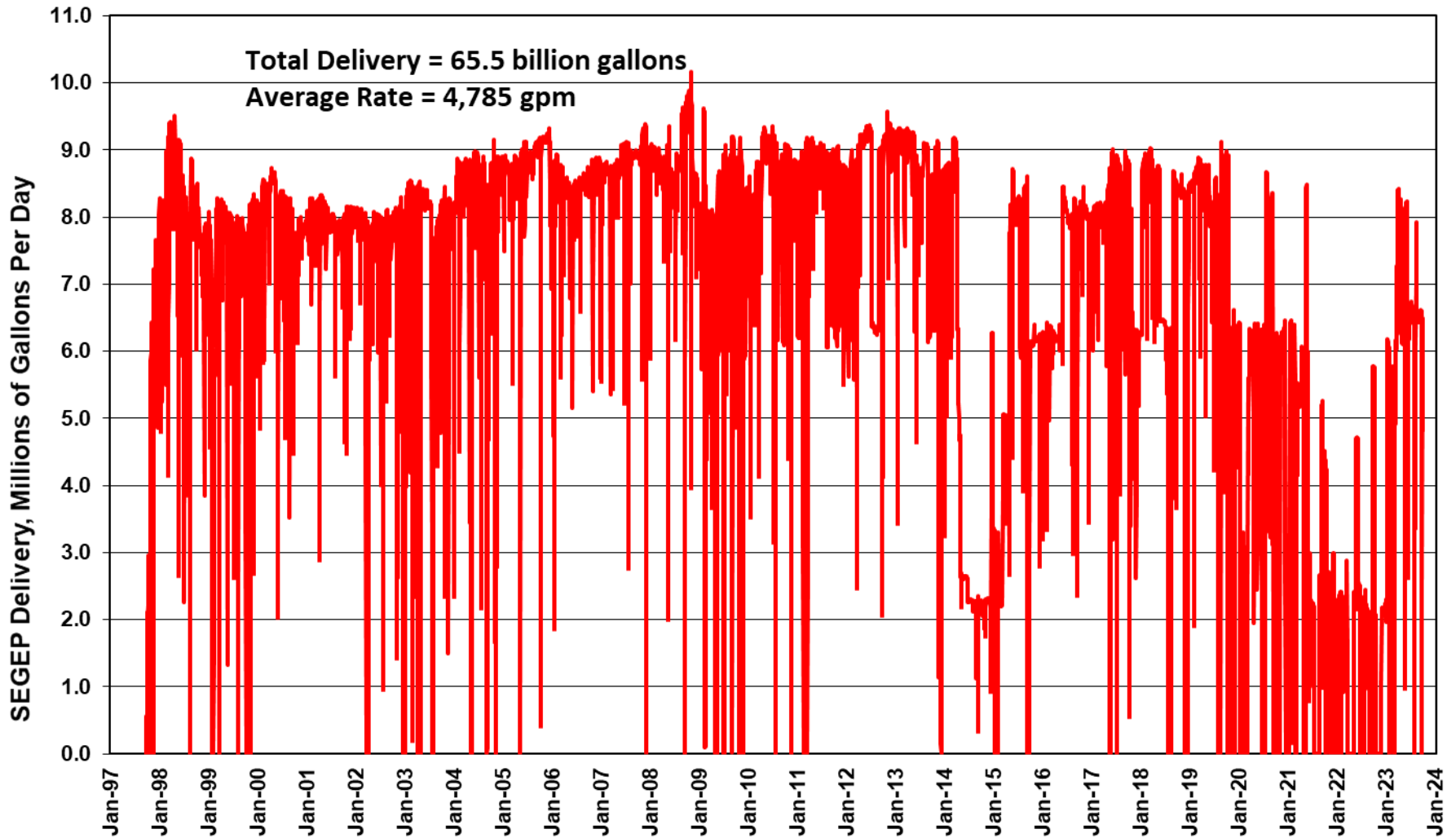
Bear Canyon #1 Pump Station



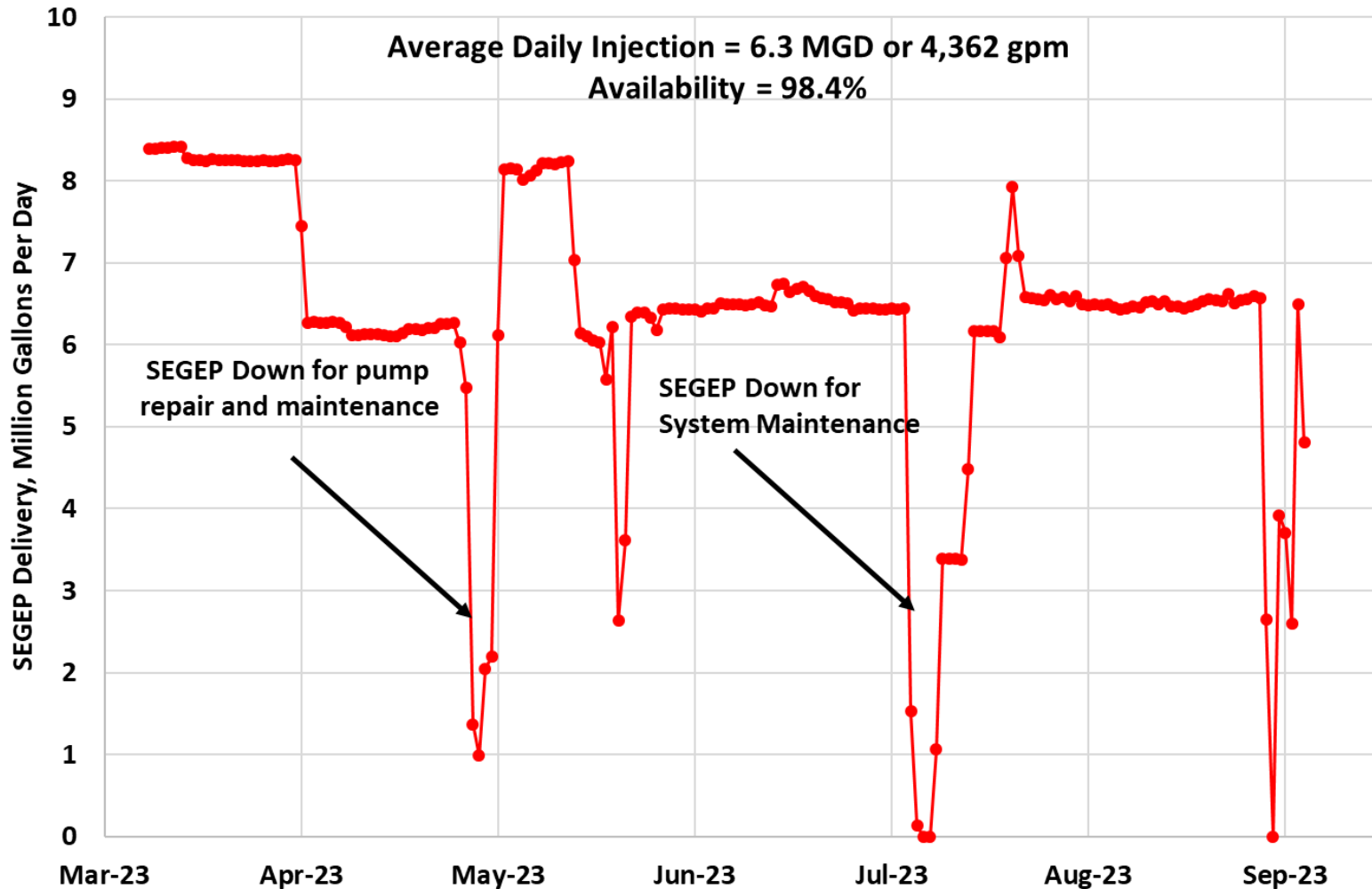
Bear Canyon Pumps



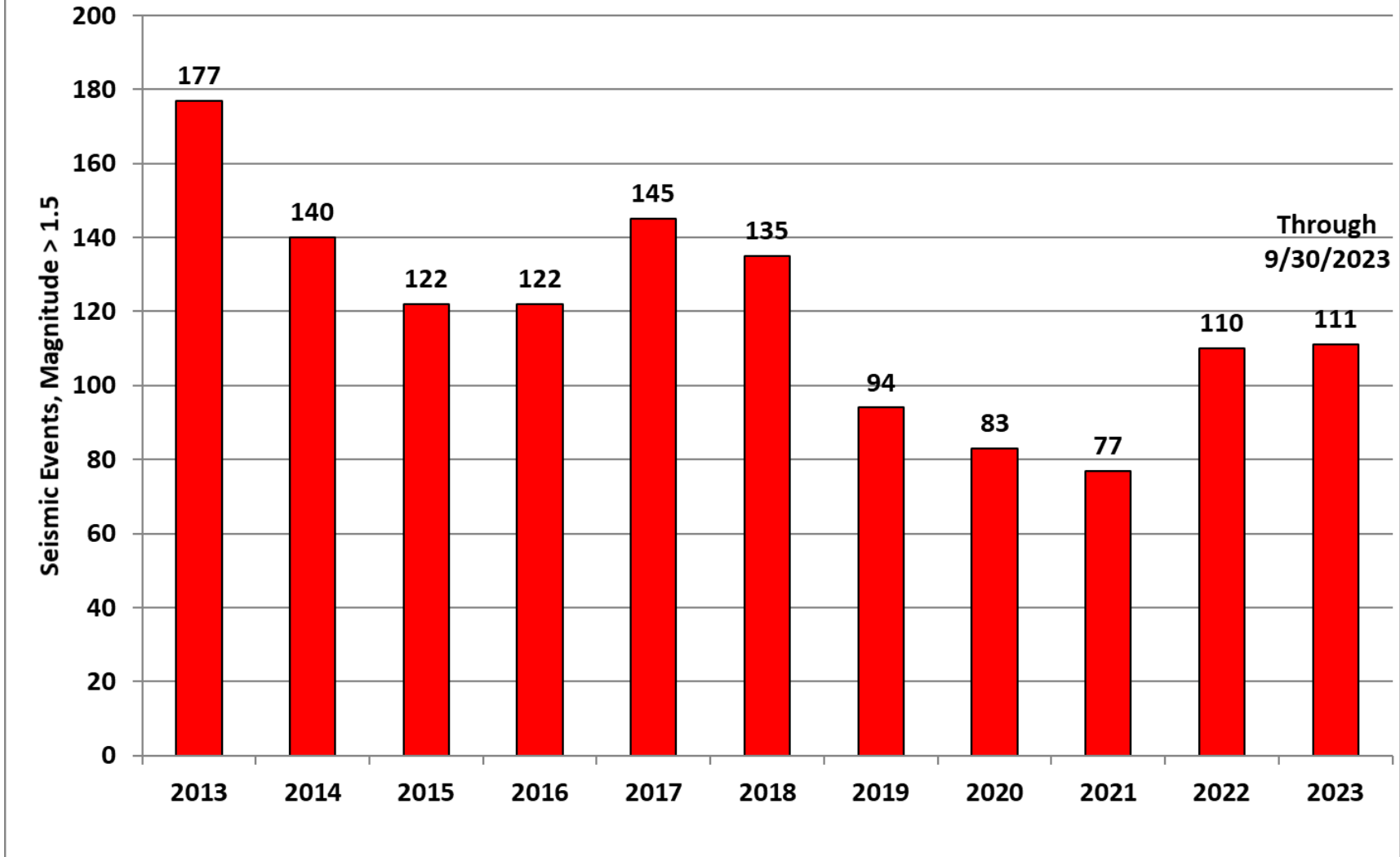
Historical SE Geysers Effluent Pipeline Deliveries to The Geysers
Figure 1



