6. Compare the hydraulic performance of the proposed action to the hydraulic performance of the existing conditions in terms of:

Changes in flood level

Changes in flood velocities

Changes in flood flow distribution

Changes in impoundment (retention) characteristics

Changes in hydraulic structure configuration

_____

_____

_____

_____

_____

7. Remarks

_____

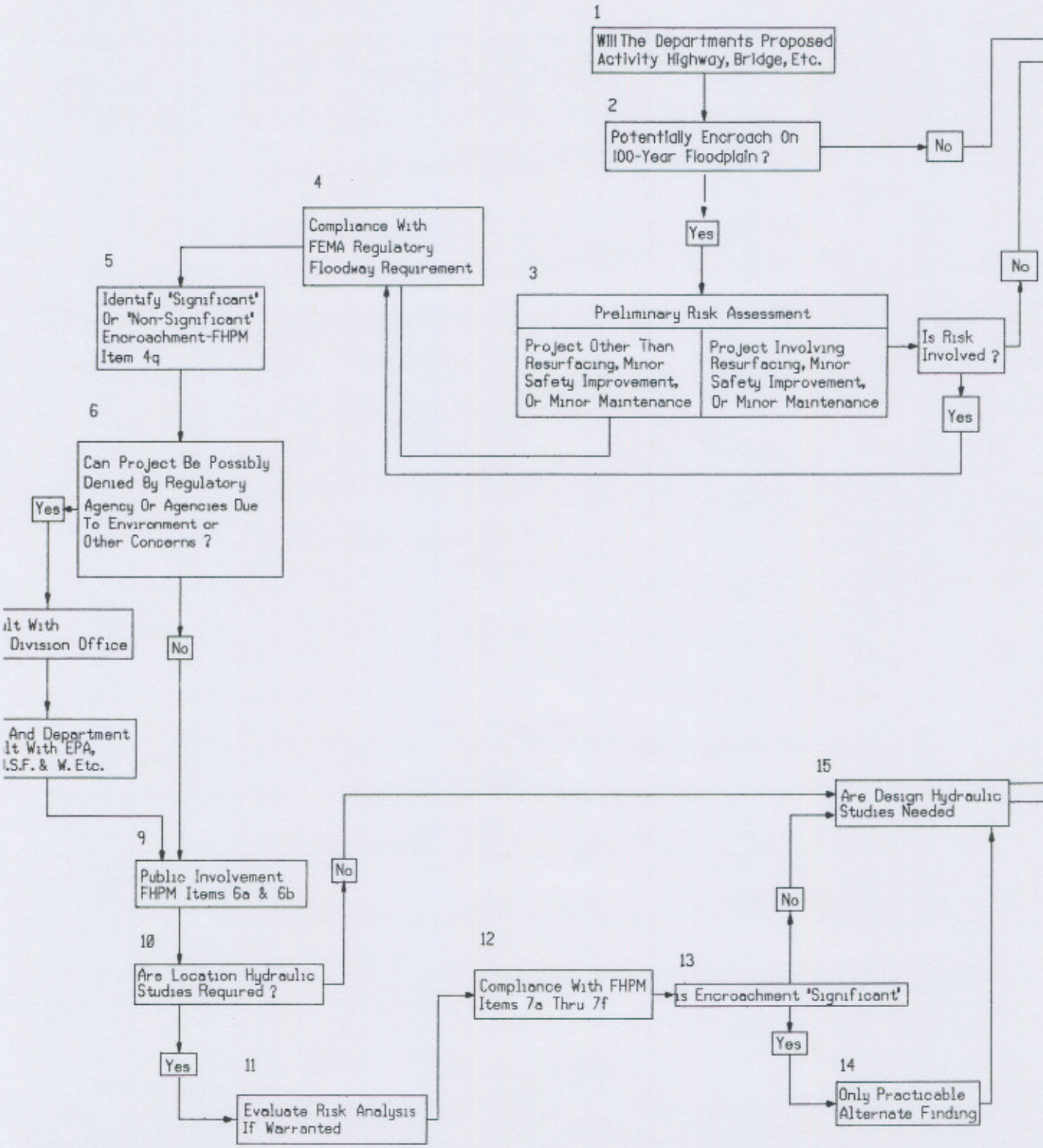
_____

_____

_____

If significant changes in hydraulic performance and/or "Risk" are present, an economic risk analysis (LTEC) may be required.

