

NAI How-to Guide for Emergency Management Case Study: Ventura County, California's Flood Warning & Response Program

Ventura County is located in southwestern California, between Santa Barbara and Los Angeles Counties. Most of the population of over 750,000 is in the southern part of the county. The northern half is national forest and wilderness areas.



The county is subject to different types of flooding, including:

- Larger rivers and creeks – These have broad floodplains, some developed, much of it in agriculture. These floodplains have the most lead time for a flood warning.
- Smaller channels, agricultural drainage ditches, and urban drains – These flood after locally intense rains and have short warning times.
- Upland flooding – Streams in steep canyons in the hillier areas also flood after local rains. When they flood, they carry sediment and debris.
- Post-fire debris flow – Floods in burned over watersheds carry a lot of sediment and debris that can clog channels and culverts.
- Alluvial fans – At the mouth of some canyons, floodwaters spread out in shallow flows. After the flood, the channels may be in different locations.
- Coastal – 43 miles of coastline are subject to tidal flooding, storm surge and wave action.
- Areas of shallow flooding – Ponding in areas due to soil and drainage conditions.

Since 1862, the county averages one flood every 10 years. The worst was in 1969 on the larger rivers. Thirteen people lost their lives and property damage was estimated at \$60 million (1969 dollars). Calleguas Creek flooded in 1983, causing \$39 million in damage, half of it to agricultural lands. Repairs to flood-control facilities after the 1983 flood were estimated to cost \$15 million.

The county's floodplain is home to 3,540 buildings, mostly agricultural and residential. Critical facilities in the floodplain include two elementary schools, a fire station, water treatment plant, oil production wells and oil processing facility.

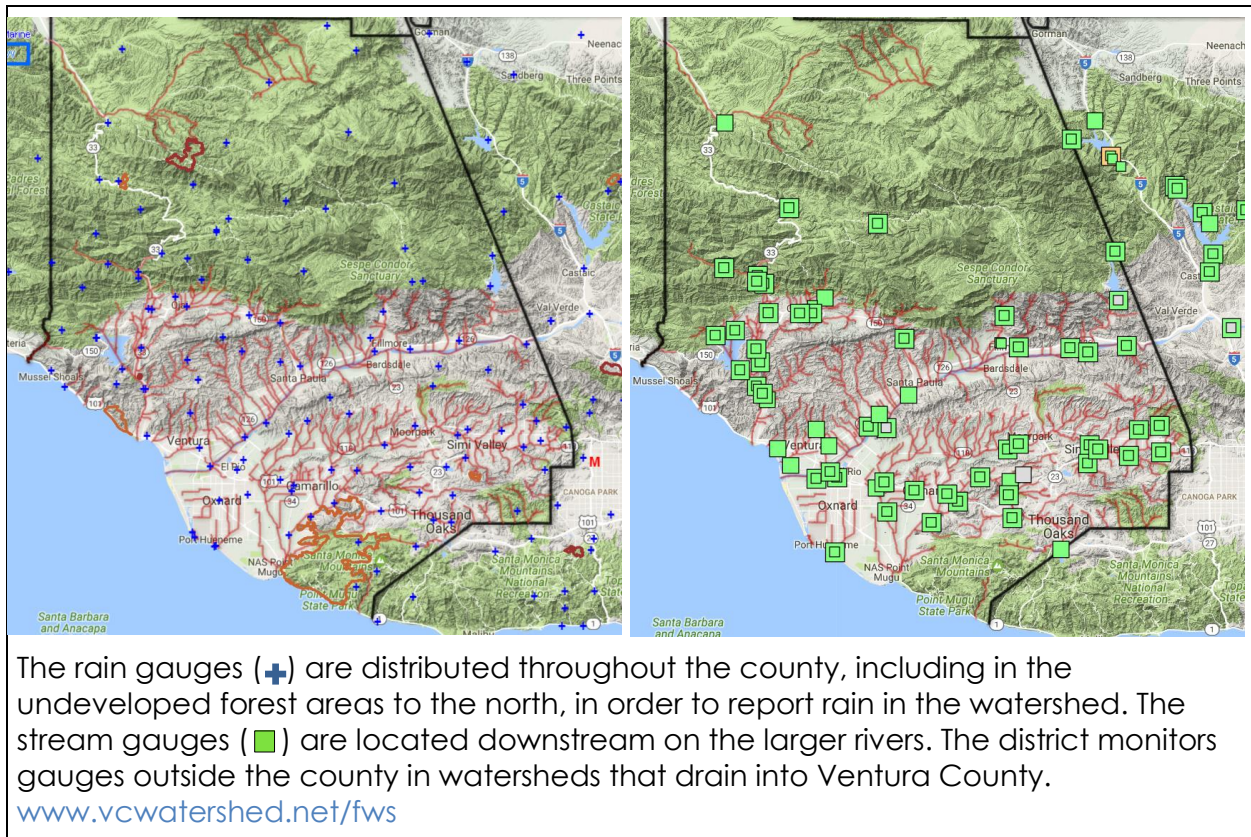
After a 1978 flood on Sespe Creek damaged homes and a wastewater treatment plant, the county established a flood-warning system for the Sespe Creek watershed. As other areas flooded, the system was expanded to include them. Cities participated. When the Point Mugu Naval Air Station was flooded, the Department of Defense chipped in. Many of the gauges are in weather stations that also collect and report data on wind speed and direction, which facilitated a fire weather monitoring system that is supported by area fire agencies.

