# MEANDERING OF THE ARKANSAS RIVER SINCE 1833 NEAR BENT'S OLD FORT, COLORADO

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*Abstract.*—Bent's Old Fort, constructed on the Santa Fe Trail in 1833 in southeastern Colorado, has been established as a National Historical Monument. The U.S. National Park Service is interested in determining the relative position of the fort, at the time it was occupied, to the meandering Arkansas River. Available data indicate there has been relatively little shift in the meanders of the river at this location.

Before 1846 the Arkansas River formed the international boundary between Mexico and the United States. The Santa Fe Trail, leading from the Missouri River at Independence, Mo., to Santa Fe, was an important commercial artery. The trail led across the dry plains of Kansas to the Great Bend of the Arkansas River and then westward along the north bank. Near present Dodge City, Kans., the Santa Fe Trail forked. One branch continued across Mexican territory to the southwest, but the main branch continued on the north side of the Arkansas River toward the west.

In 1833 William and Charles Bent, with their partner Ceran St. Vrain, established a trading post and fort on the north bank of the Arkansas River where the trail crossed the river and headed up Timpas Creek toward Raton Pass to the southwest. The remains of this fort, now preserved as Bent's Old Fort National Historical Site, is in Otero County 8 miles east of La Junta in southeastern Colorado.

At the request, and with the informal cooperation, of the U.S. National Park Service, an investigation was made to determine, if possible, the relative location of the meandering Arkansas River during the time Bent's Old Fort was occupied from 1833 until it was abandoned and destroyed in 1849.

## LOCATION OF BENT'S OLD FORT

Bent's Old Fort was built of adobe on the edge of a low terrace projecting southeastward into the flood plain of the Arkansas River. An early visitor described the fort as lying 300 yards from the river. Other descriptions indicated that the ford across the river was east of the fort. This meager information is all that has been found regarding the Arkansas River at the time the fort was occupied, from 1833 until 1849. No maps or other pertinent data are available that date back to the time the fort was occupied.

## CHARACTER OF THE ARKANSAS RIVER

The Arkansas River, in the reach under consideration, is a broadly meandering stream. It flows approximately 6 miles to cover a linear distance of 3 miles. These meanders are developed on a flood plain that, in general, is uniformly less than ¾ mile wide. The flood plain is entirely developed in unconsolidated materials and underlain by 30 to 40 feet of fill. The river gradient is about 5 feet per mile, and the sediment load carried is moderately heavy, consisting largely of silt and sand in this reach of river. The flow of the Arkansas River has ranged from no flow to 200,000 cubic feet per second during the period of stream-gaging record at La Junta, 8 miles upstream. Large diversions of water are made for irrigation, which accounts in part for the wide range in discharge of the stream. Rapid snowmelt in the mountains or cloudbursts within the basin also cause heavy flooding within the area. The maximum flood recorded was on June 4, 1921, and it resulted from a cloudburst during the period of heavy snowmelt.

## MIGRATION OF MEANDERS

Few specific data are available regarding the rate of lateral migration of meanders in a stream. When sudden channel shifts transfer territory from one country to another, as happened on the Rio Grande at El Paso, Tex., or from one State to another, as has happened along the Missouri River between Iowa and Nebraska, much publicity results. The presence of many oxbow

lakes in various degrees of filling along many of our streams tends to indicate that lateral shifts of channel and migration of meanders are exceedingly common. Wolman and Leopold (1957) present a table compiling data on lateral migration of rivers across valleys. Some of the data on which this table is based are admittedly crude, but the wide range in rates of lateral movement is of interest. Some of the streams show no appreciable movement in periods of up to 50 or 60 years; others are believed to have shifted laterally hundreds of feet a year over long periods.

It would appear that the Arkansas River in eastern Colorado, with its flood plain developed on erodible, unconsolidated material, could be expected to have appreciable lateral shifts and downstream migration of meanders. The fact that it carries a moderate load of sand and smaller sized material, and ranges widely in discharge, would serve to increase meandering of the stream. The presence of meander scallops on the edges of the terraces bordering the flood plain and more or less filled oxbow lakes tends also to confirm such movement in the past.

## PAST COURSES OF THE ARKANSAS RIVER NEAR BENT'S OLD FORT

Early descriptions state that the Arkansas River was about 300 yards from the fort between 1833 and 1849, but they do not say if it was this close on the south or east. The location of the ford on the Santa Fe Trail indicates that the river ran east of the fort. No maps or charts showing the relative position of the fort and the Arkansas River are known.

The first survey of the area was made during July and August 1869, when the U.S. General Land Office laid out the section lines south of the river. In the course of this survey a meander line was run which was intended to depict the ordinary high-water line and the sinuosities of the river. This was accomplished by starting at a known point where the section line intersected the river and chaining from this point on a stated bearing to another station located on the ordinary high-water line. A total of 14 such points, shown on figure 1*A*, were so located. The notes from this survey were taken into the office, plotted, and the course of the river, as depicted in figure 1*A*, was sketched on the plat.

