Demonstration Project to Test a New Interdisciplinary Approach to Rehabilitating Salmon Spawning Habitat in the Central Valley

Summer 2004

This was the eighth quarter of this CALFED project to demonstrate the utility of the Spawning Habitat Integrated Design Approach (SHIRA). Previously, project planning had been carried out to select the primary scientific question that should be addressed in the pending gravel-bed river rehabilitation and salmon habitat enhancement experiment, and then the best site for experimentation was selected to match that question. For the 2004 experiment, the key scientific question is whether it is possible to create and carry downstream new bed slope where none exists below a dam for use meeting geomorphic and ecologic goals by placing gravel strategically to back water into a dam thereby building an appropriate amount of hydraulic head to drive relevant hydrogeomorphic processes? The selected site was the reach located immediately downstream of the fish fence below Camanche Dam and ending in an artificially deep pool downstream of the 1999 spawning bed rehabilitation site. Given this goal, the main progress for this quarter involved addressing the fundamental question of slope adjustment and then designing the experimental design for EBMUD to implement according to prior agreements. Specific activities included initiation and completion of pre-project site characterization, design scenario development and testing for slope and other effects, final design selection and refinement, construction, and post-project assessment.

The pre project site characterization of the 2004 experimental site involved high resolution topographic surveying of the bed and banks, stage-discharge relation development, velocity and depth verification data gathering, eddy viscosity parameterization, bed roughness parameterization, spawning habitat characterization, adult holding habitat characterization, and sediment budgeting based on historic data for the site. EBMUD and UCD worked together in all aspects of pre-project characterization to cover the large amount of data requirements.

Design scenario development and testing was focused primarily on augmenting the design of the upper riffle in the study reach that was constructed in 2003 and on performing substantial gravel fill on the lower riffle in the study reach, which was last contoured in 1999 (pre-SHIRA). Secondarily, design testing was performed to determine what geomorphic and ecologic benefits could be attained from different design concepts. Initially, three different 3D design scenarios were developed and tested for the site, with different spatial distributions of gravel placement to yield different assemblages of hydraulic units and heterogeneous habitats.

In the end, all design scenarios were tested against several management issues. The primary concerns were filling in a hole in the bed at the hatchery in-take, re-balancing velocities over the upper riffle to serve as good spawning habitat and to avoid significant erosion during spawning, and using SHIRA to test competing designs for the lower riffle. At the same time, designs were also evaluated for their potential to focus high discharge scour over the pool between the two riffles using the 2D process of convective acceleration to promote self-maintenance of those pools. Beyond these geomorphic considerations related to slope and riffle-pool geometry, designs were evaluated for their relative gain in spawning habitat compared to the pre-project

condition as well as their availability of adult holding habitat. Juvenile habitat is not limiting in this system.

EMBUD constructed the project according to our experimental design plan. We participated in the construction process to help answer questions and manage problems as they arose. There was not time during design development to model boulder configurations, and this was not a primary scientific question for this experiment, so available boulders were placed as additional habitat features in locations and positions according to lessons learned from the 2001-2003 SHIRA experiments. Also, for the first time, fine gravel suitable for steelhead spawning was made available for use in the project, so that was placed ad hoc to yield a significant increase in habitat quality.

Post project assessment was carried out a few days after construction was completed. It involved high-resolution topographic surveying of the bed and banks, velocity and depth verification data gathering, eddy viscosity parameterization, bed roughness parameterization, spawning habitat characterization, and adult holding habitat characterization. EBMUD and UCD worked together in all aspects of post-project assessment to cover the large amount of data requirements.

Long-term monitoring, evaluation, and adaptive management for this site is underway, including a full suite of biological monitoring for site utilization.

During this quarter, a major outreach effort was undertaken. This effort included giving lectures in different areas of California and it included the overhaul and advertisement of the SHIRA web site, which is now located at http://shira.lawr.ucdavis.edu. On this website one can find all technical reports, MS theses, and peer reviewed journal articles that we have published. Also, the website includes extensive educational information on river rehabilitation and SHIRA, including a 60-minute video powerpoint presentation that explains in great detail what SHIRA is all about and what lessons we are gleening from these adaptive management experiments. At present, the SHIRA framework is fully documented and illustrated on the website. Also, we are in the process of making available all of our different design concepts and 2D model predictions for all of our SHIRA demonstration projects on the web site. So far we have publicly released 98 maps of results from one of our case studies, with many more to follow.