WATER FACT SHEET

U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

FLOODS IN ARIZONA, JANUARY 1993

An unusual series of storms from the Pacific Ocean starting on January 6, 1993, and continuing through January 19, 1993, caused heavy and prolonged precipitation across the State of Arizona. These heavy rains caused the most widespread and severe flooding in Arizona since the turn of the century. The highest flows of record were observed at some streamflow-gaging stations in every major river basin in the State. The protracted rainfall over the 2-week period caused multiple flood peaks on most streams and rivers.

THE STORM

Precipitation data for selected sites were obtained from the National Weather Service and compared with normal January precipitation to show the unusual nature of these storms (fig. 1). The stations for which data are presently available show precipitation from 388 to 572 percent of normal. The rainfall was greatest in the area north and east of Phoenix, although the entire State received precipitation in excess of 300 percent of normal.

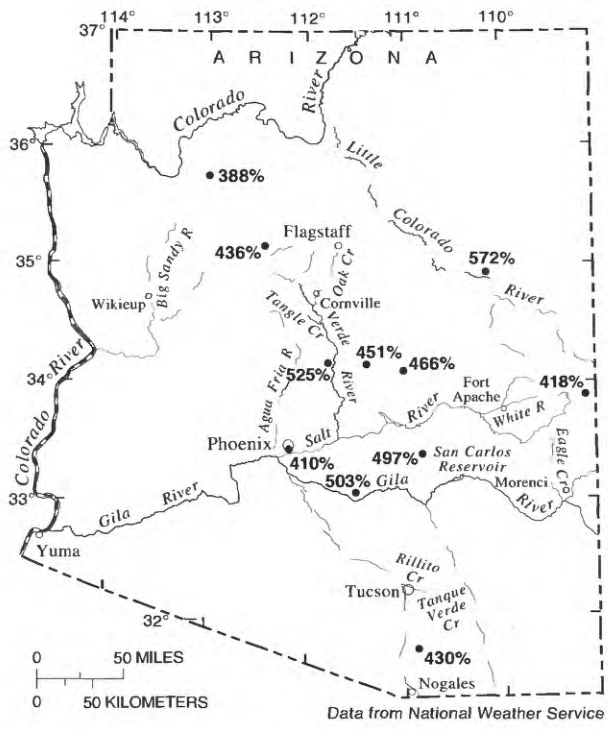

Figure 1.—January 1993 precipitation as a percentage of normal January precipitation (1931-60 period).

THE FLOODS

The first flooding occurred on small drainage basins. Floods such as those observed at Tanque Verde Creek in Tucson, Oak Creek near Cornville, Big Sandy River near Wikieup, Eagle Creek near Morenci, and White River near Fort Apache all have less than a 5-percent chance of occurring in any given year. As these small streams contributed flow to the larger streams, floods began to occur on the Verde, Salt, Gila, and Agua Fria Rivers and Rillito Creek. The accumulated waters produced floods on these streams that have only a 1- to 2-percent chance of occurring in any given year. Although these peak flows are high, the most unusual aspect of these floods was the volume of water produced. For example, on the Gila River just above San Carlos Reservoir, the highest flood ever recorded at that site occurred in 1983 during a storm that affected the southern part of Arizona. At the peak of the flood, about 150,000 cubic feet per second of water passed that station. In January 1993, the highest of the three peaks that occurred in the flood is estimated to be 109,000 cubic feet per second (fig. 2).

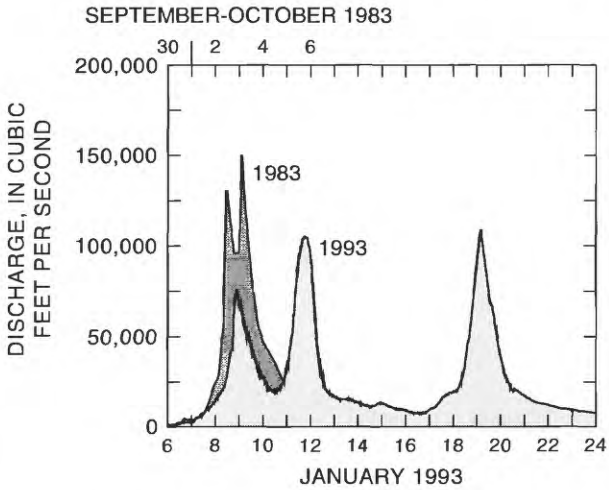

Figure 2.—Comparison of Gila River flood discharges for 1983 and 1993.

When the volumes of water in the two floods are compared, however, the flood of 1993 is estimated to be 76 percent larger than the flood in 1983. In 1983, the flood volume was 503,000 acre-feet, but in January 1993, the prolonged period of rainfall caused a much longer duration of flooding and the flood volume was 884,900 acre-feet—more than enough water to fill the San Carlos Reservoir downstream whose available storage capacity for flood control at the time was 239,500 acre-feet. Other streams also contributed water to the reservoir, resulting in a

spillway discharge from the reservoir of 32,500 cubic feet per second. To demonstrate that this phenomenon was not peculiar to just one part of Arizona, the expected volume of a flood with only a 1-percent chance of occurring in any given year is compared with the volume of the 1993 flood at several stations around the State (fig. 3).