**Southeast Geysers Effluent Pipeline Delivery
April 2023 - September 2023
Figure 2**



Southeast Geysers - Historical Seismic Activity
Magnitude > 1.5
Figure 3



April 2023-September 2023 SE Geysers Seismic Events Map

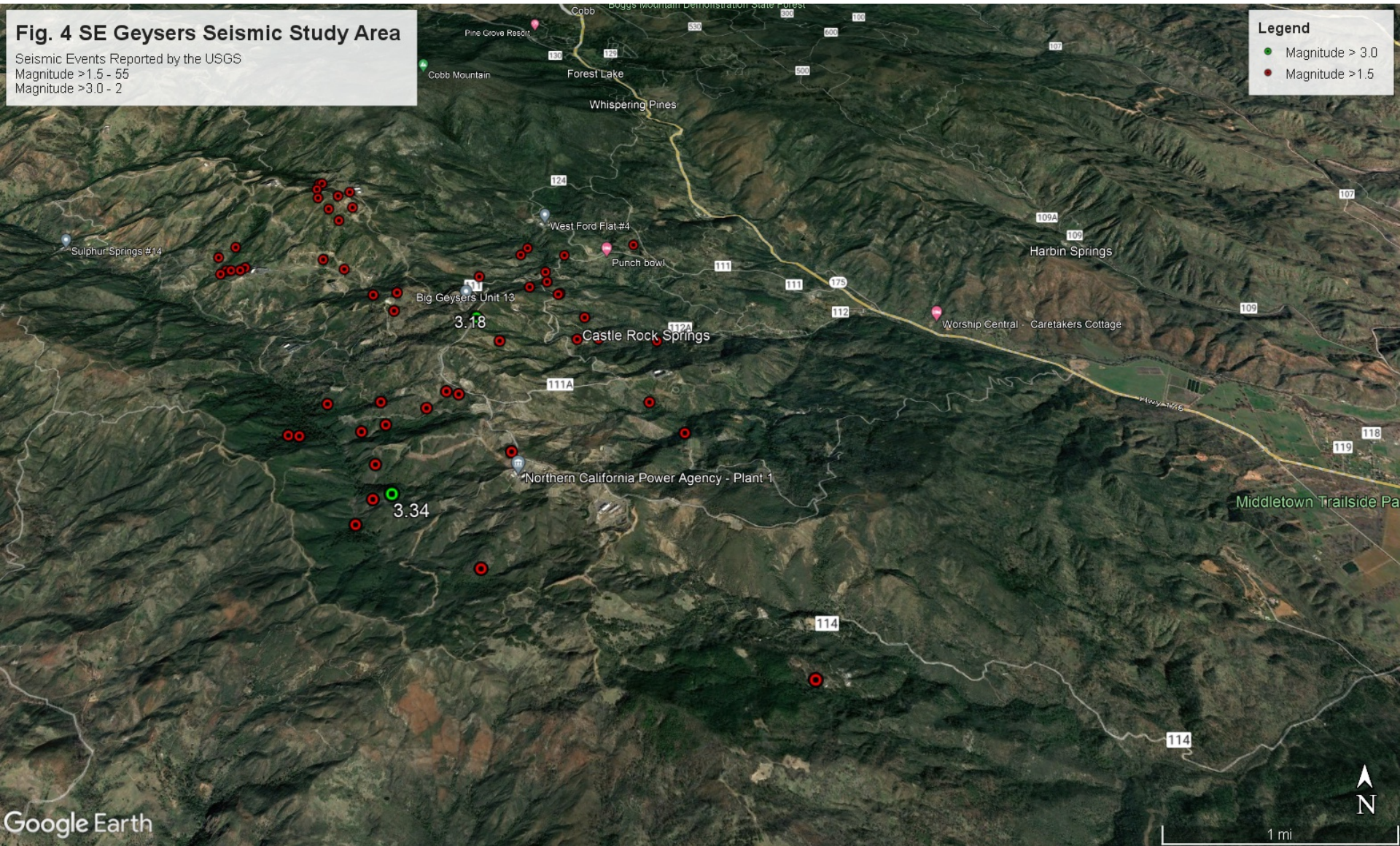
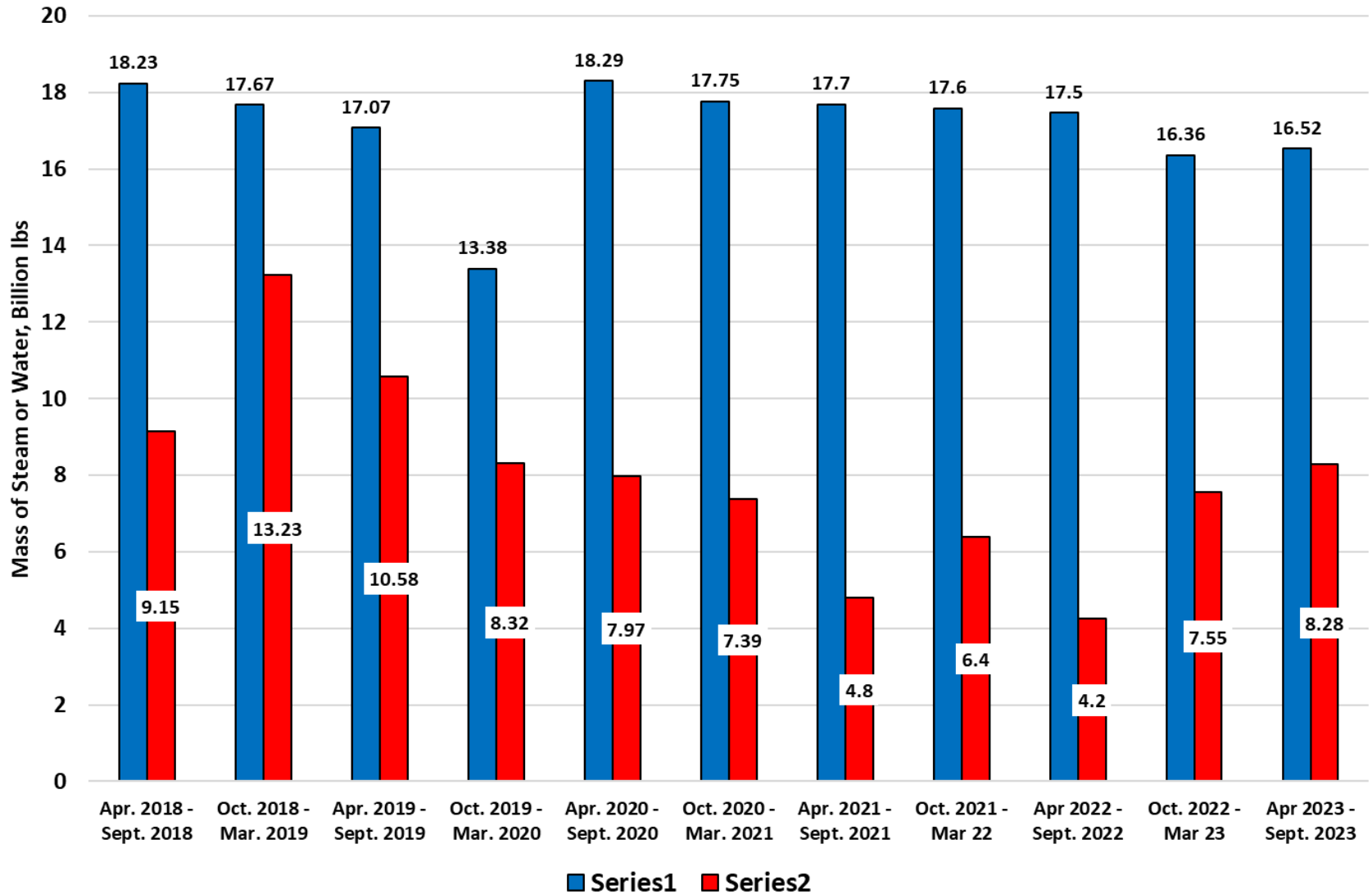


Fig. 4 SE Geysers Seismic Study Area
 Seismic Events Reported by the USGS
 Magnitude > 1.5 - 55
 Magnitude >3.0 - 2