PROCEDURES FOR COMPLIANCE WITH WATERWAY AND FLOODPLAIN MANAGEMENT REGULATIONS



PROCEDURES FOR COMPLIANCE WITH WATERWAY AND FLOODPLAIN MANAGEMENT REGULATIONS

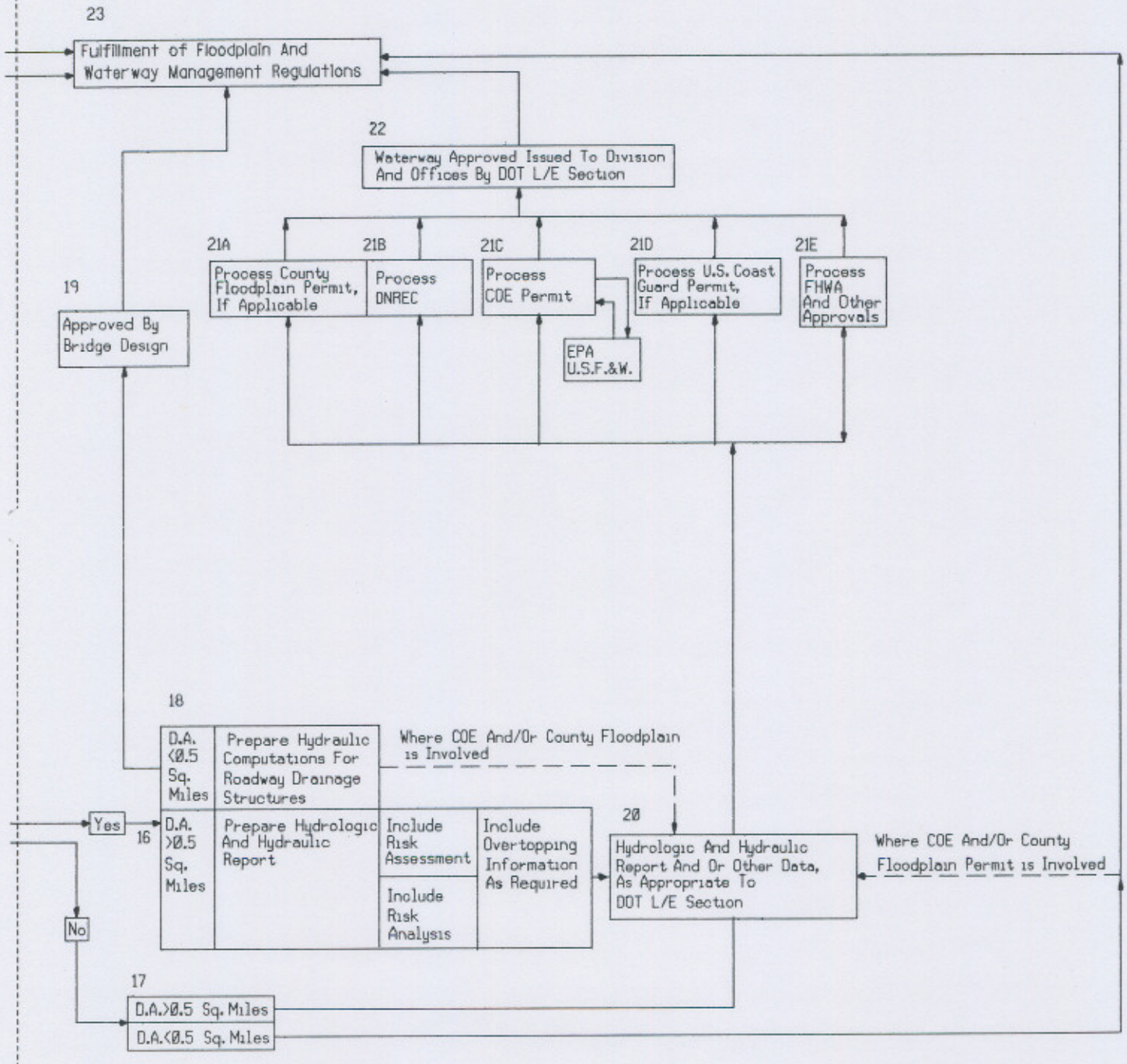


Figure 6-11

VALUES OF RUNOFF COEFFICIENT "C"

