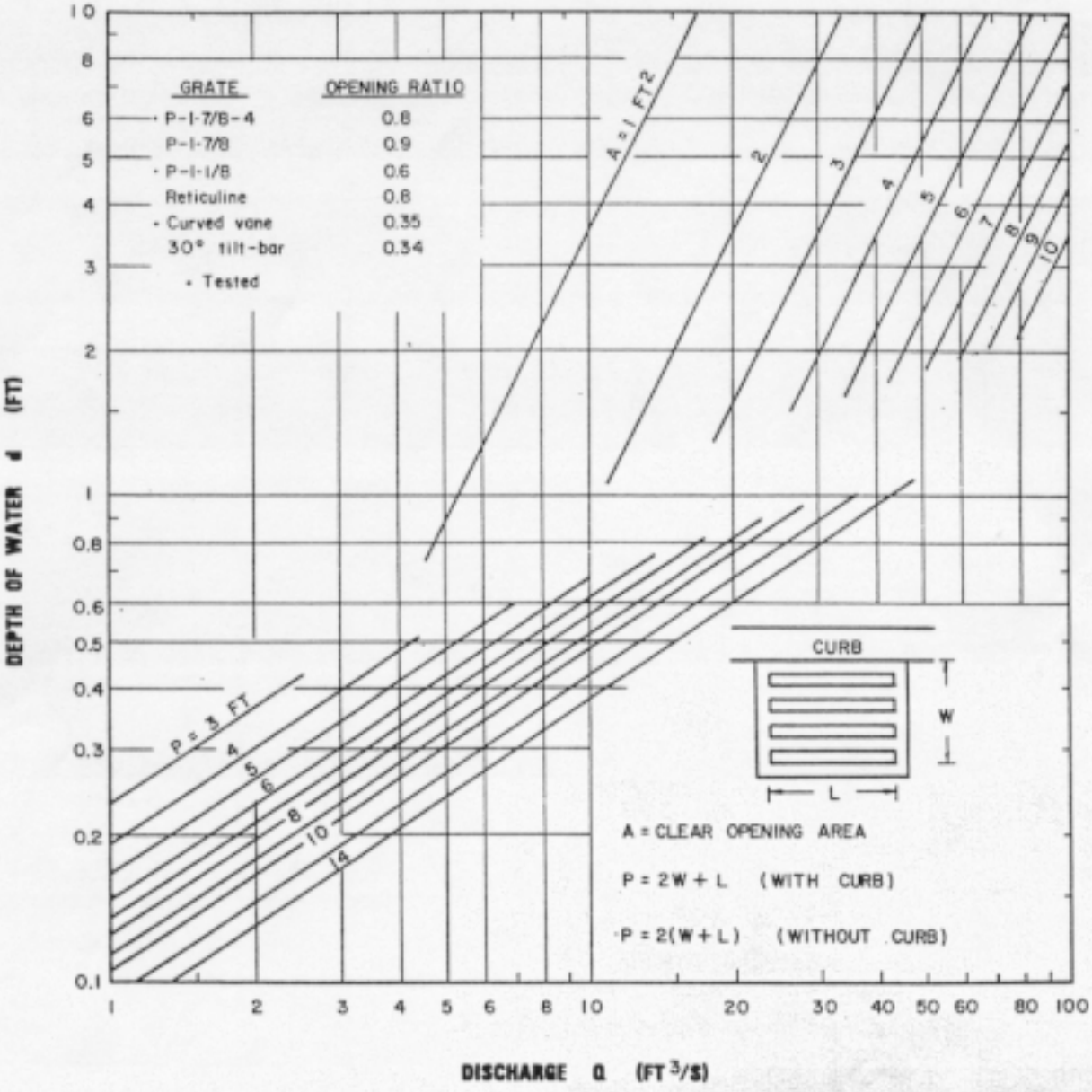


CHART 11. Grate inlet capacity in sump conditions.

