

## OUTLET PROTECTION SIZING

Project No. 15363  
 Subject Outlet Protection Sizing Calcs  
 Location Principio

Calc By MJV  
 Date 8/27/2024  
 Checked by \_\_\_\_\_  
 Date \_\_\_\_\_

Outfall: DP#1 - SE Headwall

Q=Design Discharge, (ft<sup>3</sup>/s) = **28.06** cfs (outlet from DMH#217)  
 D=Culvert Diameter, (ft) = **3.00** ft  
 TW=Tailwater Depth, (ft) = **1.2** ft, (0.4xD for unknown tailwater, or enter known tailwater)  
 (Tailwater depth is to be limited to between 0.4D and 1.0D)

**Riprap Rock Sizing**

$$D_{50} = 0.2D \left[ \frac{Q}{\sqrt{gD^{2.5}}} \right]^{4/3} \left[ \frac{D}{TW} \right] \quad g=32.2 \text{ fps}$$

D<sub>50</sub> = median rock size, ft

$$D_{50} = 0.6 \left| \frac{28.06}{22.40} \right|^{(4/3)} \left| \frac{3.00}{1.20} \right| = 2.03 \text{ ft}$$

= **24 inches**

Table 1 : Riprap Classes and Apron Dimensions

Class	D <sub>50</sub> (in)	Apron Length	Apron Depth
<b>1</b>	<b>5</b>	<b>4D</b>	<b>3.5D<sub>50</sub></b>
2	6	4D	3.5D <sub>50</sub>
3	10	5D	3.3D <sub>50</sub>
4	14	6D	2.2D <sub>50</sub>
5	20	7D	2.0D <sub>50</sub>
6	22	8D	2.0D <sub>50</sub>

**Use Class 1**

**Apron Dimensions**

Length, L=4D = **12 ft**  
 Depth=2.2D<sub>50</sub> = **11.00 Inches**  
 Width=3D+(2/3)L = **17.00 ft** (at apron end)