Erosion treatment technique # T6

ROCK BEACHING

Description
Rock beaching is placing rock against the banks of the creek to protect the bank material from the erosive forces of the stream flow and to support the bank so the risk of mass bank failure is reduced.

Variations/Alternatives
- Rock mattress lining
- Hard linings
- Brushing
- Retards or groynes

Applications
Suitable for treating a wide range of bank conditions including:
- mass failures of the bank such as undercutting
- bank slumping
- fretting
- bank scour.

Limitations
Availability of suitable rock sizes.
Available space to suitably batter the banks.

Advantages
- Does not require skilled labour.
- Easily and quickly constructed.
- Immediately protects the bank material.
- Environmentally sympathetic.
- Allows revegetation of the bank.

Disadvantages
Poor aesthetics at least in the short-term.
Weed infestation can occur.

Cost
Moderate to high – depends on length of bank to be treated. 
For a detailed discussion of this technique, see Section B2.

Duration
Permanent – depending on suitable rock and the stability of the creek bed. There have been problems in creeks close to expanding urbanisation.
Equipment and materials

- excavator or front end loader
- rock
- geotextile filter fabric

Construction Method (For detailed discussion refer to Section B2)

1. If possible, all equipment should be operated from the top of the bank. If bank is high, cut bank ramp to access bed and stockpile material for use in the restoration of the creek bank. Minimise disturbance to the creek bank and never cut ramp into the outside bank of a bend.
2. Remove any slumped material from the toe of the bank using the excavator and create a trench at toe of bank as shown on the section view on the following page.
3. If the bank is very uneven, then batter the bank before placing the rock. Maximum bank slope should not exceed 1:1.5 (V:H). Do not firm the battered bank into a hard smooth surface that will not hold the rock in place.
4. Lay fabric over all areas to be covered by rock.
5. Place suitably sized and graded rock\(^1\) using the excavator/front end loader to form the rock beaching as detailed on the construction sketches on the following page. Do not tip the rock directly over the bank from dump trucks. Be careful when placing the rock to avoid segregation of the rock fragments. The final rock mass should be well interlocked with no protruding rock faces.
6. Fill bank access ramp, spread topsoil on disturbed banks and establish appropriate vegetation

\(^1\) Consult hydraulics specialist for selection of rock size and grading. For design information see Section B2.7.

Maintenance

- Check regularly for excessive settling of the rock beaching along the bank or scour along the toe of the beaching.
- Pay particular attention to the stability of the bank at the downstream end of the rock beaching.
Figure T6.1 Plan view of typical rock placement on channel bend
Figure T6.2 Possible placement of rock on river bank

[Source: Guidelines for Stabilising Waterways, Standing Committee on Rivers and Catchments, Victoria, 1991]
Figure T6.3  Partial bank protection

Advantages:
- Reduced quantity of rock.

Disadvantages:
- Problems can occur with lateral inflows (i.e., stormwater runoff) entering or washing under the rock.
- Reduced aquatic habitat values in the absence of vegetation.

Use:
- Partial bank protection for areas where channel velocities are high, but overbank velocities are low.
- Inside face of fully shaded, high-velocity channel bends.

Figure T6.4  Full face rock protection

Advantages:
- Cheaper than vegetated rock protection.
- Generally steeper overall bank grades can be formed compared to Figure C14.

Disadvantages:
- Poor aesthetics.
- High risk of weed invasion unless fully shaded.

Use:
- Fully shaded, high velocity areas.
- Outside face of fully shaded channel bends.
- Very high-velocity regions where vegetation is not expected to survive.
Advantages:
- Improved aquatic habitat values.
- Retention of riparian values.

Disadvantages:
- Care must be taken to make sure all voids are filled with soil to prevent loss of upper bank soil into the rock protection.

Use:
- Partial bank protection is used in areas where channel velocities are high, but overbank velocities are low.
- Toe protection of channel banks in regions of high-flow velocity or areas where the channel bed may experience scour.

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Advantages:
- Retention of aquatic habitat values.
- Very high scour protection once vegetation is established.
- Retention of riparian values.
- Banks can be steeper than vegetated banks that do not contain rock protection.

Disadvantages:
- High installation cost.

Use:
- Outside face of high velocity or sharp channel bends.
- Areas where both the channel velocity and overbank flow velocities are likely to be erosive.
Advantages:
- Long-term bank stability in regions of highly erosive soils.

