Section I. BMP'S FOR SOIL STABILIZATION

Contents and Applicability

Best Management Practices (BMP's):

Temporary Treatments:

I.1 Matting - Plastic. Plastic matting can be used for dust and erosion control during construction on bare soils. It also aids early vegetative growth by increasing moisture holding capacity of the soil. Plastic net can be used as a temporary or permanent treatment for grass establishment and slope stabilization.

I.2 Erosion Control Blanket. A commercially made matting used for erosion control and slope stabilization. It is made of jute or straw and plastic netting.

I.3 Mulch - Straw. A temporary mulch which will last from one to two years. The straw will deteriorate without detrimental effects on plant growth or plant establishment.

I.4 Mulch-Wood Chips. A temporary mulch of small sized wood chips made from the trunks and branches of trees.

I.5 Compaction. A mechanical method of increasing the density of soil to reduce settling and improve resistance to erosion.

Permanent Treatments:

I.6 Gabions -- Rock-filled wire baskets for use in retaining walls or drainage stabilization.

I.7 Riprap -- A permanent rock or aggregate layer placed over the soil to protect against erosion.

I.8 Native Rock Retaining Walls -- A low wall made from locally available rock used to stabilize steep slopes.

I.9 Timing of Construction and Control Applications -- The sequence of construction activities and erosion control application to minimize erosion created by construction disturbance.

I.10 Limited Surface Disturbance -- Limiting the amount of bare soil to the minimum area required to conduct construction activities.

I.11 Biotechnical Stabilization -- Biotechnical stabilization involves using live layers of brush imbedded in the ground to control or prevent surficial erosion and mass failure of slopes. Biotechnical stabilization techniques are most effective when shrubs are cut and utilized during their dormant periods.

I.1 Matting - Plastic

Plastic Sheet matting are sheets of polyethylene plastic placed on the soil surface.

Purpose: For temporary erosion control and the protection of sprouted seeds and/or young vegetation. Matting also decreases soil moisture loss and helps hold in heat. Plastic net matting can be used to cover straw mulch as a temporary aide. It can also be used as permanent treatment for establishing grass (without mulching) and for slope stabilization. Plastic sheeting is the most effective matting for retaining moisture in the soil. Its durability depends on the thickness of the sheet. Plastic matting can provide protection from erosion for 6 to 12 months. One disadvantage in using plastic sheeting is that it blocks sunlight and can therefore retard vegetative growth.

Specifications: (See Figure I-1 -- Use similar techniques)

Individual rolls should be laid up and down the slope instead of along the contour. The rolls should be overlapped a minimum of four (4) inches, with the uphill roll overlapping the downhill roll. The edge of the sheeting should be stapled to the ground or buried to prevent movement. When mats are used, it is critical to ensure good contact between the mat and the soil to prevent erosion under the matting. If the sheeting or netting is damaged, it should be replaced immediately.

