NONPOINT SOURCE SUCCESS STORY

California

Watershed Restoration Efforts Improve Revegetation, Erosion Control and Sediment Loads in Bear Creek

Waterbody Improved

Bear Creek was listed on the Clean Water Act (CWA) section 303(d) list of impaired waters for sediment in 1991. The source of sediment was nearby ski resorts, roads and parking lots. Ski resort managers, scientists, regulators and other organizations collaborated to implement and improve erosion control techniques in the region. Through rigorous planning, implementation, monitoring, education and outreach, the parties involved significantly reduced the sediment pollution in the Truckee River watershed, which includes Bear Creek. Due to these efforts, the 3-mile segment of Bear Creek in Placer County was removed from the CWA section 303(d) list of impaired waters in 2006.

Problem

Bear Creek is in the Squaw Creek–Truckee River watershed northwest of Lake Tahoe in Placer County (Figure 1). It is one of two major tributaries that flow into the Truckee River in this watershed. Several major ski resorts are located in this area, and some of them contribute heavily to sediment deposition in Bear Creek (via ski runs, roads, parking lots and ski resort infrastructure). The sediment is carried by runoff and settles at the bottom of these waterbodies, where it degrades the natural aquatic habitat and increases the potential for flooding. All the major waterbodies in this watershed were added to the CWA section 303(d) list of impaired waters for sediment, and total maximum daily loads (TMDLs) were later established for each.

Story Highlights

In 2002 multiple partners began collaborating to reduce sediment and address TMDLs in Bear Creek through the Revegetation and Erosion Control for Ski Areas Project (Project). This effort was led by the California Alpine Resort Environmental Cooperative (CAREC); other partners included the State Water Resources Control Board (SWRCB), Lahontan Regional Water Quality Control Board (LRWQCB), Integrated Environmental Restoration Services (IERS), Sierra Business Council and many other stakeholders, dischargers, universities, private companies and nongovernmental organizations. During the Project, education was provided to the ski resorts and agencies involved. To achieve the Project goals, the Sierra

Figure 1. Bear Creek is in northern California.

Business Council collaborated with LRWQCB to develop the Sediment Source Control Handbook and a Management Practices Toolkit for this and any future projects to be used by practitioners, regulators and other interested parties. Full and standard surface treatments were installed at 103 test plots identified at 24 sites at various participating ski resorts covering approximately 132 acres. Most treatments included a combination of treatment elements, depending on site conditions and/or the test questions being

investigated. However, all treatments can be lumped into one of two general categories: full treatment or surface treatment.

Full treatment refers to the process of restoring soil function to the greatest level possible. The process includes replacing lost soil organic matter, tilling/mixing that organic matter to a depth of 12–18 inches; adding an organic, slow-release fertilizer; applying a native grass-dominated seed mix; and applying a long-lasting mulch material such as pine needles or tub-ground wood chips.

Surface treatment, the "standard" treatment, is easy to implement and has a low initial cost; therefore, it has been used for many years on erosion control projects in ski areas and other disturbed areas. Most surface treatments consist of applying fertilizer, seed, mulch and sometimes tackifier on the soil surface. Fertilizer and seed are commonly applied using a hydroseeder. Most types of mulch associated with surface treatments (such as straw) have a relatively short functional lifespan.

Results

Data show improvement. Sites that received full surface treatments had on average a sediment yield 3.1 times less than the more common, standard surface treatment. Infiltration rates dramatically increased at test plots. The maximum sediment reduction at full treatment plots was up to 20 times higher than surface treatment plots. Monitoring results indicate that there was no sediment yield at 75% of full treatment plots due to high infiltration and no runoff—as compared to 35% of surface treatment plots. Across all sites, the average steady state infiltration rates at full treatment plots were 1.2 times higher on average than surface treatment plots. Sediment yield at a highly disturbed site in the Sierra Nevada is 500 pounds of sediment per acre per inch of precipitation (lbs/acre/in).

The treatments in this study have been quantitatively shown to substantially reduce sediment yields and increase infiltration rates on highly disturbed sites. Therefore, it can be inferred that after full surface treatment, the average sediment yield measured across all sites was 73 lbs/acre/in, or an 85% reduction in sediment yield. On 1 acre of highly disturbed land, such as a graded ski run, full surface treatment would result in a reduction of 427 lbs/acre/in. Over 132 acres, the total area of the Project treatment sites, sediment would be reduced by 56,364 lbs/in. These data supported implementation of a TMDL for sediment in Bear Creek, Squaw Creek, Truckee River and Lake Tahoe.

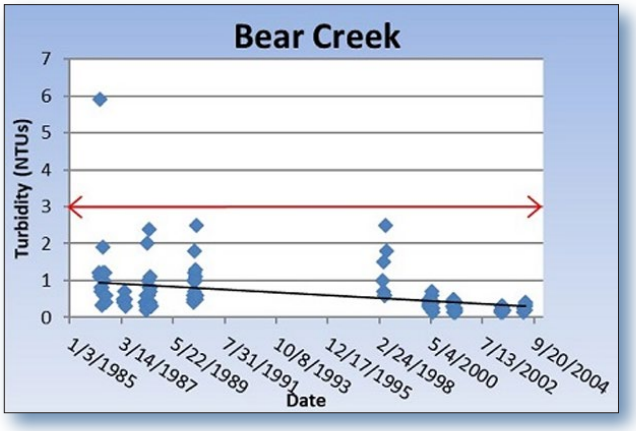

Figure 2. Bear Creek turbidity sample data (1985–2004). Data points included 122 individual measurements of turbidity and 39 monthly means taken from two locations in the Alpine Meadows Ski Area.

Bear Creek turbidity data were collected from 1985 to 2004 (Figure 2). The Lahontan RWQCB Basin Plan lists 3 nephelometric turbidity units (NTUs) as the water quality criterion threshold. Only one sample exceeded the 3 NTU limit. The Surface Water Ambient Monitoring Program reported a California Stream Condition Index score of 1.15 in 2000 and 1.16 in 2001. Both scores are very high, showing a significant improvement to the benthic community. This data was the evidence used to remove Bear Creek from the CWA section 303(d) list of impaired waters in 2006 by the SWRCB. The extensive work done as part of Project contributed to the delisting.

Partners and Funding

Partners included the Sierra Business Council, SWRCB, LRWQCB, CAREC, IERS, University of California–Davis, TEAM Engineering & Management, Tahoe Regional Planning Agency, U.S. Forest Service, Inyo National Forests, and the Lake Tahoe Basin Management Unit. The six participating ski resorts were Heavenly Mountain Resort, Northstar-at-Tahoe, Mammoth Mountain, Squaw Valley USA, Resort at Squaw Creek, and Tahoe Donner Cross Country. The Project was supported by $473,145 in CWA section 319(h) grant funds.

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