During March 1882 a similar General Land Office survey was made to lay out the sections north of the Arkansas River. No meander line along the north bank of the river was run, but wherever section lines crossed the river, points were located on both banks, presumably at the ordinary high-water line. Here again the survey notes were taken into the office, the data were

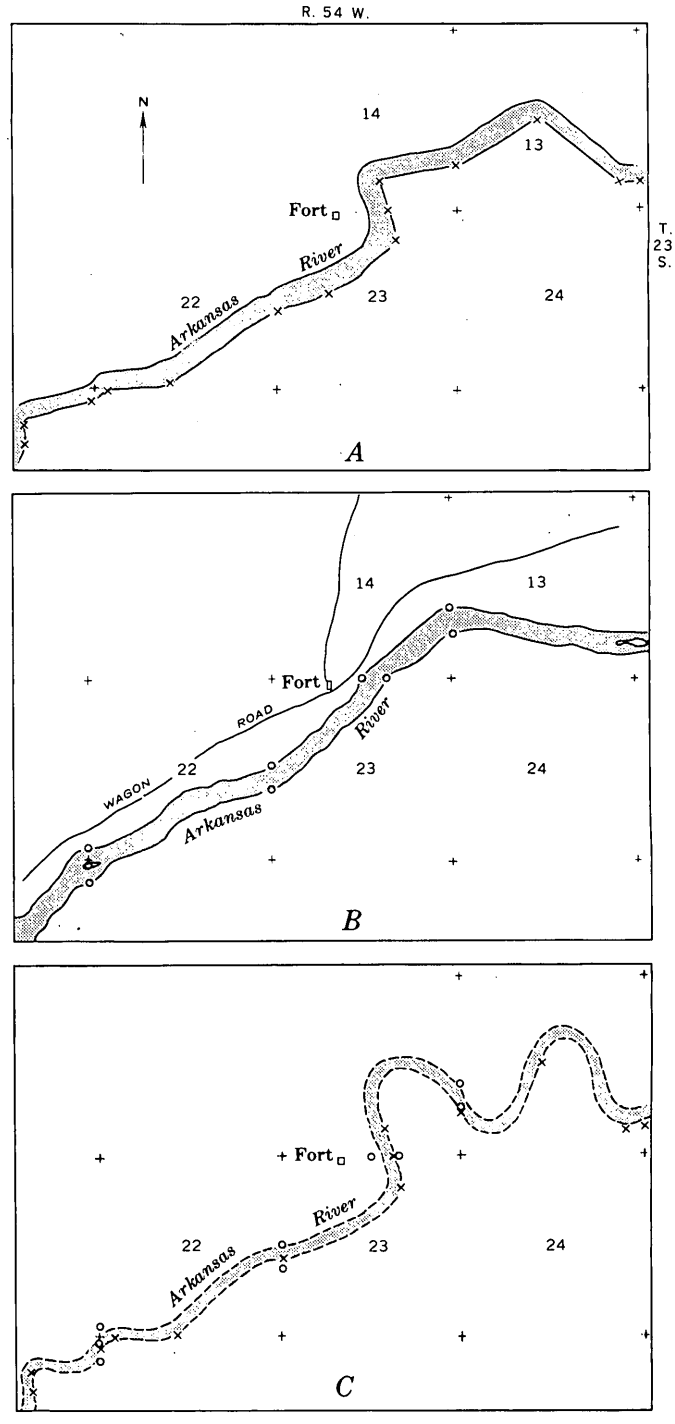


FIGURE 1.—Meanders of the Arkansas River near Bent's Old Fort. *A*, General Land Office plat of July–August 1869 survey south of river in T. 23 S., R. 54 W.; *B*, General Land Office plat of March 1882 survey north of river; *C*, composite of points from *A* and *B* with an interpretation (sketched in) of the course of the river as it probably actually existed at that time (1869).

plotted, and the course of the river was depicted as shown on figure 1*B*. This plotting would indicate a rather straight stream, entirely out of character with the river as we know it today.

When the points established by the 1869 and 1882 surveys are plotted together, there is much better control on the course of the river. The fact that there is very close agreement at all locations where the points from the separate surveys fall on section lines tends to indicate that both surveys were remarkably accurate. Some shifts of the river during the 13-year interval might be expected, and also there is the personal factor —selecting a point to establish the expected ordinary high-water mark of the stream. With the cumulative control provided by the points from the separate surveys, the writer has made an interpretation of the course of the Arkansas River as of the 1869 survey. This interpretation (fig. 1*C*) shows a meandering stream very much like the present Arkansas River. The stream, as plotted, is about 1,000 feet from Bent's Old Fort which closely approximates the 300 yards reported. The crossover of the flow of water from one meander to the other would occur east of the fort, and this would be the logical location of the ford where the Santa Fe Trail crossed the Arkansas River. Thus, it would seem that the location of the Arkansas River in relation to the fort, at the time the fort was in use between 1833 and 1849, has been roughly established.