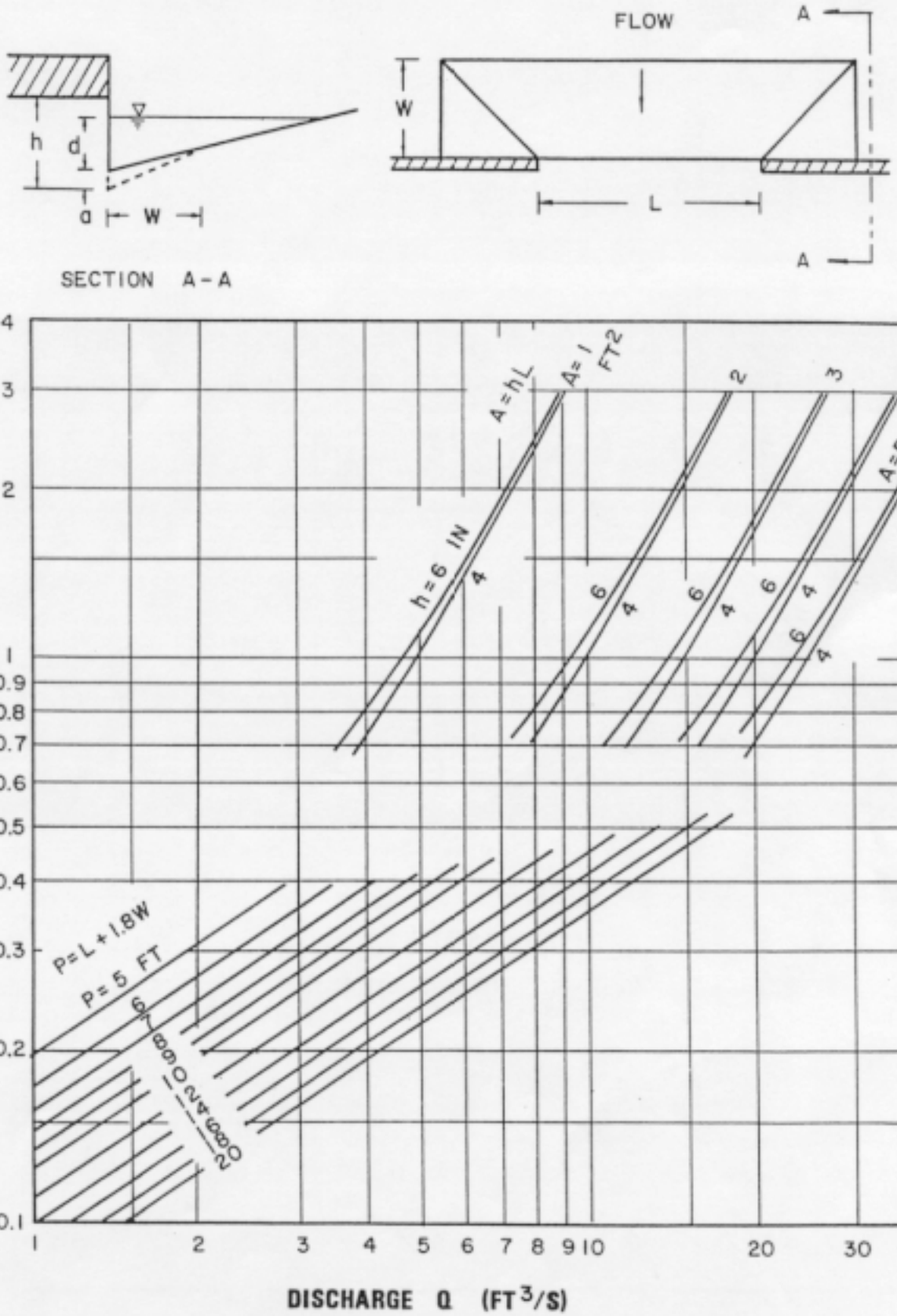


CHART 12. Depressed curb-opening inlet capacity in sump locations.