TOPOGRAPHY 7 VEGETATION	SOIL TEXTURE		
	OPEN SANDY LOAM	CLAY 7 SILT LOAM	TIGHT CLAY
WOODLAND			
Flat 0-5% Slope	0.10	0.30	0.40
Rolling 5-10% Slope	0.25	0.35	0.50
Hilly 10-30% Slope	0.30	0.50	0.60
PASTURE			
Flat 0-5% Slope	0.10	0.30	0.40
Rolling 5-10% Slope	0.16	0.36	0.55
Hilly 10-30% Slope	0.22	0.42	0.60
CULTIVATED			
Flat 0-5% Slope	0.30	0.50	0.60
Rolling 5-10% Slope	0.40	0.60	0.70
Hilly 10-30% Slope	0.52	0.72	0.82

URBAN AREAS	30% IMPERVIOUS	50% IMPERVIOUS	70% IMPERVIOUS
Flat 0-5% Slope	0.40	0.55	0.75
Rolling 5-10% Slope	0.50	0.65	0.80

PAVED AREAS	
Bituminous & Concrete Pavement	c = 0.90 - 1.00
Densely Built Paved Areas	c = 0.90
Commercial & Factory Areas, Road Shoulders	c = 0.70
Light Factories & Apartment Areas	c = 0.60
Compact Residential Areas	c = 0.50
Suburban Residential Areas	c = 0.30 - 0.40
Gravel Surfaces	c = 0.25 - 0.70
Parks, Railways Yards	c = 0.20

NOTE: Values of "C" can be combined to get a weighted average for a watershed consisting of several distinct zones.

e.g. Watershed consists of:

20% Hilly Woodland on sandy loam (c = 0.30)
30% Rolling Woodland on clay and sill loam (c = 0.35)
50% Rolling Cultivated tight clay (c = 0.70)

