Topsoil Management

Description

Practices and procedures to manage the reuse of native topsoil and other selected materials during revegetation activities. Salvaging, stockpiling, and reapplication of native topsoil is integral to successful revegetation efforts, especially for the reestablishment of native vegetation.

Applications

- Reestablishment of areas where vegetation with native plant species is desirable.
- Appropriate for sensitive habitat areas, floodplains, wetlands, and stream banks.

Installation and Implementation Requirements

- Preserve native topsoil where practicable.
- Conduct a site-specific soil survey of the area prior to soil-disturbing activities to assess the location, depth, and amount of soils suitable for salvaging.
- Salvage and stockpile all suitable topsoil and other material for future use during revegetation of the area. *See* section SM-3 Stockpile Management for more information.
- Carefully remove shrubs suitable for revegetation and store with the roots covered with mulch or loose soil.
- Apply topsoil or growth medium directly to disturbed areas and seed once construction activity is complete. Water area daily until the area is stabilized. However, avoid over-watering which can create runoff and erosion.

Topsoil Management

Installation and Implementation Requirements *(continued)*

- Restrict vehicle/equipment use in areas where vegetative stabilization will occur to avoid soil compaction.
- Soil replacement depths are determined by factors such as soil depth prior to disturbance, type of vegetation, and physical and/or chemical properties of the material to be covered. A deeper soil layer is required for soils with poor physical and chemical properties. Testing (nutrients, pH, and toxicity factors) of replacement soils and material to be covered shall be completed prior to reapplication.

TOPSOIL MANAGEMENT CONSIDERATIONS

- Quality and amount of native topsoil or growth medium.
- Area of surface disturbance to which topsoil or growth medium will be applied and the required depth of application.
- Methodology for salvaging topsoil or growth medium.
- Stockpile location, duration of storage, and required erosion control measures to protect stockpile.
- Feasibility of direct application of salvaged soils.
- Availability of other growth media to supplement topsoil reclamation.

Considerations

- Stockpiles may limit the area available for construction activity.
- Runoff from stockpiles may adversely impact water quality.
- Topsoil is contaminated prior to the start of construction activity.
- Avoid placement of topsoil prior to expected rain events.

What to Inspect

- Is topsoil effectively stockpiled?
- Are BMPs maintained to effectively prevent contact with storm water?
- Is dust originating from stockpiles?

Topsoil Management

Maintenance

- Adequately water plantings until they are established.
- Replace/repair damaged stockpile cover, as needed.
- Ensure that the plastic cover is in contact with the ground around the entire pile and properly anchored.
- Replace/repair damaged temporary perimeter sediment barrier.
- After the stockpile has been removed, revegetate the disturbed area, if applicable. Reapply temporary stabilization (i.e., hydromulch, tackifier, etc.), if needed.

Topsoil stockpiles must be fully covered with an impermeable material and protected with a temporary perimeter sediment barrier.

Flared Culvert End Sections

Description

Devices placed at the inlet or outlet of pipes and channels to enhance hydraulic operation while minimizing scour and erosion.

Applications

- Flared culvert end sections may be placed at inlets and outlets of slope drains and culverts.

Installation and Implementation Requirements

- Construct on level ground where possible. Flatter slopes reduce the potential of erosion and scour.
- Supplement with additional outlet protection devices.
- Protect the transition to the flared end section at inlets to prevent scouring.
- Extend additional rip-rap downstream of outlet to reach stable conditions and minimize scouring. Ensure geotextile filter fabric is installed under rip-rap.
- All disturbed areas must be immediately stabilized with native vegetation once construction is complete.

Additional rip-rap with geotextile filter fabric installed underneath can be extended downstream of outlet to reach stable conditions and minimize scouring.