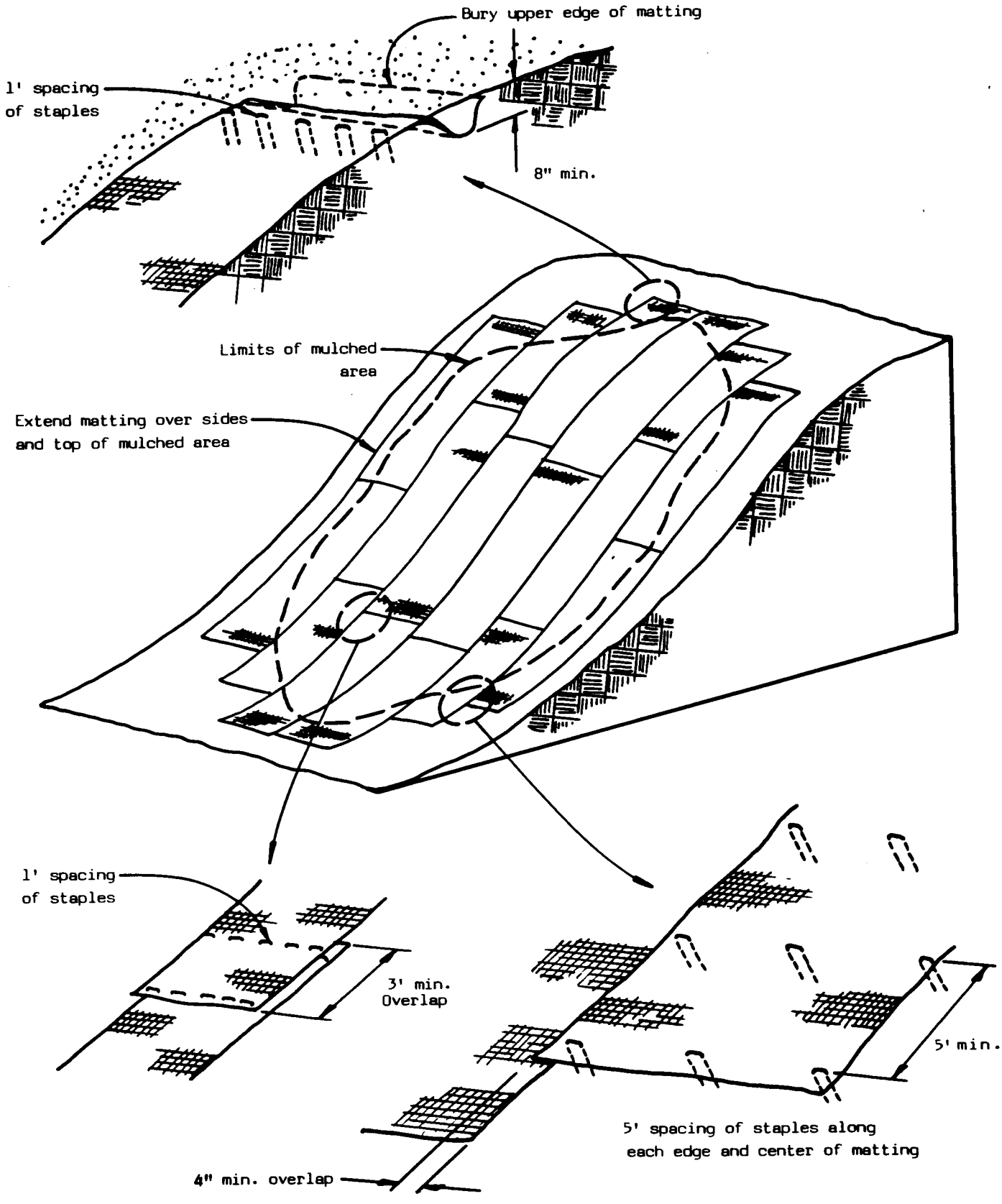
I.2 Erosion Control Blanket

Erosion control blankets are made of jute or straw and plastic netting.

Purpose: Used for slope stabilization, erosion control, and the protection of other mulches from wind and water damage. Jute and straw matting have better erosion control characteristics than straw. Erosion control blanket may be more expensive than using straw mulch secured with nylon, plastic, fabric, wire, or woven paper netting.

Specifications: (See Figure I-1)

Individual rolls should be laid up and down the slope instead of along the contour. The rolls should be overlapped a minimum of three (3) feet with the uphill roll overlapping the downhill roll. The rolls should also be overlapped on each side a minimum of four (4) inches. The matting should be stapled to the ground with staples placed one (1) foot apart. The matting should extend beyond the edge of the mulch, with at least one (1) foot at the sides and three (3) feet at the top. The top edge should be buried in a trench at least eight (8) inches deep. The matting should be laid as smooth as possible.



BLANKET INSTALLATION
FIGURE I-1

I.3 Mulch-Straw

Mulch-straw should be clean (weed free) wheat, barley, or rice straw.

