

Mile High Flood District uses lidar for mapping flood hazards

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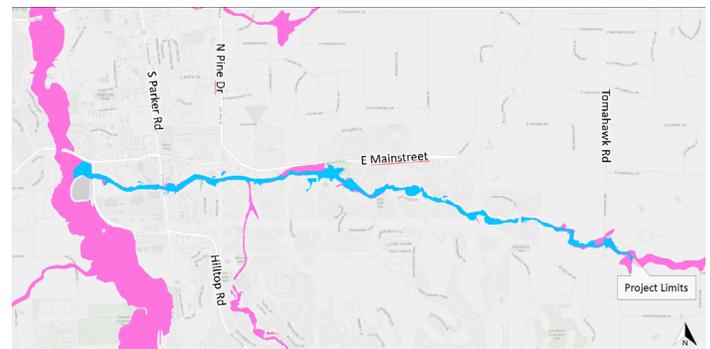
The Mile High Flood District manages over 3,000 miles of major streams in Colorado. Understanding where people and property are exposed to flood hazards is central to the Mile High Flood District's mission of preservation, mitigation and education. The Mile High Flood District partners with seven counties and 35 municipalities to conduct stream studies and projects that help reduce the risk of flooding. All of its efforts rely on access to the best available elevation data. DRCOG's partnership with the U.S. Geological Survey to collect lidar provides the advantage of a reliable and consistent dataset whether a single stream or an entire watershed is studied. The Mile High Flood District uses U.S. Geological Survey quality level 2 lidar elevation products to evaluate risk through flood plain mapping, fluvial hazard zone mapping and in dam breach analysis studies.

Flood plain mapping

Reliable flood plain maps are critical for homeowners, governments and developers to understand where flooding may occur and identifying structures at risk. The Mile High Flood District conducts flood hazard area delineation studies to create and update flood plain maps, and watershed master planning studies to identify stream improvement required to accommodate changes to the built and natural environment over time. Both are dependent on lidar-derived digital elevation models. Master planning studies provide information that can be used to guide new land development projects on flood control and stream improvement needs. The modifications to a flood plain map from a flood hazard area delineation study are submitted to the Federal Emergency

Management Agency for a physical map revision of the effective FEMA flood hazard information. Lidar-derived products are also used to supplement channel surveys on smaller scale flood plain mapping revisions.

A recently completed flood hazard area delineation along Sulphur Gulch, a tributary to Cherry Creek in Douglas County, revealed a reduction in the 100-year flood plain after the hydraulic model was developed with updated lidar-derived contours and survey of major structures in the area. Current lidar in and adjacent to the flood plain allowed for more accurate hydrologic and hydraulic modeling as well as mapping that reflected current conditions. As a result, zero insurable structures were located in the 100-year flood plain. Once the flood plain is approved by FEMA, the delineation will be reflected as the effective flood plain on FEMA flood insurance rate maps for local and federal regulation.



The modified flood plain from the Sulphur Gulch flood hazard area delineation is displayed in blue. The existing mapped flood plain is represented in pink.

Fluvial hazard zones

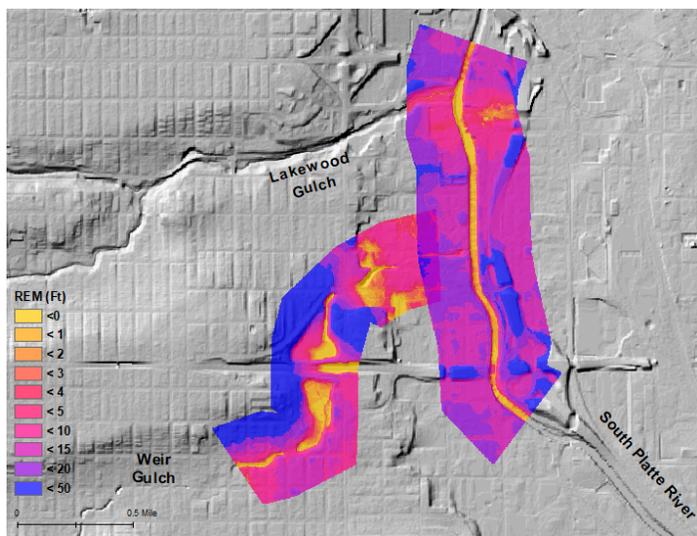
Traditional flood plain maps, although critical in flood risk assessment, do not consider dynamic river processes such as erosion and sediment deposition. Fluvial hazard