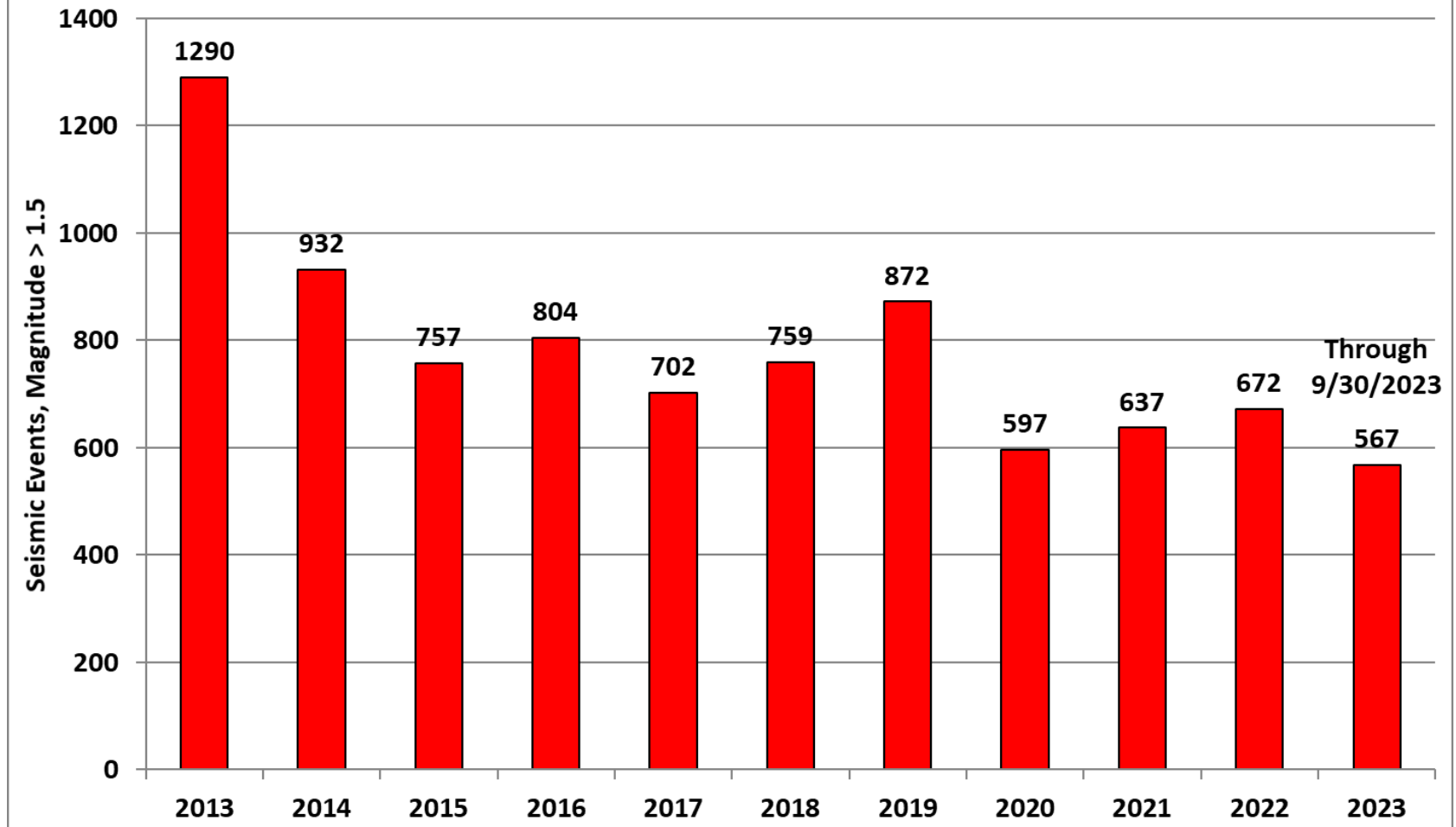
Legend

- Magnitude > 3.0
- Magnitude > 1.5

SE Geysers Production and Injection
Figure 5



The Geysers (KGRA) - Historical Seismic Activity Magnitude > 1.5 Figure 6



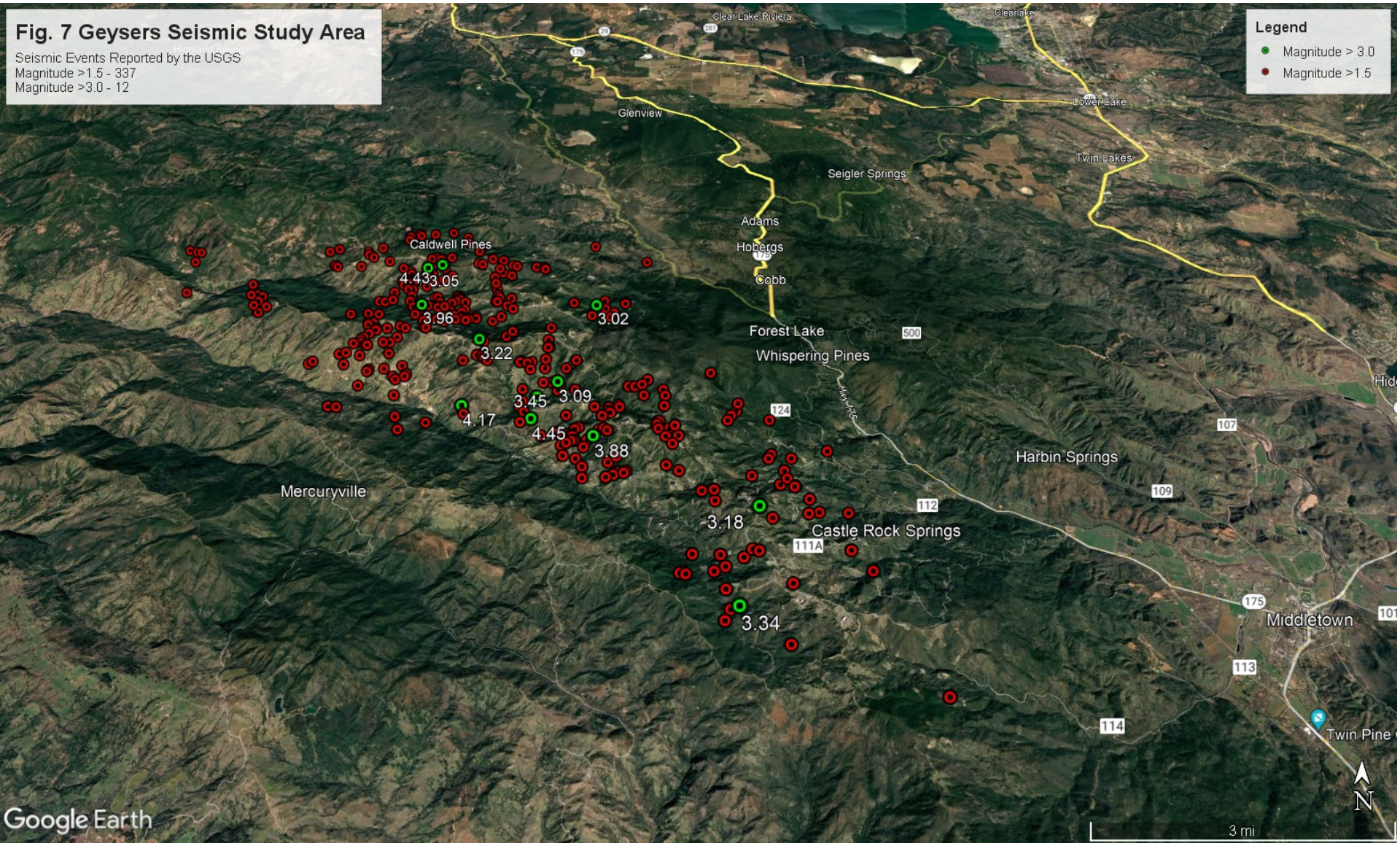
April 2023-September 2023 Geysers Seismic Events Map

Fig. 7 Geysers Seismic Study Area

Seismic Events Reported by the USGS
 Magnitude >1.5 - 337
 Magnitude >3.0 - 12

Legend

- Magnitude > 3.0
- Magnitude > 1.5



Summary

- **SEGEP Operation**
 - Injection Rate – 4,362 gpm
 - Pipeline availability – 98.4%
 - Resumed historical injection rates
- **Southeast Production & Injection**
 - Production – 16.52 Glbs
 - Injection – 8.28 Glbs
- **Seismic Activity – SE Geysers**
 - 55 Events > Magnitude 1.5
 - 2 Events > Magnitude 3.0
- **Seismic Activity – Geysers**
 - 337 Events > Magnitude 1.5
 - 12 Events > Magnitude 3.0
 - Highest Event – Magnitude 4.45

Bear Canyon Pump Station #3





November 16, 2023

To: Members of the Seismic Monitoring Advisory Committee,
Southeast Geysers Effluent Pipeline Project (SEGEP)

Fm: Northern California Power Agency

Re: SEGEP Operation and Seismicity Report for April 1, 2023 to September 30, 2023

A. Pipeline Operations

The Southeast Geysers Effluent Pipeline (“SEGEP”) has been in operation since 1997 and has delivered a total 65.5 billion gallons of wastewater at an average rate of 4,785 gpm to the South East Geysers steam field for injection. **Figure 1** illustrates the daily delivery rates since the beginning of the project.

