

Module 8: Outlet protection work problems

8a. Sediment trap work problems..... 2-3

Objective: This module will illustrate the common calculations and design considerations that should be checked by the plan reviewer. Outlet protection must be designed properly to prevent scour and downstream erosion from a discharge pipe or outfall.

Participants will work through each of the problems and discuss the answers for each one.

8a. Outlet protection trap work problems (ESCH III-154-165)

1. Given a discharge of 20 cfs from a 15 inch pipe into water depth less than half the pipe diameter (Minimum Tailwater Condition), what is the apron length, L_a (feet); median stone size of riprap, $d(50)$; upstream apron width, W_u (feet); and downstream apron width, W_d (feet), required for outlet protection?

From ESCH III-164, Plate 3.18-3 (Minimum Tailwater Condition)

On the bottom horizontal axis, select the given Discharge, $Q = (\quad)$ cfs

Read up to bottom chart to given Pipe Diameter, $D = (\quad)$ inches

Read over to right for median size riprap stone, $d(50) = (\quad)$ feet

From Discharge, $Q = (\quad)$ cfs, read up to top chart to Pipe Diameter, $D = (\quad)$ inches

Read to left for Minimum Apron Length, $L_a = (\quad)$ feet

$$W_u = 3 \times D$$

W_u (Upstream Apron Width, feet) = $3 \times D$ (Pipe Diameter, feet)

$W_u = 3 \times (\quad)$ feet = (\quad) feet

$$W_d = D + L_a$$

W_d (Downstream Apron Width, feet) = D (Pipe Diameter feet) + L_a (Apron Length feet)

$W_d = (\quad)$ feet + (\quad) feet = (\quad) feet

2. From a 24 inch pipe flows 50 cfs into water depth greater than half the pipe diameter (Maximum Tailwater Condition), what is the apron length, LA (feet); median stone size, d(50); upstream apron width, Wu (feet); and downstream apron width, Wd (feet), required for outlet protection?

From ESCH III-165, Plate 3.18-4 diameter (Maximum Tailwater Condition)

On the bottom horizontal axis, select the given Discharge, Q = () cfs

Read up to bottom chart to given Pipe Diameter, D = () inches

Read over to right for median size riprap stone, d (50) = () feet

From Discharge, Q = () cfs, read up to top of chart to Pipe Diameter, D = () inches

Read to left for Minimum Apron Length, La = () feet

$$W_u = 3 \times D$$

Wu (Upstream Apron Width, feet) = 3 x D (Pipe Diameter, feet)

Wu = 3 x () feet = () feet

$$W_d = D + 0.4 \times L_a$$

Wd (Downstream Apron Width, feet) = D (Pipe Diameter, feet) + 0.4 x La (Apron Length, feet)

Wd = () feet + 0.4 x () feet = () feet