

APPENDIX A. DEVELOPMENT OF RAINFALL INTENSITY CURVES  
AND EQUATIONS

1. Precipitation Intensity-Duration-Frequency Curves

Precipitation intensity-duration-frequency (I-D-F) information is necessary for the specific locality in which the Rational Method for estimating runoff is to be used. The two examples which follow illustrate the development of I-D-F curves from HYDRO-35 and NOAA Atlas 2.

HYDRO-35

HYDRO-35 maps included in this Appendix as figures 28 through 33 are for 2-year and 100-year frequencies and durations of 5, 15 and 60 minutes. To estimate intensities for 10-minutes and 30-minutes, the following equations are provided:

$$10\text{-min value} = 0.59 (15\text{-min value}) + 0.41 (5\text{-min}) \quad (26)$$

$$30\text{-min value} = 0.49 (60\text{-min value}) + 0.51 (15\text{-min}) \quad (27)$$

Use equations (28) through (31) to compute values for return intervals intermediate to the 2-year and 100-year frequencies.

$$5\text{-yr} = 0.278 (100\text{-yr}) + 0.674 (2\text{-yr}) \quad (28)$$

$$10\text{-yr} = 0.449 (100\text{-yr}) + 0.496 (2\text{-yr}) \quad (29)$$

$$25\text{-yr} = 0.669 (100\text{-yr}) + 0.293 (2\text{-yr}) \quad (30)$$

$$50\text{-yr} = 0.835 (100\text{-yr}) + 0.146 (2\text{-yr}) \quad (31)$$

Example 26:

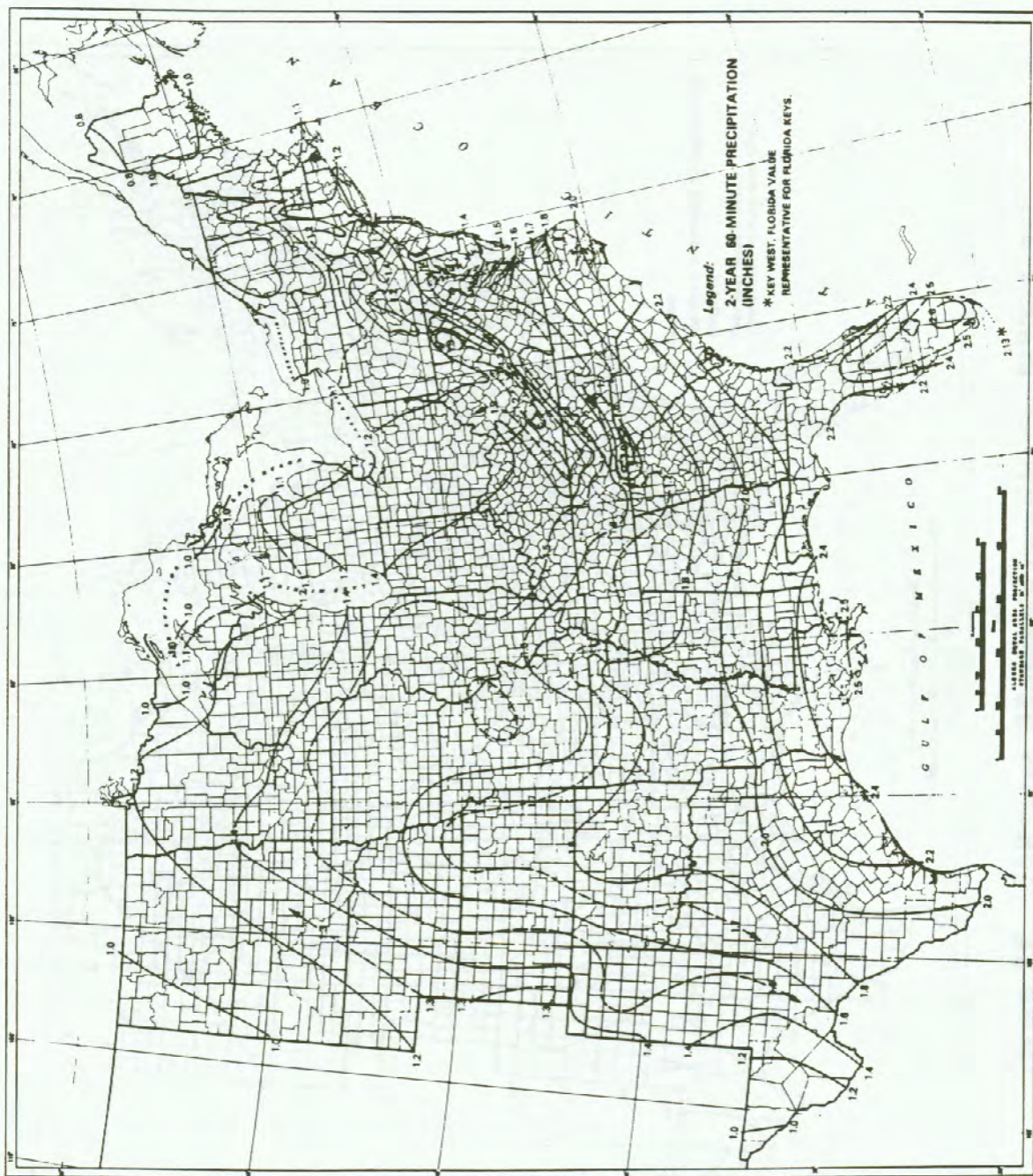
Given: Location - Charlotte, North Carolina