Flared Culvert End Sections

Installation and Implementation Requirements *(continued)*

- Monitor accumulation of debris and sediment and remove within 60 days of notification. Immediately clean culverts located where Class AA or Class 1 waters or highway safety may be adversely affected. Refer to Hawaii Administrative Rules (HAR) Title 11, Chapter 54 for state waters classification.
- Obtain guidance from the District Maintenance Engineer or Highways Division's Hydraulic Section and refer to Highways Division's Standard Plans.

Considerations

- Limited use as an erosion control measure. Primarily used to increase hydraulic efficiency.
- Improperly designed culverts could result in erosion, scouring, or ponding.
- Pipes can clog if they are not adequately protected from litter.
- Pipe outlets may cause critical levels of erosion if devices are not installed to dissipate the velocity of storm water flow.
- Additional erosion control BMPs will need to be added to slope drains on slopes greater than 10%, due to highly erosive velocities.
- The contractor may need to temporarily remove rip-rap to repair/replace geotextile filter fabric under rip-rap.

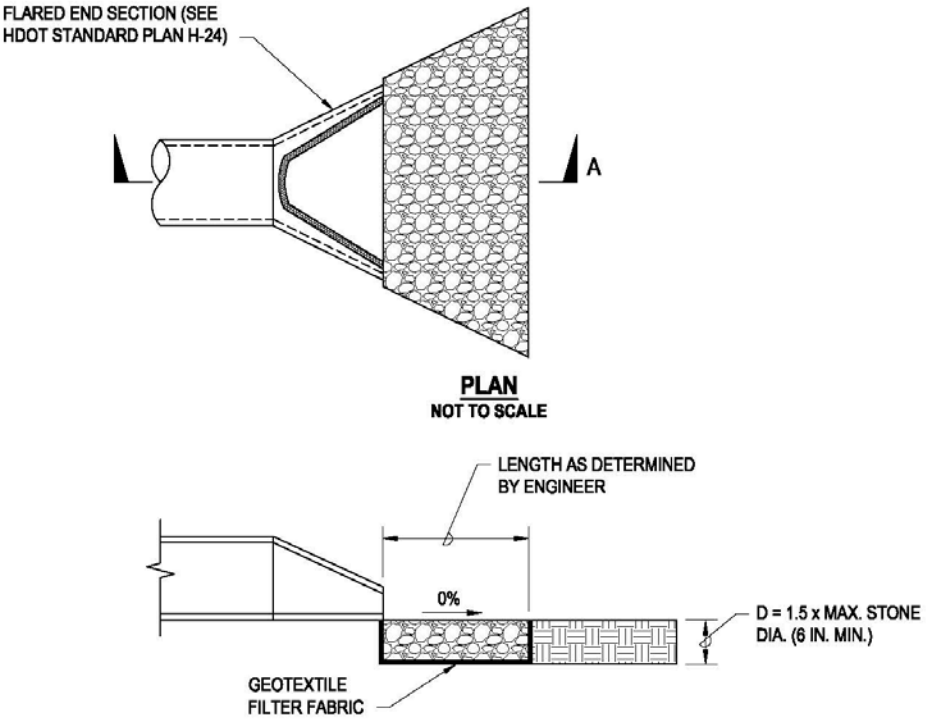
What to Inspect

- Is flared culvert end section installed correctly, per manufacturer's specifications?
- Is there evidence of scour around and beneath flared culvert end sections?
- Is there a non-storm water discharge observed from pipes?
- Is ponding occuring in traffic lanes or private property?
- Is geotextile filter fabric installed under rip-rap?

Maintenance

- Remove accumulated sediment from inlets, outlets, and rip-rap.
- Refresh rip-rap that has been dislodged.
- Add additional BMPs if erosion and scouring are observed.
- Repair geotextile filter fabric that has rips and/or tears.
- Remove temporary BMPs when drainage area is stabilized and construction is complete.

Flared Culvert End Sections



FLARED CULVERT END SECTION

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.

