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Federal Assessments and Warnings of Potential Post-Fire Debris Flows: Examples from the January 2025 Los Angeles County Wildfires

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Starting on January 7, 2025, a series of damaging wildfires impacted Los Angeles (LA) County, CA. As the fires are extinguished and weather conditions change, state and local officials are increasingly concerned that intense rainfall on hillslopes in the burned areas may cause a *post-fire debris flow* (also known as *post-wildfire debris flows*; for further discussion, see CRS Report R47618, *Post-Wildfire Debris Flows: Federal Role in Assessment and Warning*). *Debris flows* (also known as *mudflows* or *mudslides*) are types of landslides that involve a combination of water, soil, rock, vegetation, or other debris moving down a slope. Debris flows may funnel into stream channels, thus carrying the debris faster and farther. Wildfires can leave a burned area particularly susceptible to debris flows triggered by rainfall immediately and for up to two to five years after the fire. Post-fire debris flows have caused fatalities, injuries, property damage, and environmental degradation (e.g., 2018 Montecito, CA, debris flows).

The U.S. Geological Survey (USGS) prepared post-fire debris flow hazard assessments for several of the LA County wildfires, namely the Palisades (**Figure 1**), Eaton, Hurst, and Hughes fires, at the request of state officials. The National Oceanic and Atmospheric Administration (NOAA) issued several flash flood watches and warnings that referenced the possibility of debris flows in these burned areas in the days after the fires (e.g., Palisades, Franklin, Eaton, Bridge and Hughes on January 27, 2025; the USGS prepared post-fire debris flow hazard assessments for the Franklin and Bridge fires in 2024) and expects to continue to do so.

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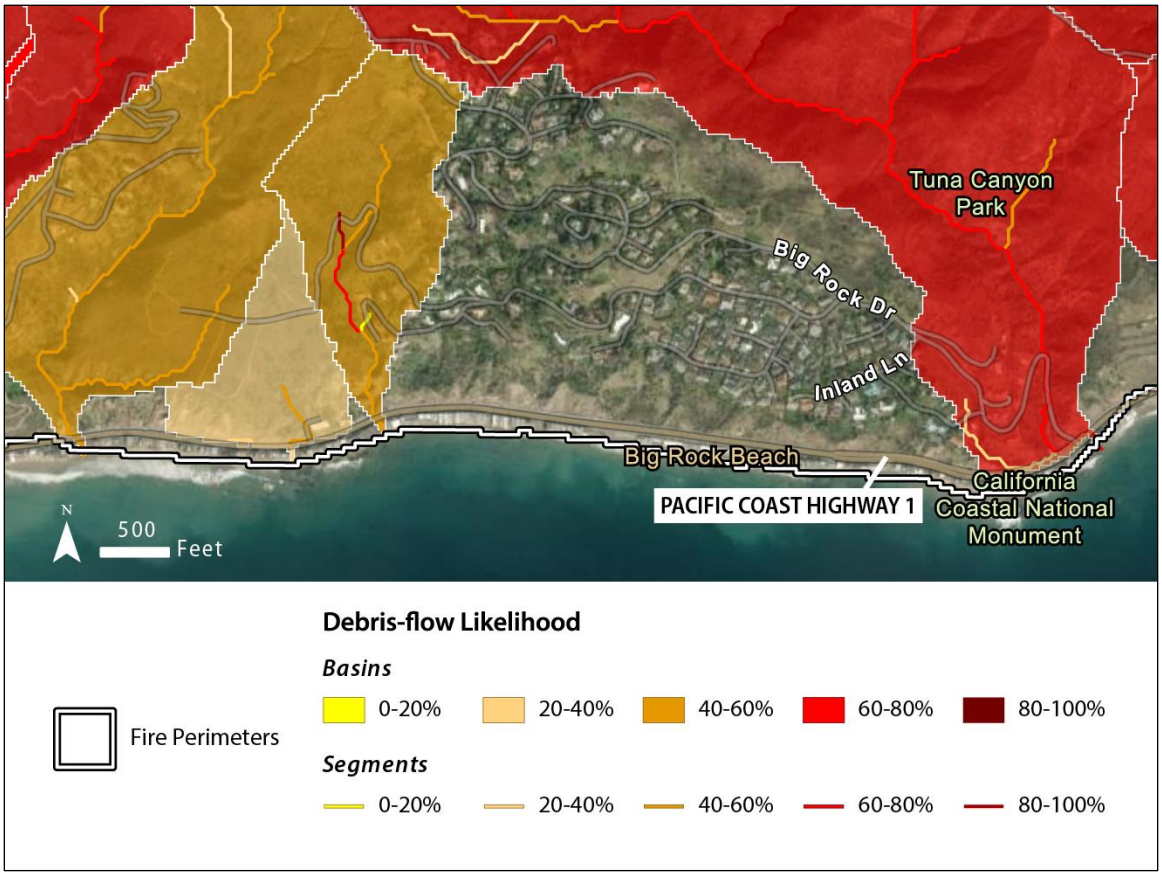
Figure 1. Excerpt from the USGS Palisades Post-Fire Debris Flow Hazard Assessment



