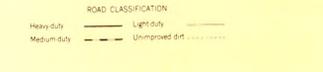


Base map from U.S.G.S. topographical maps, 1:24,000
 Series: Cave Creek (1965); Curry's Corner (1964);
 Humboldt Mountain (1964); New River Mesa (1964);
 Wildcat Hill (1965).



RECONNAISSANCE ENVIRONMENTAL GEOLOGY OF THE TONTO FOOTHILLS, SCOTTSDALE MARICOPA COUNTY, ARIZONA

by Troy L. Péwé, Ray Kenny and Jim Bales
 1985

Arizona Geological Survey Contributed Map CM-12-C
 November 2012

FLOODING

Arizona Geological Survey Contributed Map Series

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EXPLANATION

- I** Extent of inundation from the 100-year flood-flow along Cave Creek and major tributaries. Open pattern indicates flood outlines previously published. Cross-hatched pattern indicates areas where potential flood hazard is based on neotectonic evidence noted by the authors from field observations and interpretation of aerial photographs and topographic maps.
- II** High probability of flooding along small, shallow channels or by sheet flow over slightly dissected alluvial plains. High probability of deposition of mud, sand, gravel and debris from floodwaters.
- III** Flooding generally confined to defined channels of washes cut into poorly to well-indurated alluvium of slopes. Cross-hatched pattern areas susceptible to flooding by local sheetflow.
- IV** Steep mountainous terrain with high potential flood hazard in strongly defined channels. Some effects of floodflow may trigger landslides.

MAP SYMBOLS

- ▲ 2740
31** Apex of triangle points to location of design point. Upper number is flow in cubic feet per second in the 100-year flood. Lower figure is area of watershed (in square miles) upstream from design point.
- Boundary between Verde and Salt River watersheds.
- Boundary between minor watersheds.
- △** Location and orientation of illustration.

INTRODUCTION

As incongruous as it may appear, flooding is a major hazard in desert areas and probably is the major geologic hazard in the Tonto Foothills area. The principle potential flood hazard in the area is along the major drainage, Cave Creek and its tributaries. It must be emphasized that the flood hazard along the cave creek on the pediment, and alluvial slopes and plains, although generally overlooked, also constitutes a serious problem.

The washes, either in defined channels or in poorly defined low-bank channels are normally dry and can carry essentially only small flows. The flow from a 100-year magnitude event would result in water surface channels and a high velocity flow in the confined channels. The typical flood is one of rapid rise in water surface, channels and a gradual decline in water surface. Such are referred to as flash floods. As is short period of peak flow, and a gradual decline in water surface. Such are referred to as flash floods. As is short period of peak flow, and a gradual decline in water surface. Such are referred to as flash floods. As is short period of peak flow, and a gradual decline in water surface. Such are referred to as flash floods.

The zones of potential flood hazard on the map are based on the source of flooding, frequency of flooding and degree of hazard related to physical features such as land forms and drainage patterns. The zones in general re-degree of hazard related to physical features such as land forms and drainage patterns. The zones in general re-degree of hazard related to physical features such as land forms and drainage patterns. The zones in general re-degree of hazard related to physical features such as land forms and drainage patterns.

This area is inundated by 100-year flood magnitudes or greater along Cave Creek and its major tributaries. It includes the main creek channel and most of the present flood plain. The velocity of the flow would be high and the land adjacent would be subject to lateral erosion as well as shifting and migrating of creek channels. The depth of flow on the floodplain, outside of the channel, will be more than 1 foot and locally as much as 3 feet.

Obstructions or channel modifications would cause changes in the flooded area, and would also change either erosion or depositional environment, or both, for that stretch. Erosional or depositional changes would generally occur downstream from the point of a new obstruction or modification, which could include a new bridge, large open trees, or a large load of trash deposited in the channel area.

The peak discharge of the 100-year flood from Cave Creek and its major tributaries at the west edge of the map area below Greenway Highway is 36,860 cubic feet per second (cfs) (see map). One-half mile below the confluence with Rose Wash, the 100-year flow is about 35,000 cfs.

The area on Cave Creek floodplain covered by the 100-year flood downstream from its junction with Rose Wash has been defined by the U.S. Corps of Engineers (1964). Upstream from Rose Wash, the area of Cave Creek and its major tributaries south of 33°52'30" N. lat. and west of 111°52'30" W. Long. that is covered by the 100-year flood was estimated by the U.S. Geological Survey (Hjalmarson, 1978). The cross hatched area of Zone I extending upstream from these earlier works, was compiled by the present authors from field observations and interpretations from aerial photographs and topographic maps. The discharge figures on the map are from U.S. Department of Housing and Urban Development (1979).

