Outlet Protection and Velocity Dissipation Devices



Description

Devices placed at outlets of pipes and channels to prevent or minimize scouring and erosion by reducing the velocity of storm water flow.

Applications

- Outlets with continuous flows.
- Outlets located at the bottom of slopes.
- Outlets subject to short, intense flows.
- Discharge points from lined conveyances to unlined conveyances.
- Inflow protection.
- Outlet protection that diverts runoff to a natural or manmade drainage element.
- In-stream/channel designed to prevent banks from erosion.

Installation and Implementation Requirements

- Apron length shall be determined by outlet flow rate and tailwater level.
- Align apron with direction of flow and avoid curves in apron. If a curve is necessary, place it in the upper section of the apron.
- Protect the underlying geotextile filter fabric with a 4-inch minimum rock blanket if the rip-rap is 12 inches or larger.
- Increase rock size to counteract high flow velocities.

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Installation and Implementation Requirements *(continued)*

- Place geotextile filter fabric between aggregate and the underlying soil to prevent soil movement.
- Outlets on slopes steeper than 10% must have additional protection.
- Place and extend rip-rap downstream until stable conditions are met.

Considerations

- Potential for stones to wash away during high velocity flows.
- Break up of grouted rip-rap can result from hydrostatic pressure caused by water accumulation.
- It is difficult to repair underlying geotextile filter fabric without removing rip-rap.
- Larger stones are prone to damaging the geotextile filter fabric during installation when installing with a machine and may require installing by hand.

What to Inspect

- Is there scour evident beneath the rip-rap and around the outlet?
- Is accumulated sediment wedged in-between rip-rap?
- Can illicit discharge be found in the outlet?
- Is the proper size rock being used?
- Is there damage to underlying geotextile filter fabric?

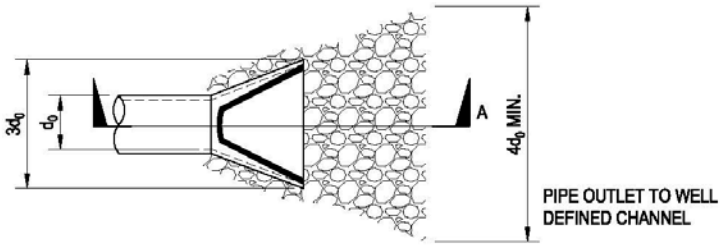
Maintenance

- Immediately repair damaged slopes or underlying geotextile filter fabric with priorities based on highway safety and protection of Class AA and Class 1 waters, followed by erosion potential and possible damage to downslope areas.
- Replace displaced rip-rap.
- Remove accumulated sediment in aggregate.

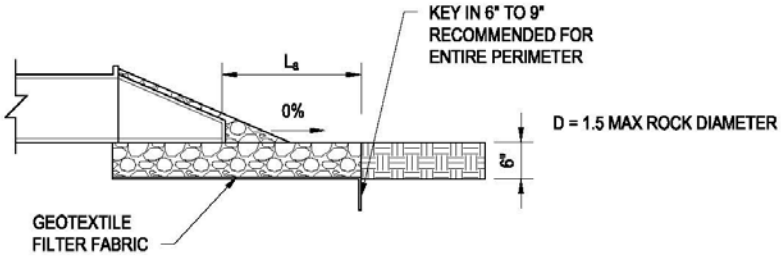


Remove accumulated sediment and replace displaced rip-rap as necessary to ensure effectiveness of BMP.

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PLAN
NOT TO SCALE



SECTION A
NOT TO SCALE

NOTES:

1. THE APRON LENGTH AND ROCK SIZE GRADATION ARE DETERMINED USING THE TABLE.

2. INSTALL RIP-RAP, GROUTED RIP-RAP, OR CONCRETE APRON AT SELECTED OUTLET. RIP-RAP APRONS ARE BEST SUITED FOR TEMPORARY USE DURING CONSTRUCTION. GROUTED OR WIRED TIED ROCK RIP-RAP CAN MINIMIZE MAINTENANCE REQUIREMENTS.

3. CAREFULLY PLACE RIP-RAP TO AVOID DAMAGING THE FILTER FABRIC.

   a. STONE 4 IN. TO 6 IN. MAY BE CAREFULLY DUMPED ONTO FILTER FABRIC FROM A HEIGHT NOT TO EXCEED 12 IN.

   b. STONE 8 IN. TO 12 IN. SHOULD BE HAND PLACED ONTO FILTER FABRIC, OR THE FILTER FABRIC MAY BE COVERED WITH 4 IN. OF GRAVEL AND THE 8 IN. TO 12 IN. ROCK MAY BE DUMPED FROM A HEIGHT NOT TO EXCEED 16 IN.

   c. STONE GREATER THAN 12 IN. SHOULD ONLY BE DUMPED ONTO FILTER FABRIC PROTECTED WITH A LAYER OF GRAVEL WITH A THICKNESS EQUAL TO ONE HALF THE D50 ROCK SIZE, AND THE DUMP HEIGHT LIMITED TO TWICE THE DEPTH OF THE GRAVEL PROTECTION LAYER THICKNESS.

4. OUTLETS ON SLOPES STEEPER THAN 10 PERCENT SHOULD HAVE ADDITIONAL PROTECTION.

PIPE DIAMETER, (inches)	DISCHARGE (ft^3/s)	APRON LENGTH, La (ft)	RIP-RAP D50 DIAMETER, MIN (inches)
12	5	10	4
	10	13	6
18	10	10	6
	20	16	8
	30	23	12
	40	26	16
24	30	16	8
	40	26	8
	50	26	12
	60	30	

FOR LARGER OR HIGHER FLOWS CONSULT A LICENSED CIVIL ENGINEER.
SOURCE: USDA-SCS

PIPE OUTLET CONDITIONS