The earliest aerial photographs available for this reach of the Arkansas River were taken November 20, 1936. There is a long time period between the 1869–1882 surveys and 1936, but there appears to have been little significant lateral migration of the meanders or shifting of the Arkansas River during the intervening 67 years (fig. 2). The largest shift of the channel was south of the fort where the river moved about 900 feet north of the meander point established in 1869. Immediately east of the fort there appears to have been no lateral migration of the upstream limb of the meander. This might be considered unusual as the current from the fairly straight upstream reach of the stream impinges against the bank at this point. The reason that lateral migration has not taken place to any great extent is that the point of impact is at the edge of the flood plain and the streambank is high, extending down from the surface of the stream terrace directly to the water surface.

Near the apex of the meander in section 14 and along the downstream limb, between 1869 and 1936, a lateral shift of the meander totaling more than 500 feet in places has occurred. There has been major shifting of the course of the river along the meander in section 13 also, except where the meander impinges on the edge of the flood plain.

Between November 1936 and July 1947 (fig. 3) there was very little shifting of the course of the Arkansas River in the large meanders in sections 13 and 14. Upstream, however, in sections 22 and 23, major changes in the stream took place. The rather straight course of 1869–82, more or less maintained through 1936, became very sinuous by 1947. Another major change also took place during this short period—the Arkansas River became a braided stream. Islands were few and of small size in 1936, but they became numerous and of large size by 1947, and this tendency has remained as shown by the 1964 (fig. 4) map. Since 1936 there has been a large increase in the amount of water diverted from the river for irrigation, and this removal of water during low flows of the summer is believed to be re-

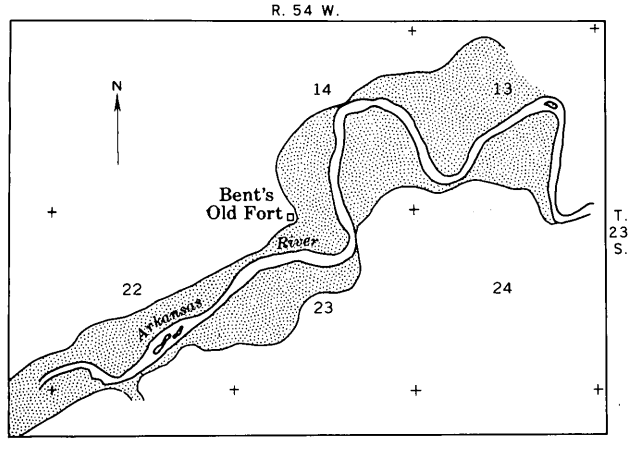


FIGURE 2.—Arkansas River course and flood plain (patterned), November 1936, mapped from first aerial photographs available.

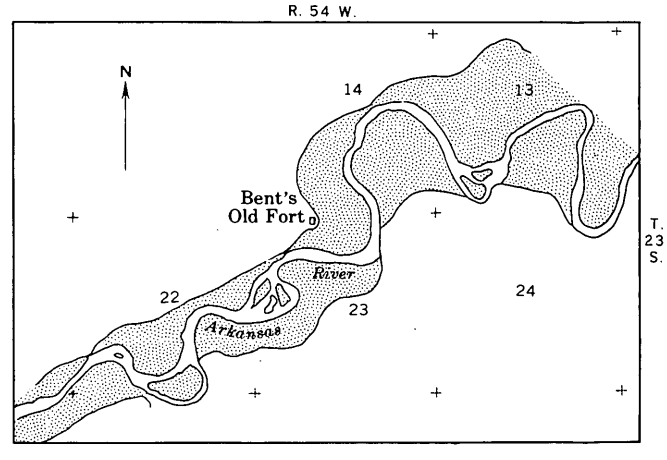


FIGURE 3.—Arkansas River course and flood plain (patterned), July 1947, mapped from aerial photographs. Note increase in number and size of islands since 1936 (fig. 2).

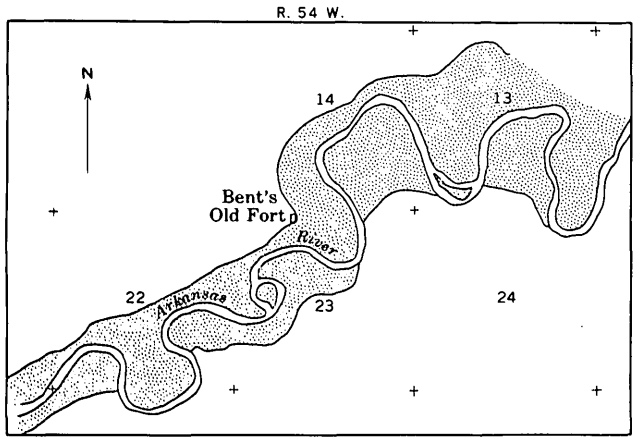


FIGURE 4.—Arkansas River course and flood plain (patterned), June 1964, mapped from aerial photographs.

sponsible for the development of the more braided character of the Arkansas River.

## CONCLUSIONS

Despite the fact that the Arkansas River, in the reach near Bent's Old Fort, has well-developed meanders and the river is flowing on easily erodible material, there has been relatively little shift of the stream since 1869. Little progressive migration of meanders downstream has occurred.

## REFERENCE

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