4 SUSPENDED SEDIMENT AND WATER HISTORY

4.1 METHODS

Water and sediment flow trends in the Bernalillo Bridge reach were analyzed through the development of single-mass curves and double-mass curves. Not enough suspended sediment data were available to generate difference-mass curves and perform a sediment continuity analysis of the reach.

The following curves were developed for the Bernalillo and Albuquerque gages, for the entire period of record:

- Mass curve of water discharge (acre-feet/year) from 1942 to 2000
- Mass curve of sediment discharge (tons/year) from 1956 to 1999
- Double mass curve with water and sediment discharge for trends in sediment concentration (mg/l) from 1956 to 1999

The slopes of each curve and the time periods of breaks in the curves were also estimated.

4.2 RESULTS

Single Mass Curves

Discharge Mass Curves

The discharge mass curves for Bernalillo and Albuquerque gages (Figure 4-1) have similar trends, indicating that there is not significant water input from the ephemeral tributaries between the two gages. There are three breaks in slope in the discharge mass curve (1942-1978, 1978 - 1987 and 1987 – 2000 periods), with an increase in annual discharge rate from 1978 to 1987 and a slight decrease from 1987 to 2000 (Figure 4-1 and Table 4-1). The drier water discharge period (1942-1978) at Bernalillo and Albuquerque gages coincides with the drier water period at Cochiti gage, as identified by Richard (2001). These slope breaks in the mass curve represent changes in water regime in the river. These changes may be due to changes in climate and/or flood management or regulation in the Rio Grande basin.

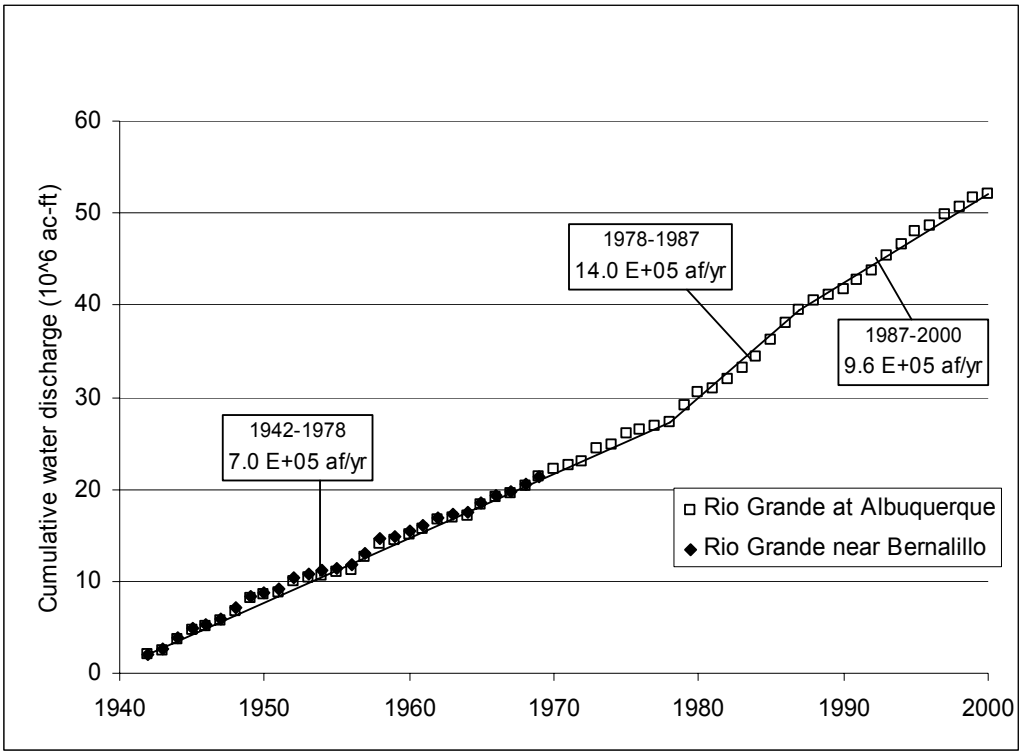

Figure 4-1 Discharge mass curve at Bernalillo and Albuquerque gages (1942-2000)

