Five-Counties Post-project Monitoring Report for the Digger Creek Culvert Replacement Project at Ocean Drive, Coastal Mendocino County: Post-project Survey #2.

Prepared By

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Digger Creek at Ocean Drive – outlet photo taken on March 10, 2005

Introduction

The purpose of this report is to fulfill the post-project monitoring requirements of a fish passage improvement project funded by the California Coastal Conservancy (Grant # 02-192) and the California Department of Water Resources. This report presents the results of the second post-project monitoring survey conducted at the Digger Creek/Ocean Drive stream crossing. The first post-project survey was conducted on May 12, 2004 by Ross Taylor and Associates and Mario Abreu of the Mendocino Coast Botanical Gardens. Taylor and Abreu also conducted this second post-project monitoring survey.

Digger Creek is a small coastal watershed located south of Fort Bragg in Mendocino County. The creek flows in a west, north-west direction, has a drainage area of approximately three square miles, and is located south of Hare Creek and north of Mitchell Creek (Figure 1). Digger Creek and its riparian corridor currently support populations of resident coastal rainbow trout, Pacific giant salamanders, and red-legged frogs. Steelhead (sea-run coastal rainbow trout) were historically present in Digger Creek and there is inconclusive, anecdotal information that suggests coho salmon were also historically present in the watershed up to the 1920's-30's.

The Ocean Drive stream crossing was initially evaluated for fish passage and storm flow conveyance in 1999 and was determined to be a significant barrier to all age classes of steelhead and resident trout, as well as severely undersized and in poor condition (Taylor, 2001). The crossing was comprised of a six-foot wide by four-foot high corrugated arch culvert that was 60 feet long and set on a 1.20% slope. The culvert's outlet was perched approximately three feet above the downstream channel. The pool below the culvert's outlet also lacked adequate depth for migrating fish to execute leap attempts.

A concrete open-bottom arch culvert was installed during August and September of 2003 by Mendocino County DOT. The culvert's dimensions were 60'L x 12'W x 4'H (see cover photograph). The stream bed through the new crossing was lined with angular cobble to small boulders to provide roughness to create adequate depth for fish migration, as well as reduce velocities through the crossing.

Post-project Monitoring Methods

The longitudinal profile of the stream channel was resurveyed through the Ocean Drive crossing to assess the upstream head-cut and to compare with the initial post-project profile and the pre-project profile. A temporary bench mark (TBM) was established on the Ocean Drive crossing's inlet let by spray-painting an "X" with orange paint on the right-bank wing-wall. The TBM was assigned an arbitrary or presumed elevation of 100.00 feet.

We utilized an auto-level (Topcon AT-G7) with an accuracy of ±2.5mm, a domed-head surveyor's tripod, and a 25-foot leveling rod in 1/100' increments. A 300-foot tape (in 1/10' increments) was laid down the channel in a downstream direction, starting approximately 100 feet upstream of the Ocean Drive crossing's inlet. A 100-foot tape was utilized for shooting cross-sections.

