

East Bijou Creek at Deertrail, Colorado

(Miscellaneous ungaged site in the South Platte River basin,
USGS Colorado Water Science Center)

Review of peak discharge for the flood of June 17, 1965

Location: This flood was located just downstream of the town of Deertrail, Colo., at 39.6132 N and 104.0504 W.

Published peak discharge: The peak discharge from the indirect measurement is 274,000 ft³/s, June 17, 1965, and the measurement was rated fair.

Drainage area: 302 mi². The map scale used to define the drainage area is unknown.

Data for storm causing flood: The flood of 1965 was the result of a sequence of extreme rainfall that persisted for about 5 days along the Front Range of Colorado in the headwaters of the South Platte River. This sequence of rain resulted in large peak discharges in most of the northward-flowing tributaries of the South Platte River as well as producing devastating floods on the South Platte River in Denver and downstream. Chatfield Dam was completed later to control floods on the South Platte River. The flooding is described by Matthai (1969) and is included in a report by Rostvedt and others (1970). Sediment deposits resulting from the flood were described by McKee and others (1967). This latter article included a site on East Bijou Creek near Highway 36, about 10 mi downstream of Deertrail.

The June flooding in Colorado was front-page news in most area papers for several days preceding and following June 18. The Denver Post and Rocky Mountain News ran articles. The June 18 edition of the Denver Post has photographs of the destruction of Interstate Highway 70 and railroad bridges at Deertrail (East Bijou Creek) and at Byers (West Bijou Creek). East Bijou Creek is ephemeral, flowing only in response to thunderstorm activity and then for only a few days in most years. Historical photographs taken after the June 17, 1965, flood and during the 2003 review and described herein are provided in figures A95–A99.

Method of peak discharge determination: The peak discharge is based on a four-section slope-area measurement. The channel top width ranges from about 3,300 to about 4,000 ft, and the cross-sectional area averages about 30,000 ft² through the measurement reach. Maximum spread between subreach discharges is about 33 percent, but the spread between three-section results is only 6 percent.

Fall in the reach is substantial (11.95 ft of fall over the 3,450-ft reach), but it is fairly well defined. This slope (0.0034) is consistent with the slope downstream on Bijou Creek at

Wiggins, Colo. Matthai (1969) noted that the water-surface slope in the reach at Wiggins (0.0034) was comparable to the slope over a 2.3-mi reach of the channel from the Weldona Quadrangle (0.0033). Agreement between the left- and right-bank profiles generally is good except on the left bank just upstream of section 3 where there is an apparent fall of about 5 ft. However, the total fall in the reach could not be changed a great deal by any reasonable reinterpretation of the profiles.

The summary notes that the cross sections were subdivided "... primarily on the basis of ground cover ..."; however, those subdivisions match what would have been done if based on shape. Each section is broken into four subsections. Alpha ranged from 1.89 at section 1 to 1.55 at section 4.

As part of the 2003 review, the original computation was coded for the current USGS slope-area computation (SAC) program. The SAC peak discharge of 274,300 ft³/s confirms the original peak discharge. The reach expands slightly from sections 1 to 3 but contracts from sections 3 to 4. The spread between 0 and 100 percent energy recovery is 12 and 21 percent, respectively, in subreaches 1–2 and 2–3. However, the SAC analysis shows only an 8-percent spread between computations for 0- and 100-percent energy recovery in the multisection result. Velocities in the main channel are high, ranging from about 17 ft/s at section 3 to about 22 ft/s at section 1. Main channel Froude numbers of 1.03, 0.99, 0.85, and 1.03 indicate that flow probably is near critical flow at all sections. The main channel subsection carries about 45 percent of the total flow.

Possible sources of error: The most likely sources of error in the measurement were in the roughness values and the assumption that the post-flood cross section represented the cross section at the time of the peak. The roughness values are consistent with verification data for steep, sand-bed streams, but the summary notes some question about the roughness of the parts of sections 1–3 located in the town of Deertrail, Colo. Condition of the streambed during the peak discharge is not known, but large quantities of sand were transported; significant scour could have occurred during the peak discharge. Because of the extreme width and relatively shallow depths and because the railroad embankment traverses the length of the reach, there is some question about the applicability of the assumption of one-dimensional flow.

Recommendations of what could have been done

differently: Reviews are not included with the measurement summary. Kenneth Wahl (USGS retired) stated that measurements of the 1965 floods in Colorado were done in assembly-line fashion, and all were reviewed. Those reviews, and the names of the reviewers, should have become a permanent part of the indirect measurement. The record of those reviews likely will not be found. A file of the newspaper coverage complete with photographs should be a part of the permanent record.

Site visit and review: The site was visited June 3, 2003, by John Costa (USGS Office of Surface Water), Joseph Capesius (USGS Colorado Water Science Center), John England (Bureau of Reclamation), Mark Smith (USGS Central Region), and Kenneth Wahl (USGS retired). The visit included a drive-by of the railroad and Interstate Highway 70 bridge crossing several miles downstream (featured in the June 18, 1965, Denver Post).

The reach used for the indirect measurement has changed little since 1965. Flood debris is still evident at places in the measurement reach, which has scattered cottonwood trees on the flood plain. However, many of those trees are clearly less than 40 years old. The 1965 photographs show a sand bed in the main channel and the overflow sections. The sand is still present but has been overgrown with grass and small shrubs. There is now a small base flow in the reach; as a result, the main channel now has pooled water and some exposed gravel.

The railroad embankment actually enhanced the possibility of one-dimensional flow. The embankment parallels the plan-view baseline and effectively served as a submerged levee, directing the flow in the downstream direction.

Recommendation: The original peak discharge of 274,000 ft³/s should be accepted as published.

Photographic and geomorphic evidence leaves no doubt that this was a water flood. The indirect measurement was done correctly, and there is no evidence of error either in procedure or in interpretation.



Figure A95. View of flood plain looking toward channel in slope-area reach, East Bijou Creek at Deertrail, Colorado, June 1965.



Figure A96. View looking across flood plain toward left bank high-water mark (woody debris), East Bijou Creek at Deertrail, Colorado, June 3, 2003.



Figure A97. View of flood plain looking downstream with main channel in tree line, East Bijou Creek at Deertrail, Colorado, June 3, 2003.



Figure A98. View from left valley side looking across flood plain and main channel toward slope-area reach, East Bijou Creek at Deertrail, Colorado, June 3, 2003. (Flow is from right to left.)



Figure A99. Walking on flood-plain surface toward main channel in slope-area reach, East Bijou Creek at Deertrail, Colorado, June 3, 2003. (Flow was 5-6 feet deep at this point during the 1965 flood.)