During the six-month period from April 1, 2023 through September 30, 2023, the SEGEP Pipeline was in operation 98.4% of the time (**Figure 2**). Pipeline delivery rates averaged 6.3 million gallons per day (MGD) or 4,362 gpm which is roughly 91% of the historical average noted above.

The injection rate has essentially been restored to regular levels, due to the recent wet year that Northern California experienced. The wastewater supplied by LACOSAN is composed of secondary treated wastewater and freshwater from Clearlake. Freshwater can make up between half to two thirds of the system volume but during drought years, freshwater extraction from Clearlake is not allowed. The increase of injection water back to normal levels is due to having the ability to pull water from Clear Lake again, after recent restrictions from drought years were relieved.

B. Observed Seismicity

Seismic Activity in the Southeast Geysers

The USGS recorded 55 seismic events of magnitude 1.5 and greater within the SE Geysers area from April 1, 2023 through September 30, 2023. This is less than the 86 seismic events over the previous six-month period. Historical trends and locations of the recent events are shown

respectively in **Figures 3 and 4**. There were two magnitude 3.0 or greater seismic events in the Southeast Geysers during this reporting period.

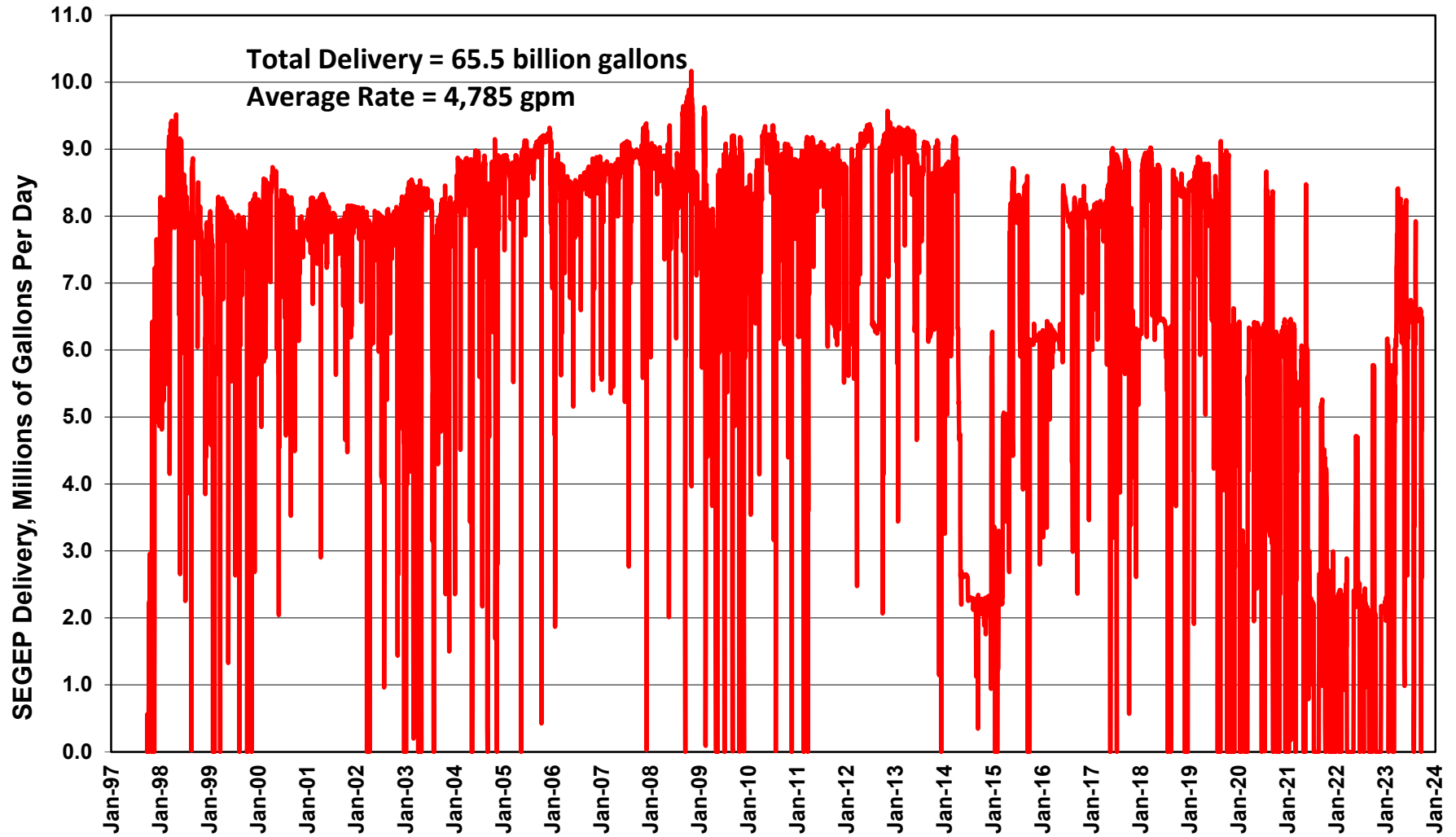
In combination with the seismic activity, steam production for the Southeast Geysers area was 16.52 billion pounds mass for the past six months while water injection was 8.28 billion pounds mass. The mass replacement was approximately 50% for the area. **Figure 5** shows the historical changes in steam production and water injection within the Southeast Geysers area.

Seismic Activity in The Geysers

Within the Geysers geothermal field, there have been 337 events of magnitude 1.5 and greater recorded from April 1, 2023 through September 30, 2023. There were twelve events of magnitude 3.0 or greater. The largest event was a magnitude 4.45 and occurred on June 3, 2023. **Figure 6** shows the trends of seismic events for the Geysers since 2013 while **Figure 7** shows the location of the events for the last six months.

