State of California
Alfred E. Alquist Seismic Safety Commission

Memo

To: Commissioners
Mr. Richard J. McCarthy, Executive Director

From: Commissioner Dr. Peggy Hellweg,
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Date: August 31, 2012

Subject: Notes on the Brawley, California earthquake sequence
August 26, 2012

Recent earthquake activity in the Brawley Seismic Zone (BSZ) began on the evening of Aug 25, 2012, with six small earthquakes (M<2.0). It picked up the next day three M2.5 events in the course of a few minutes. By the end of Sunday, Aug 26 more than 210 events had been recorded, with the two largest at 12:31 and 13:57 hrs. having M 5.3 and M5.5, respectively. More than 35 events had magnitudes greater than M 3.0. The earthquakes of this swarm are occurring on a northeast striking fault zone located about 6 km north of the northwest end of the mapped Imperial Valley fault within the BSZ. The BSZ extends from the northern end of the Imperial fault to the southern end of the San Andreas fault. Swarms have occurred in the BSC in the 1930s, the 1960s, and 1970s. In 1981 there was swarm-like earthquake activity called the Westmoreland sequence about 5 miles NW of the current activity. The largest event in that sequence had M 5.8. Some aftershocks of the Mw6.4 1979 earthquake also occurred in the same general area. The most recent significant swarm before this one was in 2005 along the south shore of the Salton Sea, with the largest event of M5.1.

In the 1960s and 1970s, the southern part of the BSZ was very active. Several swarms included many thousands of events, but with a largest magnitude of only M5.0 or less. From 1981 to 2000, the Brawley Seismic Zone was quiet. In the past decade several small swarms were recorded in the northern part of the zone.

The CISN's prototype earthquake early warning system detected and sent alert information for the events in the current swarm with magnitudes greater than M3.

Figure 1 is a map is attached showing the proximate location of the earthquakes with respect to the southern end of the Salton Sea. Figure 2 shows a map showing the epicentral locations of the current earthquakes sequence in red circles. A limited

reconnaissance by the USGS on August 27th near Brawley has not revealed any surface new faulting or liquefaction. The City of Brawley lies just to the south of the larger red circle. Locally the highest recorded pga and pgv were 0.45g and 40 cm/second respectively. This was recorded 3 miles from the epicenter of the magnitude 5.5 mainshock near Brawley. The highest intensity shaking (MMI VII) occurred near Brawley and resulted in mostly minor damage to:

- Pioneers Memorial Hospital, an acute care hospital with ceiling system damage, power and water losses resulting in 85 patients evacuated; 15 patients were medivac'd by air to other hospitals; most other patients were transported by ambulance to hospitals in Yuma Arizona, Riverside, and Northern San Diego County; some patients were sent home;
- localized loss of power and/or water; and temporary loss of power
- four skilled nursing facilities
- mobile homes that fell off their supports and in one case severed a gas line;
- stores including overturned contents and broken windows; and,
- one minor fire in the backyard of a residence.

Several instances of severe damage included:

- collapses of two porch structures that were appended to homes. One porch fell onto a toppled a wall in a rear yard;
- collapse of a plaster ceiling soffit over a sidewalk at a commercial storefront; and,
- fallen masonry from the top of a gabled wall of a church.

The two aspects of greatest initial concern during the emergency response were the evacuation of patients from the hospital and the potential adverse health impacts of the loss of air conditioning coupled with extreme heat on occupants. High temperatures were reported at 109 on Monday. However, power was restored within hours after the earthquake, so the latter concern has not resulted in reported health conditions.