Develop: I-D-F Curve for 2- to 100-year frequencies

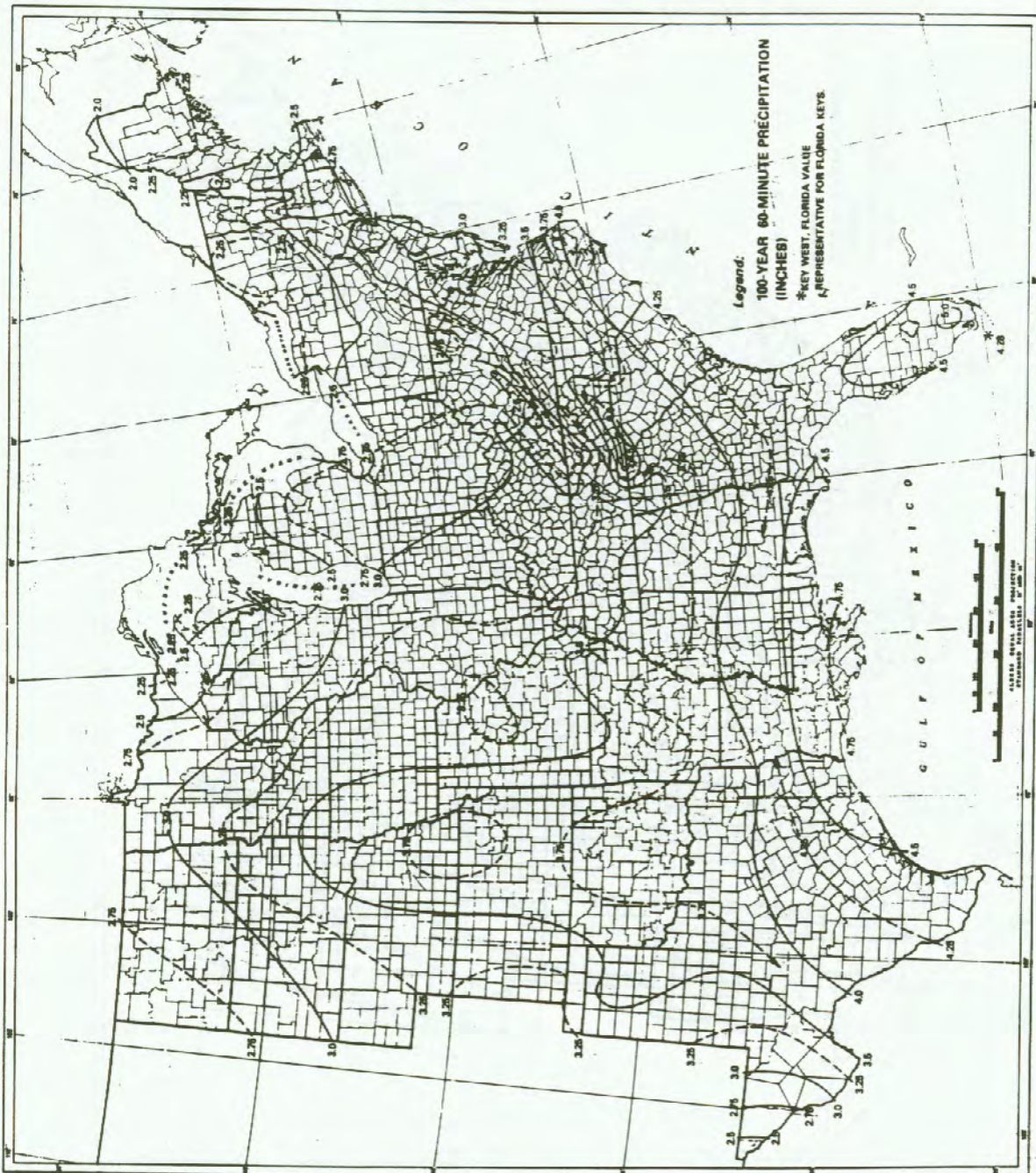
Step 1: Read 5-min, 15-min and 60-min rainfall volume values for 2-yr and 100-yr frequencies from figures 28-33 (table 6):

