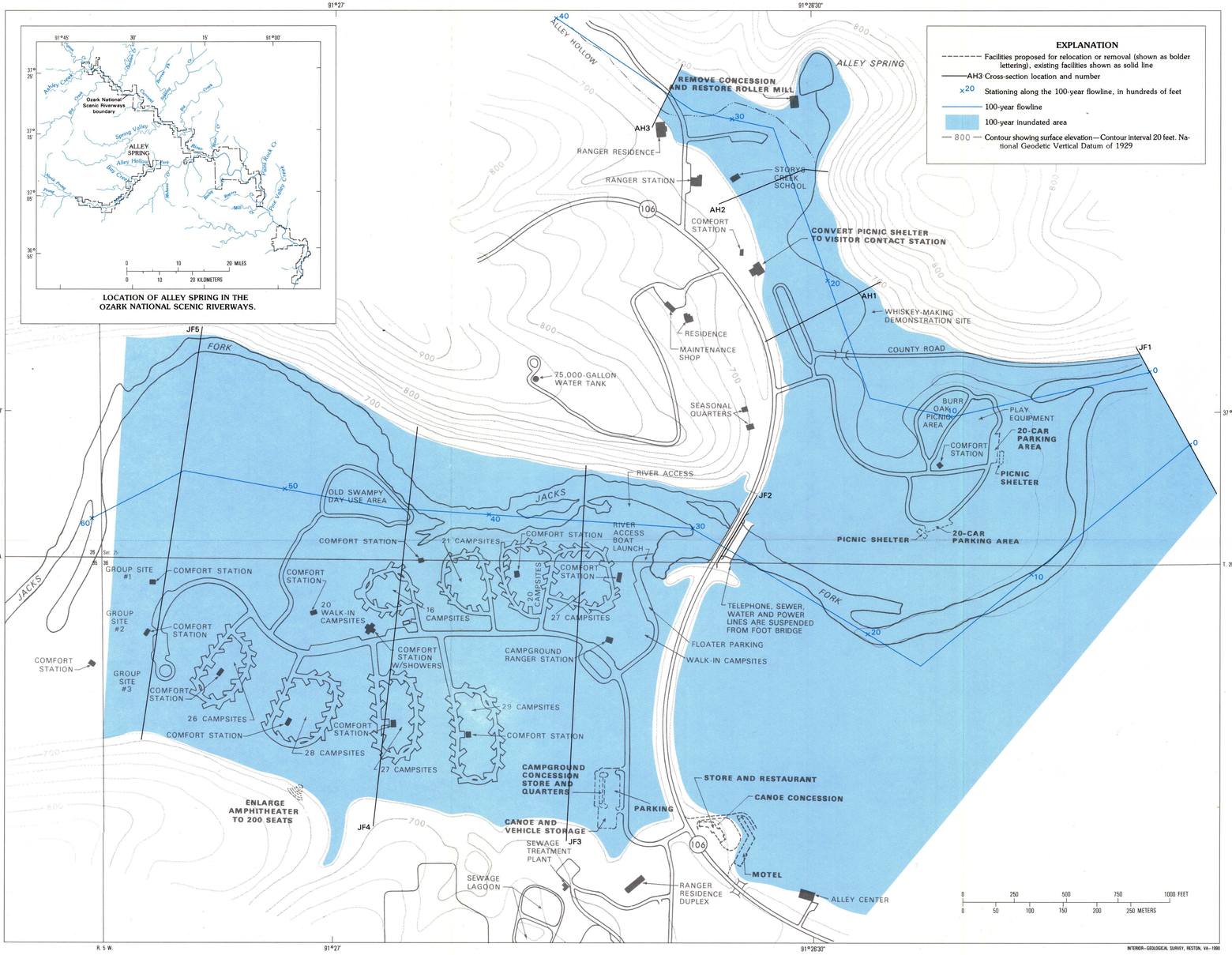


LOCATION OF ALLEY SPRING IN THE OZARK NATIONAL SCENIC RIVERWAYS.

Figure 11. Location of existing and proposed Alley Spring developments during 1981, valley cross sections, and delineation of the 100-year inundated area (modified from National Park Service, 1981).

ALLEY SPRING

The Ozark National Scenic Riverways, with the exception of Alley Spring, has few major recreational developments on the Jacks Fork. The Alley Spring development is an extensively used single-family campground and river-access point. Visitor emphasis is placed on the roller mill at Alley Spring, Storys Creek School, and the whiskey-making demonstration site (fig. 11). Like most major-use areas in the Ozark National Scenic Riverways, the Alley Spring facilities are subject to flooding:

A detailed flood analysis at Alley Spring, in conjunction with the study-area hydrologic analysis given on sheet 1, will assist in evaluating all flood-hazard areas associated with existing and proposed developments.

FLOOD ANALYSIS

The Jacks Fork drainage area includes 308 mi² with 16 mi² of area drained by Alley Hollow. The 100- and 500-year flood discharges are 11,500 ft³/s and 15,500 ft³/s for Alley Hollow; and are 53,000 ft³/s and 72,000 ft³/s for Jacks Fork (figs. 2 and 3, sheet 1). Five valley cross sections (JF1–JF5) on the Jacks Fork and three valley cross sections (AH1–AH3) on Alley Hollow were field surveyed at intervals that are as uniform in channel geometry and valley cross section roughness as practical (fig. 11). These data were used in the step-backwater method (Davidian, 1984) to compute the 100- and 500-year water-surface profiles, as shown in figures 12 and 13. Elevations obtained from the 100-year water-surface profile shown in figure 12 were used to delineate the flooded area on Alley Hollow and Jacks Fork shown on figure 11.

