

Boire Associates Inc.*Geotechnical Engineering Solutions*520 NW 4th Street
Corvallis, Oregon 97330
Tel: 541.753.5344
Fax: 541.753.5347**Addendum #2 (Technical Memorandum)**

To: Jim Hurst	From: Todd Boire, P.E.
Fax: 541.902.7999	Pages: 1
Phone: 541.997.5157	Date: July 13, 2004
Re: Shelter Cove	Cc:

This technical memorandum addresses questions raised by various regulatory agencies during preliminary design meeting. Comments made herein should be considered as an addendum to our prior work.

General Need for Riprap Stabilization

One reviewing agency indicated riprap would not be needed and that vegetative plantings or other biomaterials would be sufficient to resist erosion and stabilize the slope. In our opinion, this is a risky stabilization alternative given the harsh climate and general marine environment. That is, factors such as the direct southwest exposure with sustained high winds, tidal fluctuations, wave action, river current/ water velocities, and groundwater seepage are considered significant driving forces. Note also, the slope is comprised of cohesionless sand that is configured very near the angle of repose. Therefore, shallow biostabilization measures are not recommended as a primary corrective action.

Riprap Keyway

Our design shows a nominal 2 ft deep keyway for the riprap, which we understand is not allowed by one or more regulatory agencies. Please be advised, the keyway is intended to force any potential failures to occur within the rock rather than at the interface between the rock and compressed silt. Therefore, removing the keyway may decrease the factor of safety against sliding. At a very minimum, we would suggest a nominal "clearing excavation" to remove any loose material at the base of the riprap. We would also suggest some excavation be allowed to flatten or even back-slope the foundation area.

Vegetated Riprap

One regulatory agency will require vegetated planting within the riprap for the purposes of shading. This addition is not preferred by us but would be allowed. As a side, it should be noted that the specific surface area of a particle increases geometrically with decreasing diameter. Therefore, new riprap would already be considerably less thermally active than the existing sand. In any case, we would expect the river would be unaffected by the shore protection given its volume and direct contact with the ocean.

to plant growth. The laboratory reports should also include any recommended fertilizer and lime amendment requirements for woody plant material.

8.3 VEGETATED RIPRAP (JOINT PLANTING)

8.3.1 Description

Joint planting refers to the insertion of live cuttings (stakes) in the openings or joints between the rock in a riprap revetment, as shown in Figures 8-1 and 8-2. Alternatively, the cuttings can be tamped into the ground at the same time the rock is being placed on the slope face. The latter approach facilitates installation of the cuttings but also complicates rock placement and increases the likelihood of damage to the cuttings if the rock is tailgated or dumped in place.

8.3.2 Objective

Live cuttings placed in this manner should extend into the soil beneath the stone armor, as illustrated in Figure 8-1. The objective is to have these live cuttings root in the soil beneath the riprap, thus reinforcing the bank, anchoring the riprap, and improving drainage by extracting soil moisture.

8.3.3 Effectiveness

A vegetated riprap revetment (joint planting) provides the following advantages:

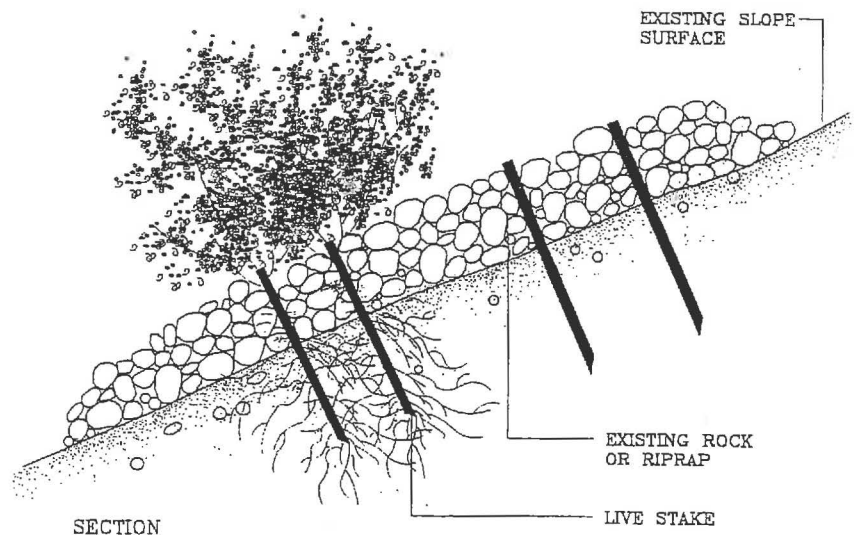


Figure 8-1. Schematic illustration of an established, growing vegetated riprap revetment.

Source: Biotechnical & Soil Bioengineering
Slope Stabilization, 1996.