Average "C" (0.2 x 0.30) + (0.3 + 0.35) + (0.5 x 0.70) = 0.52

Figure 6-12

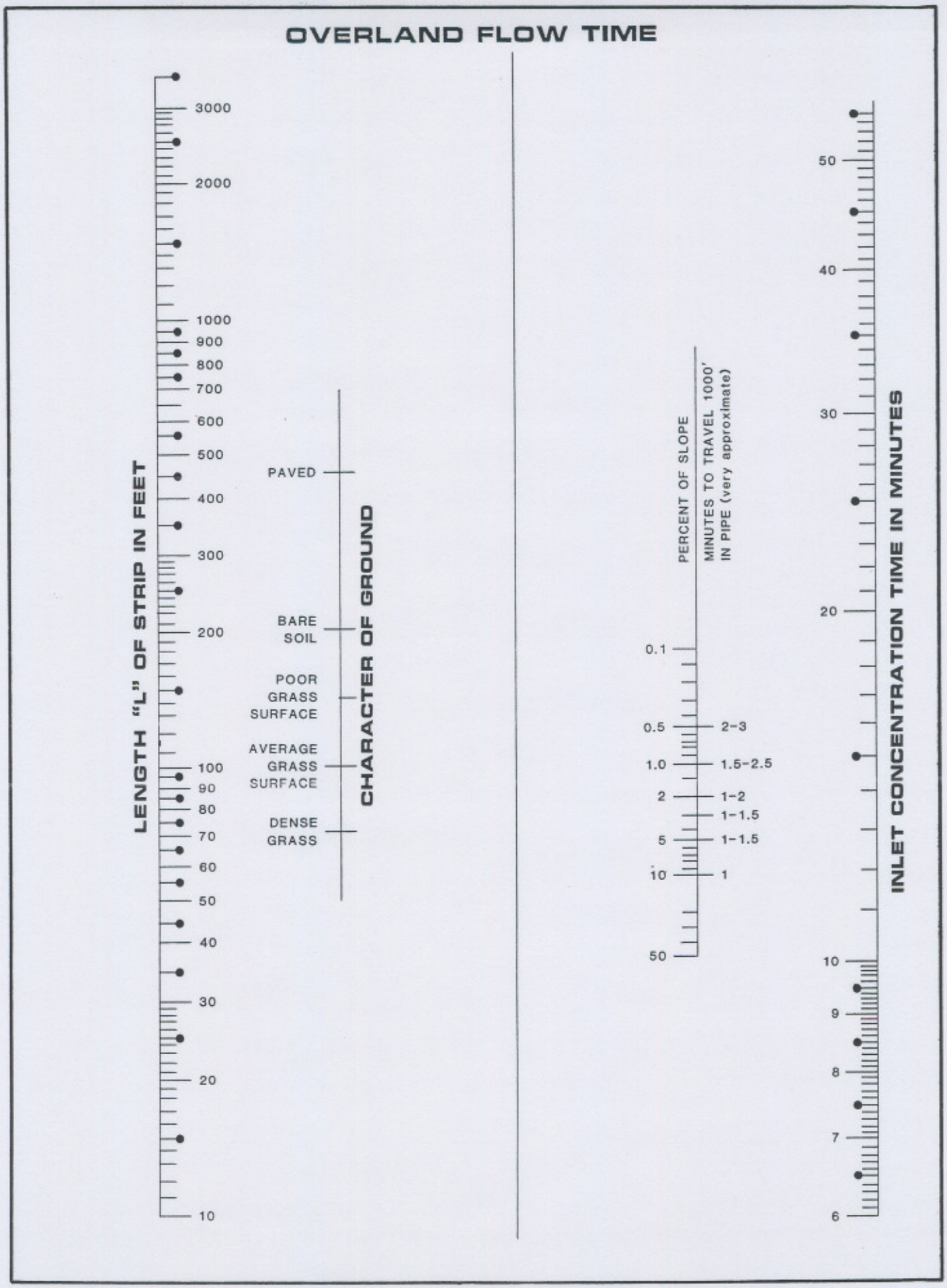

OVERLAND FLOW TIME
LENGTH "L" OF STRIP IN FEET
3000
2000
1000
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
10
CHARACTER OF GROUND
PAVED
BARE SOIL
POOR GRASS SURFACE
AVERAGE GRASS SURFACE
DENSE GRASS
PERCENT OF SLOPE
MINUTES TO TRAVEL 1000' IN PIPE (very approximate)
0.1
0.5
1.0
2
5
10
50
2-3
1.5-2.5
1-2
1-1.5
1-1.5
1
INLET CONCENTRATION TIME IN MINUTES
50
40
30
20
10
9
8
7
6