Purpose: Used as a cover over bare or seeded soil. Mulch helps soil retain moisture and nutrients, it helps reduce soil temperatures, reduces erosion and assists in establishing vegetative growth. Straw mulch can be used on slopes to help prevent wind and water erosion. The mulch however, must be held in place by matting or crimping. Straw mulch held by nylon netting may be used in lieu of jute matting as a cost saving measure. Straw mulch is a reasonably priced, effective erosion control aid. Its effectiveness will decrease with time.

Specifications:

Straw mulch can be hand broadcast or blown on by a mechanical mulcher. It should be applied so there is uniform coverage with a maximum depth of two (2) to three (3) inches (approximately 2 tons per acre). A mulch depth of four (4) inches is acceptable where frost occurs. (Excessive mulching can reduce the nutrient level of the soil) If a deep layer of mulch is used, consider applying a slow release fertilizer to help promote vegetative growth. The mulch can be rolled over with a mechanical device (sheep foot roller), to "punch" it into the ground, or be covered with matting. The mulch can also be covered with nylon, plastic, fabric, wire or woven paper netting held in place by staples. It can also be sprayed with a chemical tackifier such as asphalt emulsion.

I.4 Mulch-Wood Chips

Wood chips are made from processing tree trunks and branches in a wood chipper (do not use kiln or air dried lumber).

Purpose: Small sized wood chips are used as a temporary cover over bare or seeded soil to help reduce erosion and assist in reestablishing vegetative growth. Wood chip mulch is a reasonably priced, effective erosion control aid.

Specifications:

Wood chips are hand broadcast or blown by a mechanical mulcher. Chips should be applied so there is uniform coverage to a depth of approximately three (3) inches. The wood chip mulch can be covered with various types of erosion control netting, held in place by staples, or with a chemical tackifier such as asphalt emulsion. Wood chip mulch can be used in lieu of jute and straw matting or straw mulch. Wood chips may cause an imbalance in soil nutrients when they break down, so additional fertilizer (up to 25% more) will need to be applied if wood chips are used as mulch.

I.5 Compaction

Compaction is a means of controlling erosion by increasing the soil density which improves its strength and decreases long term soil settlement.

Purpose: Compaction is useful in stabilizing fill materials.

Specifications:

Soil compaction is usually accomplished by using a sheep foot roller on clayey soil and a smooth roller on sandy soil. Dozers or heavy equipment can also be used. Care must be taken so the surface soil is not compacted too much, as this will reduce revegetation efforts.

Compaction has a tendency to increase runoff, therefore sediment control structures (as described in Section II) need to be installed below compacted areas. The surface of compacted structures should be scarified, seeded, or seeded and mulched. This will increase the effectiveness of the BMP.

I.6 Gabions

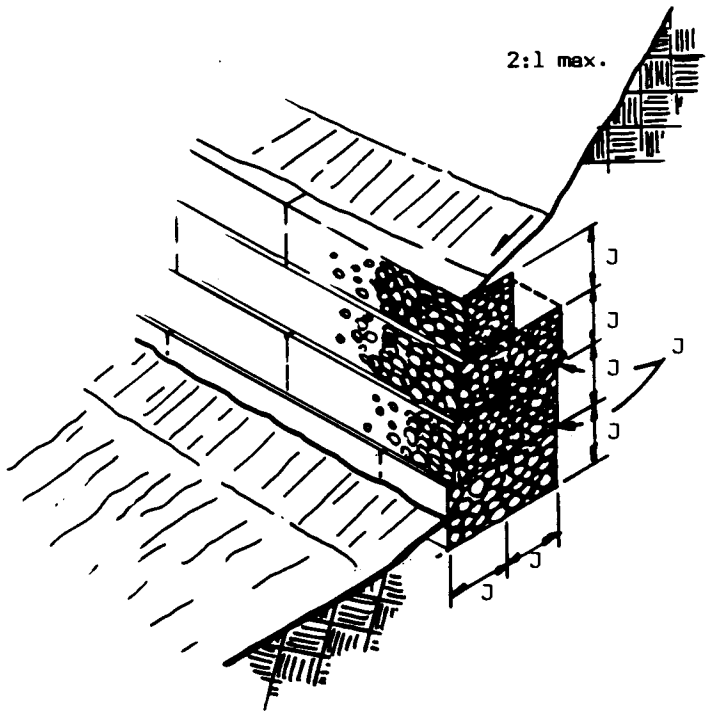
Gabions are rectangular wire boxes or baskets, filled with rocks and wired together. They must be assembled in place.

