II. HYDRAULIC CRITERIA

A. MANNING EQUATION

The Manning Equation shall be used to determine the capacity of open channels and enclosed gravity conduits:

$$Q = AV = \frac{1.486}{n} R^{2/3} S^{1/2} A \qquad \text{(E-5)}$$

where:

Q = the flow rate in cubic feet per second.

A = the cross sectional area of the flow in square feet.

V = the flow velocity in feet per second.

R = the hydraulic radius in feet.

S = the slope of the hydraulic gradient in feet per foot.

n = the Manning coefficient.

Values of the Manning coefficient for various pipes and open channels are given in Table A-3.

B. VELOCITY

Closed conduits shall be considered flowing full. Minimum velocity shall be a velocity sufficient to maintain a clean pipe or channel and generally not less than 2 feet per second. For pump discharge lines, the velocity shall not exceed 10 feet per second. Velocities in unlined open channels shall not exceed those values shown in Table A-4, or the soils engineer's recommendation. To determine the actual velocity of flow in gutters, use the gutter flow chart (Figure A-2), using one foot per second as a minimum.

C. HEAD LOSSES

Minor head losses, such as manhole and bend losses, may be neglected.

D. MINIMUM PIPE SIZE

Catch basin laterals shall be not less than 12 inches in diameter. All mains, trunk lines and cross culverts shall be not less than 18 inches in diameter. Pipe sizes shall not decrease going downstream.

E. BACKWATER

All outlets shall take into account any backwater condition in the receiving channel.