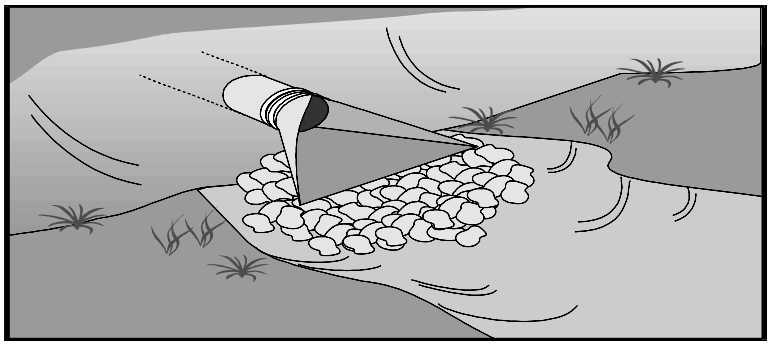
# **ACTIVITY:** Outlet Protection

PESC – 07



| Targeted Constituents | | | | |
|---|---|---|---|---|
| ● Significant Benefit | ◗ Partial Benefit | ○ Low or Unknown Benefit | | |
| ● Sediment | ○ Heavy Metals | ○ Floatable Materials | ○ Oxygen Demanding Substances | |
| ○ Nutrients | ○ Toxic Materials | ○ Oil & Grease | ○ Bacteria & Viruses | ○ Construction Wastes |

| Implementation Requirements | | | | |
|---|---|---|---|---|
| ● High | ◗ Medium | ○ Low | | |
| ◗ Capital Costs | ○ O & M Costs | ◗ Maintenance | ○ Suitability for Slopes >5% | ○ Training |

## Description

Prevent or reduce the discharge of pollutants to the storm drain system or to watercourses by utilizing devices placed at outlets to pipes and channels to reduce the velocity and/or energy of exiting water as a means of controlling erosion and scour. This management practice is likely to create a significant reduction in sediment.

## Suitable Applications

- Outlets of pipes, drains, culverts, conduits or channels.
- Outlets located at the bottom of mild to steep slopes.
- Outlets of channels which carry continuous flows of water.
- Outlets subject to short, intense flows of water, such as flash floods.
- Where lined conveyances discharge to unlined conveyances.

## Installation/ Application Criteria

- These systems should be designed by a licensed professional civil engineer.
- Carefully place rip-rap to avoid damaging the filter fabric.
- For proper operation of apron:
  - Construct apron at zero grade.
  - Align apron with receiving stream and keep straight throughout its length. If a curve is needed to fit site conditions, place it in upper section of apron.
  - If size of apron rip-rap is 12 in. (300 mm) or larger, protect underlying filter fabric with 4 in. (100 mm) minimum gravel blanket.
- Outlets at top of cut slopes or on slopes steeper than 10 percent should have additional protection due to reconcentration and large velocity of flow leaving the structural apron.
- Temporary devices should be completely removed as soon as the surrounding

drainage area has been stabilized, or at the completion of construction. However, temporary devices can serve as permanent devices if properly sized and reinforced with a factor of safety to account for less frequent inspection and maintenance.

**Maintenance**

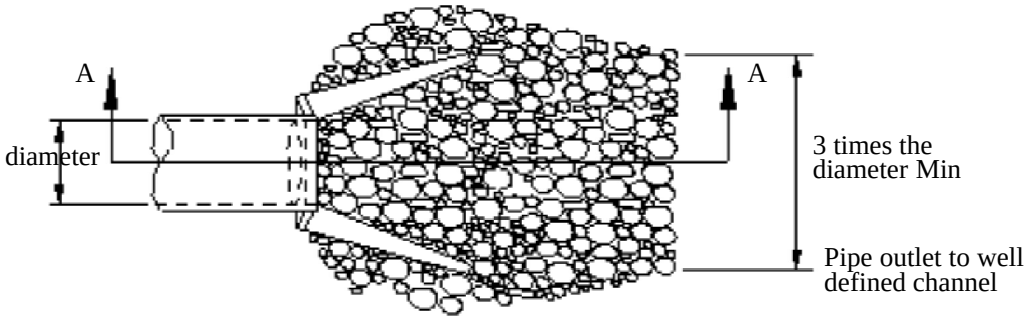
- Permanent outlet protection should be inspected monthly through the first year after construction and annually thereafter.
- Permanent outlet protection should be inspected after any storm events equal to or larger than a 10-year storm event.
- Inspect apron for displacement of the rip-rap and/or damage to the underlying fabric. Repair fabric and replace rip-rap which has washed away.
- Inspect for scour beneath the rip-rap and around the outlet. Repair damage to slopes or underlying filter fabric immediately.

**Limitations**

- Large storms can wash away the rock outlet protection and leave the area susceptible to erosion.
- Sediment captured by the rock outlet protection may be difficult to remove without removing the rock.
- While reducing flow velocities, outlet protection may negatively impact the channel habit.
- Grouted rip-rap may break up in areas of freeze and thaw.
- Grouted rip-rap may break up from hydrostatic pressure without adequate drainage.

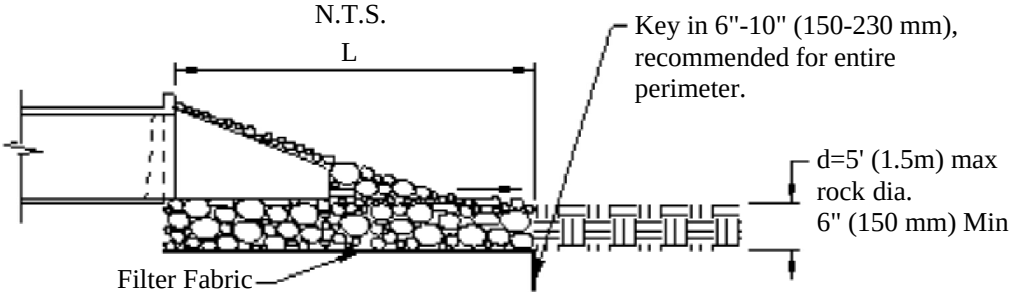
**Primary References**

*Caltrans Storm Water Quality Handbooks, Construction Contractor's Guide and Specifications,* April 1997.




PLAN VIEW

N.T.S.




SECTION A-A

N.T.S.

Adapted from: Virginia Erosion & Sediment Control Handbook, 1992

| Pipe Diameter in (mm) | Discharge ft $^3$/s ($m^3$ /s) | Apron Length, L ft (m) | Rip-Rap $D_{50}$ Diameter Min in (mm) |
|---|---|---|---|
| 12 (300) | 4.9 (0.14) | 10 (3) | 4 (100) |
| | 9.89 (0.28) | 13 (4) | 6 (150) |
| 18 (450) | 9.89 (0.28) | 10 (3) | 6 (150) |
| | 20.13 (0.57) | 16 (5) | 8 (200) |
| | 30.01 (0.85) | 23 (7) | 12 (300) |
| | 39.90 (1.13) | 26 (8) | 16 (400) |
| 24 (600) | 30.01 (0.85) | 16 (5) | 8 (200) |
| | 39.90 (1.13) | 26 (8) | 8 (200) |
| | 50.14 (1.42) | 26 (8) | 12 (300) |
| | 60.03 (1.70) | 30 (9) | 16 (400) |
| For larger or higher flows, consult a registered civil engineer | | | |

Source: Adapted from USDA-SCS

Figure PESC-07-1
Outlet Protection Sizing