

Appendix A: Time of Concentration Analysis:

Time of Concentration (t_c) Calculations for Cascadilla Creek:

I. Given constants for the Cascadilla Creek watershed used in all four t_c analyses

$$L = \text{longest flow path (ft)} = 48000 \text{ ft}$$

$$h_1 = \text{lowest elevation point (ft)} = 380 \text{ ft}$$

$$h_2 = \text{highest elevation point (ft)} = 1870 \text{ ft}$$

$$H = \text{elevation difference along the longest flow path (ft)} = h_2 - h_1 = 1490 \text{ ft}$$

$$S = \text{average slope along the longest flow path} = H/L = 3.03$$

$$CN = \text{NRCS Curve Number} = 76.76$$

$$C = \text{Rational Method Runoff Coefficient} = 0.23$$

II. Kirpich Method (1940, min.)

$$t_c = 0.0078 \cdot L^{0.77} \cdot S^{-0.385}$$

$$t_c = [0.0078 \cdot (48000)^{0.77} \cdot (3.03)^{-0.385}] \cdot \frac{1 \text{ hr}}{60 \text{ min}}$$

$$t_c = 1.99 \text{ hrs} \approx 2 \text{ hrs}$$

III. NRCS (1972, min.)

$$t_c = 0.0078 \cdot L^{1.15} \cdot H^{-0.385}$$

$$t_c = [0.0078 \cdot (48000)^{1.15} \cdot (1490)^{-0.385}] \cdot \frac{1 \text{ hr}}{60 \text{ min}}$$

$$t_c = 1.95 \text{ hrs} \approx 2 \text{ hrs}$$

IV. NRCS Lag (1973, min.)

$$t_c = 10 \cdot L^{0.8} \cdot [(10000/CN) - 9]^{0.7} / (1900 \cdot S^{0.5})$$

$$t_c = [10 \cdot (48000)^{0.8} \cdot [(10000/76.76) - 9]^{0.7} / (1900 \cdot (3.03)^{0.5})] \cdot \frac{1 \text{ hr}}{60 \text{ min}}$$

$$t_c = 7.34 \text{ hrs}$$

V. FAA (1970, min.)

$$t_c = 1.8 \cdot (1.1 - C) \cdot L^{0.5} \cdot S^{-0.333}$$

$$t_c = [1.8 \cdot (1.1 - 0.23) \cdot (48000)^{0.5} \cdot (3.03)^{-0.333}] \cdot \frac{1 \text{ hr}}{60 \text{ min}}$$

$$t_c = 18.24 \text{ hrs}$$

Time of Concentration For Tompkins County Stream Crossings:

I. Kirpich Method used for all crossings: $t_c = 0.0078 \cdot L^{0.77} \cdot S^{-0.385}$

Table A.1: Stream crossings by road name with longest flow path and average slope values for each crossing as well as the Kirpich time of concentration values for each crossing in hours.

| Stream Crossing Road Name | Longest Flow Path L (ft) | Avg. Slope of Watershed S (unitless) | Kirpich t_c values (hrs) |
|----------------------------------|---------------------------------|---|--|
| Bostwick Road | 2112.00 | 0.087 | 0.1208 |
| Enfield Main Road | 11932.80 | 0.034 | 0.6590 |
| Connecticut Hill Road | 7761.60 | 0.064 | 0.3713 |
| Leonard Road | 6758.40 | 0.065 | 0.3308 |
| Butternut Creek Road | 6916.80 | 0.061 | 0.3458 |
| Stonehaven Circle Road | 18744.00 | 0.038 | 0.8958 |
| Station Road | 4012.80 | 0.127 | 0.1712 |
| Valley View Road | 11510.40 | 0.079 | 0.4633 |
| West Danby Road (34) | 11668.80 | 0.078 | 0.4691 |
| Smiley Hill Road | 4382.40 | 0.083 | 0.2157 |
| Ekroos Road (1) | 24393.60 | 0.015 | 1.5546 |
| Ekroos Road (2) | 24393.60 | 0.015 | 1.5546 |
| Vanostrand Road (1) | 2640.00 | 0.033 | 0.2085 |
| Vanostrand Road (2) | 5808.01 | 0.062 | 0.2995 |
| Douglas Road | 4540.80 | 0.034 | 0.3125 |
| Fishkill Road | 14414.40 | 0.027 | 0.8356 |
| Thomas Road | 4329.60 | 0.068 | 0.2312 |
| Curry Road (1) | 51849.60 | 0.017 | 2.6547 |
| Curry Road (2) | 51849.60 | 0.017 | 2.6547 |
| Genung Road | 2481.60 | 0.044 | 0.1786 |
| 38 North | 6652.80 | 0.040 | 0.3952 |