Purpose: They are usually placed on steep slopes as permanent erosion control structures and are particularly useful where water seepage is anticipated. Gabions are also useful for channel stabilization.

Specifications: (See Figure I-6)

Construction specifications should be prepared by professionals familiar with gabion use. The site must be graded prior to installation. Following grading, the wire baskets are placed in position, wired together, and filled with four (4) to eight (8) inch diameter rocks.

Maintenance: The gabion should be periodically inspected for signs of undercutting and instability.



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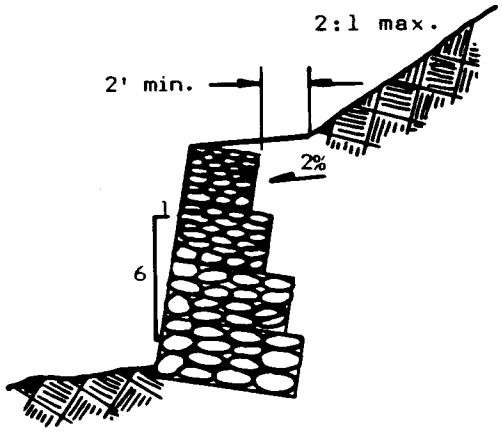
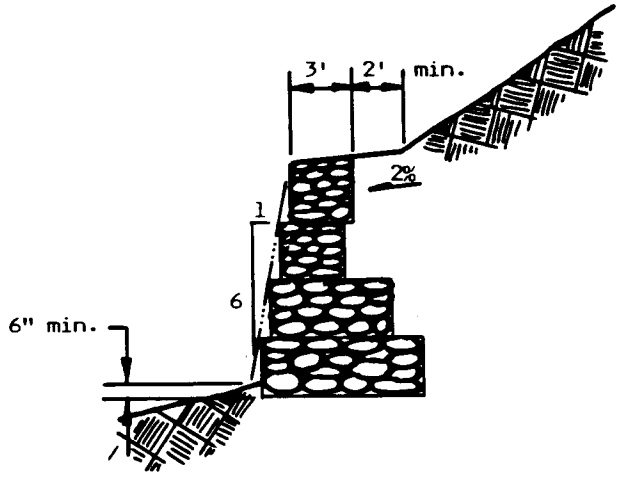


SECTION



SECTION

I.7 Riprap

Riprap is a layer of loose, hard, angular rock placed over soil to help protect against erosion.

Purpose: It is used below culverts, drainage outlets, along shorelines and stream banks, and as a lining in ditches and channels.

Specifications: (See Figure I-7)

A layer of filter material (plastic filter cloth, geotextile fabric, or a layer of sand, gravel or small stones) should be placed between the soil and the riprap to prevent migration of soils through the riprap. Riprap can be installed by hand or with heavy equipment. When installing the riprap, care should be taken so the filter material is not damaged and segregation of the stone size is prevented. A well graded mixture of rocks (well graded mixtures are composed primarily of large stones with an adequate supply of smaller cobbles to fill the voids between the larger rocks) is then placed over the filter material to a depth of six (6) inches or more. When installing riprap in channels, it should be extended from three (3) feet below the water line to a point above the high water mark where vegetation can be established. On a site specific basis, riprap must be properly sized to the maximum flow velocity, to prevent erosion.

Maintenance: Routine inspections should be made on riprapped areas to ensure that the material has not been displaced. Damaged areas should be repaired immediately.