Figure 6-13

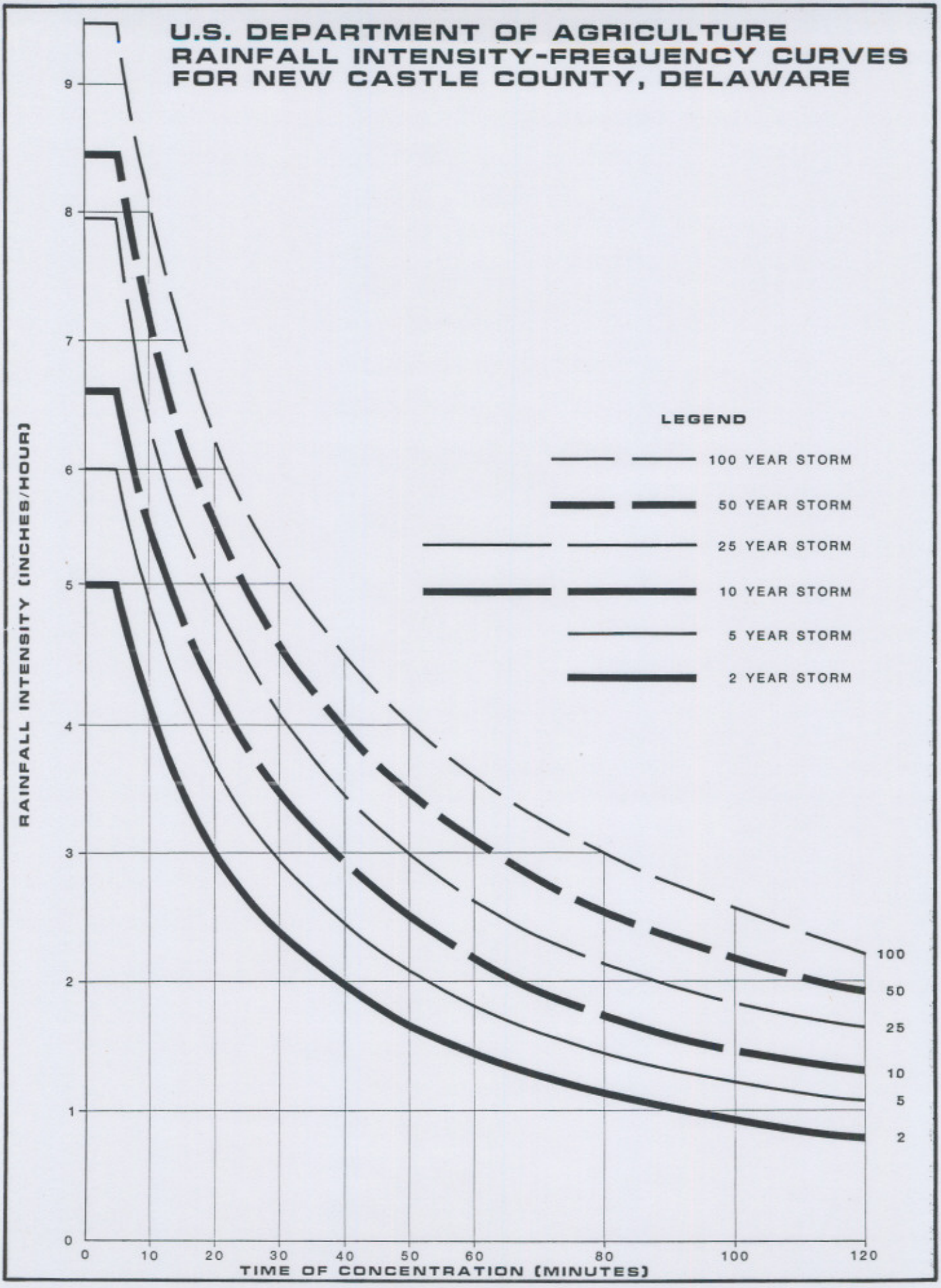

U.S. DEPARTMENT OF AGRICULTURE
RAINFALL INTENSITY-FREQUENCY CURVES
FOR NEW CASTLE COUNTY, DELAWARE
LEGEND
100 YEAR STORM
50 YEAR STORM
25 YEAR STORM
10 YEAR STORM
5 YEAR STORM
2 YEAR STORM
RAINFALL INTENSITY (INCHES/HOUR)
0
1
2
3
4
5
6
7
8
9
0
10
20
30
40
50
60
80
100
120
TIME OF CONCENTRATION (MINUTES)
100
50
25
10
5
2