Of the station records shown in figure 3, only Salt River near Roosevelt and Big Sandy River near Wikieup indicate less flood volume in the 1993 flood than for a flood with a 1-percent chance of occurring at those sites. Because of the high elevation of many tributary drainages to the Salt River, part of the precipitation fell as snow, which has yet to melt. This effect explains the low volume of flood runoff in the Salt River compared with the surrounding stations. The National Weather Service reports that because of these storms, the snowpack is at 154 percent of normal in the Salt-Verde watershed, and runoff from this snowpack is projected at 342 percent of normal.

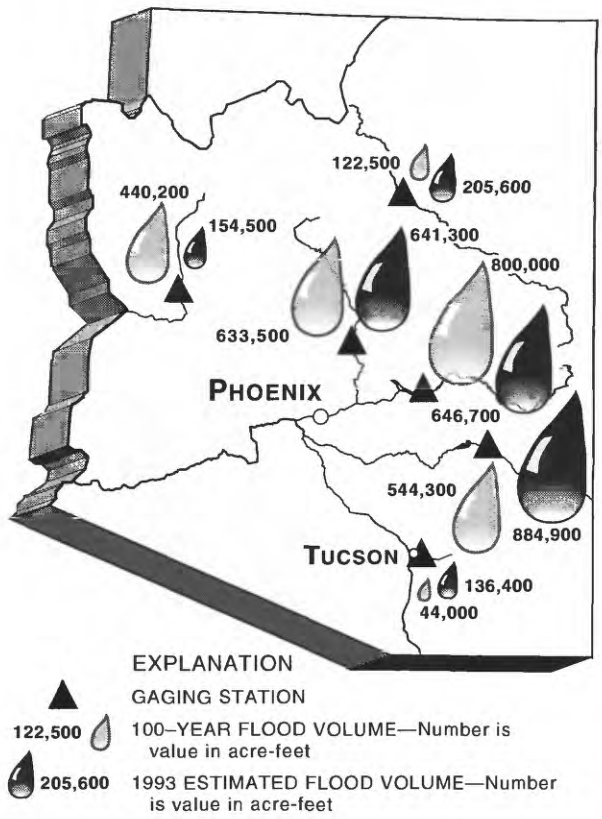

Figure 3.—Comparison of 100-year and 1993 floods.

Figure 5.—Verde River gaging station.

MONITORING STREAMFLOW

The U.S. Geological Survey (USGS) operates a network of 192 streamflow-gaging stations throughout Arizona. At 168 of these stations, the data recorded at the station are also relayed by satellite telemetry to a computer in Tucson, Arizona (fig. 4).

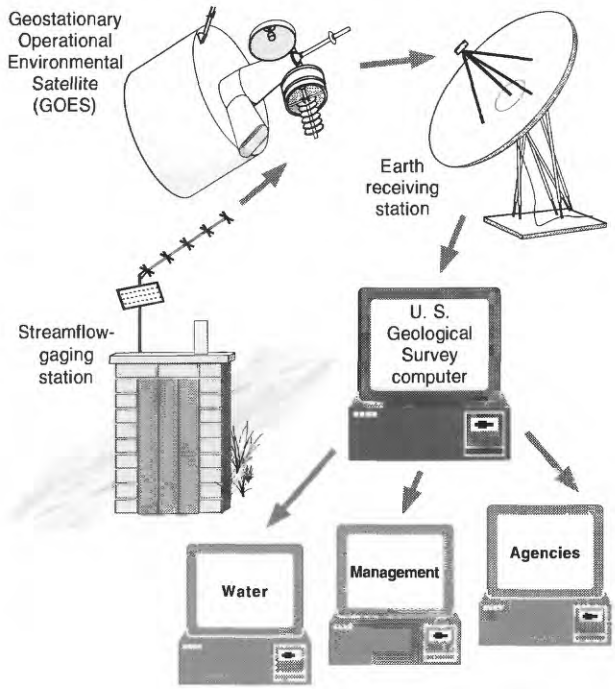

Figure 4.—Schematic diagram showing how streamflow data are transmitted, processed, and distributed.

During a flood, the data are transmitted every 15 minutes, and within 30 minutes these data are generally available to decision makers in the agencies involved in flood management. Although many agencies have additional data-telemetry networks for their operations, the USGS network is statewide and is available to County, State, and Federal agencies as well as to utility companies and irrigation districts for the management of storage and release of water. Streamflow-gaging stations, like the one shown in figure 5 on Verde River below Tangle Creek, are susceptible to damage during floods. Although 35 stations were lost or damaged during the 1993 flood, enough critical stations remained in operation to monitor the flood conditions throughout the State.

For further information, write to:

District Chief
U.S. Geological Survey
Water Resources Division
375 South Euclid Avenue
Tucson, Arizona 85719-6644

R.D. Mac Nish, C.F. Smith, and K.E. Goddard
Open-File Report 93-54 1993