Stratton Creek near Washta, Iowa

(Miscellaneous ungaged site in the Stratton Creek basin, USGS Iowa Water Science Center)

Review of peak discharge for the flood of August 9, 1961

Location: This flood was located about 3.8 mi east of Washta, Iowa, at 42.5807N and 95.6417W.

Published peak discharge: The published peak discharge for this flood is 11,000 ft^3/s. The original two-section slope-area result was rated fair but was downgraded to estimate after review.

Drainage area: The drainage area of 1.9 mi^2 drains mostly farmland that was growing crops during the storm.

Data for storm causing flood: The Stratton Creek basin, and approximately 18-20 mi^2 surrounding it, was hit by double-digit precipitation over a period of about 6 hours on August 8, 1961. Precipitation data published by the Iowa Natural Resources Council lists the storm as lasting from about 6 p.m. to 12 p.m. According to local residents most of the rainfall in the Stratton Creek basin fell in about 3 hours and totaled nearly 12 in. Mr. Peterson, a local farmer, measured 12 in. of rainfall in a newly installed stock-watering tank. The tank was dry and level before the storm started. Soil in the upstream part of the basin is rich in clay and has low infiltration rates, so rainfall of this intensity had a high percentage of runoff. Historical photographs taken after the flood of August 9, 1961, and photographs taken during the 2003 review and described herein are provided in figures A212–A231.

Method of peak discharge determination: A two-section slope-area measurement was made for a 500-ft long reach located immediately upstream of a county road crossing about 2 mi east of Washta, Iowa. The high-water profile is defined by a few high-water marks clustered at the ends of the sections. These marks were flagged on the afternoon of August 9. Intense rain continued after passage of the flood peak and made finding reliable high-water marks difficult. The right-bank overflow area was planted in soybeans. The high-water marks in this area were mostly mud or dirt lines on the bean plant leaves. The left bank was mostly sloughed off at the downstream section so no high-water marks were available. The left-bank overflow area at cross section 1 was mostly pasture. The high-water marks found in this area could be superelevated due to the bend in the channel reach. There is a small left-bank tributary that is crossed by section 1. Section 1 probably should have been located about 150 ft downstream to avoid the radical difference in cross-section geometry for the two sections, or a third section should have been surveyed between sections 1 and 2. There was sufficient fall, but the reach had poor high-water-mark definition. The result of the two-section slope-area measurement was 13,300 ft^3/s.

The measurement was closely reviewed because of the high unit discharge. Reviewers at USGS Headquarters in Washington, D.C., suggested verification with a flow-through bridge and flow-over-road computations using section 2 as the approach section. Section 2 is badly skewed to the road section and culvert. There were no high-water marks found downstream, so the road overflow measurement was computed assuming critical depth at the road section. The critical-depth method should provide a reliable peak discharge. This computation resulted in a discharge of about 6,600 ft^3/s over the road and 3,400 ft^3/s through the bridge for a total discharge of 10,000 ft^3/s. This value was combined with the slope-area computation (13,300 ft^3/s), and the final discharge was published as 11,000 ft^3/s.

The Manning's "*n*" values used were in the range of 0.040 to 0.055. Flow depths of 5 to 7 ft over the bean crop and pasture in the overflow area make the roughness coefficients for these areas seem high. The roughness values for the main channel are reasonable considering the 15-ft flow depth and type and amount of vegetation.

Possible sources of error: The base line for the slope-area reach is misaligned compared to the actual flow path. Realignment would reduce the distance between cross sections by about 5 percent, or about 440 ft. This change would not significantly decrease the flow.

The upstream section is a substantially different shape than the downstream section. The conveyance does not change uniformly between the two sections. Cross section 1 should have been relocated, or a third section should have been added at the change-in cross-section geometry.

The high-water profile is poorly defined except at the road crossing. An attempt should have been made to locate high-water marks in the long, fairly straight reach downstream of the county road. This is a good reach to use a step-backwater computation to check the high-water marks at the road embankment. Photographs taken following the flood show a tree lodged near the bridge opening, which could have affected flow through the bridge. There is no way of knowing if the tree was in place at the time of the peak discharge. The road embankment was submerged under 5 ft of water at the time of the peak discharge.

The high-water marks at the right end of cross section 2 could have been affected by water flowing out of the upstream road ditch and over the road. Both ditches probably were flowing full down the steep road grade.

Recommendations of what could have been done differently: A step-backwater model could have been used to compute discharge for the long, straight reach downstream of the bridge and road embankment. When faced with a questionable slope-area reach and a poorly defined high-water profile, it may be better to use the step-backwater model to estimate peak discharge.

A third section could have been surveyed between cross sections 1 and 2 at the substantial change in cross-section geometry. Field personnel should not hesitate to survey an extra section even though the water-surface profile is poorly defined. Be diligent in looking for high-water marks in the best reach available. In this case, the best reach appears to be downstream of the reach that was used.

Site visit and review: The site was visited on May 5, 2003, by John Costa (USGS Office of Surface Water), Ed Fischer (USGS Iowa Water Science Center), and Gary Gallino (USGS, retired). The field-review team toured the basin with Mr. Peterson, a local farmer who lived in the area during the flood. He pointed out locations of damage and of bucket precipitation measurement in a stock tank. As a result of the field review, the USGS Iowa Water Science Center surveyed cross sections and used the HEC-RAS and WSPRO step-backwater models to determine the discharge necessary to match the flow width at the inundated road embankment. The resulting discharge estimates were 11,600 and 9,500 ft^3/s, respectively. These step-backwater model analyses seem to verify critical depth at the road section.

