



Caltrans photo by Bill Lavelle

Tree debris and rocks rained down on State Route 140 after a storm passed through earlier this year. But the road had earlier been closed to traffic, a decision made by Caltrans after the National Weather Service warned that heavy rain would inundate the area burned by the Ferguson Fire.

Early Warning Road Closure System Tested Caltrans, National Weather Service Work to Protect Travelers on Yosemite Route

A novel weather monitoring system was piloted by Caltrans last winter to coordinate closures of State Route 140 into Yosemite National Park that was threatened by storm debris flows from areas scorched by the Ferguson Fire.

Following its initial run — tested by a very wet winter — the PREPARE program is being hailed for accurate forecasting and decisions that led to the timely closures of SR 140 ahead of major storms, protecting both the public and the integrity of the roadway.

Six closures of SR 140 were recorded through the winter and early spring through PREPARE, using customized forecasts for the affected area from the National Weather Service office in Hanford. The subsequent debris flows onto the highway left quite a mess for the crews of Caltrans regional District 10, but, most importantly, the incidents took place on an empty road cleared of any travelers.

The Ferguson Fire that shut Yosemite during the peak summer period left a trail of baked earth incapable of absorbing the torrents of rainwater that would inevitably come from winter storms. It was feared that post-fire debris flow could inundate SR 140, which winds through Merced River Canyon, and pose a deadly threat to residents and park visitors who use 140.

To avoid a second disaster on the heels of the first one, Caltrans partnered with the National Weather Service in developing the color-coded weather monitoring system and the criteria to close the highway in advance of potentially dangerous storms.

SR 140 serves as a major entry into Yosemite, and gets heavy local usage from nearby Sierra foothills communities.

Weather chart assigns storm risk levels

Before the onset of the rainy season, the NWS office began issuing a daily Ferguson Fire Burn Area Weather Decision Tiers forecast tailored for the vulnerable SR 140 corridor. The chart assigns a numerical value from 0 to 4 to assess the risk level of a debris or mud flow based on the predicted rainfall from a particular storm.

The Level 3 and 4 stages signify the highest state of alert, and trigger a series of actions that include pre-emptive road closures by Caltrans, changeable message sign warnings and emergency office activation. A Level 2 notification puts District 10 crews on standby status; Levels 0-1 are for normal operations. The weather service also issued an accompanying hour-by-hour, 48-hour risk assessment when heavy rainfall was

expected in the Ferguson burn area.

The decision tiers outlined in the chart are based on a post-fire assessment of the burned lands adjoining SR 140. Caltrans representatives worked with the federal Burned Area Emergency Response (BAER) team following the Ferguson Fire to survey the degree and amount of soil burned in the area, which in turn helped determine where stormwater could flow across the denuded landscape and overwhelm the highway.

Altogether, about 12 miles of the roadway was declared vulnerable to post-fire flooding in the event of heavy rainstorms. Up to 10 locations, primarily culverts and bridges, were identified on the BAER map as potential overflow points along the highway.

Armed with that information, Caltrans and its partners began mapping out the plan for protecting SR 140 and travelers during the winter season. Information about the new program also was shared with residents at town hall meetings and other public gatherings.

The collaborative effort included the U.S. Forest Service, Mariposa County Sheriff's Office, California Highway Patrol, Yosemite National Park, and the Weathernet private forecasting firm that worked with NWS on the localized forecasts.

Caltrans also readied for the upcoming season by moving extra cleanup equipment to its Midpines maintenance station on 140, near the affected area, as well as signs and barricades, and placing a weather reporting station nearby to monitor conditions.

Fog Alerts Give Drivers A Clear Warning of Conditions Ahead



Thick fog is an unwelcome fact of life for drivers, particularly those in the Central Valley. Caltrans works with the National Weather Service in Hanford to warn of expected murky conditions ahead of time through a fog severity index that forecasts where fog is expected to form, and how bad it'll get.

Caltrans also works with the National Weather Service office in Hanford to alert travelers in Central California when fog descends. The fog severity index served as a model for the weather decision tiers chart created for the Ferguson Fire burn area along State Route 140.

The fog index is issued daily by NWS during the winter months and early spring, when thick fog can reduce visibility to almost zero, particularly in the Central Valley.

