

# Flexterra® FGM Case Study: Landslide Repair in Avalon Canyon

Controlling erosion during a massive slope stabilization project



## Situation

The Pacific-facing bluffs of Daly City, California, contain highly erodible materials. This is particularly evident in the Avalon Canyon area where erosion, combined with highly concentrated development, has made slope stability a continuing problem. Under normal conditions, storm drainage systems allow runoff from the steep slopes to be collected and carried into the ocean. However, the winter of 1997-98 was not normal. Storms created by El Niño delivered heavy rains day after day, more than doubling the precipitation usually experienced.

## Problem

The torrential rainfall caused by El Niño saturated the slopes of Avalon Canyon. This far overtaxed the capacity of the 30-inch diameter corrugated metal pipe (CMP) used in the drainage system. Designed to handle flows approaching 36,000 gpm, the system failed, causing substantial erosion at the site of the break and undercutting the toe of the slope near the upstream end of the canyon.

This caused massive ground movement as one failure triggered another and several hundred thousand tons of soil tumbled down the canyon to the beach. As a result, Daly City hired Ford Construction to handle a massive cleanup and slope restoration project that was estimated to involve some 120,000 cubic yards of material.

**Flexterra® FGM**

## Alternatives

The original erosion control strategy called for the use of two products:

- Bonded fiber matrix (BFM) would be sprayed on the steeper, inaccessible slopes of the canyon.
- A three-step crimped straw treatment would be spread on the rest of the area including benches, retention basins and to plant the 3-D channel liners located throughout the project.

However various complications and delays began to push the erosion control “window” closer and closer to the rainy season. As a further complication, the project’s low bidder was unable to perform, so KCI (Karleskint-Crum, Inc.) moved from a nearby Ford job to begin slope stabilization.

## Solution

Avalon Canyon’s landscape architect, Carol Florence, of Oasis Associates, had learned about a new Flexible Growth Medium FGM presented by Profile Products at a RWQCB Erosion and Sediment Control Seminar. As a result, she directed KCI to begin applying Flexterra® FGM. This proved valuable in meeting the challenges of the site and the approaching rains.

Flexterra is a patented material which blends crimped, man-made fibers with wood fibers and provides both chemical and mechanical bonding. It was well suited to the Avalon Canyon project because:

1. Flexterra can conform to slopes which are uneven and which have grades as steep as 2H:1V. This allows it to effectively replace straw or excelsior roll-out blankets, jute or blown straw on difficult terrain.
2. Flexterra requires no curing time, giving it the ability to protect against erosion almost immediately after application.

Fighting the clock and the weather, KCI was able to cover approximately five acres of the steepest terrain prior to a four-inch rain. Although it had just been treated, this area resisted erosion and sedimentation. This was not the case for the untreated steep areas, which had to be completely retracked.

## The Results

Because earthmoving had proceeded so rapidly, the finished grade was no longer accessible by a winch/crimper truck. Having seen how Flexterra performed, Ford Construction and Oasis Associates elected to use it for erosion control on the entire site—substituting it for the balance of the punched straw, which had been specified. Fan nozzles, hand-held hoses and a tower gun were used to hydraulically apply a two-step process, which included:

1. Native Coastal Seed and fertilizer mixed with a small amount of Flexterra.
2. Bi-directional application of Flexterra over the seed/fertilizer mix at a rate of 3,500 lbs/acre.

The result was a uniform blanket of interlocking fibers completely covering a 20-acre area. This protected the restored soil surface in Avalon Canyon, and according to David Gilpin, president of Pacific Coast Seed, allowed a nurse crop of hybrid wheatgrass and the native coastal species to become well established.

At the conclusion of the project, landscape architect Carol Florence commented, “The multiple adverse environmental and synthetic conditions put all of our combined knowledge and experience to the test. Projects of this magnitude are the product of a team effort. All in all, Daly City believes that the work effort was a success.”

## Key Product Properties

### Flexterra® FGM Flexible Growth Medium

*Flexterra has been thoroughly proven in a broad range of applications from rough ground and steep, rocky slopes to moderate or steep-graded fill slopes, as well as environmentally sensitive wetlands and wildlife areas not compatible with nettings.*

- Patented technology combines chemical and mechanical bonding to create a lofty, interlocking matrix, which can improve germination and minimize soil loss.
- No cure time is required to develop intimate soil contact. Tests prove Flexterra is 98% effective 2 hours after application.
- Flexterra has consistently outperformed competitive vegetated slope protection technologies.
- It eliminates the extensive soil preparation required by blankets and has demonstrated a lower installed cost per acre including seed, fertilizer and labor.
- Versatility enables combination with complementary erosion control technologies to accommodate a broad range of conditions.



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