Table 6. Rainfall volumes, 2- and 100-yr.

	5-min	15-min	60-min
2-yr	0.47	0.97	1.72
100-yr	0.81	1.75	3.60



**Figure 26. 2-year, 60-minute precipitation (HYDRO-35).**



**Figure 29. 100-year, 60-minute precipitation (HYDRO-35).**

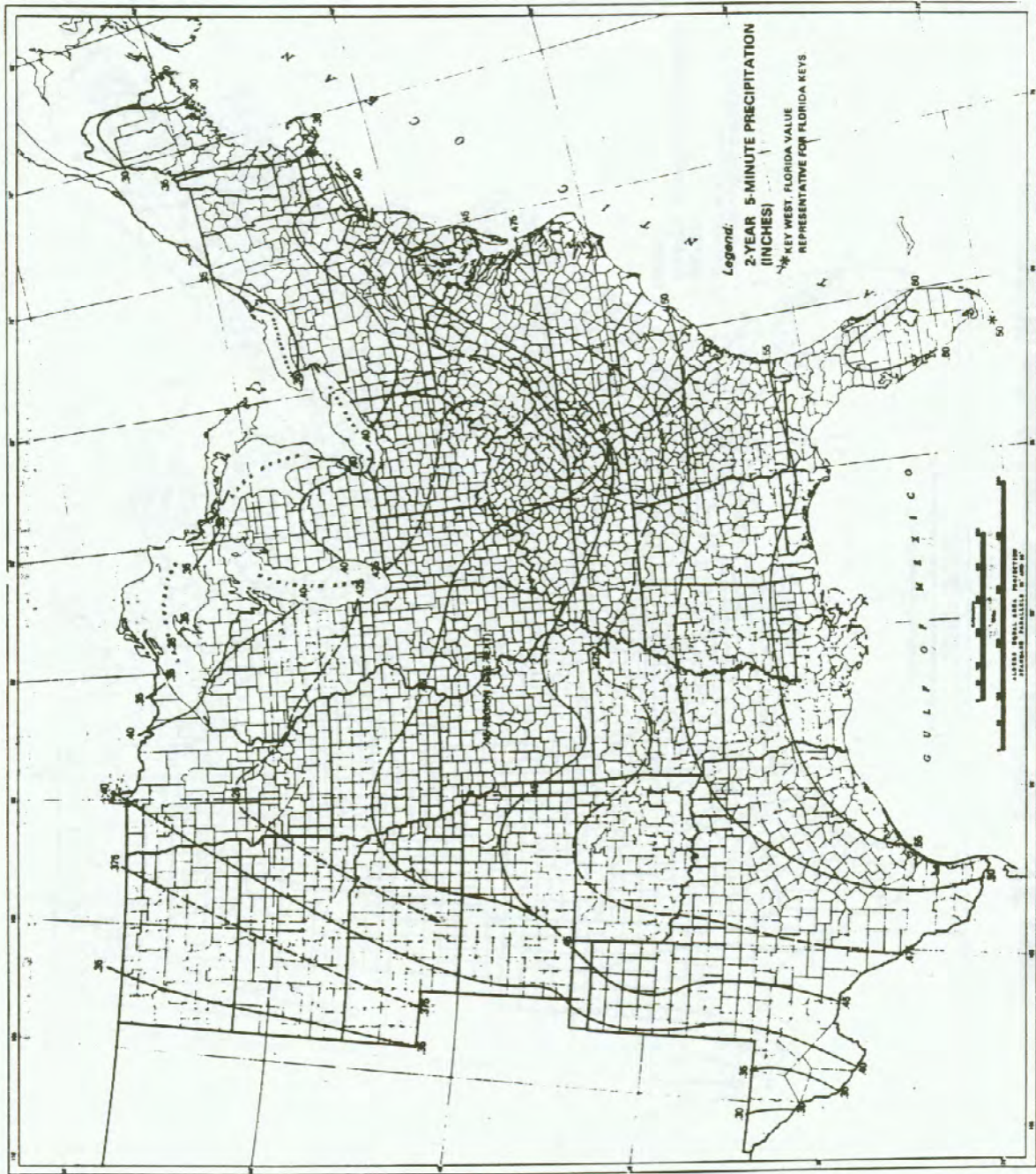


Figure 30. 2-year, 5-minute precipitation (HYDRO-35).