Outlet Protection and Velocity Dissipation Devices

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

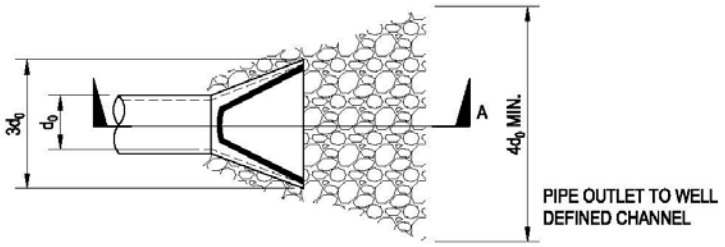
- Is there scour evident beneath the rip-rap and around the outlet?
- Is accumulated sediment wedged in-between rip-rap?
- Can illicit discharge be found in the outlet?
- Is the proper size rock being used?
- Is there damage to underlying geotextile filter fabric?

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.

Outlet Protection and Velocity Dissipation Devices



PLAN
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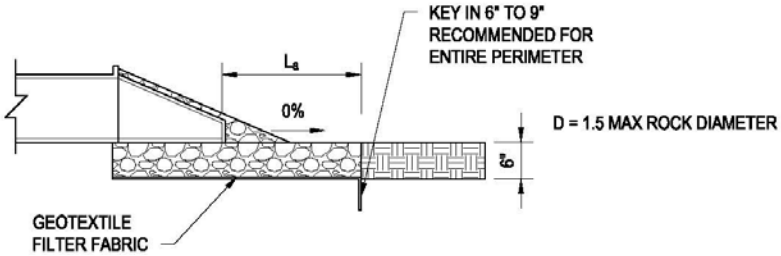

SECTION A
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NOTES:

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

Rip-rap and Gabion Inflow Protection

Description

Devices to protect soil surfaces from erosion by stabilizing slopes, and slowing the velocity of concentrated runoff.

Rip-rap is large, irregular shaped rocks that fit into place to provide erosion control and slow the velocity of concentrated runoff.

Gabions are wire baskets filled with rock, concrete, or other materials that lines drainageways to stabilize the flow channel along steep slopes, shorelines, and stream banks against erosion.

Applications

RIP-RAP

- Use of rip-rap inflow protection applies to slopes between 10:1 and 4:1 (H:V)
- Erosion-resistant ground cover
- Pipe outlet protection
- Channel lining
- Stabilized slopes
- Shoreline stabilization
- Dissipates high velocities or concentrations of storm water

Rip-rap and Gabion Inflow Protection

Applications *(continued)*

GABIONS

- Use of gabion inflow protection applies to slopes exceeding 4:1 (H:V)
- Retaining structures
- Foundation construction e.g., dams
- Aesthetic purposes
- Rip-rap and gabions are relatively maintenance free and long lasting
- These devices can be used as a temporary or permanent BMP
- Temporary flood walls
- Shoreline stabilization
- Change direction of source water
- Energy dissipation device in channels

Installation and Implementation Requirements

RIP-RAP

Rip-rap can help prevent or minimize erosion when used to stabilize shorelines.

- A licensed civil Engineer must provide a design and calculations for HDOT's approval prior to installation.
- 2:1 (H:V) side slopes, 3-foot minimum bottom width, and 1-foot minimum depth.
- Line channel with 4- to 12-inch rip-rap at a depth of 18 inches. The larger stones must be predominant, while the smaller stones fill the voids.
- Install geotextile filter fabric under all rip-rap to separate rocks with underlying soil. Prior to placing geotextile filter fabric, provide a 3-day notice to the Engineer for inspection of foundation.
- Blend rip-rap into existing ground at uniform thickness so the stream width is not radically narrowed.
- Stones shall be clean, sound, durable, and angular in shape, resistant to weathering and water action, and free from organic material. Stones shall be shaped so that neither their breadth nor thickness are less than one-third their length, not rounded, and have minimum unit weight of 155 pounds per cubic foot. Refer to *2005 Hawaii Standard Specifications for Road and Bridge Construction,* Standard Specifications & Special Provisions Section 655.

