
4.4.4 Rainfall

4.4.4.1 Introduction

4.4.4.1.1 General Discussion

Analytic methods for rainfall-runoff modeling including the Rational Method and the Unit Hydrograph Method require the definition of the rainfall for the desired flood frequency. For the Rational Method, a rainfall intensity-duration-frequency (I-D-F) table or graph is required. Site-specific I-D-F tables or graphs are to be used with the Rational Method in Coconino County. The NOAA Atlas website may be used to develop a site-specific I-D-F for application of the Rational Method in Coconino County.

For rainfall-runoff modeling using the Unit Hydrograph Method, the temporal and spatial distribution of the design rainfall must be provided. For drainage studies in Coconino County, a site-specific rainfall distribution developed from NOAA Atlas 14 point rainfall values of 5- and 15-minutes, and 1-, 2-, 3-, 6-, 12-, and 24-hour durations is used. The point rainfall values are symmetrically nested around the middle of the storm (ie. at 12-hours in the 24-hour storm). The most intense rainfall is placed at the middle, with decreasing rainfall from the middle to the beginning, and from the middle to the storm end. That rainfall distribution is called the Frequency Storm, and is applied using the US Army Corps of Engineers HEC-HMS computer program (USACE, 2010). Refer to Section 4.4.4.2.3.

4.4.4.1.2 Source of Design Rainfall Information

The rainfall depth-duration-frequency statistics for Coconino County are derived from information in NOAA Atlas 14 (Bonnin, G.M. et al, 2004). The NOAA Atlas 14 data is used to generate the site-specific D-D-F and I-D-F data for use with the Rational Method and the point precipitation values for use with the Unit Hydrograph Method. The default depth-area reduction curves for use with the Unit Hydrograph Method are those built into HEC-HMS. Temporal rainfall distributions for various durations and frequencies are derived from NOAA Atlas 14 and applied using the US Army Corps of Engineers hypothetical distribution, also called the Frequency Storm in HEC-HMS.

The NOAA Atlas 14 web site may be used for obtaining design rainfall information for use in Coconino County. Geographical Information System (GIS) coverages of NOAA Atlas 14 are available from the NOAA Atlas 14 website.

4.4.4.1.3 Applications and Limitations

The rainfall statistics that are developed by procedures in this section are dependent upon the information that is provided in the NOAA Atlas 14 (Bonnin, G.M. et al, 2004). It is recommended that the user become familiar with the assumptions, limitations and theoretical and technical basis for NOAA Atlas 14 prior to applying these procedures. NOAA Atlas 14 is the most current and comprehensive precipitation frequency atlas available for Arizona and will be used for drainage design and floodplain delineation studies in Coconino County.

The Frequency Storm distribution is a simplified and idealized representation of the temporal distribution of rainfall. It is intended for use in estimating design discharges for drainage facilities and floodplain delineations. It does not necessarily represent the temporal distribution of any historical storm in Coconino County. The use of the Frequency Storm for design purposes does provide reasonable assurance that design discharges of specified frequency are produced regardless of the size of the watershed. For very large watersheds (possibly as large as or larger than 500 square miles), where the time of concentration (T_c) exceeds 24 hours, a longer duration Frequency Storm (or other project specific distribution) should be developed and used. Procedures for estimating the watershed time of concentration are contained in Section 4.4.7.2.2.

In general, the Frequency Storm can be used as input to the HEC-HMS program for drainage design purposes in Coconino County. Similarly, site-specific I-D-F graphs generated using NOAA Atlas 14 website can be used with the Rational Method, within the limitations specified in that section, for most small watersheds less than 160 acres in area within Coconino County.

4.4.4.2 Design Rainfall Criteria

4.4.4.2.1 Modeling Methods

Rational Method

A site-specific I-D-F graph is used when estimating the design rainfall intensity.

Unit Hydrograph Modeling

The 24-hour storm duration is to be used for Unit Hydrograph Modeling in Coconino County.

4.4.4.2.2 Site-Specific I-D-F

A site-specific I-D-F may be generated using the NOAA Atlas 14 website.

Brian Head Town IDF Curves from NOAA 14 Data