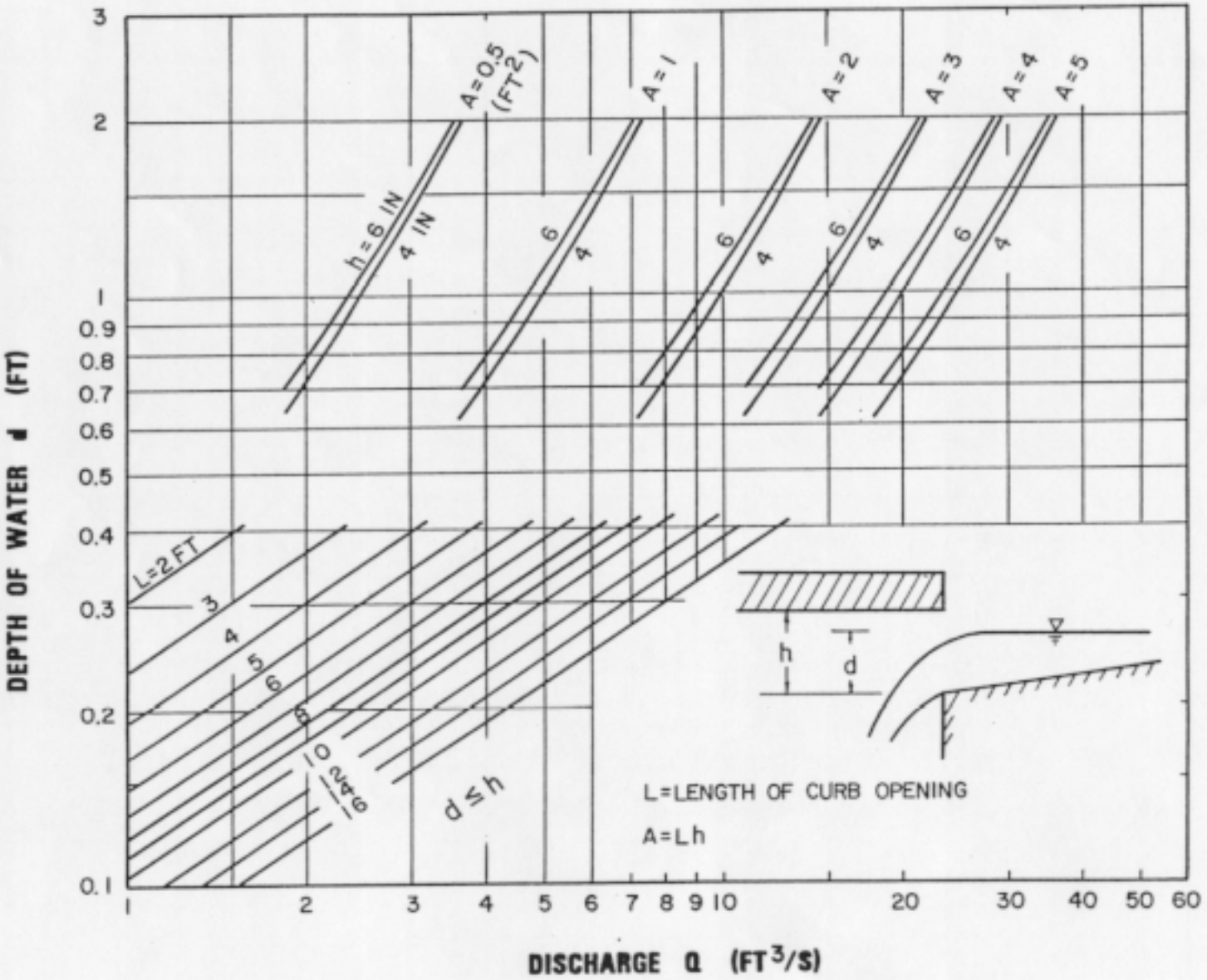


CHART 13. Curb-opening inlet capacity in sump locations.

Appendix C

Time of Concentration/Curve Number Worksheets

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project _____ By _____ Date _____

Location _____ Checked _____ Date _____

Circle one: Present Developed _____

Circle one: T_c T_t through subarea _____

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID		
1. Surface description (table 3-1)			
2. Manning's roughness coeff., n (table 3-1) ..			
3. Flow length, L (total L $\leq$ 300 ft)	ft		
4. Two-yr 24-hr rainfall, P_2	in		
5. Land slope, s	ft/ft		
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	[ ] + [ ] =	[ ]
Shallow concentrated flow	Segment ID		
7. Surface description (paved or unpaved)			
8. Flow length, L	ft		
9. Watercourse slope, s	ft/ft		
10. Average velocity, V (figure 3-1)	ft/s		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	[ ] + [ ] =	[ ]
Channel flow	Segment ID		
12. Cross sectional flow area, a	ft^2		
13. Wetted perimeter, p_w	ft		
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft		
15. Channel slope, s	ft/ft		
16. Manning's roughness coeff., n			
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s		
18. Flow length, L	ft		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	[ ] + [ ] =	[ ]
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr		[ ]

Worksheet 2: Runoff curve number and runoff

Project _____ By _____ Date _____

Location _____ Checked _____ Date _____

Circle one: Present Developed _____

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi^2 ☐ %	Product of CN x area
					Totals =	

