CONDITIONAL PROBABILITY ADJUSTMENT

For stations where the record of annual peaks is truncated by the omission of peaks below a gage base, years with zero flow, and/or low outlier criterion, the conditional probability adjustment described in reference (28) is recommended to obtain the frequency curve. These procedures should only be used when not over 25 percent of the total record has been truncated. A truncation level is defined as the minimum discharge that will exclude peaks below the gage base, zero flows, all low outliers, and no other discharges. Because data from stations treated by this procedure may not fit a log-Pearson Type III distribution, any computed frequency curve should be compared with a plot of observed values.

Prior to applying the conditional probability adjustment, the data should have been reviewed and the statistics for the above gage-base peaks computed. Procedures for detecting outliers, recomputing statistics for peaks above the truncation level, and incorporating applicable historic information should have been completed. All except the last computation step shown on the flow chart in Appendix 12 (page 12-3) should have been completed. The steps in the conditional probability adjustment are as follows:

1. Calculate the estimated probability $\tilde{P}$ that any annual peak will exceed the truncation level by the formula:

$$\tilde{P} = \frac{N}{n} \tag{5-1a}$$

in which N is the number of peaks above the truncation level and n is the total number of years of record. If historic information has been included, then equation 5-1b should be used rather than 5-1a.   *

$$\tilde{P} = \frac{H-WL}{H} \qquad (5\text{-}1b)$$

where H is the historic record length, L the number of peaks truncated and W the systematic record weight as computed in Appendix 6, equation 6-1.

2. Recompute the exceedance probabilities, P, for selected points, P_d, on the frequency curve using equation 5-2:

$$P = \tilde{P} \times P_d \qquad (5\text{-}2)$$

This accounts for the omission of peaks below the truncation level.

3. The exceedance probabilities, P, computed by equation 5-2 are usually not those needed to compute the synthetic sample statistics. Therefore, it is necessary to interpolate either graphically or mathematically to obtain log discharge values for the 0.01, 0.10, and 0.50 exceedance probabilities.

4. Since the conditional probability adjusted frequency curve does not have known statistics, synthetic ones will be computed. These synthetic statistics will be determined based on the values for the three exceedance probabilities determined in step 3, using the following equations.

$$G_s = -2.50 + 3.12 \ \frac{Log(Q_{.01}/Q_{.10})}{Log(Q_{.10}/Q_{.50})} \qquad (5\text{-}3)$$

$$S_s = \frac{Log \ (Q_{.01}/Q_{.50})}{K_{.01} - K_{.50}} \qquad (5\text{-}4)$$

$$\overline{X}_s = Log(Q_{.50}) - K_{.50}(S_s) \qquad (5\text{-}5)$$

where G_s, S_s, and $\overline{X}_s$ are the synthetic logarithmic skew coefficient, standard deviation, and mean, respectively; $Q_{.01}$, $Q_{.10}$, and $Q_{.50}$ are discharges

*with 0.01, and 0.10, and 0.50 exceedance probabilities respectively; and $K_{.01}$ and $K_{.50}$ are Pearson Type III deviates for exceedance probabilities of 0.01 and 0.50 respectively, and skew coefficient G_s. Equation 5-3 is an approximation appropriate for use between skew values of +2.5 and -2.0.

    5. The frequency curve developed from the synthetic statistics should be compared with the observed annual peak discharges. The plotting position should be based upon the total number of years record, n or H, as appropriate.

    The minimum additional requirement to arrive at a final frequency curve is the determination of the weighted skew. Examples 3 and 4 of Appendix 12 illustrate the basic steps in computing a frequency curve using the conditional probability adjustment. Other considerations in a complete analysis might include two-station comparison, use of rainfall data, or other techniques described in this report. *

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NOTATION

G_s = synthetic logarithmic skew coefficient

H = historic record length

$K_{.01}$, $K_{.50}$ = Pearson type III deviate from Appendix 3 for exceedance probabilities of 0.01 and 0.50 respectively, and skew coefficient G_s.

L = number of peaks truncated

N = number of peaks above the truncation level

n = total number of years of record

P = exceedance probabilities

$\tilde{P}$ = estimated probability that an annual peak will exceed the truncation level.

P_d = selected points on the frequency curve

$Q_{.01}$, $Q_{.10}$, $Q_{.50}$ = discharges with exceedance probabilities of 0.01, 0.10, and 0.50, respectively

S_s = synthetic logarithmic standard deviation

W = systematic record weight from Appendix 6

$\bar{X}_s$ = synthetic logarithmic mean