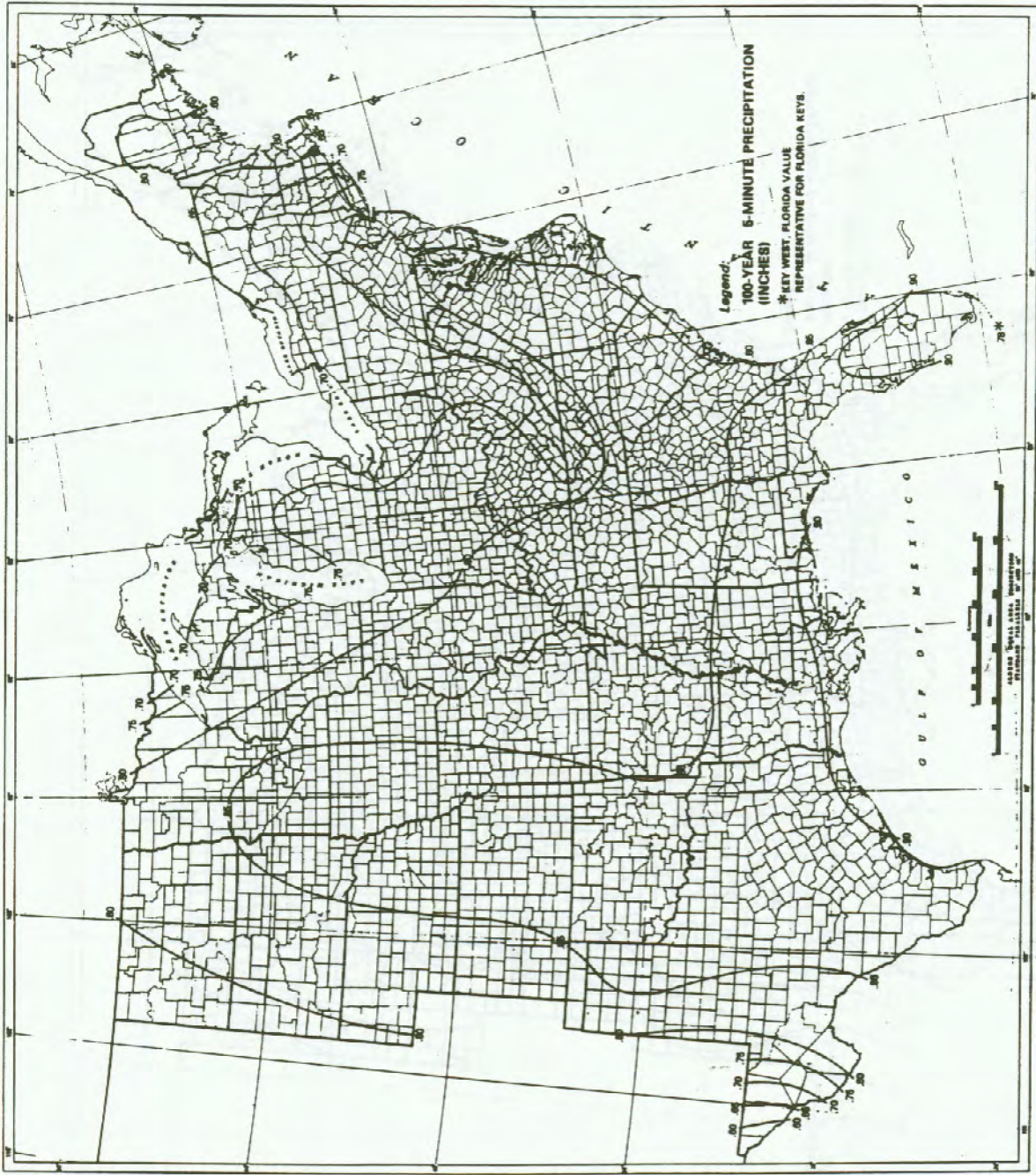