Figure 6-14

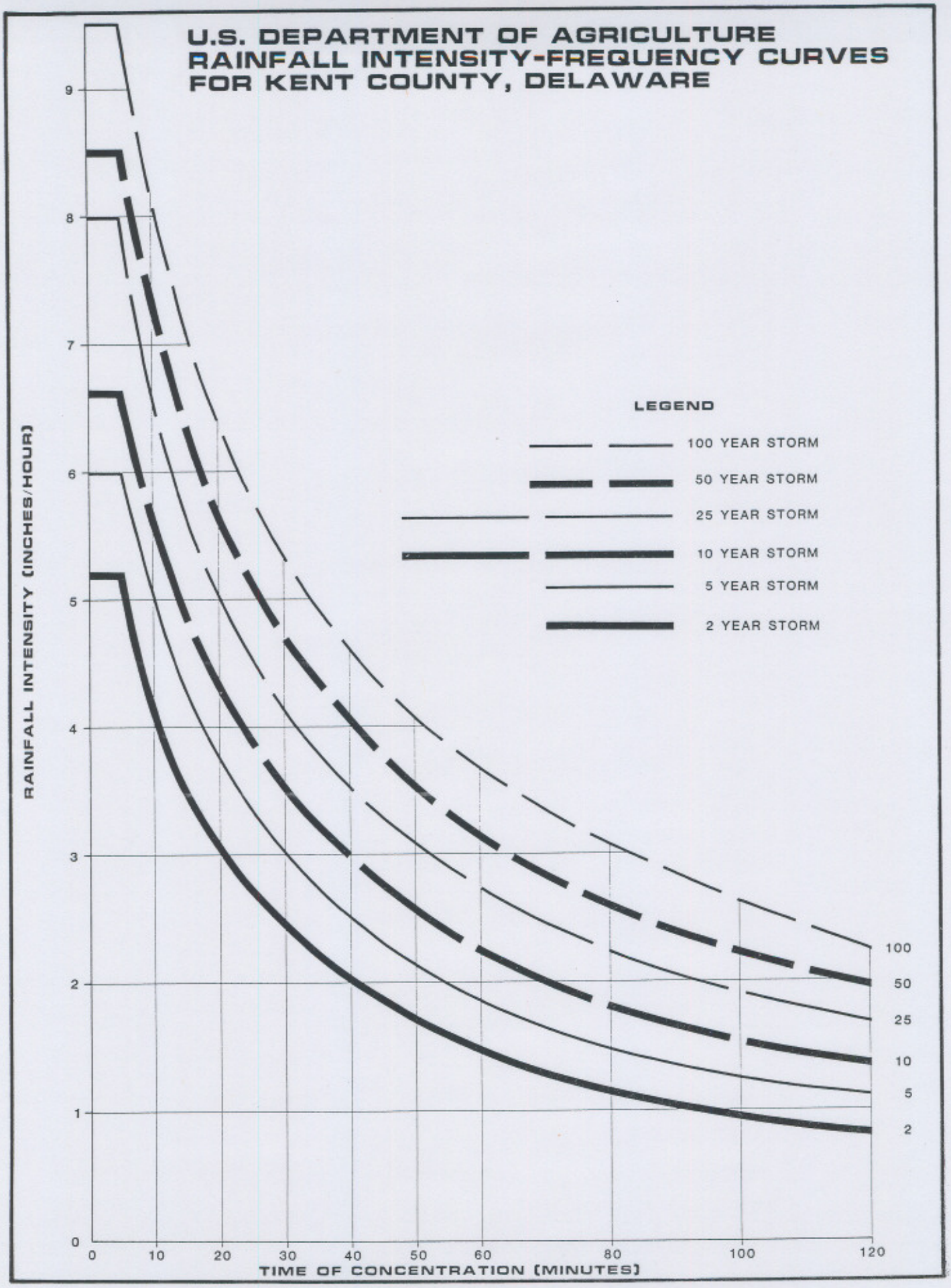

U.S. DEPARTMENT OF AGRICULTURE
RAINFALL INTENSITY-FREQUENCY CURVES
FOR KENT COUNTY, DELAWARE
LEGEND
100 YEAR STORM
50 YEAR STORM
25 YEAR STORM
10 YEAR STORM
5 YEAR STORM
2 YEAR STORM
RAINFALL INTENSITY (INCHES/HOUR)
0
1
2
3
4
5
6
7
8
9
0
10
20
30
40
50
60
80
100
120
TIME OF CONCENTRATION (MINUTES)
100
50
25
10
5
2

