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Article 150

TEMPORARY STORAGE OF FINE SEDIMENT IN ISLANDS AND POINT BARS OF ALLUVIAL CHANNELS OF THE RIO GRANDE, NEW MEXICO AND TEXAS

By CARL F. NORDIN, JR., and JOSEPH P. BEVERAGE,
Fort Collins, Colo., and Albuquerque, N. Mex.

Abstract.—Islands and point bars are semipermanent features of alluvial channels. They contain as much as 20 percent surficial material finer than 0.062 mm which is deposited during receding flows. Some of the scatter generally noted in discharge-transport relations probably derives from the transient storage of the fine material, which is flushed during higher discharges.

The fine material transported by a stream is obtained from the soil of the watershed, from old flood plains by bank cutting and sloughing, and from deposits within the active channel of the stream. Deposits in the channel include islands, point bars, and other slackwater deposits. Although islands and point bars may be semipermanent channel features, they are periodically inundated and reworked in streams that have fairly wide variations in flow. The Rio Grande in New Mexico is such a stream.

Figure 150.1 shows the particle-size distribution of channel bed material and bar material from the Rio Grande near Bernalillo, N. Mex., on June 1, 1962, at a sampling location designated section F. At the time of sampling, the bar projected 0.1–0.4 feet above the water surface and occupied about half of the high-flow channel width. Samples from the bar contained about 9 percent more fine material (diameter <0.062 mm) than samples from the wetted perimeter. Figure 150.2 shows similar curves for the Rio Grande, downstream, near Anthony, Tex., on April 16, 1962. Bar material at this site contained about 17 percent more fine material (diameter <0.062 mm) than channel material. These samples were collected from bars or islands formed in areas of decreased velocity during receding flows. At both sampling sites the bars occupied a third to a half of the bankfull channel width.

Islands and point bars are generally considered to be deposits of coarser material, which is transported in appreciable quantities only at high flows. The samples from the Rio Grande near Bernalillo, N. Mex., and Anthony, Tex., indicate, however, that the bars and islands of the river may include from 10 to 20 percent fine material. Wolman and Leopold (1957, p. 95) reported three point-bar samples from Watts Branch near Rockville, Md., that averaged 20 percent fine material. They concluded that part of the material eroded from the drainage basin "is stored temporarily in point bars and in the flood plain at various places in the channel system."

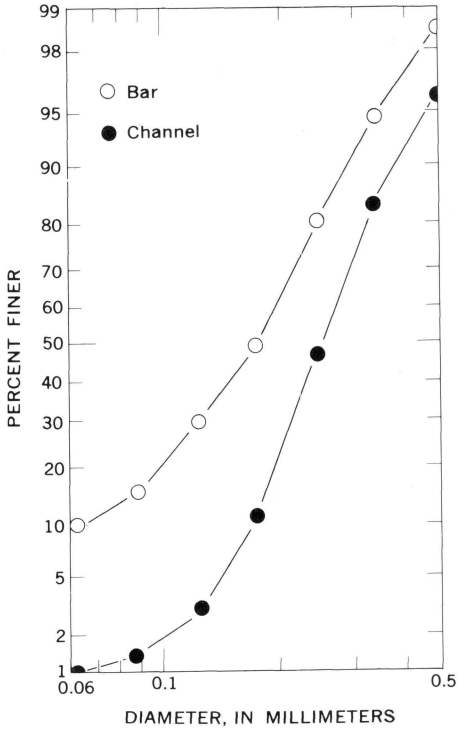

FIGURE 150.1.—Particle-size analyses of bar and channel material from the Rio Grande near Bernalillo, N. Mex., on June 1, 1962.

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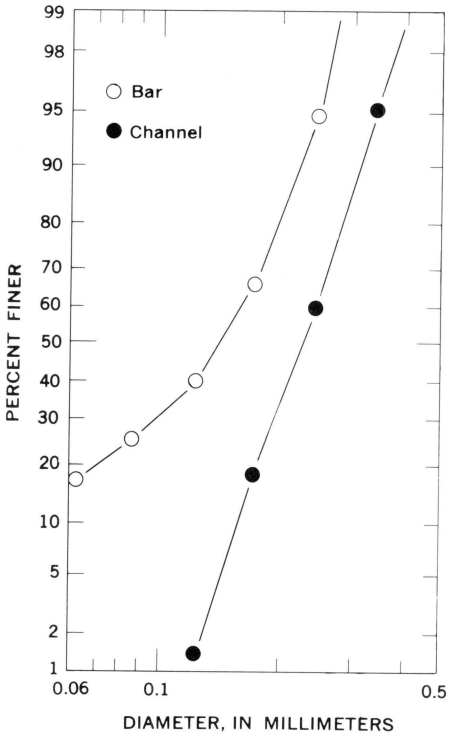

FIGURE 150.2.—Particle-size analyses of bar and channel material from the Rio Grande near Anthony, Tex., on April 16, 1962.