Similar to the burn area chart, the index ranks levels of fog severity by color, ranging from a Level 1 green signifying no transportation risk to Level 5 purple, issued when conditions are most severe — zero to 200 feet visibility — and the greatest danger for chain reaction accidents exists.

The index also features a series of maps overlaid with the risk-level colors that correspond to the current conditions in the region, and hourly projections of where fog is predicted to occur for the next 15 hours. The fog zone shown encompasses

a wide area, from San Joaquin to Kern counties, and from the Coast Range to the west side of the Sierra Nevada.

At times when dense fog is forecast, Caltrans' District 6 office in Fresno uses the index to deliver warnings to drivers via its changeable message system along the regional highway network, sometimes several hours before fog develops. This can allow travelers driving in the late afternoon to prepare for dense fog the next morning.

Unfortunately, predicting fog is not an exact science. The conditions that create it can quickly change, and the vaporous clouds can be highly localized.

But NWS' fog severity index, which wrapped up its second year of operation, is felt to be another valuable tool that can help Caltrans inform and protect travelers on State highways, and is an example of multi-agency partnerships that can save lives.


Readying for the storm

The notifications given through the weather threat tier system gave the various regional entities involved time to brace for incoming storms. Area schools were notified of the highway closure, as were public safety agencies and the National Park Service, which gave time to send employees home early. Caltrans District 10 got the word out through traditional and social media, and changeable message signs in the region, and Division of Maintenance crews performed road preparations, all according to plan.

When the rain did hit, Caltrans was ready to respond. In addition to being helped by accurate forecasting of a storm's intensity and duration, District 10 maintenance staff found that the BAER map correctly zeroed in on highway locations where debris flows would occur.

Caltrans crews hauled off about 5,000 cubic yards of muck, rocks and dead vegetation that flowed from the Ferguson burn area onto SR 140 through early April — the equivalent of 500 dump truck loads. In a typical season, about half that amount of material is collected.

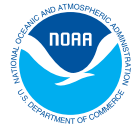
With its pinpoint predictive forecasting, better interagency and community communications, and heightened response ability, the PREPARE program equips Caltrans with a better arsenal of tools compared with its previous storm readiness protocol. Instead of responding to an event as it happens, or only on short notice, decisions to close the roadway can be made hours ahead of a potentially dangerous situation.

The success of PREPARE, and its potential for statewide application, convinced the Federal Highway Administration in May to award \$50,000 for its further development with partner agencies. The State is adding \$12,500 in matching funds. 

Source: Lisa Worthington, Caltrans Senior Landscape Architect, Special Projects; Jess McCoy, District 10 Midpines Maintenance Supervisor; Kristian Mattarochia, NWS Science and Operations Officer, Hanford office; Thomas Lawrence, D10 public information officer.

Ferguson Fire Burn Area Weather Decision Tiers

■ Very Low
 ■ Low
 ■ Moderate
 ■ High



Day	Wednesday 11/28	Thursday 11/29	Friday 11/30	Saturday 12/01	Sunday 12/02	Monday 12/03	Tuesday 12/04
Level/Risk	Moderate Afternoon/ Evening	High Afternoon/ Evening	Low All Day	Moderate All Day	Very Low All Day	Very Low All Day	Low Afternoon/ Evening

Wednesday																		
Time	6am	7am	8am	9am	10am	11am	12pm	1pm	2pm	3pm	4pm	5pm	6pm	7pm	8pm	9pm	10pm	11pm
Risk	low	low	low	low	mod	mod	mod	mod	mod	mod	mod	mod	mod	low	low	low	low	low

Thursday																								
Time	12am	1am	2am	3am	4am	5am	6am	7am	8am	9am	10am	11am	12pm	1pm	2pm	3pm	4pm	5pm	6pm	7pm	8pm	9pm	10pm	11pm
Risk	low	low	low	low	low	low	low	low	low	mod	mod	mod	high	high	high	high	high	high	high	mod	mod	mod	mod	mod

Discussion: A stalled cold front over Central California will be responsible for **Orange** (moderate) level late this morning into this evening. A stronger storm system will pass eastward over the northern half of California on Thursday. This low pressure system will be responsible for **Red** (high) level Thursday afternoon into Thursday evening. Precipitation rates should decrease Thursday night as this storm system moves eastward into the Great Basin. Light precipitation possible Friday ahead of another cold front.