

SECTION 5
RAINFALL

**CITY OF FORT LUPTON
STORM DRAINAGE DESIGN AND TECHNICAL CRITERIA**

SECTION 5 RAINFALL

5.1 INTRODUCTION

Presented in this section is the design rainfall data to be used with the Rational Method and the Colorado Urban Hydrograph Procedure (CUHP). All hydrological analysis within the jurisdiction of these CRITERIA shall utilize the rainfall data presented herein for calculating storm runoff.

The design storms and Time-Intensity-Frequency curves for the CITY were developed using the rainfall data and procedures presented in the MANUAL and are presented herein for convenience.

5.2 COLORADO URBAN HYDROGRAPH PROCEDURE DESIGN STORMS

For drainage basins less than five square miles, a two-hour storm distribution without area adjustment of the point rainfall values shall be used for the Colorado Urban Hydrograph Procedure (CUHP). For drainage basins between five and ten square miles, a two-hour storm distribution shall be used with the incremental rainfall values adjusted for the large basin area in accordance with suggested procedures in the NOAA Atlas for Colorado. The adjustment is an attempt to relate the average of all point values for a given duration and frequency within a basin to the average depth over the basin for the same duration and frequency. For drainage basins between ten and twenty square miles, a three-hour storm duration with adjustment for area shall be used. The distribution for the last hour was obtained by uniformly distributing the difference between the two-hour and three-hour point rainfall values. The adjustment for the basin area was obtained from the NOAA Atlas for Colorado. The incremental rainfall distributions for all basin areas up to 20 square miles are presented in Table 501.

5.3 TIME-INTENSITY-FREQUENCY CURVES FOR THE RATIONAL METHOD

The one-hour design point rainfall values obtained from the NOAA Atlas for Colorado area are as follows:

ONE-HOUR POINT RAINFALL (IN.)

2-YEAR	5-YEAR	10-YEAR	50-YEAR	100-YEAR
1.00	1.42	1.68	2.35	2.71

The Time-Intensity-Frequency curves were developed by distributing the one-hour point rainfall values using the factors obtained from the NOAA Atlas presented below:

FACTORS FOR DURATIONS OF LESS THAN ONE HOUR

Duration (minutes)	5	10	15	30
Ratio to 1-hour depth	0.29	0.45	0.57	0.79

Source: NOAA Atlas 2, Volume III, Colorado 1973

The point values were converted to intensities and plotted on Figure 501. The data are also presented in Table 502.

Table 501
 CUHP Design Storm for the City of Fort Lupton
 Incremental Rainfall Depth/Return Period