Flood threat recognition: The flood threat recognition system is managed by the Ventura County Watershed Protection District. The system relies on the following gauges:

- 90 self-reporting rain gauges operated by the district,
- 65 rain gauges operated by other agencies, such as the USGS, Los Angeles Department of Public Works and California Department of Water Resources,
- 30 self-reporting stream gauges operated by the district, and
- 23 stream gauges operated by other agencies.

These gauges are part of the Ventura County Advance Hydrologic Prediction System.

Information on them and their current readings is available on the district's Flood Warning website at www.vcwatershed.net/fws. Website screenshots are displayed below and on the next two pages.



Alarm criteria for specific flood levels and rainfall rates are set by specific thresholds for each gauge. Once an alarm is triggered, an alarm message is sent via email, pager text, SMS cell text and Twitter messages to county emergency personnel.

The gauge data is read at the district's primary Storm Operations Center at the County Government Center. There is also a backup Storm Operations Center five miles away. Both centers have computers to receive telemetered data from the self-reporting rain and stream gauges. They also contain computers that run the hydrologic models that provide forecasts of the magnitude and timing of peak flows. The system can be monitored and operated remotely and can operate even if one or more computers fail.

When required, a district hydrologist is available to monitor the storm and hydrologic models. The hydrologist can be positioned at the county Emergency Operations Center to advise emergency personnel on how the channels are responding to the storm and to clarify any discrepancies between observed peaks and forecasted peaks.

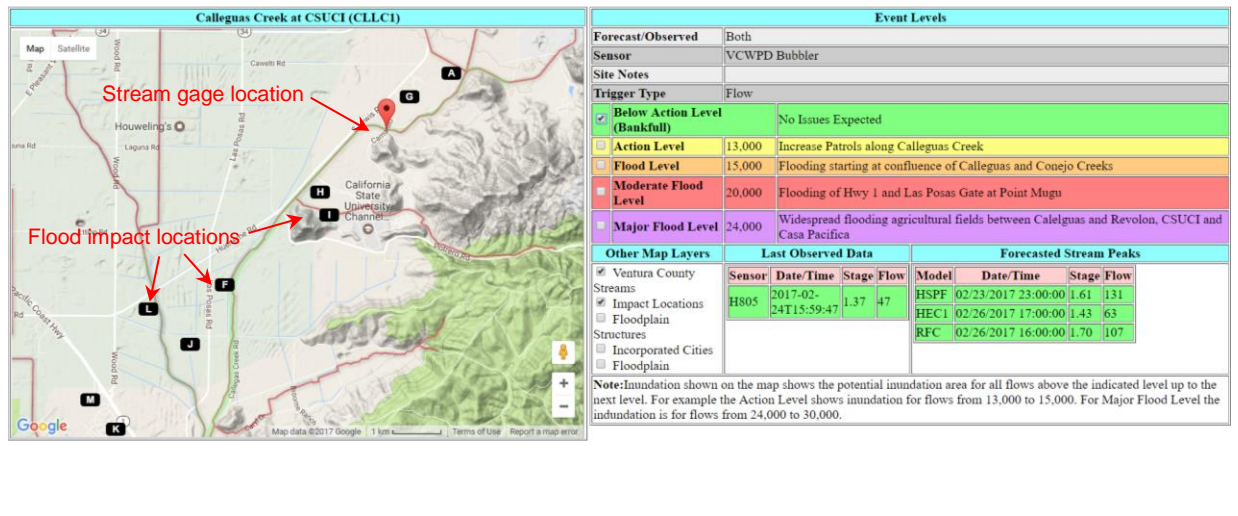
District staff are responsible for maintaining the self-reporting gauges and the computer systems. All the self-reporting gauges have regular maintenance schedules with tests from every three months to once a year, depending on the gauge.