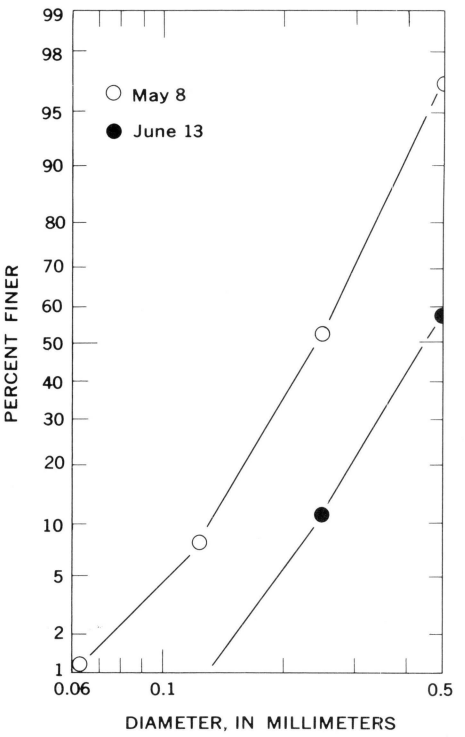

FIGURE 150.3.—Particle-size analyses of bed material from the Rio Grande near Bernalillo, N. Mex., May 8 and June 13, 1958.

The fine material in islands and point bars of the Rio Grande is generally flushed out by high flows, such as spring snowmelt and sustained reservoir releases. The accompanying table lists discharge and concentration of various size classes of suspended sediment for the Rio Grande near Bernalillo during two spring runoff periods. In both runoff periods, the concentration of fine material decreased with time regardless of wide variations in discharge.

Discharge and concentration of suspended sediment, by size class, in the Rio Grande near Bernalillo, N. Mex., during the spring runoff of 1952 and 1958

Date	Discharge (cfs)	Concentration, by size class (ppm)		
		<0.062 mm	0.062–0.125 mm	0.125–0.250 mm
1952:				
April 25	2, 910	1, 270	959	423
May 12	6, 390	1, 160	646	753
June 17	6, 100	375	390	555
June 20	4, 720	321	336	555
June 26	2, 850	222	264	273
1958:				
May 8	6, 730	2, 020	1, 080	1, 360
May 13	8, 310	1, 650	1, 270	1, 060
May 21	8, 700	1, 210	904	1, 070
May 27	9, 970	1, 040	796	1, 040
June 4	7, 790	750	575	675
June 10	5, 450	621	476	724
June 13	4, 380	318	418	856

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The apparent lack of relation between discharge and concentration of the sand sizes (>0.062 mm) suggests that these fractions, like the fine material, behave as "wash load." Wash load is that part of suspended sediment "which is washed through the stream channel without any deposition" at a rate dependent only on its availability from the watershed (Einstein and Chien, 1953, p. 31). Although changes in availability of material from the watershed may explain some of the lack of relation for the sand fractions, changes in the size distribution of the bed material should be considered as well. Figure 150.3 indicates that the diameter of the bed material can increase markedly during several weeks of sustained high flow. As the size of bed material increases, the amount of the finer sand fractions available for suspension and transport by the stream decreases.

During receding and low flows, clayey silt and fine sand are stored on islands and point bars and, to some extent, within the active channel (fig. 150.3). During rising stages and during sustained high flow, the bars and islands serve as a source for fine material. Throughout sustained high flows, the concentrations of the fine material and of the fine sand fractions seem to vary as a function of time rather than of discharge (see table). Both the magnitude of the concentration and the rate of change in concentration with time probably

depend partly upon antecedent conditions, that is, upon how much fine material was stored during previous low flows.

Storage time of fine material in bars and islands of the Rio Grande ranges from several months to a year and depends on subsequent climatic and hydrologic conditions, which determine when the channel features again become part of the wetted perimeter. When the stage rises, the stream begins to erode the deposits and to resuspend the fine material.

This study indicates that some of the apparently random scatter in discharge-transport relations can be explained in terms of the time dependency of the concentration of the finer sand classes and of material finer than 0.062 mm. This time dependency is due, in part, to temporary storage within the active channel.

REFERENCES

Einstein, H. A., and Chien, N., 1953, Transport of sediment mixtures with large ranges of grain sizes: California Univ. Inst. Eng. Research, Missouri River Div. Sediment Ser. 2.

Wolman, M. G., and Leopold, L. B., 1957, River flood plains—some observations on their formation: U.S. Geol. Survey Prof. Paper 282–C, p. 87–109.