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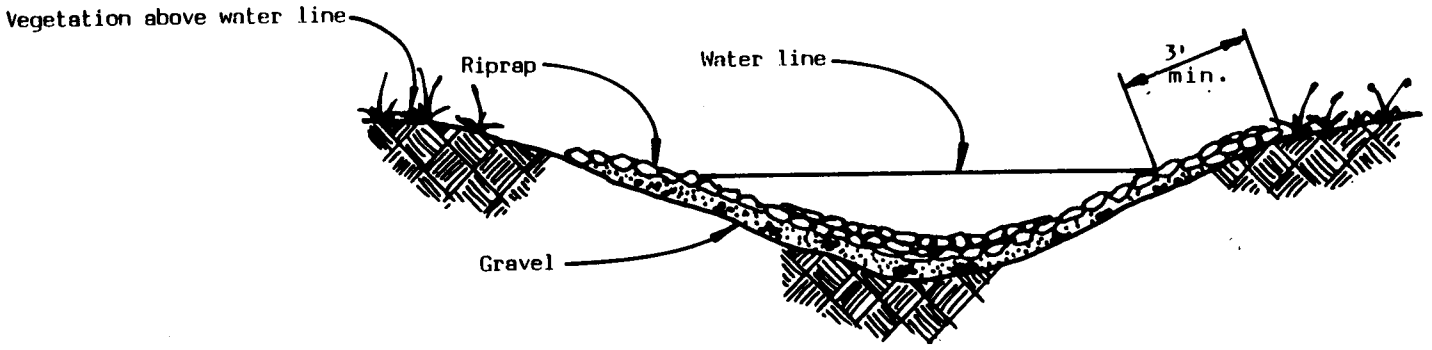


RIP RAPPED DITCH OR CHANNEL
FIGURE I-7

I.8 Native Rock Retaining Walls

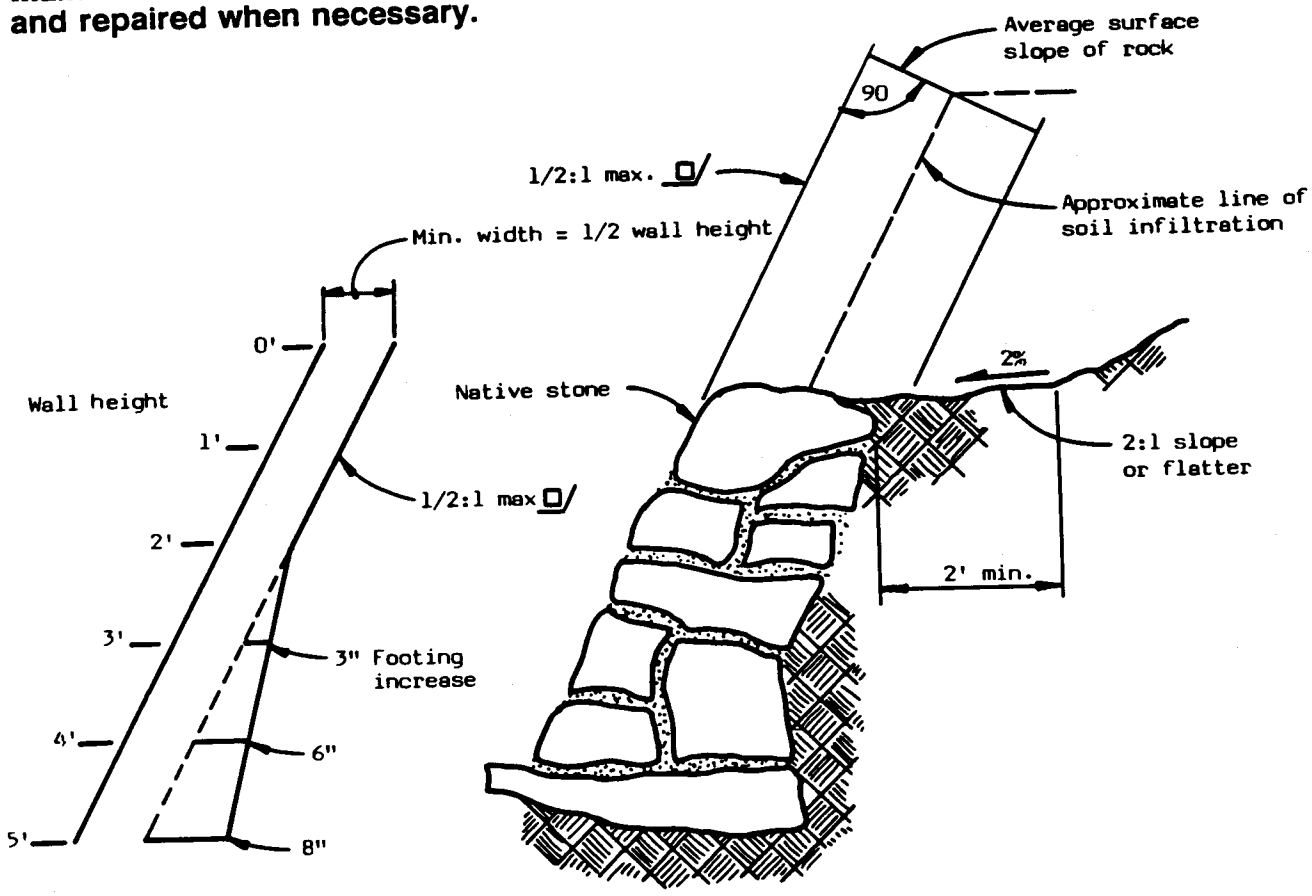
A native rock retaining wall is a wall constructed of native rocks which provides an aesthetically attractive means for physically stabilizing slopes.