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = ☐

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Appendix D

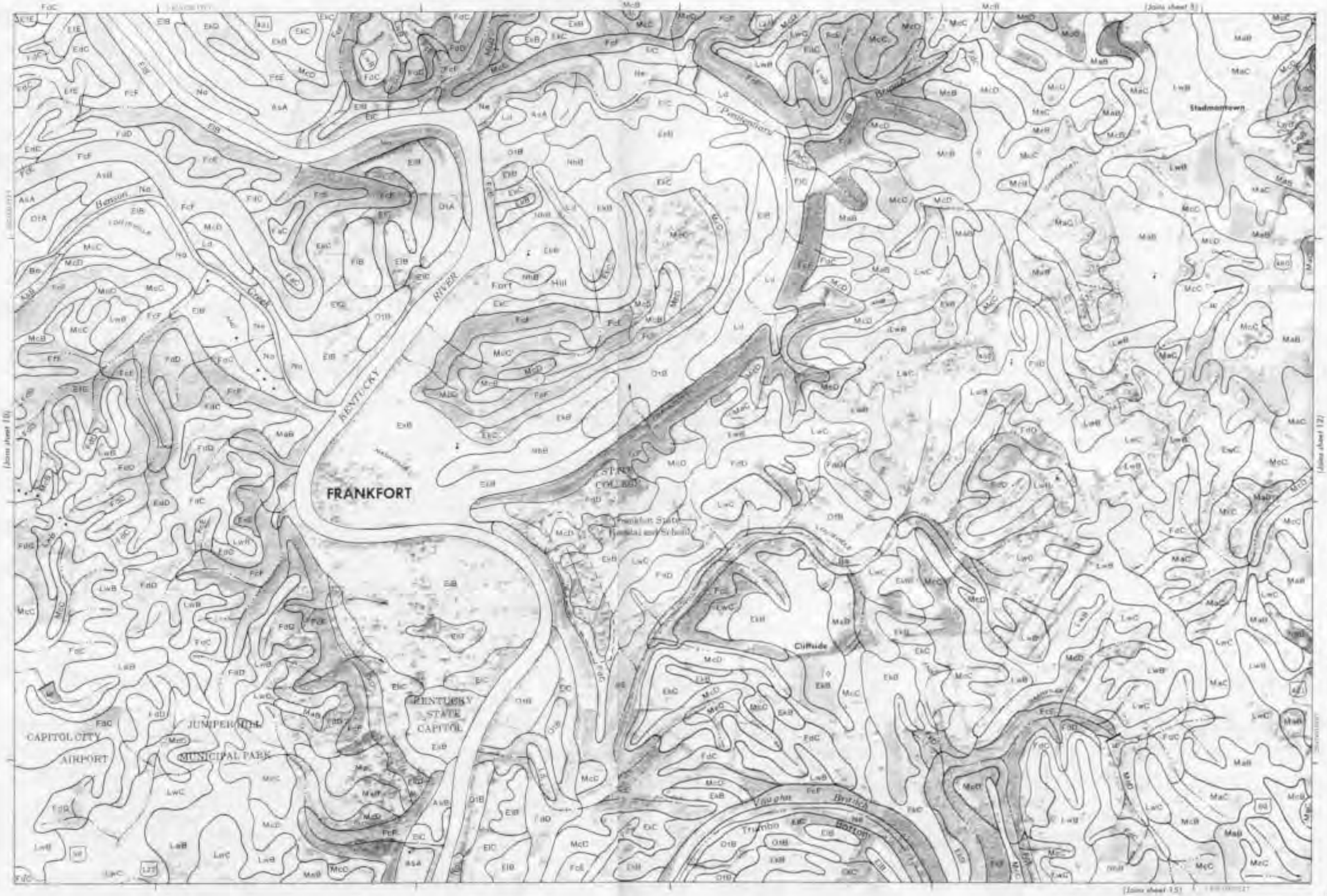
SCS Soil Maps

8


N
(Joins sheet 5)
(Joins sheet 7)
(Joins sheet 9)
(Joins sheet 11)
Scale 1:20000
Kilometer
RIVER
KENTUCKY
Creek
Backbone

ANDERSON AND FRANKLIN COUNTIES, KENTUCKY — SHEET NUMBER 15

ANDERSON AND FRANKLIN COUNTIES, KENTUCKY NO. 15



ANDERSON AND FRANKLIN COUNTIES, KENTUCKY NO. 11

Appendix E

Sample Calculations for Rational Method, Manning's Equation, and Tractive Force Method

Sample Calculations

Rational Method: Q = CIA

Where: Q = Peak Runoff Rate (cfs)
C = Land Use Coefficient (dimensionless)
I = Rainfall Intensity (in/hr)
A = Drainage Area (acres)

Sample: 3.5 acre basin with 60% impervious area and 40% grassed landscape. Find 10-year peak runoff rate.