Recommendations: The original peak discharge of 11,000 ft^3/s should be accepted as published and the rating should be rated as “estimate.”

Results of the step-backwater models bracket this discharge. There is too much speculation in some of the data used in the models to recommend change in peak discharge after a time lapse of more than 40 years.

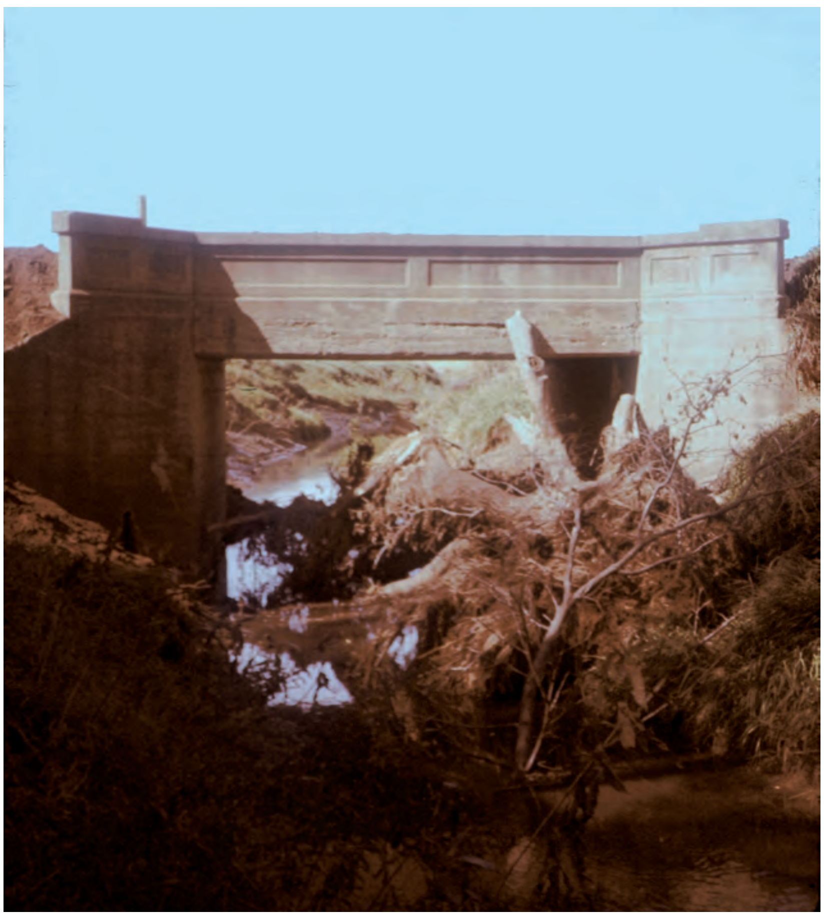

Figure A212. View looking downstream of road crossing and culvert, Stratton Creek near Washta, Iowa, August 1961.

Figure A213. View of right-bank high-water mark at bridge crossing, Stratton Creek near Washta, Iowa, August 1961. Flow is from right to left.

Figure A214. View looking downstream along channel upstream of cross section 1, Stratton Creek near Washta, Iowa, August 1961.

Figure A215. View looking from left bank to right bank long cross section 1, Stratton Creek near Washta, Iowa, August 1961.

Figure A216. View looking downstream of left bank, Stratton Creek near Washta, Iowa, August 1961.

Figure A217. View looking downstream of right bank, Stratton Creek near Washta, Iowa, August 1961.

Figure A218. View of left bank high-water mark at bridge crossing, Stratton Creek near Washta, Iowa, August 1961. Flow is from left to right.

Figure A219. View of right bank high-water mark of downstream side of road and culvert crossing, Stratton Creek near Washta, Iowa, August 1961.

Figure A220. View of slope-area reach upstream of culvert, Stratton Creek near Washta, Iowa, August 1961. Flow is from left to right.

Figure A221. View looking from right to left along cross section 1, Stratton Creek near Washta, Iowa, August 1961.

Figure A222. View looking from right to left along cross section 2, Stratton Creek near Washta, Iowa, August 1961.

Figure A223. View looking toward left bank from downstream side of road and culvert, Stratton Creek near Washta, Iowa, August 1961.

Figure A224. View looking toward left bank from end of cross section 2, Stratton Creek near Washta, Iowa, August 1961.

Figure A225. View looking upstream of culvert and road crossing, Stratton Creek near Washta, Iowa, August 1961.

Figure A226. View looking from right to left bank along road crossing, Stratton Creek near Washta, Iowa, May 5, 2003.

Figure A227. View looking downstream of culvert and road crossing, Stratton Creek near Washta, Iowa, May 5, 2003.

Figure A228. View looking from right to left bank with people standing on approximate high-water mark, Stratton Creek near Washta, Iowa, May 5, 2003.

Figure A229. View looking upstream of culvert and road crossing, Stratton Creek near Washta, Iowa, May 5, 2003.

Figure A230. View looking from right to left bank at culvert crossing, Stratton Creek near Washta, Iowa, May 5, 2003. Flow is from left to right.

Figure A231. View of headwaters of Stratton Creek near Washta, Iowa, May 5, 2003.