

Flood of January 1997 in the Carson River Basin, California and Nevada

Background

Northern California and western Nevada were devastated by floods during January 1-3, 1997. Flood waters in the Carson River Basin (fig. 1) contributed to \$55 million in projected damages in Douglas County and \$19.5 million in Lyon County (Reno Gazette-Journal, 1997). Flooding in Douglas and Lyon Counties was extensive along the levee and irrigation systems, and agricultural land. In Carson City, damage to public facilities was estimated at \$6.4 million (Reno Gazette-Journal, 1997).

In late December 1996, storms built up a large snowpack (more than 180 percent of normal) in the higher altitudes of the Sierra Nevada (Daniel Greenlee, Natural Resource Conservation Service, oral commun., 1997) and also covered the valleys along the eastern Sierra Nevada. Then, a subtropical storm system originating in the central Pacific Ocean near the Hawaiian Islands brought heavy, unseasonably warm rain to the Sierra Nevada from December 30, 1996, through January 3, 1997. During this period, the Natural Resource Conservation Service recorded 16.4 inches (provisional data; Daniel Greenlee, oral commun., 1997) of precipitation at Ebbetts Pass, Calif. (8,700 feet above sea level), and the National Weather Service recorded 3.5 inches (National Oceanic and Atmospheric Administration, National Climate Data Center, written commun., 1997) at Minden (4,710 feet above sea level). Rain falling below about 10,000 feet depleted about 20 percent of the high-altitude snowpack and melted about 80 percent of the snowpack below about 7,000 feet.

Data Collection

The U.S. Geological Survey (USGS) operates more than 30 streamflow and lake-level monitoring stations in the Carson River Basin. Most of these stations are funded by partnerships with the USGS by other Federal, State, and local agencies, and Indian tribes. Data from these stations are crucial for water-supply planning; flood monitoring and emergency response; Lahontan Reservoir operation; establishing flood-insurance rates; and engineering and maintenance of bridges, roads, and other structures.

Several stations provide real-time data through satellite relay or ground-communication links. Data from these stations are used by the National Weather Service and other agencies to maintain water supplies, forecast floods, and issue flood warnings. USGS field crews obtained some of the highest river stage (depth) and discharge (flow) measurements ever recorded at several gaging stations at or near the peak of the January 1997 flood. At stations where field crews were unable to obtain discharge measurements, hydraulic surveys were made after the flood to determine peak discharge. These data contribute to understanding flood behavior, enhance efforts to minimize the destruction by floods, and provide data for water-resources management.

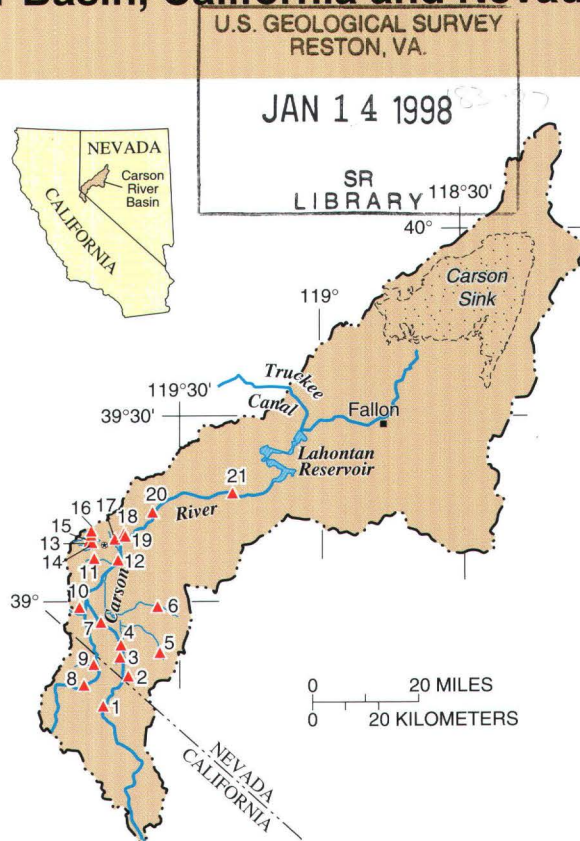


Figure 1. Geographic and hydrologic features of the Carson River Basin, California and Nevada. Gaging-station site numbers refer to table 1.



Figure 2. Downstream view of Carson River in Carson Valley above U.S. Highway 395 on January 3, 1997. (Photograph by Patrick A. Glancy, U.S. Geological Survey.)

Flood Magnitude of January 1997

The magnitude of peak discharges for selected gaging stations in the Carson River Basin is shown in table 1. Table 1 also includes the site number (used in fig. 1); gaging station number and name; January 1997 peak discharge, stage, and recurrence interval; 100-year peak discharge; years of peak-flow record; and date and magnitude of the largest historical peak discharge prior to January 1997. The 100-year peak discharge is one that, statistically, has a 1-percent chance of happening in any given year (Garcia, 1997).