zone mapping, used in conjunction with flood plain mapping, helps communities better understand where they have the potential for flooding. The Colorado Water Conservation Board developed a protocol for mapping fluvial hazard zones, and access to the U.S. Geological Survey quality level 2 standard lidar provides the Mile High Flood District with data at the level of accuracy needed to map fluvial hazard zones using the Colorado Water Conservation Board's protocol. The quality level 2 data allows for the creation of lidar-derived digital elevation models with 2-foot resolution, which identifies landforms most influenced by the natural dynamics of a stream. Digital elevation model-derived datasets that are important in fluvial hazard zone visualization and analysis are hillshade and slope rasters, as well as relative elevation models.

“The relative elevation model enhances visualization of the fluvial signature (i.e. relic channel scars, flood plain surfaces, alluvial terraces) particularly when laid over a hillshade raster.”

(Colorado Water Conservation Board, 2020)

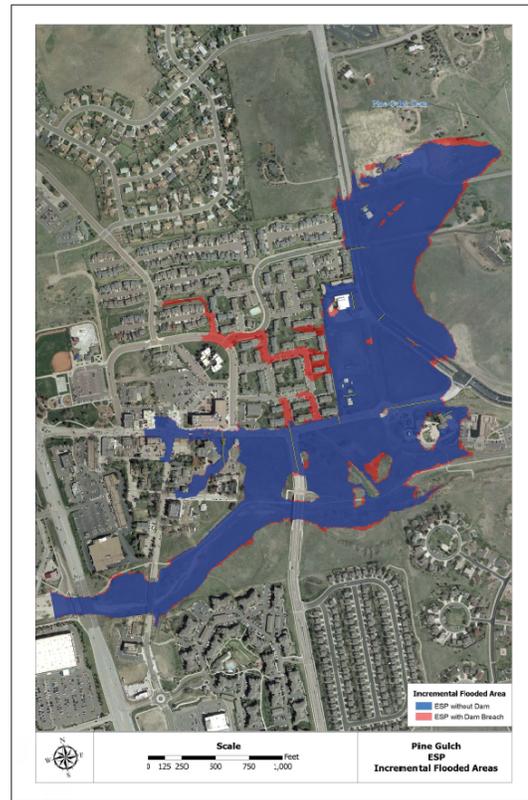
By considering fluvial hazard zones during the design and construction of mitigation projects, the Mile High Flood District helps reduce the risk of flood damage and encourages municipalities to make more informed land use decisions.



Relative elevation model for South Platte River and Weir Gulch. Lower relative elevation values highlight areas that could have a higher risk for erosion during a flooding event.

Dam breach analysis

With several dams in the Mile High Flood District, conducting dam breach analysis and inundation mapping studies is critical for local emergency managers to understand the associated flood hazards. Significant development, both residential and commercial, downstream of the Pine Gulch Dam prompted the need for a dam breach analysis study to understand the flood risk to people, vehicles and structures if an overtopping event occurred. Lidar-derived 2-foot contours and lidar-derived digital elevation models were used to determine the reservoir's surface area, storage capacity and the watershed boundary upstream of the dam, all of which were used in the hydraulic model to simulate flooding under different conditions.



The Pine Gulch Dam was classified as high hazard because a dam failure could affect at least one resident downstream. Classifying dams as high hazard allows emergency managers to plan ahead and monitor higher-risk areas during an event.