Table 4-1 Summary of the discharge mass curve slope breaks at Bernalillo and Albuquerque gages (1942-2000)

Time Period	Slopes of the water discharge mass curve (10^6 ac-ft/yr)
1942-1978	7.0 E+05
1978-1987	14.0 E+05
1987-2000	9.6 E+05

Suspended Sediment Mass Curve

The suspended sediment mass curve for Bernalillo and Albuquerque shows nine slope breaks (Figure 4-2). In general, the slopes are steeper from 1956 to 1973 than after 1973. The slope values range from 2.3 to 10.8 tons per year between 1956 and 1973. After 1973, the slope values are between 0.25 to 2.79 tons per year. This change in sediment rate in 1973 coincides with the closure of Cochiti Dam. There was an increase of suspended sediment discharge from 1993 to 1995 (2.79 E+06 tons/yr) with respect to the 1978-1993 discharges

(1.11 E+06 tons/yr and 0.25 E+06 tons/yr). However, the 1995-1999 suspended sediment discharge has decreased to 0.8 E+06 tons/yr and is comparable to the 1978-1985 sediment discharge (1.11 E+06 tons/yr). Table 4-2 summarizes the slope values of the suspended sediment discharge mass curve.

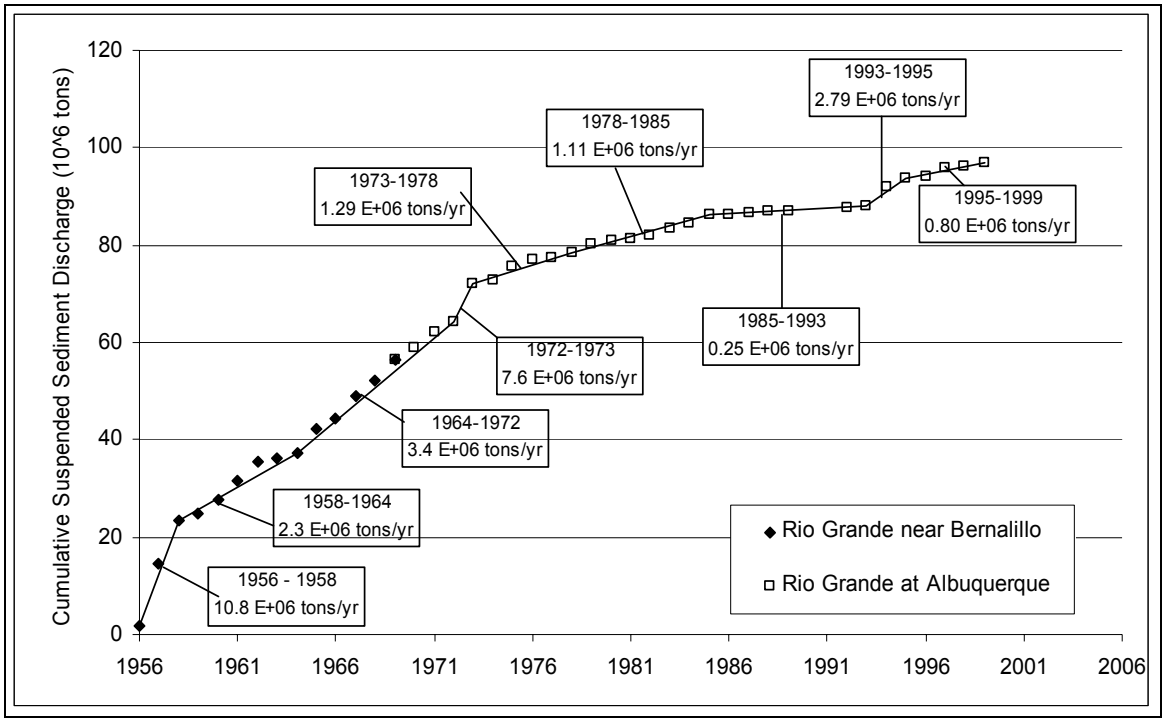

Figure 4-2 Suspended sediment mass curve at Bernalillo and Albuquerque gages (1956-1999)

