

Improving hazard prediction for glacier lake outburst floods from Suicide Basin near Juneau, Alaska

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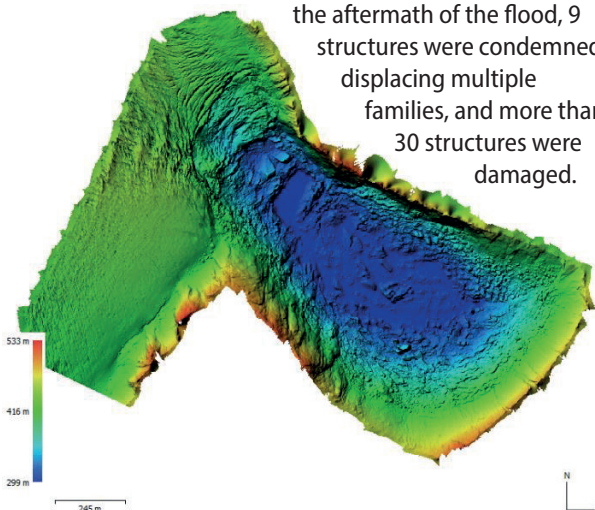


Suicide Basin after water drained during the August 2023 flood.

The Issue

Suicide Basin holds a glacier-fed lake along the margin of the Mendenhall Glacier in Juneau, Alaska. Each summer since 2011, Suicide Basin has collected melt and rainwater, creating a temporary glacier-dammed lake (image above). Water that accumulates in the basin is typically released through channels that run beneath the glacier. These lake drainage events start slowly and then rapidly accelerate as the flowing water widens the drainage channels beneath the ice, resulting in a glacier lake outburst flood. Between 2011 and 2022, these annual outburst events led to minor to moderate flooding along Mendenhall Lake and Mendenhall River, which flows through the most heavily populated neighborhood in Juneau. In August 2023, the outburst flood from Suicide Basin created the largest flood event ever measured on the Mendenhall River resulting in extensive damage to structures located along the river from both bank erosion and inundation (image right). In

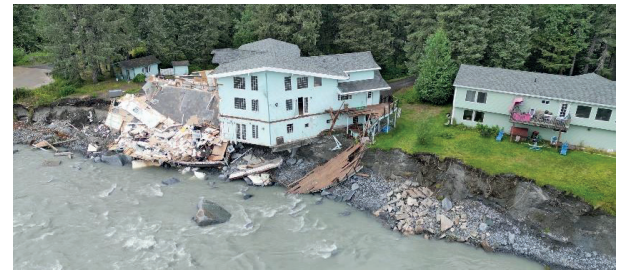
the aftermath of the flood, 9 structures were condemned, displacing multiple families, and more than 30 structures were damaged.



Images courtesy of the University of Alaska Southeast

The Needs

Because of the threats to people and infrastructure in the Mendenhall Valley, it is critical that we improve our knowledge of the glacier-dammed lake system at Suicide Basin and enhance our ability to monitor and forecast outburst flood events from Mendenhall Glacier. From a hazard and risk perspective, there are two primary research objectives that will enhance our ability to forecast future glacier outburst floods: (1) Develop an operational outburst flood model that will allow us to more accurately model outburst floods in real time, and (2) Evaluate how future melt-driven changes in the geometry of Mendenhall Glacier and Suicide Basin will alter water storage in the basin over decadal timescales. To date, we have made significant progress in quantifying changes in the storage capacity of Suicide Basin, which factors into both of those research avenues, using repeat drone-based aerial photographic surveys to create digital maps of the basin (image bottom left). These efforts should be continued in order to monitor the basin evolution.



Damage to houses and properties along the Mendenhall River in Juneau during the August 2023 flood event.

The threat of glacier lake outburst floods at Mendenhall Glacier is likely to persist, but the magnitude of the floods and the exact lifespan of this hazard from Suicide Basin is difficult to predict. Our current ability to predict outburst floods in real time is clearly insufficient, but we have worked with our federal and state agency partners to identify several tractable research objectives that will enhance our ability to forecast future outburst floods at Mendenhall Glacier. More accurate flood forecasts will improve the process of initiating and implementing closures and evacuations in the Mendenhall Valley. In addition, the monitoring and modeling tools and techniques we develop at Mendenhall Glacier will be transferrable to other locations in Alaska such as Snow Glacier and Valdez Glacier where outburst floods similarly pose significant threats to human health and safety and critical infrastructure.

Left: Digital elevation model of Suicide Basin following the August, 2023 glacier outburst flood.