Weighted C Factor: C = 60% (0.95) + 40% (0.20) = 0.65
I = 6.0 in/hr (from Table 2.1-2 w/Tc = 6 min)
Q = 0.65 x 6.0 (in/hr) x 3.5 acres = 13.6 cfs

Typical C Factors

Land Use	C
Impervious Areas	0.95
Grassed, Wooded, Pasture, Farmed Areas:	
Slope ≤ 7%	0.20
Slope > 7%	0.30
Compacted Earth/Gravel	0.80

Sample Calculations

Manning Equation: $V = \frac{1.49}{N} R^{2/3} S^{1/2}$

Alternatively: $Q = \frac{1.49}{N} R^{2/3} S^{1/2} A$

Where:

V = Velocity (fps)
N = Manning's N (see Table 2.4-1)
R = Hydraulic Radius = Flow Area (A) / Wetted Perimeter (P) (ft)
S = Friction Slope (ft/ft)
A = Flow Area (ft^2)
P = Wetted Perimeter (ft)
Q = Flow Rate (cfs)

Sample:

Given: Grass lined open channel with bottom width of 5 feet, 3H:1V side slope, and channel slope of 2%.

Find: Normal depth (Y) for Q = 1,200 cfs

$A = (5 + 3Y) \times Y$
$P = 5 + 2(Y^2 + (3Y)^2)^{½}$
N = 0.045 (Table 2.4-1)
S = 0.02
Q = 1,200

$$1{,}200 = \frac{1.49}{0.045} \quad \frac{[(5 + 3Y)Y]^{5/3} (0.02)^{1/2}}{(5 + 2Y10^{1/2})^{2/3}}$$

$$1.68 \times 10^7 = \frac{[(5 + 3Y)Y]^5}{[5 + 2Y10^{1/2}]^2}$$

Root Solve: Y = 5.6 feet

Find: Required freeboard for above channel (required freeboard is the larger of 1 foot or 2 velocity heads)

$$\text{Velocity Head} = \frac{V^2}{2g}$$

V = Q/A = 1,200/122 = 9.8 fps
Velocity Head = $(9.8)^2/2(32.2) = 1.49$
Required Freeboard = 3.0 feet

Sample Calculations

Tractive Force Method: $\tau = 62.4YS$

Where: τ = Tractive Force (lbs/ft^2)
Y = Normal Depth (ft)
S = Channel Slope (ft/ft)

Sample: Find the tractive force (shear stress) exerted upon the grass channel in the previous example.

Y = 5.6 ft
S = 0.02

τ = (62.4 lbs/ft^3) (5.6 ft) (0.02) = 7.0 lbs/ft^2

From Table 2.4-2, the maximum allowable shear stress for a grass channel is 1.0 lb/ft^2; thus the grass lining is not acceptable. Recommend a gabion mattress or armored channel lining.

This is an iterative process since selecting a new channel lining will change Manning's N, resulting in a different normal depth.

Appendix F

Submittal Checklist and Sign-Off

Improvement Plan Submittal Checklist

The items below shall be submitted to the City/County along with the plans and specifications. Submitted documentation will generally be in the form of an organized notebook with a list of attachments and labeled dividers. If any item on this checklist is not applicable to a particular submittal, a sheet of paper with an explanation of the absence of that item shall be included in place of the omitted item. This checklist, signed and stamped by a professional civil engineer, will be included in the front of the submittal notebook.

1. Grading and Erosion/Sediment Control Plan

2. Hydrologic documentation (Section 6.1)

3. Post development floodplain and analysis

4. Design documentation for all storm water appurtenances (Sections 6.2 - 6.5)

5. List of all local, state, and federal permits that will be obtained

I hereby certify that the improvements plans, calculations, and other documents submitted herein have been prepared in accordance with the City of Frankfort or Franklin County, Kentucky regulations and ordinances in effect at the time of submission.

Signature and Registration Number

Date