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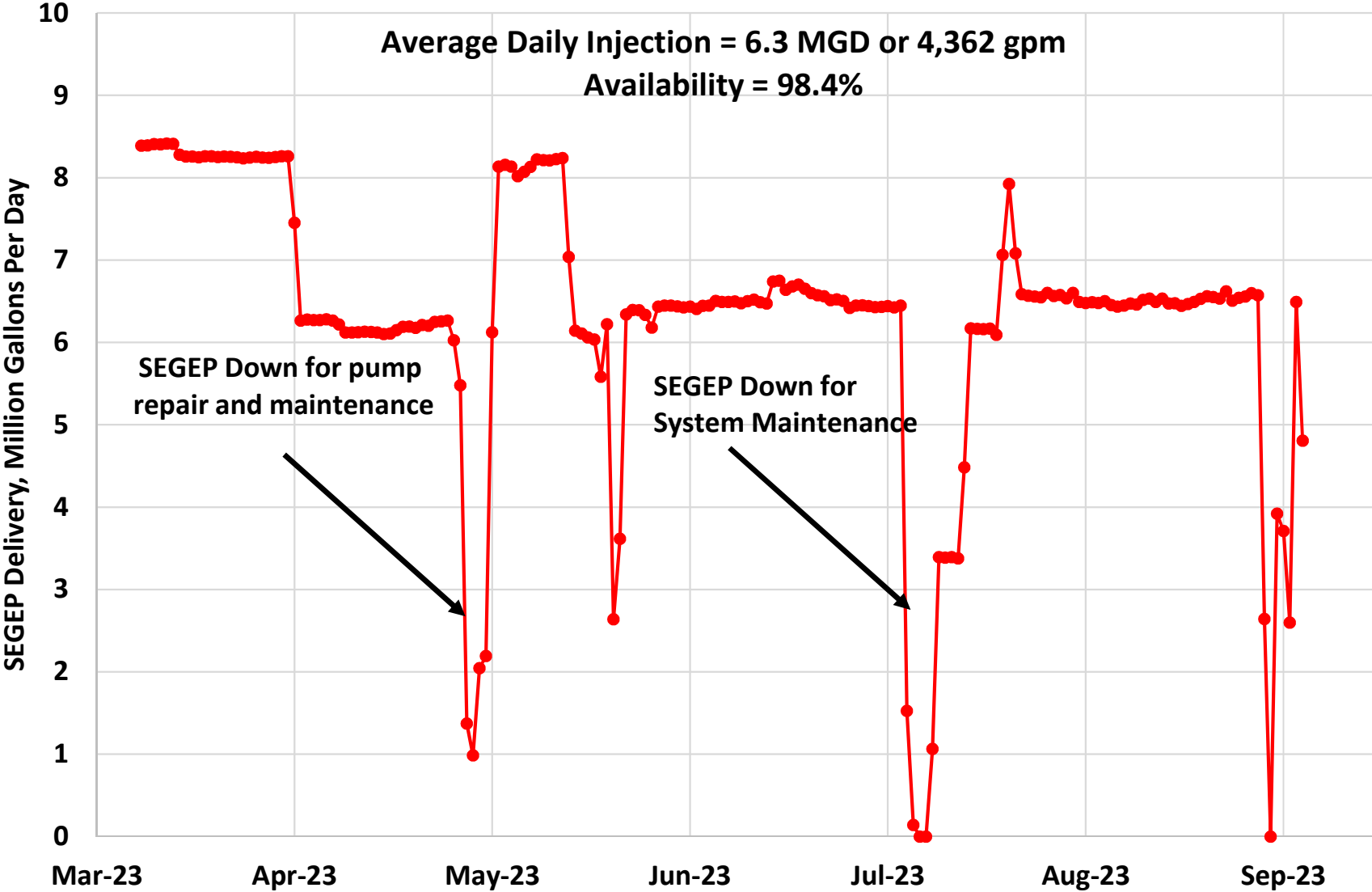
**Historical SE Geysers Effluent Pipeline Deliveries to The Geysers
Figure 1**



Southeast Geysers Effluent Pipeline Delivery