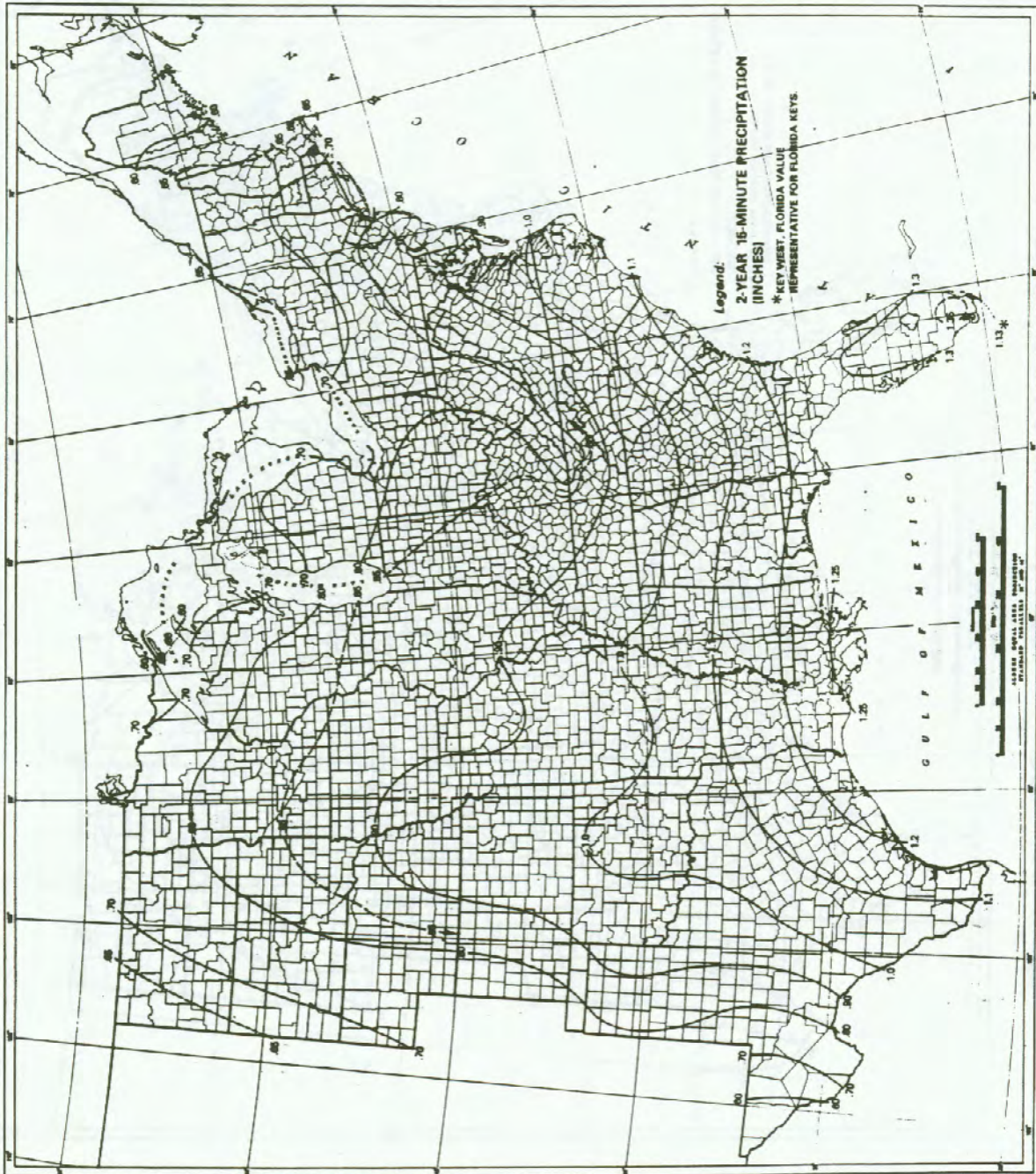


