

**MILLER CREEK:
Pioneering compound channel still provides habitat
while conveying flows in stabilized channel**

MARIN COUNTY, CALIFORNIA



Photo credits (a) – (c) by Jeffrey Haltiner and photo (d) by Wan-Chih Yin and Caitlin Pope-Daum.

What was done and why?

The Miller Creek compound channel project in southeast Marin County was completed in 1990 as part of the Lucas Valley Estates housing development, making it one of the oldest compound channel projects in California. The lower hills of the watershed have been grazed continuously since Mexican settlement in the 1800s, and grazing can largely be blamed for the degraded condition of the stream. The effects of grazing include compaction of the land surface and destruction of native hillside vegetation, leading to reduced infiltration and thus increased rate and volume of sediment delivery. In addition, trampling by animals in the creek has degraded the banks and destroyed riparian vegetation. The result has been a dramatic deepening and widening of the channel, with steep, nearly vertical banks in excess of 20ft. In more recent decades, the watershed has seen urbanization in the form of residential subdivisions. Although the creek was well degraded before these subdivisions were built, the general effects of urbanization are similar to grazing. Impervious surfaces dramatically decrease infiltration, leading to higher volumes of discharge and more flashy flows that exacerbate bed incision.

The Miller Creek restoration project was designed and constructed during the 1980s, in conjunction with a residential subdivision that was being built on either side of the stream. This subdivision, first known as Deerfield Park and later as Lucas Valley Estates, is currently the upstream most subdivision in a series of developments along Miller Creek. The purpose of the project was to protect the housing development from further channel widening, and to do so in a manner that was more ecological than traditional engineering treatments and provided habitat value within the stream corridor.

The project created a low flow channel flanked by a floodplain terrace, and banks receding back at a 3:1 slope. At the top of the slope, individual property lines are set back 10-50 ft., providing the stream with a corridor of about 200ft., within which to meander

or flood. In selected reaches, an un-reinforced low-flow channel was graded through the overly wide creek bottom, which was to serve as the new floodplain. In the majority of the reach, the overly wide channel bottom was not graded, but the designers hoped that the stream would naturally achieve a narrower configuration based on influent water and sediment regimes. At bends, or where mature trees or the road was threatened, the toes of the banks were stabilized with rock and willow cuttings to prevent channel migration. At one bend a crib wall protects Lucas Valley Road, and at another bend a series of spur dikes protects some mature trees. The entire channel was completely re-shaped, and the banks were then planted with willows and a mixture of native trees and shrubs, and hydro seeded with native perennial grasses.

Who was involved?

The Marin County Flood Control District commissioned PWA to develop design recommendations for stream stabilization and restoration of Miller Creek.

Where can I see the project?

The Miller Creek restoration project is located near the town of San Rafael in Marin County, off of Lucas Valley Road in the Lucas Valley Estates subdivision (-122.5912 N 38.0364 W).

Why is this a model project?

Post-project monitoring indicates that riparian vegetation has been successful at this site, despite relatively low survival (35% - 88%) of vegetation planted shortly after project construction. Failed plantings have apparently been replaced by natural recruitment, especially on fresh surfaces created along migrating portions of the low flow channel. Aquatic habitats are revealed on the longitudinal profile and exhibit high diversity. The riparian corridor has become densely vegetated since the project was completed, adding approximately 2.2 acres of new riparian vegetation.

Facies mapping conducted by Tompkins (2006) indicates that facies are diverse in Miller Creek, alternating between gravel riffles and runs with varying amounts of sand, to silty and sandy pools. Median bed particle sizes on exposed bars ranged from 17 to 42 mm, with larger material in reaches with little or no floodplain. This high diversity of facies suggests that Miller Creek is dynamic and formed by natural processes of erosion and sedimentation. The thalweg of the low flow channel has also shifted over this period, indicating that the low flow channel is dynamic in most reaches. Where floodplain surfaces exist in this compound channel project, vegetation has been extremely successful in colonizing constructed and naturally created surfaces, and at trapping sediment and other debris.

Tompkins (2006) estimated water surface elevations for the 100-year flow (610 cfs), and the flow that just overtops the low flow channel using Manning's equation and found that

the compound channel reach conveys the 100-year flow with freeboard ranging from 3.1 to 20.6 feet throughout the site at low and high roughness.

Since this project was implemented, channel incision has been arrested, the low flow channel has been reconnected to a floodplain in most reaches, riparian and floodplain vegetation has flourished, and dynamic processes appear to be creating diverse conditions in the low flow channel.

For more information on these projects, please contact:

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