Rip-rap and Gabion Inflow Protection

Installation and Implementation Requirements *(continued)*

GABIONS

Gabions must be filled with a well graded mixture of aggregate, with larger stones being predominant and smaller stones to fill the voids.

- A licensed Civil Engineer must provide a design and calculations for HDOT's approval prior to installation.
- Gabion inflow may be used in lieu of rip-rap inflow protection.
- Gabions are prefabricated wire baskets filled with a well-graded mixture of aggregate. The larger stone must be predominant, while the smaller stones fill the voids.
- Baskets must be made of hexagonal triple twist mesh with heavily galvanized steel wire.
- Construct 2:1 (H:V) side slopes, 3-foot bottom width, and 1-foot deep from 9-foot × 3-foot × 1-foot gabion baskets. Install geotextile filter fabric under all gabion baskets.
- A bedding layer of aggregate can be placed before the gabion baskets are installed to level the surface and maximize stability.
- Fill gabion baskets with 4- to 7-inch clean (no fines) stone.
- Hand place rocks in gabion baskets to minimize voids and/or bulges. Rock edges must not poke through the gabion basket. Install gabions in accordance with manufacturer's recommendations.
- The wire mesh of the gabion basket will eventually fail due to corrosion. The designer must consider this and plan for overall stability when the basket fails.

Considerations

- Gabion installation is labor intensive (hand installation).
- Costly compared to vegetative devices.
- Not always aesthetically pleasing.
- Scour tends to occur at toe and end of rip-rap.
- If gabions or rip-rap is used within a U.S. Army Corps of Engineers (USACE) jurisdictional waterbody that coordination with the USACE is required.

What to Inspect

- Is there evidence of scour around rip-rap or gabions?
- Has debris and/or sediment accumulated around or in rip-rap?

Rip-rap and Gabion Inflow Protection

What to Inspect *(continued)*

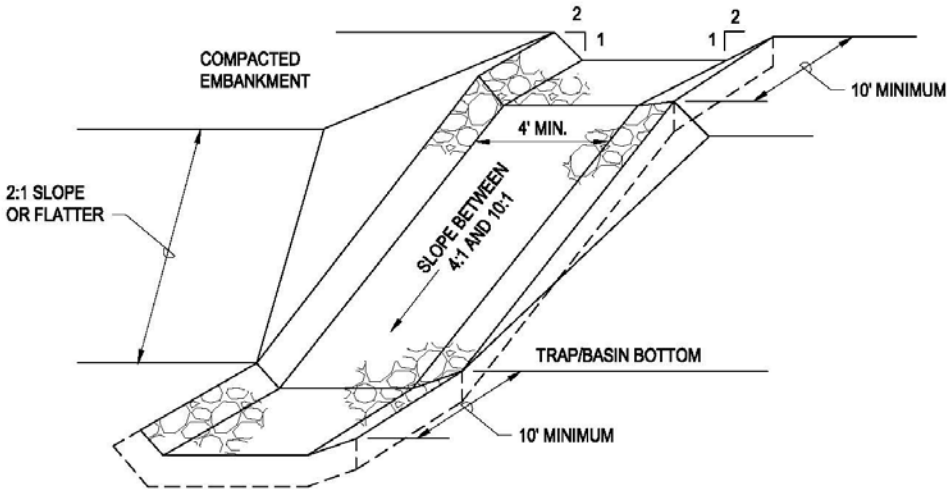
- Has an underlying filter fabric/geotextile been installed?
- Has the BMP device been installed correctly?
- Are rocks displaced?
- Does the gabion structure show signs of bulging or gaps?
- Is there damage to the gabion basket?
- Is there evidence of rock failure?
- Does the BMP need to be cleaned out or replaced?