Figure 31. 100-year, 5-minute precipitation (HYDRO-35).



**Figure 32. 2-year, 15-minute precipitation (HYDRO-35).**

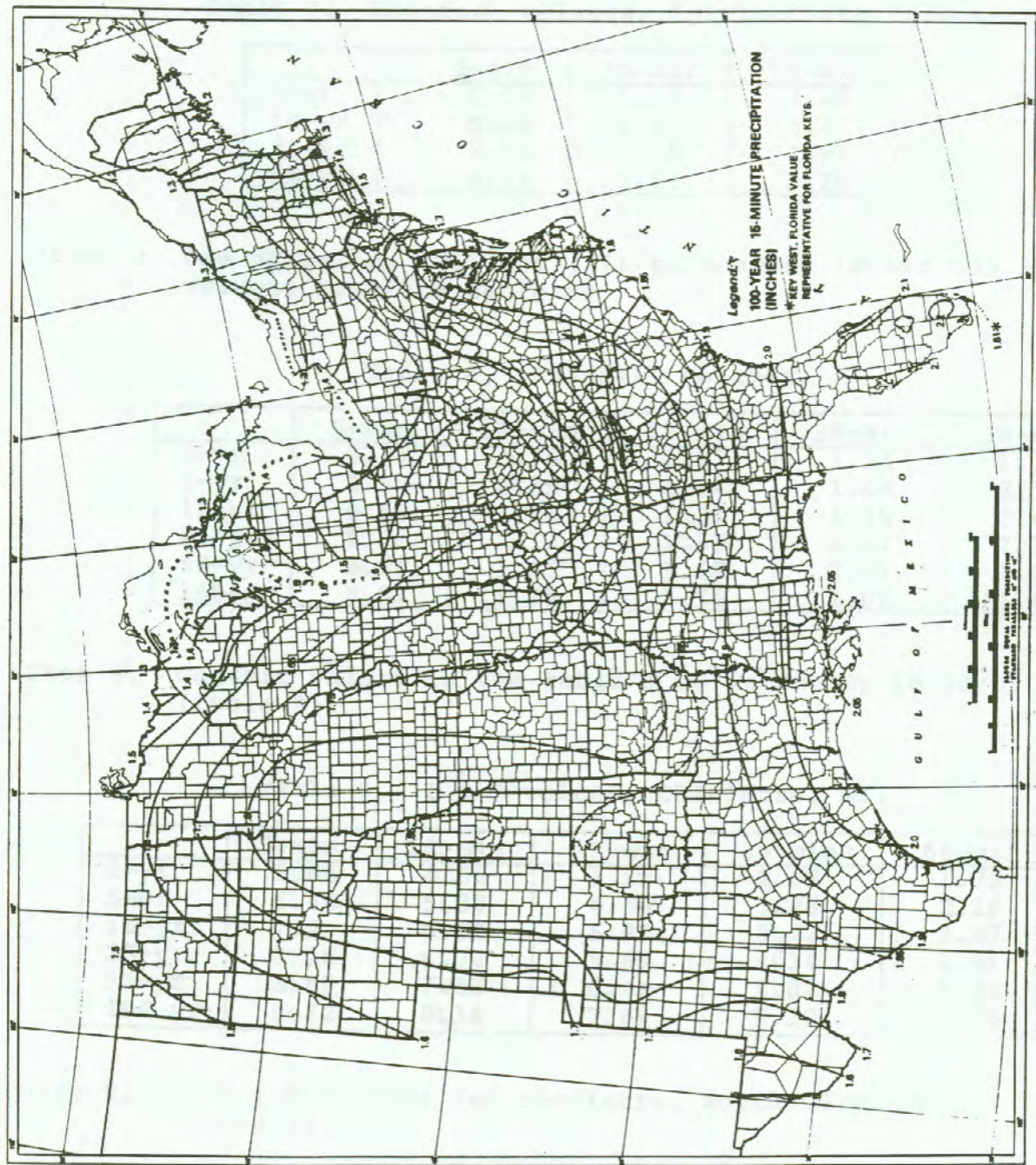


Figure 33. 100-year, 15-minute precipitation (HYDRO-35).

Step 2: Use equations (28) - (31) to compute 5-, 10-, 25-, and 50-yr frequency values (table 7):

Table 7. Rainfall volumes, intermediate frequencies.

	5-min	15-min	60-min
5-yr	0.54	1.14	2.16
10-yr	0.60	1.27	2.47
25-yr	0.68	1.45	2.91
50-yr	0.74	1.60	3.26

Step 3: Use equations (26) and (27) to compute 10-min and 30-min values; complete table 8:

Table 8. Rainfall volumes.

