

PC-3 CHANNEL PROTECTION—FLEXIBLE LINERS

Refer to: ITD Standard Specifications, Sections 212 and 624.
ITD Standard Drawings P-2-A and P-2-C.



BMP Objectives	
<input checked="" type="checkbox"/>	Perimeter Control
<input checked="" type="checkbox"/>	Slope Protection
<input type="checkbox"/>	Borrow and Stockpiles
<input checked="" type="checkbox"/>	Drainage Areas
<input checked="" type="checkbox"/>	Sediment Trapping
<input type="checkbox"/>	Stream Protection
<input checked="" type="checkbox"/>	Temporary Stabilizing
<input checked="" type="checkbox"/>	Permanent Stabilizing

Definition and Purpose

Flexible channel protection uses a flexible material as a lining to stabilize and prevent erosion in open drainage channels.

Appropriate Applications

Flexible liners may be applied as a continuous sheet covering an open channel or may be used in conjunction with rock check dams installed in a trench perpendicular to the direction of flow.

The most commonly used liners are as follows:

- Riprap is composed of large angular stones placed along the stream bank or shore where water is turbulent and fast flowing and/or where soil may erode under design conditions. Riprap forms a dense, flexible, self-healing cover that adapts well to uneven surfaces.
- Riprap and gabions are usually placed over a filter blanket (a gravel layer of erosion control geotextile).
- Revet mattresses are rock-filled wire cages that are used to protect a channel bank or bed.
- Matting is useful as a protective measure when seeding for permanent, grassed waterways. Turf reinforcement and jute are two common types of matting used for channel protection.
- Jute matting is a type of temporary, biodegradable erosion control blanket that can be used to promote post-construction revegetation.

Limitations

- Turf Reinforcement Mats (TRM) should not be used where their presence or appearance is aesthetically unacceptable.

- Effectiveness of matting may be reduced if not properly selected, designed, or installed. Matting is for use on minor channels with low-flow velocities, or for intermittent channels or drainages that do not normally contain water other than during snowmelt or stormwater runoff. A channel’s optimum configuration for this type of control is a low-gradient, shallow, U-shaped swale without physical instability.
- Matting is not suitable for channels with steep sides or erodible, uncompacted soil. Riprap orrevet mattresses should be used for these situations.
- Riprap andrevet mattress are of limited suitability if the channel is to be revegetated. 1H:1V or flatter channel side slopes are required for riprap lining. Typical channel side slopes forrevet mattresses are 1½ H:1V or flatter.
- The use of flexible liners below the high water mark of a stream or other water body (waters of the U.S.) should be carefully evaluated due to Section 404 permit requirements. A Section 404 permit (401 Certification) and an Idaho Department of Water Resources Stream Alteration Permit may be required.

Design Parameters

- **Channel configuration:** Open channels lined with flexible mat channel liners should have side slopes of 3H:1V or flatter and an anticipated low-flow velocity. Determination of hydraulic capacity should include evaluation of limitations imposed by mature vegetation.
- The following table offers suggested guidance in the selection of flexible channel protection linings. Values for an unlined earth ditch are included for reference.

<i>Channel Type</i>	<i>Velocity (meter/second)</i>	
	<i>Low</i>	<i>Maximum</i>
<i>Unlined earthen ditch</i>	<i>0.3</i>	<i>0.6</i>
<i>Riprap lining</i>	<i>1.0</i>	<i>3.0</i>
<i>Vegetation</i>	<i>0.6</i>	<i>1.2</i>
<i>Revet mattress lining</i>	<i>0.6</i>	<i>4.5</i>
<i>Jute or Turf Reinforcement Mat*</i>	<i>0.3</i>	<i>1.0</i>

** Refer to design characteristics of the individual products being considered for further information. If individual products are identified in the specification, three products or approved equals should be specified.*

- **Riprap:** Riprap protects soil from erosion and is often used on steep slopes built with fill materials and that are subject to harsh weather or seepage. Riprap can also be used for flow channel liners, inlet and outlet protection at culverts, stream bank protection, and protection of shorelines subject to wave action.

- Riprap is used where water is turbulent and fast flowing and where soil may erode under the design flow conditions. Riprap is either a uniform size or graded (different sizes) and is usually applied in an even layer. Riprap has the advantage of adjusting to differential settlement along the channel while protecting against erosion.
- Riprap that is utilized for channel lining should consist of a well-graded layer about 1.5 times or more as thick as the dimensions of the largest rock, with a bulk specific gravity of 2.5 or greater. Rock fragments should be large enough to provide surface protection from erosion during the peak design flows. Riprap lining should be placed over a filter layer and extended to an elevation of at least 12 inches above the design waterline. The graded filter layer should be erosion control geotextile or crushed base material at least 6 inches thick with a gradation sized to preclude erosion through the riprap.
- Riprap and revet mattresses are usually placed over a filter blanket (a gravel layer or erosion control geotextile).
- **Revet Mattress:** Revet mattresses permit higher flow capacity than other types of liners. The revet mattress requires a firm, compacted, stable foundation and must be carried below the channel bed to prevent undercutting and at least 12 inches above the design waterline. Side slopes should be 1½H:1V or flatter.
- Refer to the Materials Phase Reports for sizing of the filter material, or obtain a recommendation from the District Materials Engineer.
- **Turf Reinforcement Mat:** TRM is a long-term, non-degradable, rolled erosion control product composed of UV-stabilized synthetic fibers, nettings, and/or filaments processed into three-dimensional reinforcement matrices designed for permanent and critical hydraulic applications where design discharges exert velocities and shear stresses that exceed the limits of mature, natural vegetation. TRM provides sufficient thickness, strength, and void space to permit soil filling and/or retention and development of vegetation within the matrix.

Construction Guidelines

- Use flexible, long-lasting mats or membranes of geosynthetics or rock with erosion control geotextile. Allow for an overlap of 3 feet where one roll of material ends and another begins. Construction guidelines for rock for riprap, rock for revet mattress, wire for revet mattress, and gabion revetment construction are included in the Standard Specifications.
- Turf Reinforcement Mat: Shape and grade the waterway or channel as required by plans and specifications. Remove rocks, clods, sticks, and other material that will prevent contact of the liner with the soil surface. Protect the outlet in the same manner as in the main channel. Apply the liner for the tributary first, and overlap the matting in the main channel. Apply the liner from the upper end of the channel, and continue downgrade. Install matting in accordance with the manufacturer's recommendations.
- After completing the job, check that the matting is in contact with the soil in all places and critical areas are securely stapled. Complete contact of the matting with the underlying soil surface is vital to keep water flow over (not under) the matting.

Maintenance and Inspection

- Conduct inspections as required by the NPDES permit or contract specifications during construction.
- Periodic inspection and maintenance will be required based on post-construction site conditions.
- Make any repairs necessary to ensure the measure is operating properly.
- If the desired vegetation has not become established through a mat, reseed as necessary.
- Do not disturb any areas of established vegetation.
- Clean and remove debris as necessary.