Maintenance

- Remove accumulated sediment lodged between rip-rap that is affecting filtration purposes.
- Replace/refresh rocks that have been displaced.
- Repair damage to filter fabric/geotextile under rip-rap.
- Any evident damage or abnormalities to the gabion must be repaired.

If rip-rap is displaced by storm water during a large rain event, refresh the channel with 4- to 12-inch rip-rap.

Rip-rap and Gabion Inflow Protection



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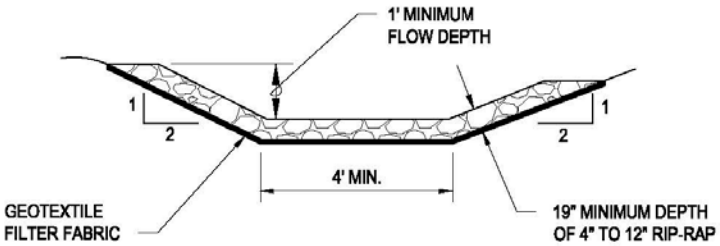

CROSS SECTION
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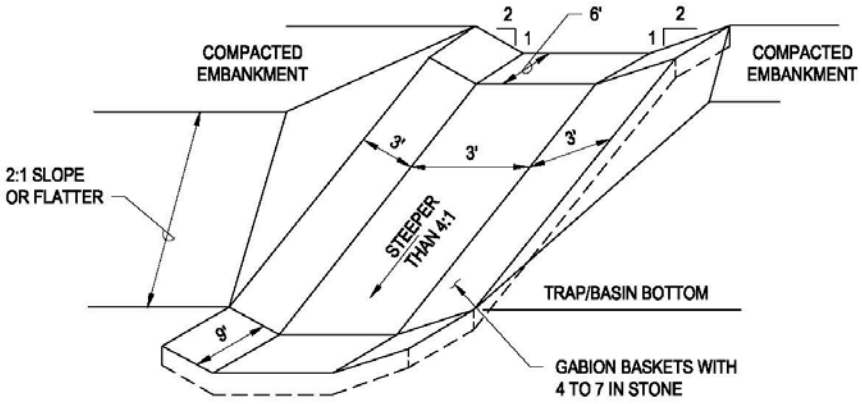
RIP-RAP INFLOW PROTECTION

Rip-rap and Gabion Inflow Protection



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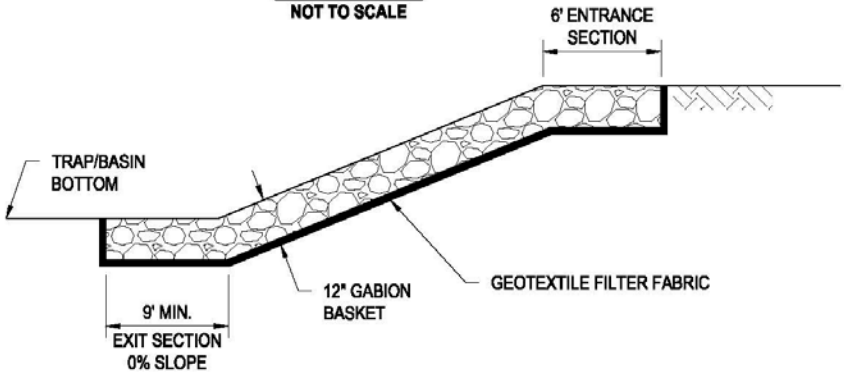

PROFILE ALONG CENTERLINE
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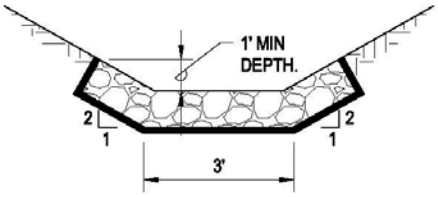

CROSS SECTION
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GABION INFLOW PROTECTION