Figure 6-15

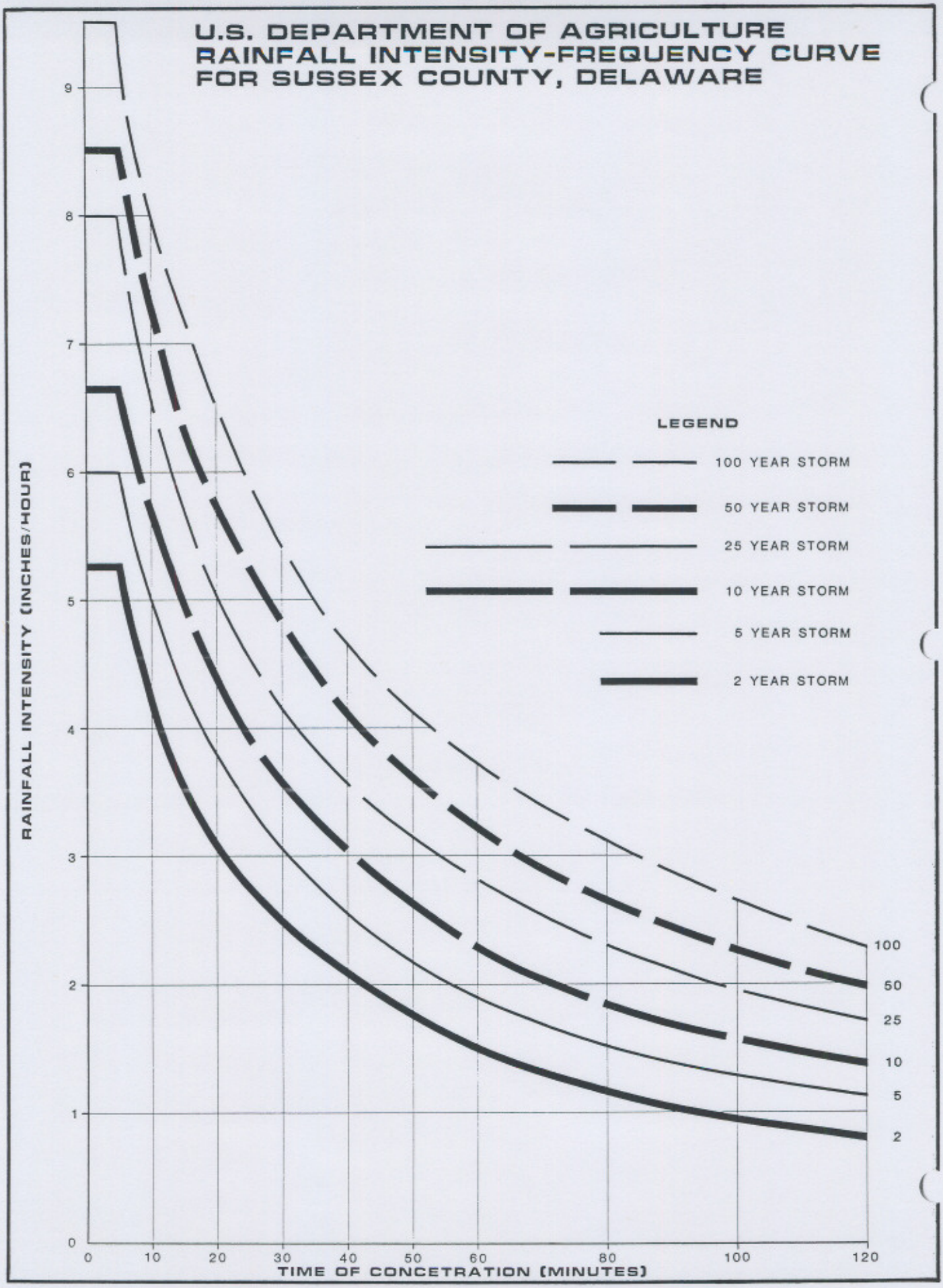
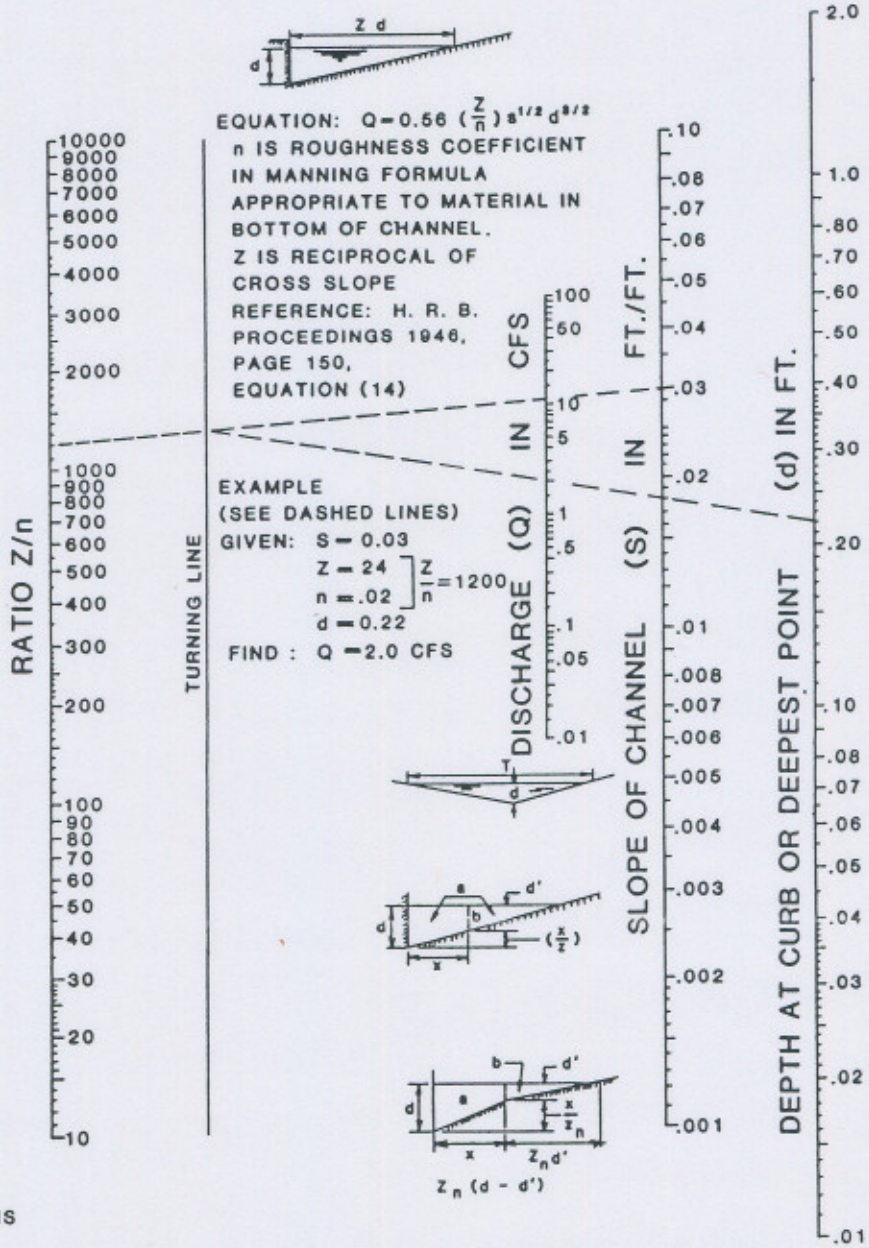

