

## Appendix 9

### Worksheet #1: Time of Concentration (T<sub>c</sub>) or Travel Time (T<sub>t</sub>)

Project \_\_\_\_\_ By \_\_\_\_\_ Date \_\_\_\_\_  
 Location \_\_\_\_\_ Checked \_\_\_\_\_ Date \_\_\_\_\_  
 Circle One: Present      Developed  
 Circle One: T<sub>c</sub>    T<sub>t</sub>      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<sub>c</sub> Only)**      **Segment ID**

1. Surface description (table 3-1).....				
2. Manning's roughness coefficient, n (table 3-1).....				
3. Flow length, L (total L ≤ **150 ft).....ft				
4. Two-year 24-Hour rainfall, P <sub>2</sub> .....in				
5. Land slope, s.....ft/ft				
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} \times S^{0.4}}$ Compute T <sub>t</sub> .....hr		+		= <span style="border: 1px solid black; display: inline-block; width: 40px; height: 20px; vertical-align: middle;"></span>

**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. $T_t = \frac{L}{3,600 \times V}$ Compute T <sub>t</sub> .....hr		+		= <span style="border: 1px solid black; display: inline-block; width: 40px; height: 20px; vertical-align: middle;"></span>

**Channel Flow**      **Segment ID**

12. Cross sectional flow area, a.....ft <sup>2</sup>				
13. Wetted perimeter, P <sub>w</sub> .....ft				
14. Hydraulic radius, R = $\frac{a}{P_w}$ Compute r .....ft				
15. Channel slope, s.....ft/ft				
16. Manning's roughness coefficient, n.....				
17. $V = \frac{1.49 \times r^r \times s^{1/n}}{n}$ Compute V .....ft/s				
18. Flow Length, L.....ft/s				
19. $T_t = \frac{L}{3,600 \times V}$ Compute T <sub>t</sub> .....hr		+		= <span style="border: 1px solid black; display: inline-block; width: 40px; height: 20px; vertical-align: middle;"></span>
20. Watershed or subarea T <sub>c</sub> or T <sub>t</sub> (add T <sub>t</sub> in steps 6, 11 and 19).....hr				= <span style="border: 1px solid black; display: inline-block; width: 40px; height: 20px; vertical-align: middle;"></span>

\* Table 3-1 per latest TR-55, Urban Hydrology for Small Watersheds  
 \*\* 150 Feet Sheet flow length per latest TR-55 revision