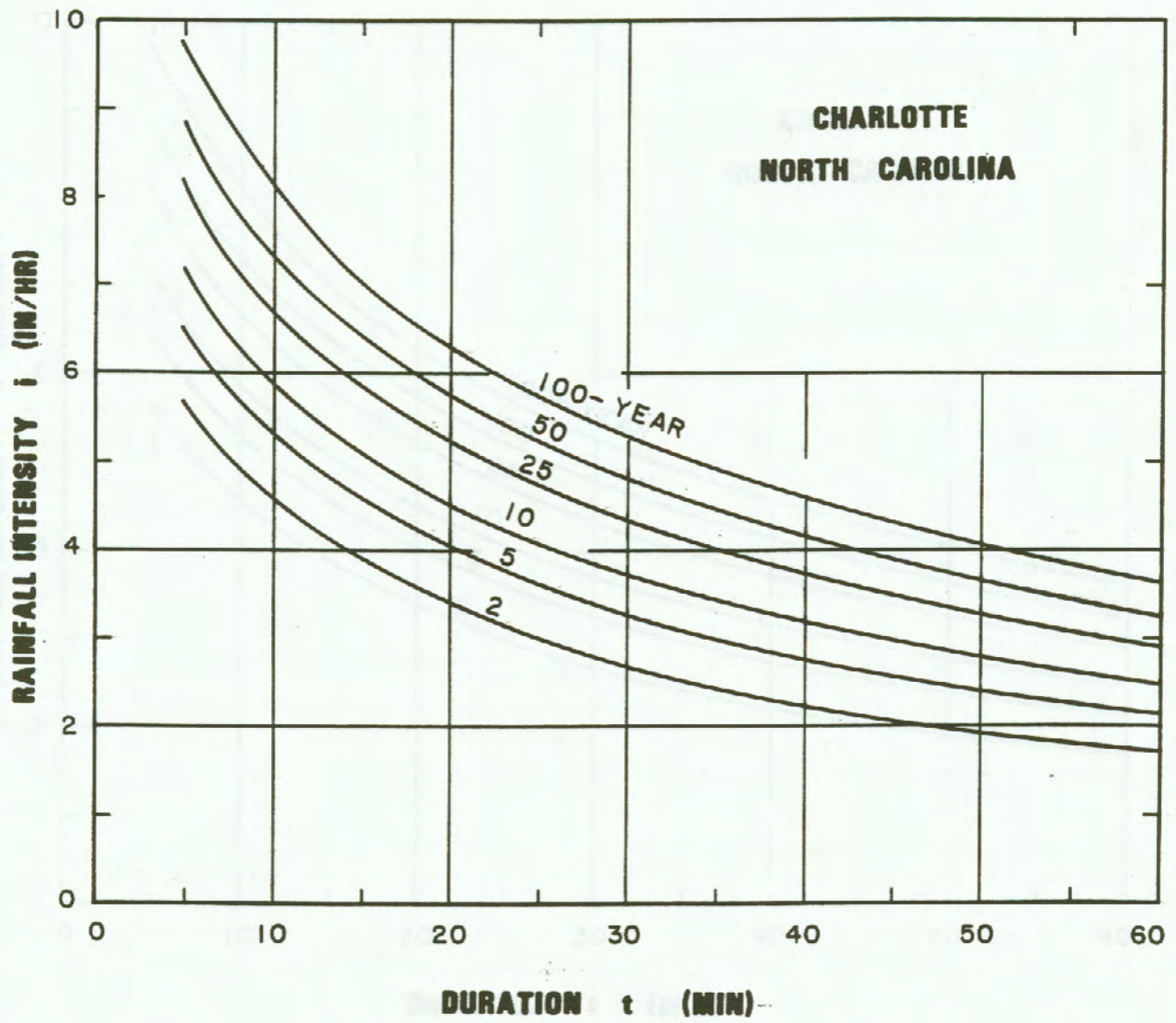
	5-min	10-min	15-min	30-min	60-min
2-yr	0.47	0.76	0.97	1.34	1.72
5-yr	0.54	0.89	1.14	1.64	2.16
10-yr	0.60	1.00	1.27	1.86	2.47
25-yr	0.68	1.13	1.45	2.17	2.91
50-yr	0.74	1.25	1.60	2.41	3.26
100-yr	0.81	1.36	1.75	2.66	3.60

Step 4: Convert values in the table 8 to intensity in in/hr (table 9):

Table 9. I-D-F values, Charlotte, NC.

	5-min	10-min	15-min	30-min	60-min
2-yr	5.64	4.56	3.88	2.68	1.72
5-yr	6.48	5.34	4.56	3.28	2.16
10-yr	7.2	6.00	5.08	3.72	2.47
25-yr	8.16	6.78	5.80	4.34	2.91
50-yr	8.88	7.50	6.40	4.82	3.26
100-yr	9.72	8.16	7.00	5.32	3.60

Step 5: Plot I-D-F Curve for Charlotte, North Carolina, figure 34.



**Figure 34. Intensity-duration-frequency curves for Charlotte, North Carolina.**