

## CHAPTER 5

### OPEN CHANNEL HYDROLOGY

#### 5.2 Design Criteria

##### 5.2.1 General Criteria

In general, the following criteria should be used for open channel:

- 5.2.1.1 Channels with bottom widths greater than 10 feet shall be designed with a minimum bottom cross slope of 12 to 1.
- 5.2.1.2 Low flow sections shall be considered in the design of channels with large cross sections ( $Q > 100$  cfs).
- 5.2.1.3 Channel side slopes shall be stable throughout the entire length and side slope shall depend on the channel material. A maximum of 3:1 is allowed for vegetation and 2:1 for riprap, unless otherwise justified by calculations.
- 5.2.1.4 Superelevation of the water surface at horizontal curves shall be accounted for by increased freeboard.
- 5.2.1.5 Trapezoidal or parabolic cross sections are preferred and triangular shapes should be avoided.
- 5.2.1.6 For vegetative channels, if the channel slope exceeds 10 percent, or a combination of channel linings will be used, special design procedures presented in HEC-15 and HEC-14 should be used.
- 5.2.1.7 For vegetative channels, design stability should be determined using low vegetative retardance conditions (Class D) and for design capacity higher vegetative retardance conditions (Class C) should be used.
- 5.2.1.8 For vegetative channels, flow velocities within the channel should not exceed the maximum permissible velocities given in Tables 5.3-1 and 5.3-2
- 5.2.1.9 If relocation of a stream channel is unavoidable, the cross-sectional shape, meander, pattern, roughness, sediment transport, and slope should conform to the existing conditions insofar as practicable. Some means of energy dissipation may be necessary when existing conditions cannot be duplicated.

- 5.2.1.10 Streambank stabilization should be provided, when appropriate, as a result of any stream disturbance such as encroachment and should include both upstream and downstream banks as well as the local site.
- 5.2.1.11 Open channel drainage systems are sized to handle a 25-year design storm. The 100-year design storm should be routed through the channel system to determine if the 100-year plus applicable building elevation restrictions are exceeded, structures are flooded, or flood damages increased.
- 5.2.1.12 Sediment transport should be considered for conditions of flow below the design frequency. A low flow channel component within a larger channel can reduce maintenance by improving sediment transport in the channel.

## 5.2.2 Channel Transitions

The following criteria shall be considered at channel transitions:

- 5.2.2.1 Transition to channel sections shall be smooth and gradual. A straight line connecting flow lines at both ends of the transition shall not make an angle greater than 12.5 degrees with the axis of the main channel without additional design considerations approved by the City.
- 5.2.2.2 Transition sections should be designed to provide a gradual transition to avoid turbulence and eddies.
- 5.2.2.3 Energy losses in transitions should be accounted for as part of the water surface profile calculations.
- 5.2.2.4 Scour downstream from rigid-to-natural and steep-to-mild slope transition sections should be accounted for through velocity slowing and energy dissipating devices.

## 5.2.3 Velocity Limitations

- 5.2.4 The final design of artificial open channels should be consistent with the velocity limitations for the selected channel lining. Maximum velocity values for selected lining categories are presented in Table 5.3-1. Seeding and mulch should only be used when the design value does not exceed the allowable value for bare soil. Velocity limitations for vegetative linings are reported in Table 5.3-2. Vegetative lining calculations are presented in Section 5.6 and riprap procedures are presented in Section 5.7.

END OF SECTION 5.2