April 2023 - September 2023

Figure 2



Southeast Geysers - Historical Seismic Activity

Magnitude > 1.5

Figure 3

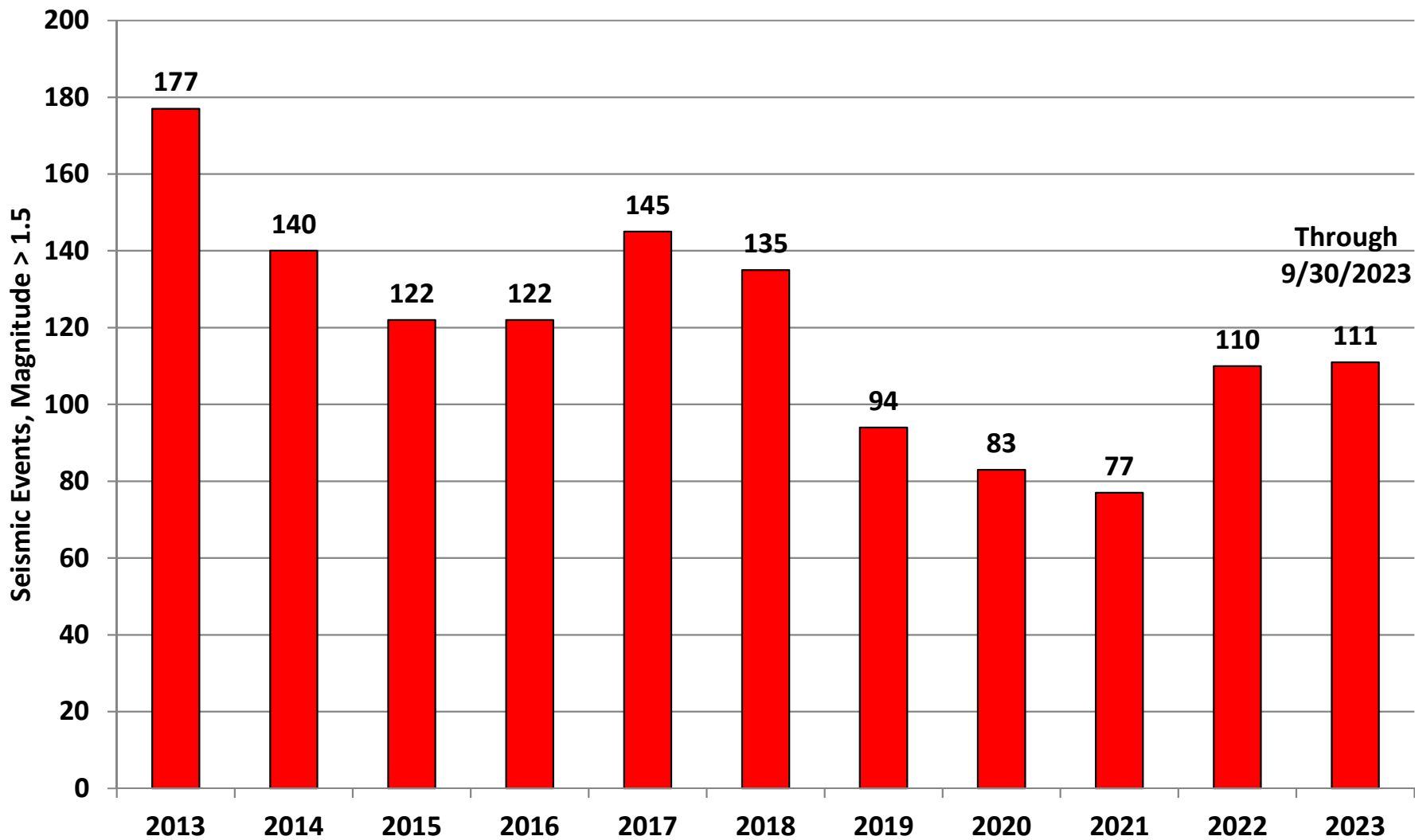
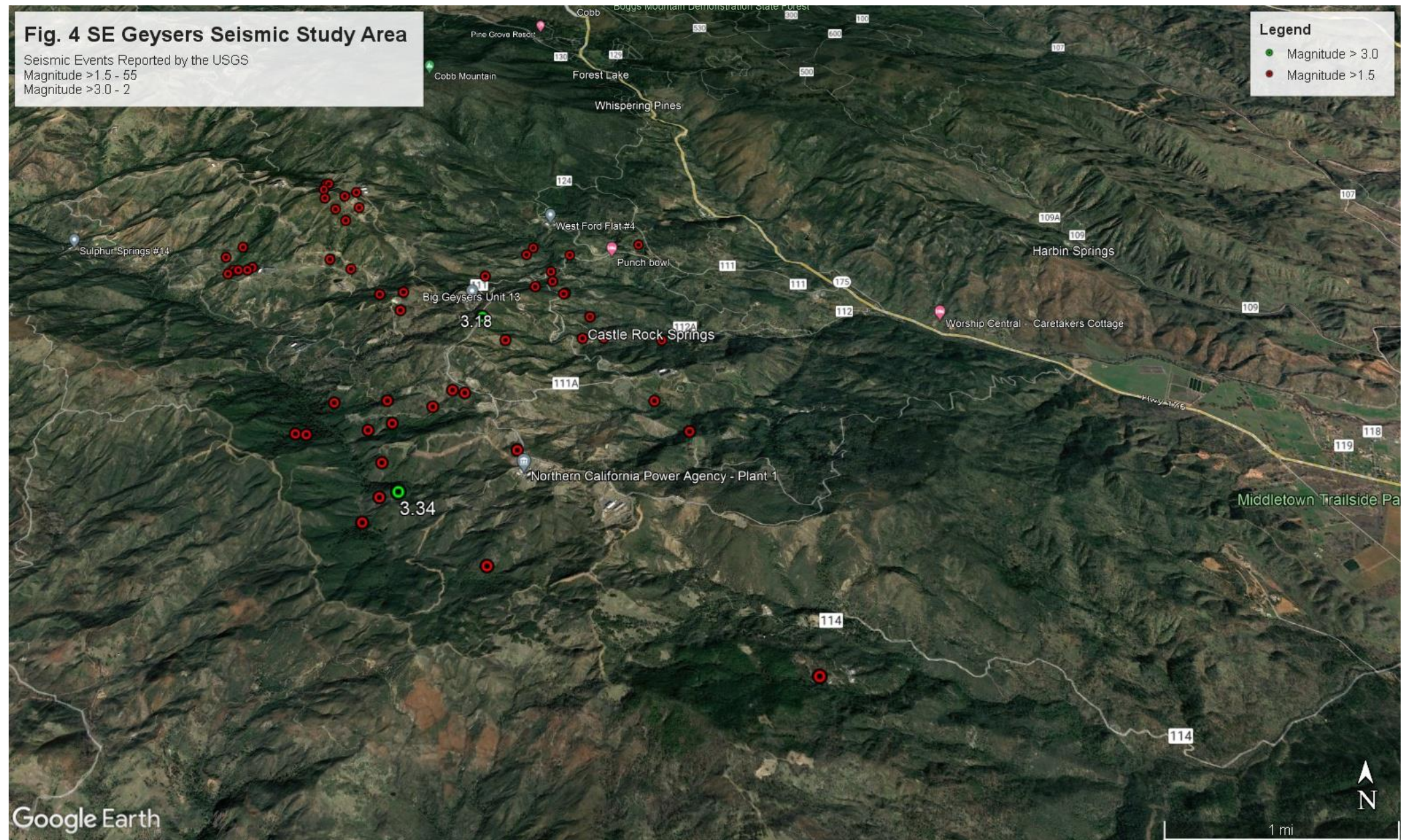


