

# THE OAK CREEK DEBRIS FLOWS OF JULY 12, 2008, INDEPENDENCE, INYO COUNTY, CALIFORNIA

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## Introduction

On July 12, 2008 tropical moisture moved westward across southwestern United States to southern California where it caused thunderstorms and local pockets of intense rain. In the late afternoon, a cell of intense rain was centered on the Oak Creek drainage just north of Independence in Inyo County, California. This area had been burned in an intense, lightning-sparked range fire in July 2007. Around 5 pm, water, sediment, and debris began moving down tributaries in the Oak Creek drainage area, eventually concentrating in the north and south forks of



Mud along north fork of Oak Creek. Mt. Whitney Fish Hatchery in the background. Photo by Ken Babione

of Oak Creek. At about 5:30 pm a hyperconcentrated flow destroyed a motor home parked at the Oak Creek campground on the north fork of Oak Creek, and its sole occupant jumped into the flow but he managed to survive. By then, the Mt. Whitney Fish Hatchery had been severely damaged along with several Fish and Game employee residences. The Inyo County Register (July 15, 2008) reported that along Oak Creek, 25 homes were destroyed and another 25 were damaged to some extent. Relatively few people were home and amazingly there were no serious injuries or fatalities among the residents. At 5:30 pm, the Independence Volunteer Fire Department received reports of flooding and propane leaks and responded along with Cal Fire personnel to find mud flowing across Highway 395. Boulder-rich debris flows also moved down the south fork of Oak Creek destroying the Bright Ranch. Fortunately, no one was there at the time. Debris flows from the south fork merged with sand-rich hyperconcentrated flows from the north fork near the fish hatchery and filled the channel of Oak Creek. Mud flowed east of Highway 395 through the Ft. Independence Indian Reservation eastward, almost reaching the Los Angeles Aqueduct. Highway 395 was closed during the evening and night of July 12 and was subject to restricted travel for over a week.

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Remains of the main house at the Bright Ranch on the south fork of Oak Creek.



**Map of the Oak Creek water-sediment flows of July 12, 2008 and their source areas.**

### **Extent of the Flows**

Rilling of slopes and scouring of stream channels extend up to 3000 m elevation on the escarpment of the Sierra. From the high country, mud moved through the Oak Creek drainage, onto alluvial

fans and out into Owens Valley, a distance of over 16 km with 1800 m of relief. Slopes are veneered with aeolian sand, decomposed granite, and ash from last year's fire and the channels are filled with sandy, bouldery sediment that is both fluvial and alluvial. Source areas for the south fork of Oak Creek are underlain by glacial till so flows moving down this part of the drainage contained more and bigger boulders than those in the north fork.

Water and sediment moved down the narrow canyons of the North Fork drainage as a hyperconcentrated flow (40-70 % sediment by weight). At the apex of the fan of the North Fork of Oak Creek the channel turns sharply south and the flow spread across the fan carrying boulders, logs and trees. Flows continued down the channel of the North Fork of Oak Creek which turns east and heads for the Mt. Whitney Fish Hatchery. Just upstream from the hatchery, the debris flow (70-90% sediment by weight) from the south and north forks merged and headed east through the hatchery and destroying homes. Flows then crossed Highway 395, passed through the Ft. Independence Reservation and came to rest in the flat lands west of the Los



**Hyperconcentrated flow from the North Fork of Oak Creek. The Mt. Whitney Fish Hatchery is at the left side of the photo. Flows from the north and south forks of Oak Creek merged just upstream from the hatchery. Photo by Ken Babione.**

## The man who surfed the flow

At about 5:30 on July 12, 2008, Don Rockwood was preparing dinner in his motor home parked at the Oak Creek campground when a tree crashed through the wall of his motor home.



**Don Rockwood, who surfed over a mile in the flow. Photo from the Inyo County Register.**

Moments later the motor home came apart and Rockwood jumped into the flow to escape. An accomplished body surfer, he began ride the flow. As he surfed the flow for hundreds of meters, he saw his pickup truck, also swept away, bearing down on him from behind. He was able to steer sideways, avoiding the truck, and managed to reach shallower and slower mud where he was able to stand. A wave, about three feet high, swept him away again, submerging him and smashing him against a rock. Now, suffocating, he thought the end was near but the mud slowed and he was able to stand again, making his way to the Fish Hatchery Road. Most of his clothing had been torn away and his shoes were gone. He knew there would be people at the fish hatchery so he began to walk along the road but soon it became impassable due to flowing mud, probably from the South Fork of Oak Creek. Lightning began to strike nearby and he was shivering so he looked for shelter but there was none. Rockwood decided he must make it to the hatchery so he picked up a branch to use as a

pole and headed through the flow toward the hatchery.