This zone has a high probability of flooding (I) along any of the small, shallow channels in this area of a slightly dissected alluvial plain, and (2) from overland flow or sheetflow less than 2 feet deep on the generally flat surfaces between the small channels. Streams debouching from steeper ground onto Zone II areas can transport large quantities of mud, sand, gravel, and debris. This sediment will be deposited where the velocity of flow slows. There is a high probability that such flood sediments will be deposited in, and adjacent to buildings, pools, slabs, etc. Erosion is generally not a problem within Zone II.

The potential flood hazard for a specific point in Zone II is very difficult to estimate, and is generally underestimated, because a specific drainage area cannot be easily determined. Most channels in Zone II are less than 3 feet deep and divide or split, which invalidates normal procedures for determination of the area of a watershed, upon which the calculation of precise precipitation volumes depend.

A further difficulty concerns the movement of a channel across the land surface. Comparison of aerial photographs and topographic maps which had been prepared about 10 years apart reveal many channel changes; also branching or joining points had changed location.

Any evaluation of flood-hazard potential must consider site evaluation, the cross-sectional configuration, the gradient of the terrain, the distance from the site to adjacent flood washes, the location and estimate of overland flow upstream, and although rarely applicable here, long since the soil was saturated.

ZONE III

The greatest potential hazard in Zone III is caused by flooding in the confined channels between the defined ridges of the dissected land surface of the pediment, the alluvial slopes, and the creek terraces. Within this zone, both erosional and depositional processes will add to the potential hazard. Scour and bank erosion have occurred along many of the channels and along the incised short segments of floodplains found in this zone. Deposition has occurred where the short floodplain segments are being built or are aggrading. The depth of flooding generally does not exceed 10 feet and will depend upon the amount of erosion or deposition that occurs during the flood flow. Occasionally debris jams occur at natural channel constrictions, or at man-made obstructions, and there the depth of floodwaters will increase on the upflow side. The hazard potential in the larger washes of Zone III is very similar to that for Zone I; however, the channels in Zone III are not as wide nor have they achieved the degree of near-permanence by being entrenched as Cave Creek or its major tributaries. The narrow channels can only be clearly depicted on very large scale maps. There has been less changing locations of channels in Zone III than in Zone II. The areas shown in the cross hatched pattern are susceptible to flooding from local sheet flow.

ZONE IV

The high potential flood hazard in Zone IV exists within the strongly confined or well defined channels of the steep slopes of hills and mountains. Sudden flooding and high velocity of flow are common. There is low potential flood hazard on the well drained mountain slopes of this zone, however sheetflow down the slopes may occur and be the initiating factor for other geologic hazards such as landslides, boulder rolling, or debris flows. Debris flows would generally be confined to the ill-defined minor channels which are tributary to the major mountain channels. See Plate 2 for information on the other geologic hazards.

*This map involves a general evaluation on a broad scale and does not preclude the necessity of a specific site investigation.

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Figure 1 - Looking downstream along a small unnamed wash in Zone II. The channel is about 12 ft (3.7 m) wide, and the banks are from 1 to 1.5 ft (0.3 to 0.5 m) high. The capacity of the channel is about 10% of the potential peak discharge of the 100-year flood. The hydraulic characteristics and general appearance of many small washes in Zone II are similar to those of the wash in the photograph. Floodwater may spread over the adjoining land as much as 2 ft (0.6 m) deep and as much as 100 ft (30 m) from the channels (from Hjalmarson, 1978).



Figure 2 - Looking downstream and west along one of the large washes in Zone II. Channel is about 40 ft (12 m) wide and has a 3 ft (0.9 m) high bank on the south and a 1 ft (0.3 m) high bank on the north. The capacity of the channel is a small fraction of the potential 100-year flood. Land adjacent to large washes is susceptible to inundation, erosion, and deposition of sediment. Floodwater can spread out from the washes to depths of more than 3 ft (0.9 m). The floodflow on land adjacent to the channels generally is less than 2 ft (0.6 m) deep; the floodflow in the channels may be as much as 1 ft (0.3 m) deep, and velocities may be more than 10 ft/s (3.0 m/s). The small manmade mound of sediment indicated by the arrow in the right foreground of the photograph is adjacent to a subdivision lot to the north (from Hjalmarson, 1978).