Source: CRS from U.S. Geological Survey (USGS), "USGS Post-Fire Debris Flow Hazard Assessment Viewer," as of January 29, 2025.

Notes: Debris flow likelihood is for a peak 15-minute rainfall intensity of 24 millimeters per hour. The debris flow hazard assessment does not consider how any built environment may impact the likelihood of a debris flow and does not include debris flow runout paths or possible damage from debris flows. *Segments* refers to navigation networks in basins.

The USGS provides assessments of and NOAA provides warnings for potential post-fire debris flows. The USGS may prepare a post-fire debris flow hazard assessment for a burned area at the request of federal, state, or local officials (USGS Post-Fire Hazard Assessment Viewer). Officials typically use the assessments for planning, preparedness, and emergency response. The USGS assessments, based on empirical models, primarily consider rainfall, topography, and soil burn severity but do not consider any built environment burn severity within the fire's extent. The USGS debris flow empirical models estimate the likelihood and volume of a potential debris flow for a design storm. A *design storm* is a peak amount of rainfall over a 15-minute duration; the peak amount may vary for each assessment. The likelihood and volume are modeled at two spatial scales: basin and navigation networks in a basin (also called segments; **Figure 1**). Soil burn severity may contribute to debris flow likelihood and/or volume, as burned soil may become more impermeable to water infiltration, creating flood conditions, and as burned soil may become less stable (i.e., more likely to flow as a volume of debris downhill) because any root structures that may hold the soil in place have been burned. To prepare assessments, the USGS requires a soil burn severity map from the requesting official. The USGS prefers satellite-based (prepared using observations from Landsat and Sentinel) and field-based maps but can use only a satellite-based map when there is not enough time for field-based investigations. At the federal level, a Burned Area Emergency Response team that includes federal, state, and local officials may prepare soil burn severity maps. At the state level, the California Department of Forestry and Fire Protection (CAL FIRE) may request a debris flow hazard

assessment and the California Watershed Emergency Response Team may prepare a soil burn severity map, for example. The USGS models primarily have been validated in the western United States and do not identify debris flow paths, areas of inundation, or possible damage (ongoing research considers these factors).

NOAA's National Weather Service (NWS) monitors for and forecasts rainfall across the country, including in recently burned areas. Local NWS weather forecast offices issue forecasts with flash flood watches and warnings that note risks of mud and debris flows for burned areas based on rainfall intensity-duration thresholds provided by the USGS. As of the FY2025 budget request, the USGS and NWS planned to continue to collaborate and extend the debris flow warning system.

In 2021, Congress passed the National Landslide Preparedness Act (NLPA; P.L. 116-323), which directed the Secretary of the Interior (Secretary), through the USGS Director, to establish a National Landslide Hazards Reduction Program (NLHRP; 43 U.S.C. §§3101-3102). NLPA authorized activities to reduce risks from landslide hazards, including from post-fire debris flows. The act called for the Secretary, with the Secretaries of Commerce and Homeland Security, to "expand" a post-wildfire debris flow early warning system.

As of January 2025, agencies had not fully implemented the debris-flow-specific tasks called for in the NLPA. Congress may examine the NLPA's implementation, including the status of debris flow-related tasks. Congress may consider what level of annual or supplemental appropriations to provide to implement NLPA, including debris flow-related activities; whether to reauthorize NLPA appropriations beyond the NLPA's authorization of appropriations (which ended in FY2024); and whether to direct agencies to support other debris flow-related activities. For FY2025, the USGS requested continued funding for debris flow science and warnings, while NOAA proposed continued funding for forecasts and products to prepare communities for impacts after fire, including debris flows.

In addition, some researchers have cautioned that damaging post-fire debris flows may occur more frequently in the western United States because of increasing swings between dry and wet extremes due to climate change. Congress could review how agencies are accounting for these potential changes in their assessments, forecasts, and research and could evaluate the role of federal and nonfederal agencies and others in managing potential debris flow risks.

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