

Ecologist

Craig L

## Some Preliminary Observations on Capulin Canyon Flood of June 26, 1996

Steven Reneau, Geology and Geochemistry Group, Los Alamos National Laboratory, July 7, 1996

I accompanied Sue Cannon, U.S. Geological Survey, into Capulin Canyon on July 3-5, 1996, in order to assist with her landslide and debris flow hazard evaluation. Some general observations of the effects of the June 26 flood were made on July 3 and 4 in the 4.3 km long reach between the upper trail from the Dome Trailhead and Base Camp. In addition, on July 5 I made additional observations in the 4.5 km long reach between Base Camp and Painted Cave in order to examine general downstream changes in geomorphic effects of the flood.

Upstream of Base Camp the main effects of the flood appeared to local but irregular incision of the channel bed and erosion of the channel banks, with at least 0.5-1.0 m of apparent incision being common (estimated from memory, not measured). In four locations, sandstone bedrock was observed in the stream bed, indicating complete scour of previously deposited bed sediments. The canyon bottom outside of the main channel generally appeared to be "swept" or lightly scoured, with the flood stripping ash, litter, and likely the uppermost soil horizon. Little sediment deposition was apparent in this reach, with the exception of local gravel deposits behind obstructions in the channel such as log jams, and isolated sand deposits in quieter areas marginal to the main flood, although deposition of woody debris was common. The most extensive area of deposition of fine sediment was in an abandoned channel on the southwest side of the canyon, about 1.7 km above Base Camp, where about 20 cm of fine sand and ash was deposited in a backwater area. There was no evidence of significant transport of coarse gravel from tributary drainages into the main channel, suggesting that the cobble-to-boulder sized gravel transported during the flood was largely or entirely derived from channel and bank erosion.

It is notable that there is abundant evidence for significantly larger floods on the floor of Capulin Canyon throughout this reach, specifically extensive boulder deposits commonly containing boulders much larger than those transported in the June 26 event. Although possible relations of these older events to past fires is unknown, their presence demonstrates the potential in this canyon for significantly larger floods. A piece of a log buried by boulders up to 1.5 m in long dimension, larger than observed transported in the June 26 flood, was sampled from the stream bank at Base Camp for possible radiocarbon dating, as the age of this log could help indicate the general time scale of larger flood events in Capulin Canyon.

Between Base Camp and Painted Cave, measurements were made at irregular intervals of approximate flood depth and channel incision, and indicated a general but irregular decrease in both flood depth and channel incision through this reach. In the upstream part of this reach, below Base Camp, depths of 2-2.5 m were commonly estimated, whereas maximum flood depth had apparently decreased to about 1-1.5 m in the area upstream of Painted Cave. The most common channel change observed was again incision, although the amount of incision appeared to be less (estimated at 0-0.6 m at

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different sites) than upstream from Base Camp. Many areas apparently experienced no channel incision, and local aggradation of the stream bed with sand was inferred in some areas (although this sand deposition could have occurred after June 26, particularly since the stream was clearly transporting abundant sand on July 3-5). Local coarse gravel deposition was noted in some areas within box elder (?) groves, including boulders up to 0.85 m in long dimension, causing very local channel aggradation. The most common effect on the flooded areas outside the main channel was again "sweeping" or light scouring, in addition to deposition of woody debris, although areas of sand deposition were much more common than upstream of Base Camp, and appeared to increase in frequency and size downstream. These changes are consistent with the apparent decrease in flood depth and also with a progressive decrease in channel gradient ( $\sim 0.04$  or  $2.3^\circ$  at Base Camp and  $\sim 0.03$  or  $1.7^\circ$  at Painted Cave, as measured from 7.5' quadrangles), both of which should tend to decrease the potential for erosion and increase the potential for sediment deposition.

Evidence for a significant flood was also seen in the tributary drainage about 0.9 km upstream of Painted Cave, which drains the area between St. Peters Dome and Boundary Peak, with an estimated maximum flood depth of 1.5 m. However, the next drainage to the east, about 0.25 upstream of Painted Cave and apparently out of the main burn area, did not experience a flood.

Based on these observations, it seems likely that future floods similar to or smaller than the June 26 flood would cause additional bank erosion and possibly additional channel incision, particularly in upstream areas, and cause some additional sediment deposition, particularly in downstream areas. The widespread occurrence of steep newly-eroded banks adjacent to the channel may increase the potential for future bank erosion, although it is notable that the vast majority of the trees in the flood zone appear to be intact, and their root networks should help impede erosion in the near future. Lateral changes in channel location are possible in areas where the channel aggrades due to the deposition of sediment, either behind log jams and other obstructions or possibly in lower-gradient downstream reaches.

The effects of potential future floods larger than the June 26 event are more difficult to predict. More extensive bank erosion and channel incision are clearly possible, both in already eroded upstream areas and in downstream areas that experienced relatively little erosion on June 26. However, the older, prehistoric flood deposits indicate there is also the potential for significantly different flood effects. Specifically, the widespread boulder deposits indicate that under some conditions the supply and transport of boulders in the part of Capulin Canyon within the Monument can be many times that occurring on June 26, likely causing filling of the previous channel in many areas, in turn causing the channel location to migrate and new areas to be subject to bank erosion. The cause and frequency of such events is unknown, but they have probably been responsible for creating many of the features of the canyon bottom that exist today.