Several technical methods can be used to determine the recurrence interval of floods. For this analysis, flood-frequency characteristics for stations with at least 10 years of record through January 1997 were computed by fitting the logarithms of annual peaks to a Pearson Type III frequency distribution. This technique follows guidelines recommended

by the U.S. Interagency Advisory Committee on Water Data (1982). For the mainstem Carson River stations, all the annual peak discharges for period of record were used in the analysis because the upstream Carson River Basin has no reservoir regulation. For those stations on tributaries with less than 10 years of data, regression equations were used to determine the 100-year peak discharge (Thomas and others, 1994, p. 45).

The January 1997 peak discharge was larger than recorded for previous floods at almost all stations on the Carson River. The peak discharge in January 1997 was greater than or equal to the 100-year peak discharge at five gaging stations in the Carson River Basin (table 1). Flood-frequency analysis for Carson River near Carson City (site 12) and Carson River near Ft. Churchill (site 21) determined that the 100-year peak discharges were 37,700 and 16,800 cubic feet per second, respectively.

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Table 1. Information on January 1997 flood for selected sites, Carson River Basin, California and Nevada

[Abbreviation and symbols: ft³/s, cubic feet per second; <, less than; >, greater than; --, not determined]

Site number (fig. 1)	Gaging station		January 1997			100-year peak discharge ¹ (ft ³ /s)	Years of record	Largest recorded historical flood peak prior to January 1997	
	Number	Name	Peak discharge (ft ³ /s)	Peak stage (feet)	Recurrence interval (years)			Date	Magnitude (ft ³ /s)
1	10308200	East Fork Carson River below Markleeville Creek, near Markleeville, Calif.	18,900	11.78	<75	26,200	1960-97	Jan. 31, 1963	15,100
2	10308800	Bryant Creek near Gardnerville, Nev.	1,180	8.89	<25	3,460	1961-69, 1978-80, 1994-97	Mar. 10, 1995	1,060
3	10309000	East Fork Carson River near Gardnerville, Nev.	20,300	13.00	100	20,000	1890-94, ³ 1901-11, 1917, ³ 1925-29, 1936-37, 1939-97	Dec. 23, 1955	16,700
4	10309035	Indian Creek above Mouth near Gardnerville, Nev.	513	4.57	10	² 2,700	1994-97	Mar. 10, 1995	1,800
5	10309050	Pine Nut Creek near Gardnerville, Nev.	23	4.29	<5	260	1980-97	Mar. 8, 1986	165
6	10309070	Buckeye Creek near Minden, Nev.	279	6.58	5	2,190	1980-97	Aug. 29, 1984	1,070
7	10309100	East Fork Carson River at Minden, Nev.	10,900	10.41	--	--	1974-84, 1994-97	Jan. 14, 1980	8,000
8	10310000	West Fork Carson River at Woodfords, Calif.	8,100	7.32	>100	6,270	1901-20, ³ 1910-11, 1939-97	Feb. 1, 1963	4,890
9	10310300	Fredericksburg Canyon Creek near Fredericksburg, Calif.	5,000	7.52	>100	² 350	1988-97	Jun. 28, 1995	26
10	10310400	Daggett Creek near Genoa, Nev.	42	1.81	<25	73	³ 1964-83, 1989-97	Aug. 5, 1971	63
11	10310500	Clear Creek near Carson City, Nev.	234	3.94	50	320	1948-62, ³ 1963-97	Feb. 20, 1968	130
12	10311000	Carson River near Carson City, Nev.	30,500	18.43	>75	37,700	1939-97	Dec. 24, 1955	30,000
13	10311090	North Fork Kings Canyon Creek near Carson City, Nev.	150	3.96	>25	² 314	1989-97	May 16, 1996	4.6
14	10311100	Kings Canyon Creek near Carson City, Nev.	133	5.06	25	326	1976-97	Feb. 19, 1986	150
15	10311200	Ash Canyon Creek near Carson City, Nev.	330	5.48	<50	633	1976-97	Feb. 17, 1986	58
16	10311260	Vicee Canyon Creek near Sagebrush Ranch near Carson City, Nev.	4,000	9.66	>100	² 370	1979-80, 1982, 1984-86, 1989-97	Feb. 16, 1982	200
17	10311300	Eagle Valley Creek at Carson City, Nev.	990	9.32	<25	3,230	1979, 1982, 1985-97	Feb. 19, 1986	1,110
18	10311400	Carson River at Deer Run Road near Carson City, Nev.	24,000	24.45	<100	² 26,600	1979-85, 1990-97	Jan. 15, 1980	7,650
19	10311450	Brunswick Canyon near New Empire, Nev.	80	3.71	<10	2,170	1966-78, 1980-97	Mar. 11, 1995	245
20	10311700	Carson River at Dayton, Nev.	23,100	15.80	>75	² 28,400	1994-97	Mar. 12, 1995	6,690
21	10312000	Carson River near Fort Churchill, Nev.	22,300	15.27	>100	16,800	1911-97	Feb. 19, 1986	16,600

¹ Determined from U.S. Interagency Advisory Committee on Water Data (1982) guidelines except where noted.

² Estimated by methods of Thomas and others (1994).

³ Does not include periods of broken record.

References Cited

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For More Information

For more information on water resources in Nevada

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