Carmel River Reroute and San Clemente Dam Removal Monitoring Update

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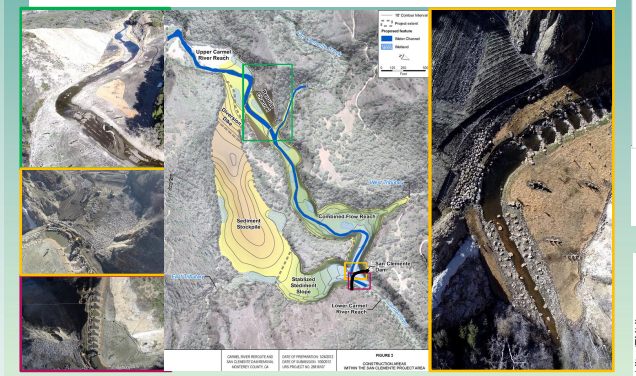
Introduction

San Clemente Dam (SCD) was built in 1921 by the Del Monte Properties Company to provide water to the growing Monterey Peninsula. At the time of construction, the SCD stood 106 ft. high and had the potential to hold 1,425 acre-feet of water. By 2008 the SCD's water capacity was 70 acre-feet due to 2.5 million cubic yards of accumulated sediment. To improve steelhead habitat, allow for sediment transport, and remove a seismically unsafe structure, the California American Water, in collaboration with multiple other agencies, decided to remove the SCD.

The Carmel River Reroute & San Clemente Dam Removal (CRRDR) is the first major project to stabilize the reservoir sediment pile, remove the dam, and reroute the river. In theory this method would have minimal downstream impact. To test this, we implemented various monitoring strategies including channel cross sections and pebble counts, turbidity measurements, and woody debris inventories. So far, only turbidity has been measured in the after dam timeframe.



Monitoring Locations

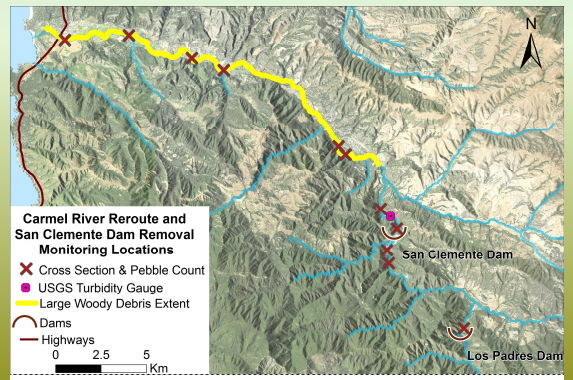


Figure 1. Monitoring locations in relation to the former San Clemente Dam and Los Padres Dam on the Carmel River, Monterey, CA.

Baseline Results

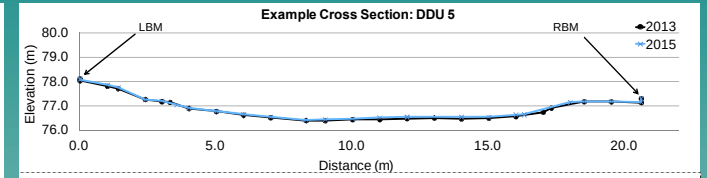


Figure 2. Example cross section (DeDampierre Upper #5) from summer 2013 and 2015, both before dam removal.

Overall, between survey precision is very high. Future surveys should be able to distinguish a change in channel morphology after dam removal of over 4 cm.

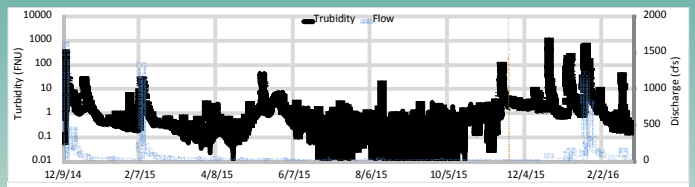


Figure 3. Time series of turbidity (FNU) and surface discharge (cfs).

Overall, higher turbidity correlates with higher surface flows. Vertical line (pink) indicated the date that the Carmel River was allowed to freely flow through the restoration channel.

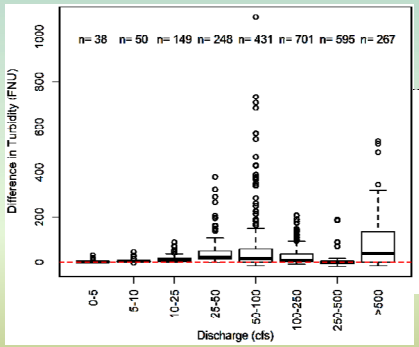


Figure 4. Difference in turbidity readings during and after CRRDR construction.

At higher flows, post-dam turbidity appears significantly higher than pre-dam-removal turbidity readings for all flows except 250 – 500 cfs (Mann-Whitney U, $p_{250\text{-}500} = 0.11$, $p_{other} < 0.05$).

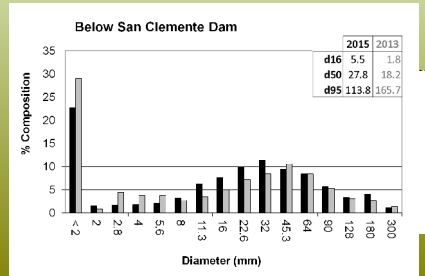


Figure 5. Grain size distribution among cross-sectional transects from downstream San Clemente Dam (6 sites).

There has been minimal change since the 2013 surveys during pre-dam removal time.

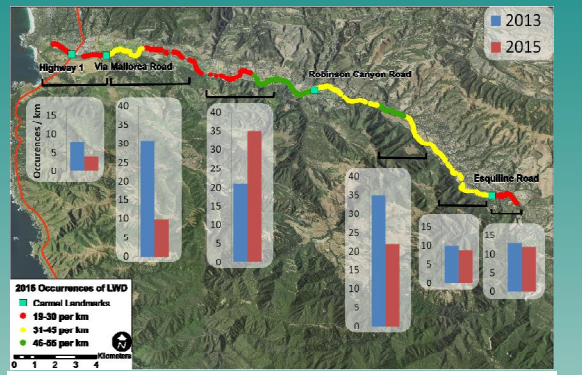


Figure 6. Occurrences of Large Woody Debris (LWD) per kilometer for each surveyed reach.

No consistent trend was found since 2013.

Conclusion

- Between survey uncertainty for all channel morphology and turbidity monitoring is small enough to detect changes between before and after dam time frames.
- Pebble count and large woody debris distribution are variable between years, but can still detect large changes.
- The next series of surveys will take place in the summer of 2016 to quantify any post-dam removal impacts.

Literature Cited

Chow K., Luna L., Delforge A. and Smith D. 2016. 2015 Pre-San Clemente Dam Removal Morphological Monitoring of the Carmel River Channel in Monterey County, California. The Watershed Institute, California State University Monterey Bay, Publication No. WI-2016-01, 49 pp.

MacCarter, L., Fields, J., Smith, D.P. 2016. Large Woody Debris on the Carmel River from Camp Steffani to the Carmel Lagoon, Fall 2015: Watershed Institute, California State University Monterey Bay, Publication No. WI – 2016 - 05, 25 pp.

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