Purpose: Retaining walls are usually constructed on steep slopes which are up to five (5) feet in height and that cannot be effectively regraded or stabilized by another method.

Specifications: (See Figure I-8)

Before installing the retaining wall all large rocks should be removed from the face of the slope where the wall is to be placed. Then a "footing" trench should be put in at the toe of the slope. Large rocks are then placed in this footing trench as indicated in Figure I-8. Arrange additional layers so that each rock above the foundation is securely placed on the ones beneath it. After completing the retaining wall, the footing trench must be backfilled. The slope above the wall should be vegetated, where applicable.

Maintenance: Native rock retaining walls must be inspected periodically and repaired when necessary.



NATIVE ROCK RETAINING WALL

FIGURE I-8

I.9 Timing of Construction and Control Applications

The timing of construction and installation of erosion control measures is of utmost importance. Construction should be undertaken during periods when the potential for erosion is at the lowest, i.e. during periods of low seasonal precipitation and runoff. Under all conditions, erosion control measures should be installed in stages to protect work already completed. In highly erodible areas, sediment control measures should be installed before general construction activities commence.

I.10 Limited Surface Disturbance

The amount of disturbed land should be kept to a minimum. This will reduce the amount of bare soil exposed to erosion and help control run-off sedimentation. Concurrent reclamation should be carried out as work progresses to help minimize the amount of disturbed soil.

I.11 Biotechnical Stabilization

Biotechnical stabilization involves using live layers of brush imbedded in the ground to control or prevent surficial erosion and mass failure of slopes. Biotechnical stabilization techniques are most effective when shrubs are cut and utilized during their dormant periods.

Purpose: Biotechnical stabilization is a cost effective method of controlling erosion on and mass failure of slopes, especially steep cut slopes adjacent to roadways.

Specifications: (See Figure I-11)

1. Cut branches and stems (up to three inches in diameter) of willows, alder, or poplar during the dormant season (fall - early spring).

2. Lay the branches and stems atop successive lifts of compacted soil (horizontal terraces cut into the slope) in a criss-cross fashion so the stem will extend the full width of the compacted fill. Branches should protrude from the compacted fill as shown in Figure I-11.

3. Cover criss-crossed branches and stems with a layer of compacted fill.

4. Space brush layers three to five feet apart. Closer Spacing of brush layers might be necessary near the toe of the slope.

5. Continue alternating brush layers with compacted fill as you proceed up the slope from the toe to the top.

6. After a reasonable period of time, roots and shoots will develop. The live vegetation that grows from the cuttings are effective in controlling erosion.

Maintenance: Once vegetation has been established, maintenance will not be required.

