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UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service - Northeast Technical Service Center
1974 Sproul Road, Broomall, Pennsylvania 19008

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TECHNICAL NOTES

NETSC TECHNICAL NOTE - WATERSHEDS-24 (Rev.)

Re: Partial-Duration Frequency Series in Estimating Floodwater Damages

This technical note explains the use of the partial-duration frequency series in estimating floodwater damage. This series may be used for all watershed and RC&D evaluation analyses. It is useful for evaluating agricultural watersheds. Figure No. 1 is provided for adjusting crop and pasture damage to account for recurrence of flooding within the same growing season.

PROJECT FORMULATION

Project objectives may indicate that a growing season level of protection is wanted. Level of protection is the minimum discharge that causes significant damage.

Growing season partial-duration frequency-discharge curve may be used to determine if project objectives have been met. Discharges used for project evaluation are used for channel design. Benefits must be discounted for recurring floods in a single season when the partial-duration frequency curves are used.

HYDROLOGY

The four basic frequency series used in hydrology are:

1. Annual series (the largest flood each year).

2. Growing season annual series (the largest flood each year during the growing season).

3. Partial-duration (full year data of floods 15 days apart, of a certain size or larger).

4. Growing season partial-duration (data for floods 15 days apart, of a certain size or larger, during the growing season).

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This technical note is concerned with the two partial-duration series, full year and growing season.

Full Year - stream gage data

The full year partial-duration frequency-discharge curve may be developed from stream gage data using annual peaks.

1. Develop the annual series frequency-discharge relationship using Log-Pearson Type III distribution procedures.

2. Determine the average number of peak discharges above the base.

   a. If the length of record is 25 years or more, use station data

   b. If less than 25 years, use two floods per year

3. Use table 18-8, Chapter 18, NEH-4 to determine the correct plotting position based on the number of floods per year.

4. Plot adjusted peak flow frequency curves for selected locations.

Full Year - no stream gage data

The full year partial-duration frequency discharge curve may also be developed from precipitation data (National Weather Service precipitation values).

1. Develop full year partial-duration 24-hour precipitation frequency curve from NWS Technical Paper 40.

2. Convert precipitation to runoff using weighted runoff curve numbers.

3. Plot peak flow frequency curves for selected locations using Chapter 16, NEH-4 or TR-20 computer program printout.

Growing Season - stream gage data

The growing season partial-duration frequency discharge is developed from stream gage data.

1. Determine all peak discharges above a base for the growing season for the period of record.

2. Use the Log-Pearson III distribution procedures assuming each value is an annual value (see page 18-20, NEH-4).

3. Plot peak flow frequency curves for selected locations.

<u>Growing Season</u> - no stream gage data

When stream flow data is not available growing season partial-duration frequency curves are developed as follows:

1. Develop full season partial-duration 24-hour precipitation frequency curves from NWS Technical Paper 40.

2. Convert precipitation to runoff using weighted runoff curve numbers.

3. Plot peak flow frequency curves for selected locations using procedures in Chapter 16, NEH-4 or TR-20 computer program printout.

4. Convert the full year partial-duration to growing season partial-duration using the following table.

Full Season Frequency in years	Conversion Factor
10	.85
5	.80
3	.75
2	.70

Example: If the 5-year peak discharge based on the full year partial-duration frequency curve is 1,000 cfs, then the growing season partial-duration 5-year peak discharge would be (1,000)x(.8) or 800 cfs.

<u>Economics</u>

Average annual crop and pasture damages, evaluated using the frequency analysis, need to be adjusted to account for recurring or sequential flooding within the same growing season. When the partial-duration series is used, crop and pasture damages need to be adjusted downward to account for lower damageable values caused by previous flooding. Separate adjustments must be made for alternative projects (without project, with project, etc.).

The Fort Worth EWP Unit made a historical analysis of 15 southwest watersheds to determine the effects on computed damages. Damageable values for sequential floods were reduced by the damage resulting from previous flooding during the crop year. The results are reflected in Figure No. 1. The adjustment factors were tested in the Northeast on high-valued truck crops and found to be applicable. The vertical axis represents the ratio between the crop damage adjusted for previous flooding and the unadjusted damage. The horizontal axis is the ratio of the average annual acres flooded to the acreage flooded by the largest event in the evaluation series.

To illustrate the use of Figure No. 1, assume the average annual area flooded from all damaging floods is 1,500 acres and 1,000 acres are flooded by the largest event in the evaluation series used to compute average annual acres flooded. The value of the horizontal scale would be 1.5. This gives a value of 0.85 on the vertical scale. If the unadjusted average annual crop and pasture damage from all floods is 10,000, the adjusted damage would be 10,000 x .85 = $8,500.

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Attachment

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DAMAGE ADJUSTMENT FACTOR FOR RECURRENCE

Figure - I