

Two-Dimensional Flow Modeling for a Flood Insurance Study in Montana

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A two-dimensional flow model was used by the U.S. Geological Survey, in cooperation with the Federal Emergency Management Agency, to refine previous estimates of the Tenmile Creek flood-plain boundaries in Lewis and Clark County, Montana. Tenmile Creek, which has a perched channel with a relatively small capacity, has overflowed its banks and flooded parts of the Helena Valley at least 3 times in the past 30 years. Historically, floods have inundated agricultural and suburban areas as much as about 2.5 miles north of the channel. Previous estimates of the extent of this valley flooding were developed using aerial photography of historic floods. However, flow rates, depths, and velocities—all of which are important data for flood-plain management—have not been available.

The Surface-Water Modeling System (SMS)¹ and the Two-Dimensional Depth-Averaged Flow and Sediment Transport Model (FST2DH)¹ were used to simulate the two-dimensional flow patterns for the overflow area north of the Tenmile Creek main channel. The graphics-based SMS computer program manages input and output data for the surface-water model. FST2DH is a computer program that utilizes the finite-element method to simulate two-dimensional flow in rivers, estuaries, and coastal waters. The combined use of the SMS and FST2DH for two-dimensional flow analysis provided estimates of flow rates, depths, and velocities for Tenmile Creek overflow flooding across the Helena Valley.

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