Table 4-2 Summary of the suspended sediment discharge mass curve slope breaks at Bernalillo and Albuquerque gages (1956-1999)

Time Period	Slopes of the suspended sediment discharge mass
1956-1958	10.8E+0.6
1958-1964	2.30E+06
1964-1972	3.40E+06
1972-1973	7.55E+06
1973-1976	1.29E+06
1976-1985	1.11E+06
1985-1993	0.25E+06
1993-1995	2.79E+06
1995-1999	0.80E+06

Double Mass Curve

The double mass curve of cumulative water discharge versus cumulative sediment discharge shows the changes of suspended sediment concentration with time. Figure 4-3 shows higher concentrations of suspended sediment from 1956 to 1973 with average concentration varying from 3,741 mg/l to 6,670 mg/l. After 1973, the concentration does not exceed 1,602 mg/l. In general, the double mass curve shows a similar trend as the suspended sediment single mass curve. An average concentration of 664 mg/l has persisted from 1995 to 1999 and is comparable to the 1978-1984 average concentration (650 mg/l). Table 4-3 summarizes the suspended sediment concentrations at Bernalillo and Albuquerque gages between 1956 and 1999.

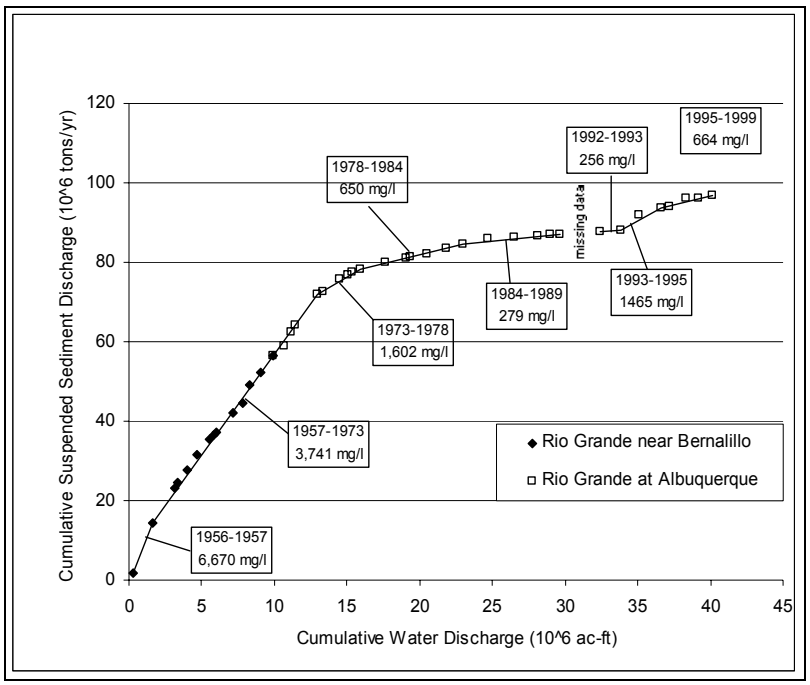

Figure 4-3 Cumulative discharge vs. cumulative suspended sediment load at Rio Grande at Bernalillo and Rio Grande at Albuquerque (1956 - 1999)

Table 4-3 Summary of suspended sediment concentrations at Bernalillo and Albuquerque gages (1956-1999)

Time Period	Concentration (mg/l)
1956-1957	6670
1957-1973	3741
1973-1978	1602
1978-1984	650
1984-1989	279
1992-1993	256
1993-1995	1465
1995-1999	664