Mud was up to his chest but he made it through, emerging caked with mud, astonishing a group of fire

fighters. He was quickly airlifted to the hospital and treated for major lacerations but otherwise he was ok.

Observations by Don “Rock” Rockwood:

- First “wave” was about 3 feet high; hit his motor home at about 5:30 pm
- Second “wave”, about 8-12 feet high, hit moments later, destroying the motor home so he jumped into the mud and body surfed about a mile until it slowed enough for him to stand
- Third “wave”, about 3 feet high, knocked him off his feet; he surfed about another 0.5 mile before he was able to stand.
- After the three “waves” there was a steady flow of mud. Rain had stopped but there were lightning strikes nearby



**Remains of Don Rockwood's motorhome.**



**Don Rockwood's truck**

## North Fork of Oak Creek

The largest single source area for the flow is drained by an unnamed tributary to the North Fork of Oak Creek, here informally referred to as the middle fork of Oak Creek. Extensive rilling occurred on the slopes at elevations mostly between 2000 and 2800 m. Deep incision and scouring in the middle fork is apparent above 2200 m elevation and becomes more pronounced downstream. Below 2000 m elevation incision is typically 5 to 15 m; usually bedrock is exposed at the thalweg. Headward and sideward erosion in the form of slumping is ongoing. Deposits exposed in the walls of the new channel are both fluvial boulder gravel and alluvial debris flows attesting to a history of events such as this one. Calculations based on run-up (superelevation) around channel bends suggest the largest surge was traveling about 12 miles per hour



**Rilling of slopes in Charlie Canyon. Photo by J. DeGraf, USFS.**



**Granitic boulder (~1 cubic m) that came to rest against a tree trunk on the middle Fork of Oak Creek.**



**Bends in the channel of the middle fork of Oak Creek where speed of the flow was estimated by measuring run-up (superelevation).**



**Deeply incised channel of the middle fork of Oak Creek. Note run up of mud above the new channel.**

## South Fork of Oak Creek

The South Fork of Oak Creek has a different channel morphology than the north fork. It is much wider, as much as 300 to 400 m in places. It had three major source areas that collectively rival the size of middle fork. Extensive rilling occurred on the slopes below Onion Valley, Sardine Canyon and above Tub Springs. Most of the rilling occurred between 2000 and 2800 m elevation. This area is underlain by boulder-rich glacial till, so the water-sediment flows that moved down the south fork carried more and bigger boulders than in the north fork giving rise to a more complex flow regime. The leading edges of the flows were debris flows with boulder snouts which clogged the stream channel forcing the south fork into a new channel. Hyperconcentrated flows followed the bouldery debris flows and overtopped the boulder plugs. A second avulsion forced sediment out across the fan of the South Fork of Oak Creek.



Sediment from north and south fork of Oak Creek merged west of the Mt. Whitney Fish Hatchery. The South Fork of Oak Creek was forced into a new channel closer to the mountain front. The old channel marked by vegetation near the top of the photo is now abandoned. A second avulsion caused sediment to flow across the fan of the south fork but it eventually joined Oak Creek just west of the fish hatchery. Photo by Ken Babione

## Damage to homes and Highway 395

Twenty-five homes along Oak Creek just east of the Mt. Whitney Fish Hatchery were reportedly destroyed (Inyo Register, July 15, 2008). They were situated very close to the creek and were battered by boulders and logs.



Home destroyed along Oak Creek

Mud and debris filled the Oak Creek channel and new channel was established to the south. The creek was diverted back to its original channel soon after the event by CALTRANS allowing residents to reach their homes. Mud flowed across Highway 395 and through the Ft. Independence Indian Reservation damaging another 25 homes. Mud and water flowed across the highway for days requiring traffic detours or escorts to pass through the area.



**Mud flowing across Highway 395 requiring CHP escorts to guide traffic through.**

Photo by Ken Babione

### **Acknowledgments**

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