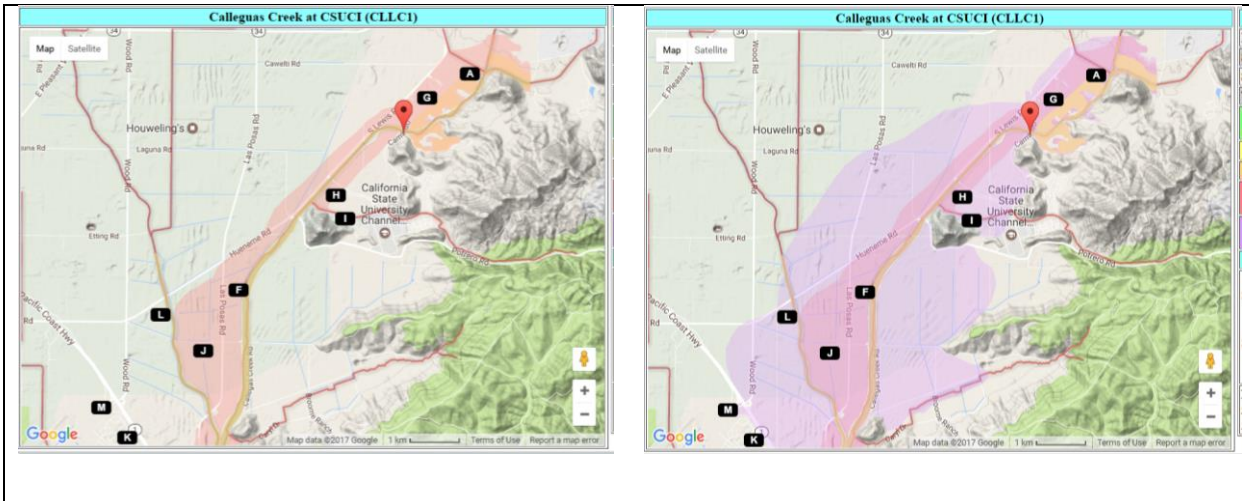
Post-fire debris flow and coastal flooding warnings are issued by the National Weather Service office in Oxnard, which is in Ventura County. Tsunami warnings are issued by the Pacific Tsunami Warning Center in Hawaii.

Inundation Maps: The system has inundation maps for all unincorporated areas in the county that have been mapped as Special Flood Hazard Areas. Along the rivers, there are five inundation levels as shown in the examples below. Coastal areas have two levels: coastal high hazard SFHA (VE Zone) and tsunami inundation area.

Ventura County Flood Inundation Maps

Flood inundation maps can be seen for most of the stream gauges on the county's [Flood Warning System Website](#). Five levels are shown for the river gauges – green for “below action level” through purple for “major flood level.” The green level is shown below. Instead of elevation, this system uses flood flow (e.g., 13,000 cfs) to delineate action levels.






The map above left shows the orange moderate flood level (20,000 cfs at the gauge) and the map on the right shows the purple major flood level (24,000 cfs). The letters refer to the flood impact locations that are discussed under the flood response activities below.

Flood Response: For each gauge, there’s a list of impact locations. The list below is for sites A-F on the above maps for Calleguas Creek. For each site there is an action threshold. At site E, for example, a predicted flow of 19,000 cfs triggers a notification to CHP and Cal-Trans about flooding at Highway 1.

Flood Impact Locations											
Location	CF	Name	Jurisdiction	Impact	Trigger	Action	Flood	Description	Personnel	Time Req	Action Needed
A		Calleguas and Conejo Confluence	Ventura County	Flooding	Flow	14,000	15,000	Breakout and flooding of agricultural fields below Calleguas and Conejo confluence	EOCOPS	0.5 Hours	Increase patrols near Casa Pacifica
B	2	Mugu Drain Tidal Gate	Ventura County	Action	Flow	14,000	15,000	Possible flooding from backwater from Mugu Lagoon	EOCOPS	0.5 Hours	Notify Point Mugu of high flows in Calleguas Cr and to monitor Tidal Gate
C	2	Las Posas Rd near Hwy 1	Ventura County	Flooding	Flow	18,000	19,500	Flooding between Las Posas Rd and Hwy 1 near Point Mugu	EOCOPS	1 Hour	Notify Point Mugu that flooding is occurring along Las Posas Rd
D	2	Las Posas Gate at Point Mugu	Ventura County	Action	Flow	17,000	20,000	Flooding of Las Posas Gate area. Flood wall must be in place to prevent flooding of the base	EOCOPS	4 Hours	Notify Point Mugu that Flood Wall needs been inserted at Las Posas Gate
E		Hwy 1 at Calleguas Creek	Ventura County	Flooding	Flow	19,000	21,000	Flooding of Hwy 1 at Calleguas Creek	EOCOPS	1.5 Hours	Notify CHP and Cal-Trans about flooding at Hwy 1
F		Calleguas Creek Levee near CSUCI	Ventura County	Erosion	Flow	19,000	21,500	Erosion may cause breach of levee below CSUCI and flood agricultural fields	EOCOPS	2 Hours	VCWPD monitor for possible levee failure. Prepare VC Trans to close Las Posas, Hueneme, and Wood Roads

Critical facilities: The county maintains a list of all critical facilities, including schools, fire and police stations, hospitals, bridges and stream channels. The list of those facilities that would be impacted during a flood includes contact information and warning criteria, and is updated annually.

StormReady/TsunamiReady: The county is a StormReady and TsunamiReady community recognized by the NWS. It does not receive CRS TsunamiReady credit because it does not meet all the credit criteria for that element. The county is currently a Class 5 CRS community.

Ventura County's program receives Activity 610 (Flood Warning and Response) credits:			
		<u>County</u>	<u>Max</u>
	FTR – Flood threat recognition system	75	75
	EWD – Emergency warning dissemination	70	75
	FRO – Flood response operations	55	115
	CFP – Critical facilities planning	25	75
	SRC – StormReady community	25	25
	TRC – TsunamiReady community	0	30
	Total	250	395