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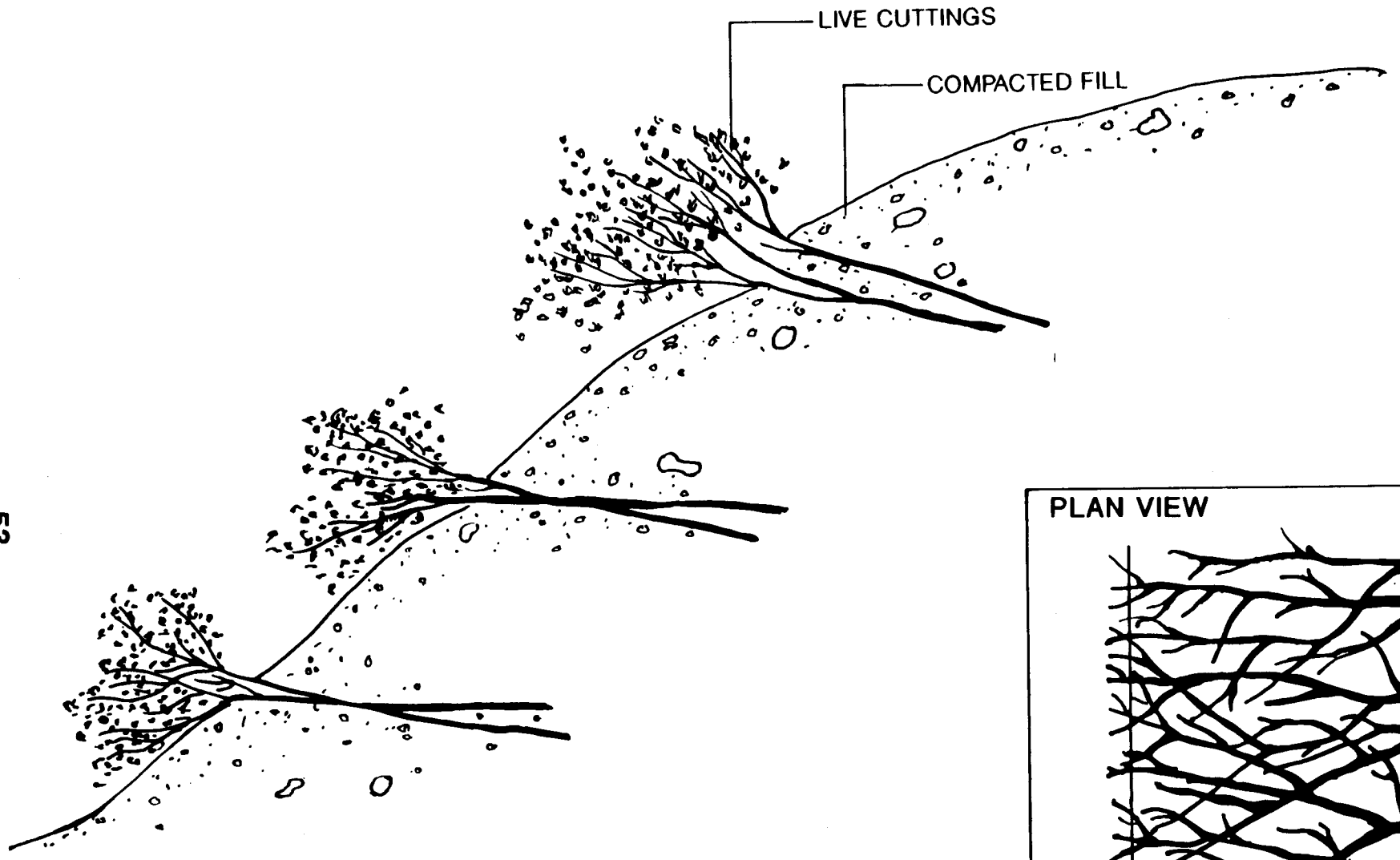
CROSS SECTION VIEW



PLAN VIEW

BIOTECHNICAL STABILIZATION
FIGURE I-11