Case Study: Natural Resources Conservation Service, Emergency Watershed Protection

Project: Butte Creek Emergency Watershed Protection Phase II "Parrott-Phelan Irrigation Diversion"

The Situation

The high precipitation event that occurred during the last hours of 1996 and the first days of 1997 in Northern California led to flooding that may end up as the largest on record for this century. In Butte Creek Canyon, Butte Creek rose to levels never before seen by European-Americans (35,600 cfs), and the destruction of property was the largest on record. The creek itself experienced changes in its bed morphology and course. These changes in stream course (termed "avulsion") resulted in some property owners gaining land that was once creek, others losing land and personal possessions to the creek, and still others having water diversion structures destroyed or made inoperable by avulsion.

This is exactly what happened at the Parrott-Phelan Diversion Dam, also known as the Okie Dam. During the night of January 31, 1996, Butte Creek changed its course from where it ran through the dam/diversion structure, and shifted to the south, leaving the dam and diversion approximately 500 feet from the new channel (see Figures 3.2 and 3.3).

An Emergency Watershed Protection proposal by the NRCS has, in two phases, diverted Butte Creek from its post-flood channel back to its "pre-flood" channel that runs through the diversion dam. The Parrott-Phelan Irrigation Diversion - Butte Creek Emergency Watershed Protection Project - Phase II (Project), involved more than just returning Butte Creek to its former channel. The Project consisted of three separate construction sites, A, B, and C, with A being a secondary "flood control" channel (a modification of the post-flood channel), high flow-weir and fish ladder. Site B is a channelization and bank stabilization project that seeks to keep Butte Creek from meandering and jeopardizing work done at site A. Site C, similarly, is an attempt to keep the creek from gaining access to the flood plain where it may raise flood heights behind the structures at sites A and B.

The Project

Emergency Watershed Protection construction began the last week in April 1997 with the excavation of the aggraded material from Butte Creek's former stream course that ran through the dam. This material was transported and deposited on a point bar that formed during the floods, just downstream of the avulsion point on the right side of the creek. Some of the material was pushed out into the stream itself to form a coffer dam. On May 1, 1997, at approximately 3:30 p.m., as this structure was nearly finished, an excavator began to break through the last section of aggraded material that separated the old channel from the post flood channel. As the creek began to flow into the old channel, clean-washed gravel was pushed across the post-flood channel, and the coffer dam was completed. This was termed Phase I of the Project.

Phase II of the project, initiated in October 1997 and finished the first week of November 1997, consisted of much more than re-routing the creek. Site A consists of a total of 2,632 feet of rip-rap, some of it concreted. Overall, the structure is designed to act as a flood over-flow channel. It has a weir incorporated into it to keep flows below flood-level going through the Okie Dam channel. The weir has a fish ladder to allow fish attracted to the overflow channel during high flows to escape from being stranded in the pool below the weir in the event flows drop quickly and strand the fish. Energy dissipation devices are placed below the weir to slow water after it falls over the weir. The lower portion of the temporary coffer dam from Phase I was incorporated into the weir.

Site B is located upstream on the creek's left bank. It consists of 1120 feet of rip-rap. This structure appears to be an attempt to eliminate the natural meandering of Butte Creek in this section of the stream and eliminate access to the flood plain. If a high flow event similar to that of this past January were to have occurred without this work, it is apparent from site observations and aerial photo interpretation that major erosion into the historic gold dredge tailings would have occurred, and the creek may have been able to create a new channel through the dredge gravel mining ponds, and jeopardize three homes and structures located near site A.

Figure 3.2 Parrott-Phealan Diversion Area Aerial Photograph 1995

Figure 3.3 Parrott-Phealan Diversion Area Post-1997 Flood
White lines represent NRCS EWP project areas.

Site C is situated on the left side of the creek upstream from site B. It is a relatively small plug in the stream bank of only 56 feet. Despite its size, this site is crucial in an attempt to eliminate access to the flood plain, where the creek, again, may flood the three homes downstream and could erode structures from the backside. This site was where the majority of water that ended up flowing through the Spanish Gardens area (homes south of site A) originated. From a hydrologic standpoint, it is interesting to note that by eliminating flood-flows from gaining access to the flood plain, water levels downstream will be elevated significantly, and the chances for failure of structural flood control devices will be increased. When a structure does fail, the confined stream has such increased energy that it is more devastating than if it had been allowed to spread out onto the flood plain.

The Results

After one winter, several observations can be made regarding the sustainability of these structures. While the 1997/1998 winter will be known as the winter of El Nino, and remembered as an exceedingly wet one for Butte Creek and the residents of its watershed, it will not be remembered for any outstanding floods. Flows peaked at about 10,500 cfs in the area of Okie Dam (around February 3rd), a level that was only 29% of that which was seen during the floods of 1997.

While these flows were not extreme, they were sustained, with flows approaching or exceeding that of the bankfull stage occurring for much of the months January through May. Even early June had flows over 1600 cfs. These flows did not come close to exceeding the capacity of the structures constructed by the NRCS. But these sustained flows did have the competence to move a substantial amount of bed load into the confluence where the creek is allowed to go through either the Okie Dam channel or the newer flood-control channel. During higher flows (around 2,000 cfs or so) the creek slows and forms an eddy as it rounds the bend on its way to Okie Dam. It is at this point that the bed load is beginning to form a sizable gravel and sand bar. This bar is easily viewed by pulling off Honey Run Road, just above Okie Dam. Looking upstream, the bar is visible on the left side of the channel. This site will be a good place for interested parties to view how fluvial processes change a creek over the course of time.

This material and bar will undoubtedly continue to accumulate and grow with time, bringing up the question of whether the Okie Dam channel will continue to exist as the main channel through this reach of Butte Creek. Assuming that the Parrott-Phelan water diverters and the county wish to maintain the current configuration of the creek, it appears that excavation of aggraded material in this section of creek will be required in the not too distant future. According to Chico Enterprise-Record reporter Nick Ellena (1997), responsibility for this maintenance lies with the County of Butte.

Even with a thoroughly wet spring, no vegetation is taking hold on the rip-rapped sites. The combination of geotextile being placed under the rock, and multiple layers of rock, with smaller, more consolidated pieces underlying larger rocks exposed on the surface, makes growth of riparian species extremely difficult. While these banks may have been stabilized, the project falls short on "watershed protection." These sections of creek will be devoid of streamside vegetation and riparian canopy for many years to come.