

COUNTY OF SANTA CRUZ

DEPARTMENT OF PUBLIC WORKS

Rev. 11-05

Instructions and notes for “**DRAINAGE SYSTEM CALCULATION**” sheet (SWM-6).

Circled numbers below refer to circled numbers shown in column headings on the calculation sheet.

- ① **AREA DESIGNATION** — Designate each drainage area beginning with the uppermost reach by a letter (e.g., B).
- ② **AREA A** — Areas in acres of each drainage area draining to inlet ⑦.
- ③ **C** — Runoff coefficient for drainage AREA A ②. See County Design Criteria (CDC). Future land use shall be taken into account.
- ④ **A * C** — Drainage AREA A ② multiplied by runoff coefficient C ③.
- ⑤ **T_c** — Time of concentration in minutes for drainage AREA A ②. See CDC. Minimum time is 10 minutes, or less if required by the County.
I — Rainfall intensity in inches per hour for T_c ⑤. See CDC.
- ⑥ **Q** — Runoff flow in cubic feet per second from $Q = CIA$ (Rational Formula). Multiply $A * C$ ④ by lower portion of I ⑤.
- ⑦ **JUNCTION DESIGNATION** — Designate each inlet and manhole by a number (e.g., 3) and each junction (more than one inlet pipe) by a number and J (e.g., 4J).
- ⑧ **Σ AC** — Progressive accumulation of $A * C$ ④.
- ⑨ **Σ T_c** — Progressive accumulation of time of concentration to upstream end of pipe to be sized beginning with T_c ⑤.
(e.g., $T_c ⑤ + \Delta T_{c_{1-2}} ⑨ = \Sigma T_{c_2} + \Delta T_{c_{2-3}} = \Sigma T_{c_3}$). Use whichever is largest value T_c ⑤ or Σ T_c ⑨ for determining runoff Q ⑪.
Δ T_c — Pipe flow travel time in minutes. Divide L ⑬ by V (fpm) ⑯.
- ⑩ **I** — Rainfall intensity in inches per hour for Σ T_c ⑨. See CDC.
- ⑪ **Q** — Runoff flow in cubic feet per second for accumulated area. Multiply Σ A*C ⑧ by I ⑩.
- ⑫ **PIPE LINE DESIGNATION** — Designate each pipe line by number designation of upstream inlet and downstream inlet (e.g., 2 - 3).
- ⑬ **L** — Length of pipe in feet. Maximum inlet spacing is 500 feet.
- ⑭ **D** — Diameter of pipe in inches. Minimum diameter is 18 inches. Designate type (e.g. RCP, PVC).
- ⑮ **PIPE AREA** — Cross-sectional area of pipe in square feet. See King's Handbook.
n — Manning's n, roughness coefficient of pipe. See CDC.
- ⑯ **V (fps)** — Velocity of flow in feet per second. Divide Q ⑪ by PIPE AREA ⑮.
V (fpm) — Velocity of flow in feet per minute. Multiply V (fps) ⑯ by 60 sec/min.
- ⑰ **S_n** — Neutral slope in feet per foot. Identical to friction slope, slope of energy grade line, or slope from Manning's equation. See King's Handbook.
- ⑱ **FRIC** — Pipe friction loss in feet. Multiply L ⑬ by S_n ⑰ for pipe flowing full.
- ⑲ **H_i** — Entrance and exit head loss of pipe in feet. Usually equal to $1.4 V^2/2g$ for CMP, and $1.1V^2/2g$ for other types of pipes. See King's Handbook.
- ⑳ **ΣH** — Summation of head losses in feet. ⑱ + ⑲ if flow is subcritical.
- ㉑ **W.S. ELEVATION** — Outlet Control. Water surface elevation at inlet, manhole or junction. Calculate by adding Σ H ㉑ to known downstream water surface elevation and progress upstream.
- ㉒ **T.G. ELEVATION** — Top of grate elevation, or top of cover for manholes and junction boxes.
- ㉓ **W.S. ELEVATION** — Inlet Control. Calculate by adding PIPE F.L. ㉔ + pipe diameter ⑭ + H_i from ⑲. Design value is the greater of ㉑ or ㉓.
- ㉔ **PIPE F.L.** — Elevation of pipe entrance flowline.

FIG. SWM-7