

Napa River Spawning Gravel Study

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The Napa County Resource Conservation District (RCD) just completed the first year of a pilot monitoring project to assess spawning conditions for steelhead and salmon in the Napa River watershed. This study, which is funded by the California State Water Resources Control Board and the US EPA, focuses on streambed scour and gravel permeability - two indicators of conditions for incubating eggs. Because of their biological significance, the State established numeric targets for these two parameters in the total maximum daily load, or TMDL, for sediment in the Napa River. The purpose of this project is to develop a monitoring strategy for collecting these types of data and then to conduct pilot monitoring to test the methods and see what the initial results suggest.



Installing a scour chain.

So, what are gravel permeability and streambed scour? Simply put, permeability is a measure of how easily water can flow through the streambed, and scour is the depth to which the streambed scours away and fills back in during a typical winter storm. Since steelhead and salmon bury their eggs in streambeds, they are at risk of being washed away if deep scour occurs. The TMDL requires that the maximum amount of scour measured in all potential Napa River watershed spawning sites be less than 15cm (~6 inches). In addition, inter-gravel flow

(permeability) is vital for bringing fresh, oxygenated water to developing fish eggs and for carrying waste products away. The rate at which water is able to flow through the gravel directly relates to the survival of incubating eggs, with higher flow rates corresponding to higher survival and vice-versa. The TMDL dictates that potential spawning locations in the Napa River watershed should have a median permeability value of at least 7,000 cm/hr, which translates into about 50 percent or more of the eggs successfully hatching and emerging as fry.

In fall 2012 and winter 2013, RCD staff along with our partner, Stillwater Sciences, measured permeability at 80 sites in the mainstem Napa River and 80 sites in tributary streams, including Ritchey, York, Sulphur, and Carneros Creeks. Permeability was measured with a backpack-mounted vacuum pump, which draws water through a perforated pipe driven into the streambed. A crew of two people operates the pump and measures the amount of time taken to draw a known volume of water through the gravel and into the pipe. Of the 80 tributary sites, slightly less than half achieved the TMDL target of 7,000 cm/hr. In the mainstem, 21 of the 80 measurements achieved the TMDL target. There was considerable variation between streams and amongst sites, so the RCD is planning to repeat the measurements again in 2013 and 2014 for comparison.

Streambed scour was measured at 20 sites in the mainstem Napa River during the 2012/13 water year. RCD and Stillwater staff buried 40 chains vertically in the streambed at potential spawning locations and carefully measured the exposed lengths of chain left on the surface. We then made a series of follow-up visits to recover the chains and re-measure the exposed lengths. By comparing the original exposed length to subsequent measurements, we were able to document the depth to which the bed had been scoured away or filled in. The average scour value for the entire monitoring effort was 5.2 cm (2 inches) with a standard error of 3.7 cm (1.5 inches). Assuming that the measurements from the recovered chains are representative of all sites, the mean depth of scour/deposition achieved the TMDL target.



Recovering a buried scour chain from the river.

The primary challenge encountered during the pilot monitoring effort was the low number of recovered scour chains: only 21 of 40 chains were recovered, despite extensive searching. The low recovery rate was likely caused by high flow conditions during the study. A series of large storms occurred in fall 2012 with peak flows on November 30 and December 23 shortly after we installed the chains. These flows were similar in magnitude - both were approximately 5-year storm events. The TMDL, however, specifies that scour targets are applicable for 2-year storm events and less. Therefore, RCD is re-installing chains at the same sites in the river again this winter in hopes of measuring scour during a more "normal" flow year for comparison.

We would like to thank the San Francisco Regional Water Quality Control Board for helping to coordinate and fund this project, as well as all of the landowners that granted us access. A full report is available at www.naparcd.org.