The average basin lag for flood-peak discharges within the Alley Spring development is 3 hours on Alley Hollow (16 mi²) and 15 hours on the Jacks Fork (308 mi²). See figure 4, sheet 1.

Most existing facilities are situated on the first terrace above the main-channel banks, and are subject to flooding from Alley Hollow and Jacks Fork. For this reason, a duration-of-flooding analysis at selected locations within the Alley Spring development is an important consideration in the development of a flood-warning system that could provide adequate time to evacuate visitors. One facility on both Jacks Fork (single-family campground) and Alley Hollow (whiskey-making demonstration site) was selected for analysis using the HEC-1 model (U.S. Army Corps of Engineers, 1982) that transforms excess basin rainfall using duration-frequency data developed by the National Weather Service (Hershfield, 1961) into elevation hydrographs. An elevation-duration curve can be determined for each of the two facilities based on these elevation hydrographs. The cumulative rainfall-duration relations (figs. 14–15) give the duration, in hours, that the flood-elevation hydrographs at each facility equal or exceed the ground elevation at which local flooding occurs. The average duration of flooding for each of these two facilities can be estimated by using cumulative rainfall, in inches, and figures 14–15.

EXAMPLE

During periods of excessive rainfall within the Ozark National Scenic Riverways, a possible flood-alert situation could exist. The following is an example of potential flooding within the Alley Spring development:

Description of hypothetical storm

Rainfall began throughout the Jacks Fork and Alley Hollow basins upstream from the development at Alley Spring on the evening of day 1 at about 2100 hours (9 p.m.). The morning of day 2, it had stopped raining by 0700 hours (7 a.m.), with a total cumulative rainfall of 4.5 in. It was noted by the National Park Service personnel that the more intense rainfall had occurred around 0200 hours (2 a.m.) of day 2.

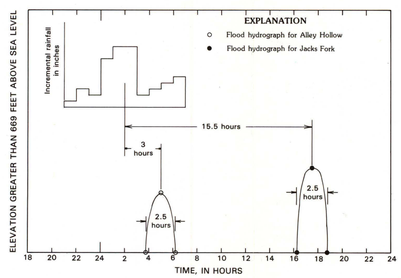
Problem

Assuming this hypothetical rainfall condition, what would be the average potential flooding expected from Alley Hollow and the Jacks Fork at the whiskey-making demonstration site within the Alley Spring development?

Solution

The Alley Hollow drainage area is 16 mi² and has an average basin lag time of 3 hours, whereas the Jacks Fork drainage area is 324 mi² (including Alley Hollow) with an average basin lag time of 15.5 hours (fig. 4, sheet 1). Using 0200 hours (2 a.m.) of day 2 as the assumed center of mass of effective rainfall, the expected peak-flood elevation and discharge would occur on day 2 at 0500 hours (5 a.m.) on Alley Hollow and 1730 hours (5:30 p.m.) on the Jacks Fork. From figure 14, the average duration of flooding above 669 ft (elevation above which flood damage may occur) at the whiskey-making demonstration site for both Alley Hollow and Jacks Fork is 2.5 hours.

From these data, the flood hydrographs can be estimated for the hypothetical 4.5 in. rainfall as shown below:



Results

The average potential for flooding at the whiskey-making demonstration site would be on day 2 from 0345 hours (3:45 a.m.) until 0615 hours (6:15 a.m.), and again at 1615 hours (4:15 p.m.) until 1845 hours (6:45 p.m.).

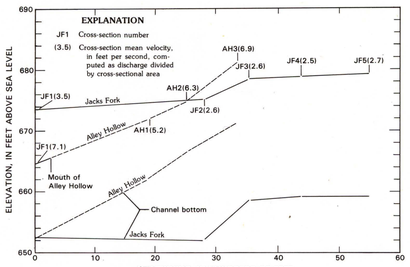


Figure 12. Water-surface profile for the 100-year flood discharge on Alley Hollow and the Jacks Fork.

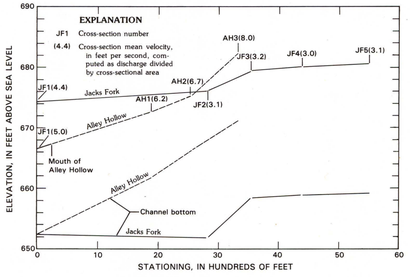


Figure 13. Water-surface profile for the 500-year flood discharge on Alley Hollow and the Jacks Fork.

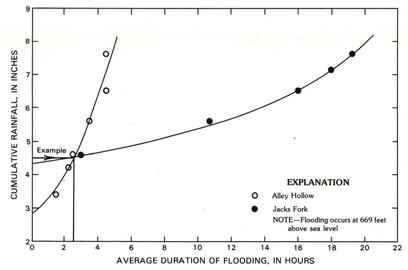


Figure 14. Relation between duration of flooding at the whiskey-making demonstration site and cumulative rainfall throughout Alley Hollow and the Jacks Fork basins.

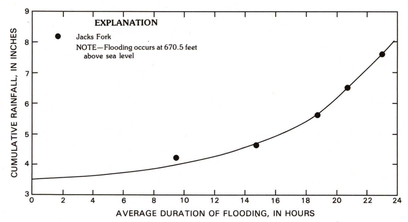


Figure 15. Relation between duration of flooding at the single-family campgrounds and cumulative rainfall throughout Jacks Fork basin.

Alley Spring

DELINEATION OF FLOODING WITHIN THE OZARK NATIONAL SCENIC RIVERWAYS IN SOUTHEASTERN MISSOURI—AKERS AND ALLEY SPRING

By
Terry W. Alexander

1990