Fig. 4 SE Geysers Seismic Study Area

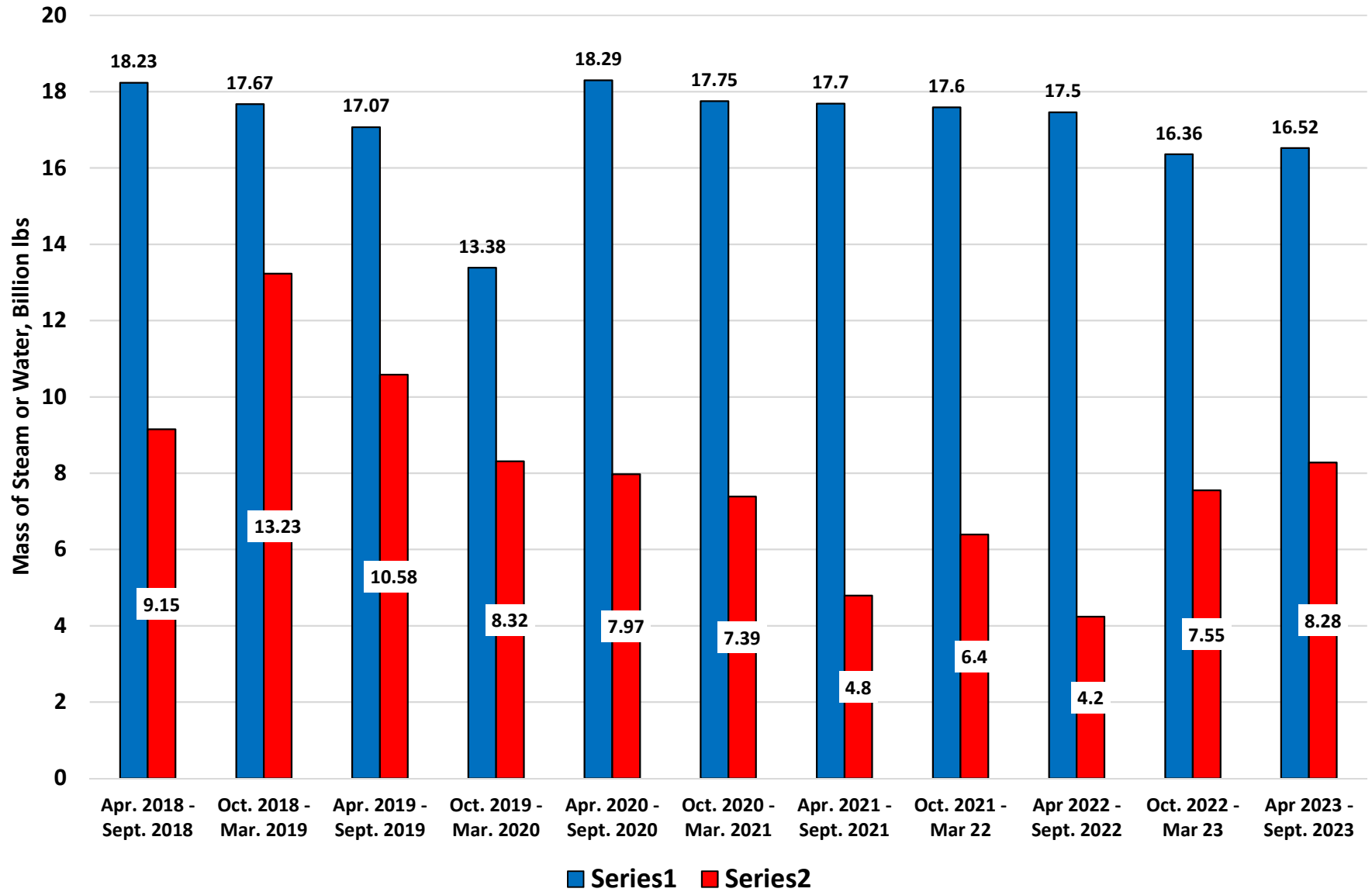
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Magnitude >3.0 - 2