U.S. DEPARTMENT OF AGRICULTURE
RAINFALL INTENSITY-FREQUENCY CURVE
FOR SUSSEX COUNTY, DELAWARE
LEGEND
100 YEAR STORM
50 YEAR STORM
25 YEAR STORM
10 YEAR STORM
5 YEAR STORM
2 YEAR STORM
RAINFALL INTENSITY (INCHES/HOUR)
0
1
2
3
4
5
6
7
8
9
100
50
25
10
5
2
0
10
20
30
40
50
60
80
100
120
TIME OF CONCETRATION (MINUTES)

Figure 6-16

NOMOGRAPH FOR GUTTER CAPACITY



INSTRUCTIONS

1. CONNECT Z/n RATIO WITH SLOPE (S) AND CONNECT DISCHARGE (Q) WITH DEPTH (d). THESE TWO LINES MUST INTERSECT AT TURNING LINE FOR COMPLETE SOLUTION.
2. FOR SHALLOW V-SHAPED CHANNEL AS SHOWN USE NOMOGRAPH WITH $Z = \frac{T}{d}$
3. TO DETERMINE DISCHARGE Q_z IN PORTION OF CHANNEL HAVING WIDTH X: DETERMINE DEPTH d FOR TOTAL DISCHARGE IN ENTIRE SECTION a. THEN USE NOMOGRAPH TO DETERMINE Q_h IN SECTION b FOR DEPTH $d' = d - \left(\frac{X}{Z}\right)$
4. TO DETERMINE DISCHARGE IN COMPOSITE SECTION : FOLLOW INSTRUCTION 3. TO OBTAIN DISCHARGE IN SECTION a AT ASSUMED DEPTH d: OBTAIN Q_b FOR SLOPE RATIO Z_b AND DEPTH d'. THEN $Q_t = Q_a + Q_b$

Figure 6-17

COEFFICIENT OF ROUGHNESS VALUES
(Manning's "n")

CORRUGATED METAL PIPE:

Corrugations	Annular 2 2/3 x 1/2 In.	Helical							
		1 1/2 x 1/4 in (11.12)		2 2/3 x 1/2 in (13)					
	All Diameters	8"	10"	12"	18"	24"	36"	48"	60" and Larger
Unpaved 25% Paved Fully Paved	.024 .021 .012	.012	.014	.011	.014	.016 .015 .012	.019 .017 .012	.020 .020 .012	.021 .019 .012

	Annular 3 x 1 In.	Helical - 3 x 1 in.										
						48"	54"	60"	66"	72"	78" and Larger	
Unpaved 25% Paved Fully Paved	.027 .023 .012					.023 .020 .012	.023 .020 .012	.024 .021 .012	.025 .022 .012	.026 .022 .012	.027 .023 .012	
Corrugations 6 x 2 in.								60"		72"		120"		180"
Plain -- Unpaved 25% Paved								.033 .028		.032 .027		.030 .026		.028 .024

* AISI

CONCRETE PIPE: "n" = 0.013