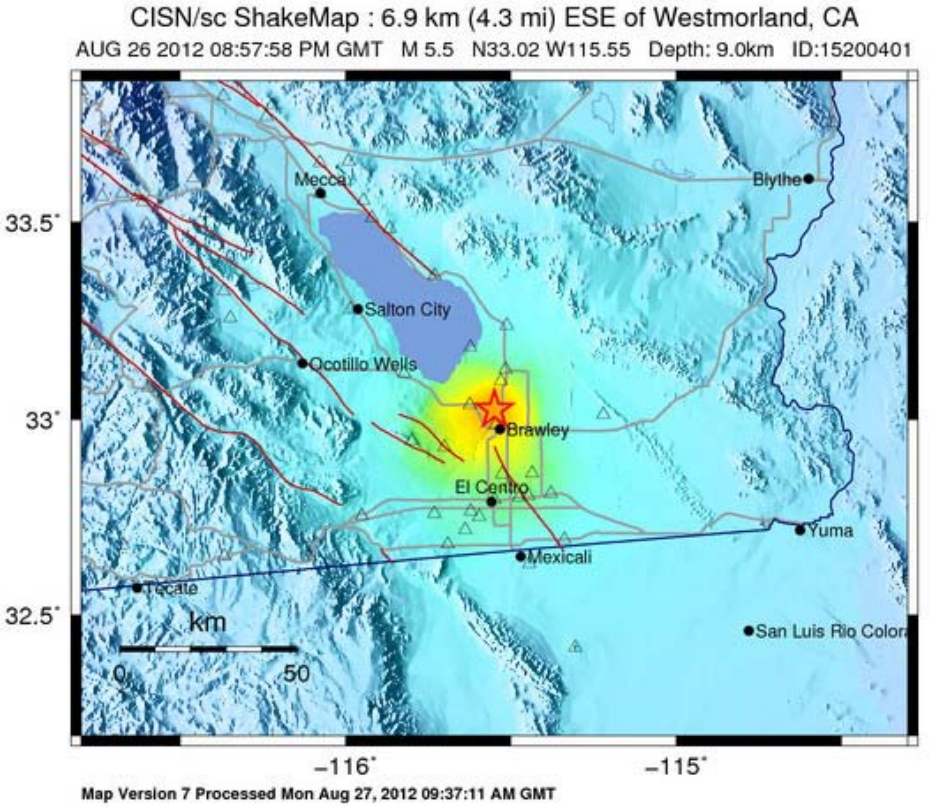
Building safety assessments were conducted Sunday evening and Monday at the hospital as well as public and private schools. The hospital reportedly suffered from ceiling damage but no significant structural damage was reported.

Most schools were scheduled to start classes for the school year on Monday, August 27th and that schedule was postponed to allow time for safety assessments. Schools were opened on the morning of August 28th. Damage reports from schools have not been made available as of late Monday, August 27th.

The area affected by the earthquakes has significant agricultural resources including feed lots for cattle as well as various seasonal crops. No significant damage has been reported to agribusiness at this time. Earthquake activity in the past has resulted in some damage to irrigation canals, weirs and drains for fields. Commission staff are looking into lessons that may be learned about preparedness and recovery in the agribusiness and other business sectors.

There are no estimated losses from the earthquake sequence as of noon on August 30th. The earthquake sequence is still underway.

Recommendation: This is an informational item only. Commissioners are invited to ask questions.



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.05	0.3	2.8	6.2	12	22	40	75	>139
PEAK VEL.(cm/s)	*<0.02*	*0.1*	*1.4*	*4.7*	*9.6*	*20*	*41*	*86*	*>178*
INSTRUMENTAL INTENSITY	I	II–III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Worden et al. (2011)

Figure 1 SHAKE map of the magnitude 5.5 earthquakes 3 miles NW of Brawley California North is to the top. The red lines trending to the northwest above and below the star showing the epicenter are the traces of the San Andreas and Imperial faults.