Legend

- Magnitude > 3.0
- Magnitude > 1.5



SE Geysers Production and Injection
Figure 5



The Geysers (KGRA) - Historical Seismic Activity

Magnitude > 1.5

Figure 6

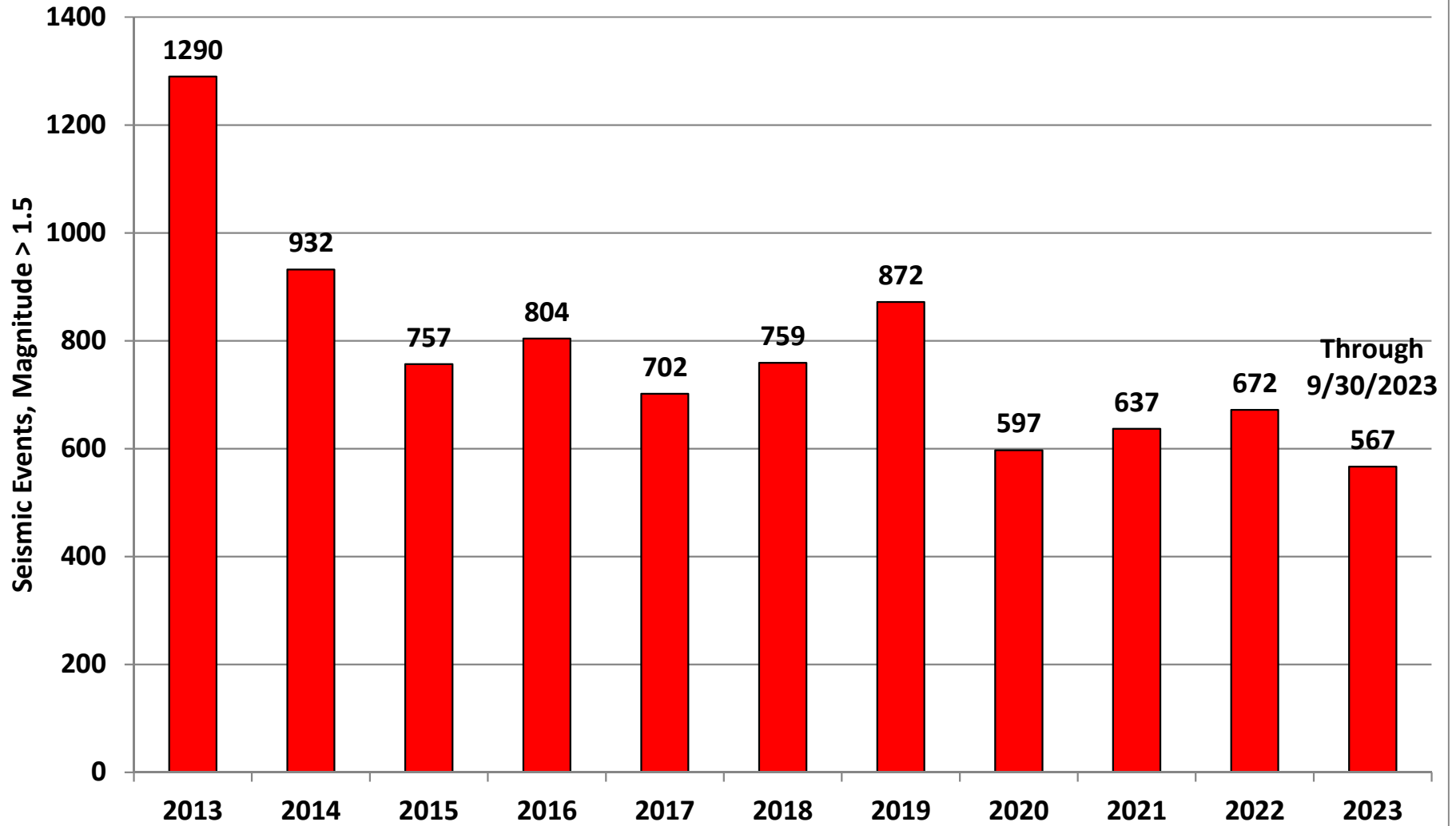
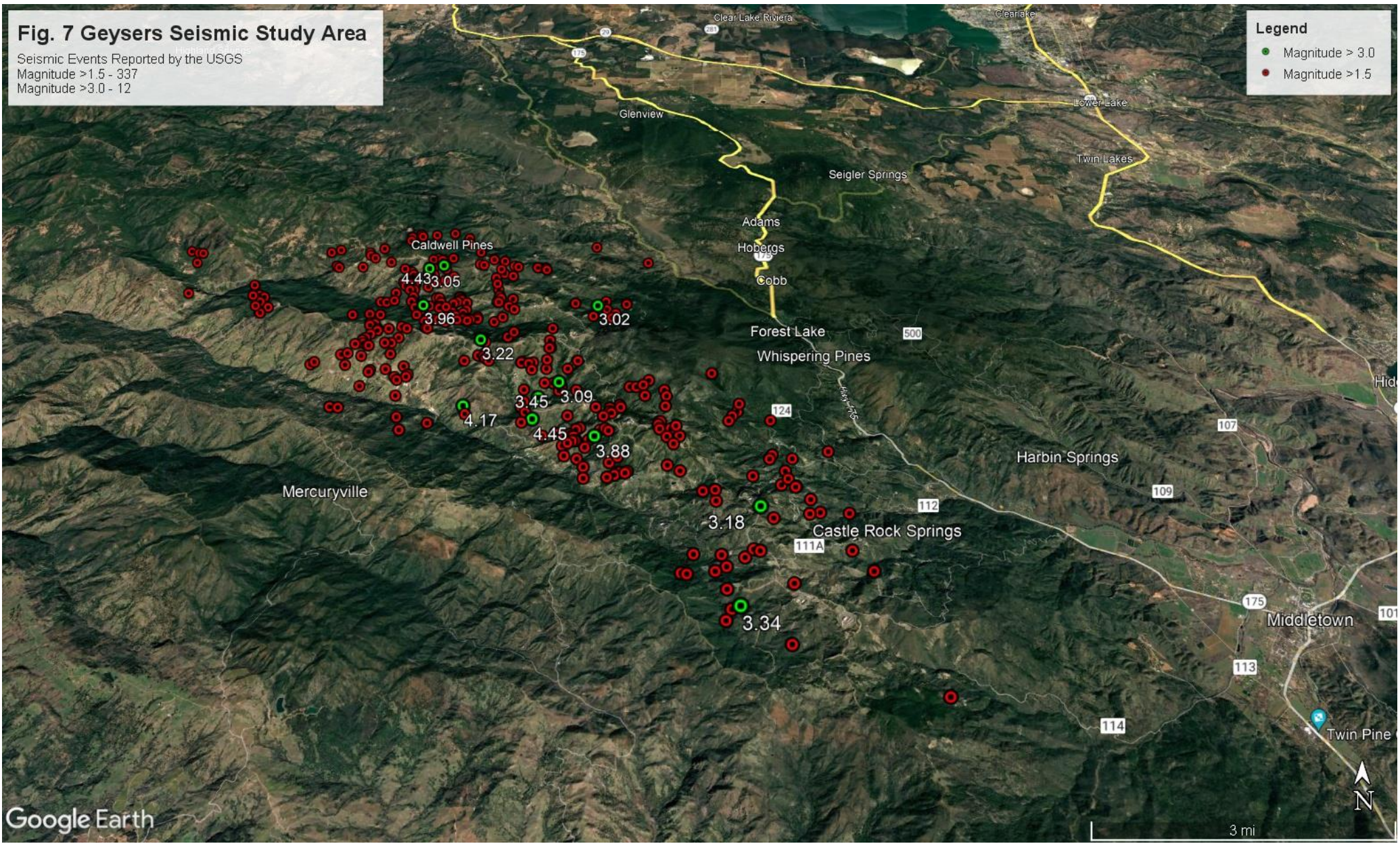


Fig. 7 Geysers Seismic Study Area

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- Magnitude > 1.5



Google Earth

3 mi