Disadvantages:
- Poor aesthetics.
- High risk of weed invasion unless fully shaded.
- Very poor aquatic habitat values.

Use:
- Rock protection in fully shaded areas containing dispersive soils.

Advantages:
- Retention of aquatic habitat values.
- Long-term bank stability of highly erosive channel banks.
- Reduced maintenance costs.

Disadvantages:
- High installation cost.

Use:
- Outside face of high-velocity or sharp channel bends in dispersive soil regions.
- Dispersive soil areas where both the channel velocity and overbank flow velocities are likely to be erosive.
Erosion treatment technique # T7

HARD LININGS

Description
Hard linings are either pervious or impervious protective layers applied to an excavated (battered) bank and bed to control erosion in areas of high velocity or highly turbulent flow.

The liners can consist of reinforced concrete, spraycrete, grout filled mattresses, or interlocking precast concrete units which allow for limited vegetation.

Variations/Alternatives
- Rock beaching
- Rock mattress lining
- Hard linings
- Brushing
- Retards or groynes

Applications
Suitable for treating a wide range of bank conditions including:
- mass failures of the bank such as undercutting
- bank slumping
- fretting
- bank scour.

Limitations
Generally poor aesthetics.

Advantages
- Easily and quickly constructed.
- Immediately protects the bank material.

Disadvantages
- Aesthetics – at least in the short-term.
- Destroys in-stream ecology.

Cost
Moderate to high – depends on length of bank to be treated.

For a detailed discussion on this technique, see Section B2.

Duration
Long-term.
Equipment and Materials
- excavator or front end loader
- lining material

Construction Method
See manufacturer’s specifications for the installation of hard lining materials.

Maintenance
Check regularly for failure of the lining, slumping of the banks or scour immediately upstream and downstream of the lined area.

Figure T7.1 Alternative bank stabilisation design using rock/boulders and vegetation
Figure T7.2 Alternative bank stabilisation design using timber and vegetation. Use with caution – generally NOT recommended in Brisbane.

Figure T7.3 Hard bank linings can use soft bed material to minimise environmental/ecological impact. Foundation design must allow for expected long-term bed erosion. Only recommended as a last resort measure within Brisbane.
Erosion treatment technique # T8

ROCK MATTRESS LINING

Description
Rock mattress lining is rock-filled wire mattresses laid over the bed and banks of the creek to provide a protective layer against the erosive forces of the stream flow.

Although the lining improves the stability of the bank material, the main role of the lining is as a protective layer.

Variations/Alternatives
- Bank material may be battered before placing mattresses
- Rock beaching
- Hard linings
- Brushing
- Retards or groynes

Applications
Rock mattress linings are suitable for treating a wide range of bank conditions such as:
- bed scour
- bank erosion resulting from direct bank scour or fretting
- mass failures caused by undercutting and slumping but significant bank battering might be needed to control slumping.

Limitations
- Requires sediment to deposit or directly placed within the mattress and vegetation to establish to achieve long-term protection and stability to the bank.
- Only suitable for bank slopes of 1:1.5 (V:H) or flatter.

Advantages
Immediately protects the bed and/or banks.

Disadvantages
- Poor aesthetics until suitable vegetation is established.
- Weed infestation can be a maintenance problem.
- Durability can be a problem. The wire basket can be damaged by debris and sediment conveyed within the stream flow.
- Labour-intensive to construct and needs good supervision.
**Cost**
High

**Duration**
Long-term (if vegetation can establish over the mattresses).

**Equipment and Materials**
- excavator (general excavation works and rock filling of wire baskets)
- PVC coated, galvanised wire mattresses and binding wire
- rock (graded to wire mattress manufacturer’s specification)
- geotextile filter fabric

**Construction Method**
See either of the following manuals for the design and construction of rock mattress lining.

1. Flexible gabion and Reno mattress structures in river and stream training works – Section two - Longitudinal structures, (Agostini et. al.).

2. Guidelines to the design and construction of gabion and mattress structures, Gabion Engineering Services Pty. Ltd.

Consult a hydraulic specialist for structural design of rock gabion wall and sizing of the mattresses and rock fill grading.

**Maintenance**
- Inspect works regularly for damage to mattresses and loss of rock fill. Repair damaged mattresses and replace rock fill as necessary.
Figure T8.1  Alternative mattress assembly to incorporate vegetation cover