KIM ENGINEERING

Riprap Calculations

The following calculations were computed to determine whether the existing riprap at the existing outfall (Structure 1) are sufficient for the total flow being conveyed from both the existing storm drain system and the proposed storm drain outfall from the site.

The existing outfall is 47.5' in length and is assumed to be Class I riprap. To be conservative, the smaller diameter of the two outfalling pipes is being used (1 ft instead of 2.75 ft).

Q_{10} Existing = 9.49 cfs

Q_{10} Proposed = 2.15 cfs

Q_{10} Total = 11.64 cfs

Riprap Outfall Calculations

Circular Pipes

$d50 = (0.020*D/TW*((Q/D^{5/2})^{4/3}))D$ **(4-9)**

TW< 0.5D

$L= (1.8(Q/D^{2.5})+7)*D$ **(4-11)**

TW>=0.5D

$L = (3(Q/D^{2.5}))*D$ **(4-12)**

d_{50} = Diameter of Average Size Stone (ft)
D = Diameter of outlet for circular, Height for all other shapes (ft)
TW = Tailwater Depth above inverts of storm drain outlet (ft)
Q = Discharge (cfs)
q = Unit Discharge per foot of width for rectangular and other shaped outlets (cfs/ft)

Outfall (existing)

D (ft) = 1
Q_{10} (cfs) = 11.64
Inv Out = 511.1
TW (ft) = 1
Conservative assumption

$D_{50} = 0.020(D/TW)((Q/(D^{5/2}))^{4/3})(D)$
D_{50} = 0.527595 ft
D_{50} = 6.33 in

$L = (3(Q/(D^{/2})))D$
L = 34.92000 ft
L = 35 ft

Existing riprap exceeds minimum parameters.

The required riprap outfall length is 35 feet which is less than the existing riprap outfall length. The required average size stone diameter is 6.33 in which is less than the 9.5 in provided by the assumed existing Class I riprap. Therefore, the existing riprap outfall is sufficient for both the existing and proposed flow outfalling to it.