

Estimating Peak Flow Frequencies for Natural Ungaged Watersheds
A Proposed Nationwide Test
U.S. Water Resources Council, Hydrology Committee, 1981

An Interagency Work Group of the Hydrology Committee of the U.S. Water Resources Council (WRC) conducted a pilot test of 10 hydrologic procedures for estimating flood frequency that were commonly used by Federal, State and local agencies and the private sector. The pilot test was conducted during 1976 to 1981 with publication of the report in 1981. The 10 hydrologic procedures were applied at 42 gaging stations in the Midwest (Ohio, Indiana, Illinois and Missouri) and 28 gaging stations in the Northwest (Idaho, Montana, Oregon and Washington) where there were at least 20 years of annual peak flow data available for frequency analysis and no significant man-made effects (flood detention structures, urbanization, etc.). The hydrologic procedures included regression equations based on the T-year flood discharge, index flood procedures, the Rational Method, TR-55 procedures and rainfall-runoff models (TR-20 and HEC-1). Each hydrologic procedure was applied at each gaging station by five different people. About 200 persons from Federal agencies, non-Federal agencies, consultants and academia participated in the pilot test.

The 10 hydrologic procedures were evaluated using the following criteria:

- Accuracy – how close the frequency estimate (2-, 10- and 100-year frequencies) from the hydrologic procedure compared to the gaging station estimate,
- Reproducibility – the ability of different people (five testers at each site) to get the same results using the same procedure, and
- Practicality – an estimate of how long to took each tester to apply the procedure.

Statistical techniques, analysis of variance and multivariate analysis of variance, were used to determine if the 2-, 10- and 100-year estimates were significantly different among the hydrologic procedures. The variability of the flood estimates were displayed in box plots. The results of the pilot test are summarized in the 1981 report for the two hydrologic regions. Because the test was limited to two hydrologic regions, there are no recommendations on which hydrologic procedure to use for given watershed conditions.

A more comprehensive nationwide test of hydrologic procedures was proposed by the USWRC work group in order to provide an authoritative based for national guidelines on estimating flood frequency for ungaged watersheds. The nationwide test was never conducted due to lack of funding.

The USWRC report is one of the most comprehensive comparisons of hydrologic procedures for estimating flood frequency for ungaged watersheds ever conducted. Even though the report was completed over 35 years ago, it is relevant for future work of the Hydrologic Frequency Analysis Work Group (HFAWG). One the original charges to the HFAWG was to provide guidance on determining the most appropriate methodology for flood frequency analysis for ungaged watersheds. A paper was prepared by the HFAWG in August 2001 for evaluating flood discharges from regression equations and rainfall runoff models and judging the reasonableness of the flood discharges from these hydrologic methods (https://acwi.gov/hydrology/Frequency/pdf/ungaged_101602-rev-5-june-2015.pdf). However, more definitive guidance is needed for flood frequency analysis for ungaged watersheds and the USWRC

1981 report is posted here on the HFAWG web site because it provides a good starting place for developing the needed guidance.

Any questions on the 1981 USWRC report should be provided by email to Will Thomas, Chair of the Hydrologic Frequency Analysis Work Group, at wthomas@mbakerintl.com.

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