(Source: USGS)

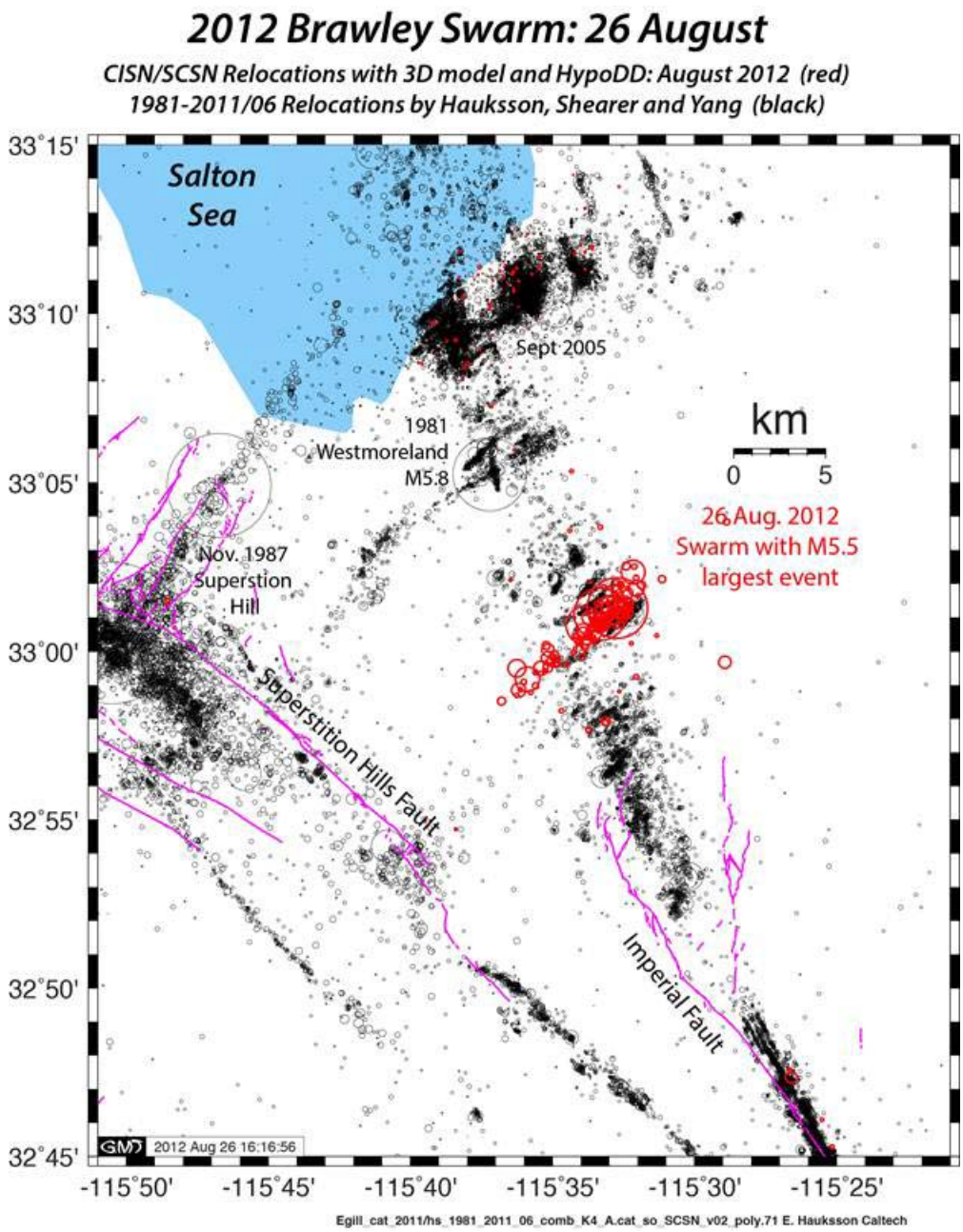


Figure 2 Map showing current earthquake sequence in red. The City of Brawley is 3 miles southeast of the largest red circle. North is to the top. Note: The Imperial fault had a magnitude 6.6 earthquake on October 15, 1979. The black dots represent the epicenters of historic earthquakes including some of the aftershocks from the Imperial Valley earthquake. (Source: Southern California Seismic Network)