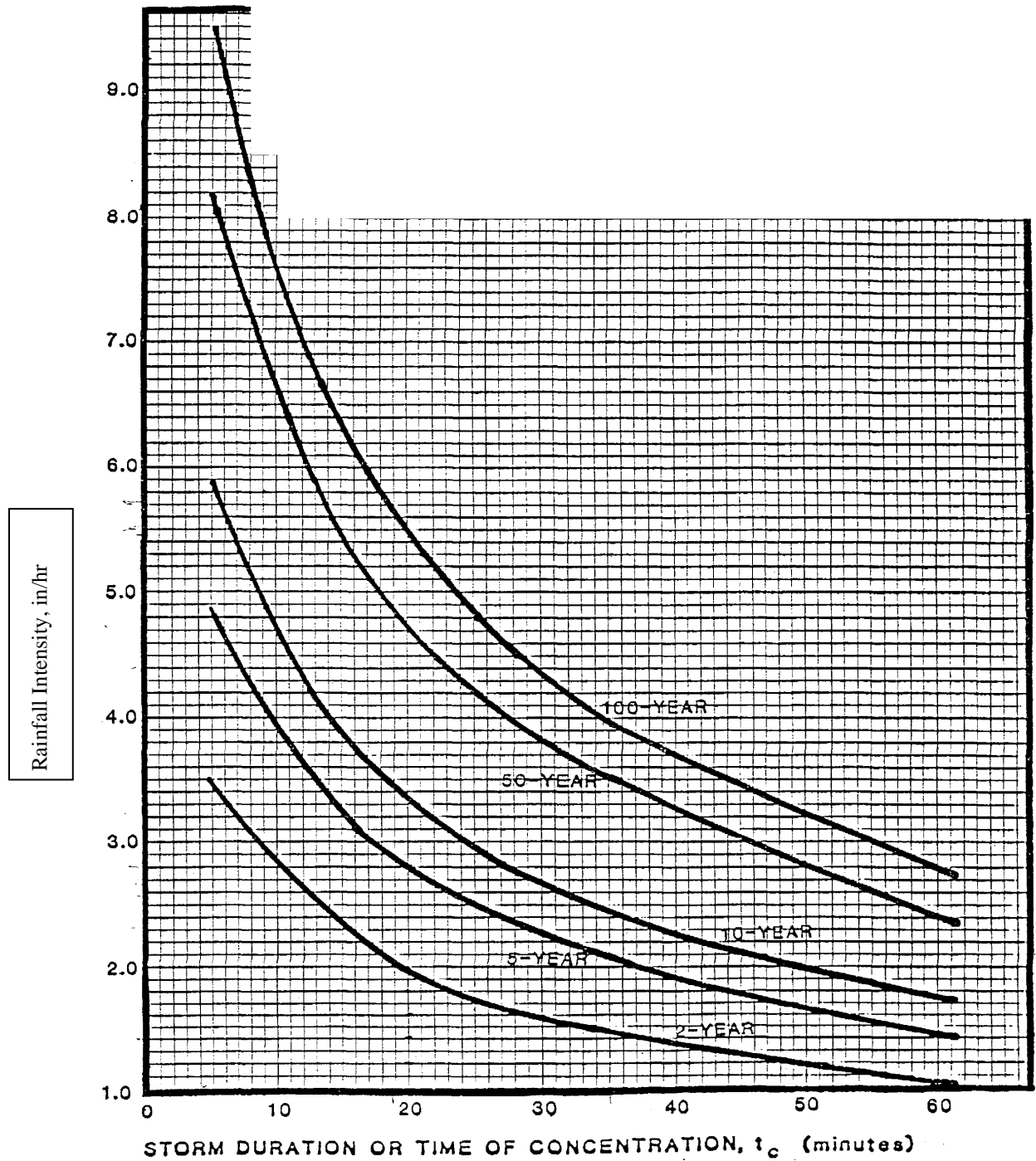
Time (min)	<i>Basins less than 5 sq. miles</i>					<i>Basins between 5 and 10 sq. miles</i>					<i>Basins between 10 and 20 sq. miles</i>				
	2-yr (in)	5-yr (in)	10-yr (in)	50-yr (in)	100-yr (in)	2-yr (in)	5-yr (in)	10-yr (in)	50-yr (in)	100-yr (in)	2-yr (in)	5-yr (in)	10-yr (in)	50-yr (in)	100-yr (in)
5	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
10	0.04	0.05	0.06	0.08	0.08	0.04	0.05	0.06	0.08	0.08	0.04	0.05	0.06	0.08	0.08
15	0.08	0.12	0.14	0.12	0.12	0.08	0.12	0.14	0.12	0.12	0.08	0.12	0.14	0.12	0.12
20	0.16	0.22	0.25	0.19	0.22	0.15	0.21	0.25	0.19	0.22	0.14	0.20	0.25	0.19	0.22
25	0.25	0.36	0.42	0.35	0.38	0.24	0.35	0.40	0.34	0.36	0.23	0.32	0.38	0.32	0.34
30	0.14	0.18	0.20	0.59	0.68	0.13	0.17	0.19	0.57	0.65	0.13	0.16	0.18	0.53	0.61
35	0.06	0.08	0.09	0.28	0.38	0.06	0.08	0.09	0.27	0.36	0.06	0.08	0.09	0.25	0.34
40	0.05	0.06	0.07	0.19	0.22	0.05	0.06	0.07	0.19	0.22	0.05	0.06	0.07	0.19	0.22
45	0.03	0.05	0.06	0.12	0.17	0.03	0.05	0.06	0.12	0.17	0.03	0.05	0.06	0.12	0.17
50	0.03	0.05	0.05	0.12	0.14	0.03	0.05	0.05	0.12	0.14	0.03	0.05	0.05	0.12	0.14
55	0.03	0.04	0.05	0.08	0.11	0.03	0.04	0.05	0.08	0.11	0.03	0.04	0.05	0.08	0.11
60	0.03	0.04	0.05	0.08	0.11	0.03	0.04	0.05	0.08	0.11	0.03	0.04	0.05	0.08	0.11
65	0.03	0.04	0.05	0.08	0.11	0.03	0.04	0.05	0.08	0.11	0.03	0.04	0.05	0.08	0.11
70	0.02	0.04	0.05	0.06	0.05	0.02	0.04	0.05	0.06	0.05	0.02	0.04	0.05	0.06	0.05
75	0.02	0.03	0.05	0.06	0.05	0.02	0.03	0.05	0.06	0.05	0.02	0.03	0.05	0.06	0.05
80	0.02	0.03	0.04	0.04	0.03	0.02	0.03	0.04	0.04	0.03	0.02	0.03	0.04	0.04	0.03
85	0.02	0.03	0.03	0.04	0.03	0.02	0.03	0.03	0.04	0.03	0.02	0.03	0.03	0.04	0.03
90	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
95	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
100	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
105	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
110	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
115	0.01	0.02	0.03	0.03	0.03	0.01	0.02	0.03	0.03	0.03	0.01	0.02	0.03	0.03	0.03
120	0.01	0.02	0.02	0.03	0.03	0.01	0.02	0.02	0.03	0.03	0.01	0.02	0.02	0.03	0.03
125											0.01	0.02	0.02	0.02	0.02
130											0.01	0.01	0.02	0.02	0.02
135											0.01	0.02	0.01	0.02	0.02
140											0.01	0.02	0.01	0.02	0.02
145											0.01	0.01	0.01	0.02	0.02
150											0.01	0.01	0.01	0.01	0.02
155											0.01	0.01	0.01	0.01	0.01
160											0.01	0.01	0.01	0.01	0.01
165											0.01	0.01	0.01	0.01	0.01
170											0.01	0.01	0.01	0.01	0.01
175											0.01	0.01	0.01	0.01	0.01
180											0.01	0.01	0.01	0	0
Total	1.15	1.61	1.89	2.72	3.12	1.12	1.58	1.86	2.68	3.05	1.22	1.68	1.97	2.76	3.14

Table 502
Time-Intensity-Frequency Tabulation
for the Rational Method

Rainfall Intensity
(in/hr)/duration

Frequency	5-min	10-min	15-min	30-min	60-min
2-year	3.48	2.70	2.28	1.58	1.00
5-year	4.92	3.84	3.24	2.24	1.42
10-year	5.88	4.56	3.84	2.66	1.68
50-year	8.16	6.36	5.36	3.72	2.35
100-year	9.48	7.32	6.16	4.28	2.71

Figure 501
Time-Intensity-Frequency Curves
for the Rational Method



Reference: WRC Engineering, Inc. TM-1, November 1986