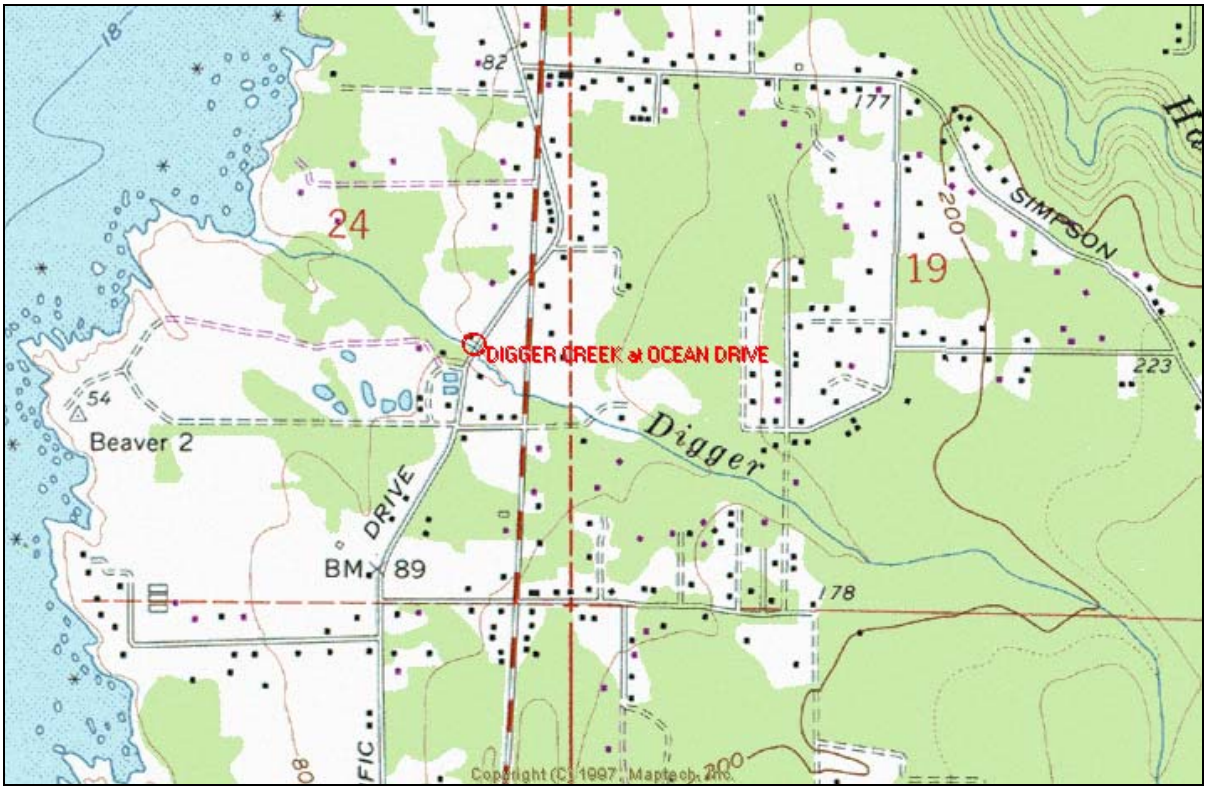

Figure 1. Site map of Ocean Drive stream crossing on Digger Creek, Mendocino Co.

All survey points were referenced to a station number off of the 300-foot tape. The leveling rod was placed at the thalweg (deepest point of channel cross-section at any given point along the center tape) at various stations along the center tape, generally capturing visually noticeable breaks-in-slope along the stream channel. Through pools, we captured the maximum depth and the riffle-crest (or tail-water control) immediately below the pool. Two cross-sections were also surveyed, one at the crossing inlet and one at the crossing outlet.

Results of Digger Creek Longitudinal Profile Survey

For the initial post-project assessment, seven hundred and seventeen feet of Digger Creek's channel was surveyed (Figure 2). Prior to conducting the second survey the channel was carefully examined and a 12-foot long bedrock sill located approximately 30 feet upstream of the crossing was obviously acting as the check-point of any head-cutting during channel adjustment. Thus, we started the second survey ninety-six feet upstream of the crossing and surveyed a total of two-hundred fifty feet of channel (Figure 2). This second survey captured elevations at 43 points along the channel and required two turning points to complete the survey. Within the Ocean Drive crossing, 12 points were surveyed, mainly to capture the steeper break-in-slope along the lower 22 feet of the crossing (Figure 3).

The overall slope through the crossing (from inlet to outlet) was 3.98 % (4.25% for 2004 survey) and the slope of the steeper break-in-slope along the lower 22.1 feet of the crossing was 7.19% (8.33% for 2004 survey). Although this lower section of the new crossing is still fairly steep, the roughness of the cobbles and small boulders may likely reduce velocities and still allow fish passage. Also, it appears that subsequent winter storms have caused a minor re-grade of the substrate through the crossing and lessened the slope of this steeper section (Figure 4). Comparison of the 2004 and 2005 longitudinal profiles also revealed an overall down-cutting of the stream bed elevation from the exposed bedrock located 30 feet upstream of Ocean Drive to the bedrock TWC of the outlet pool (Figure 4). Comparison of the two post-project longitudinal profiles with the pre-project profile documents the elimination of the extremely perched outlet that was the main impediment to fish migration at the pre-project culvert (Figure 5).

At the time of the survey, 12 water depths through the Ocean Drive crossing were similar to depths measured at 14 riffle crests located in the natural channel (Table 1). The average riffle depth within the crossing was actually slightly deeper than the average riffle depths within the natural channel.

Tail-water Control depths – at riffles in natural channel (feet)	**Riffle depths within Ocean Drive crossing (feet)**
0.9	0.5
0.6	0.5
0.7	0.5
0.7	0.4
0.6	0.5
0.7	0.6
0.4	0.4
0.5	0.6
0.4	0.7
0.2	0.5
0.1	0.6
0.5	0.7
0.5	
0.5	
Average depth = 0.52 feet	**Average depth = 0.54 feet**

Table 1. Comparison of water depths measured at riffle crests within the natural channel and within the Ocean Drive crossing on March 10, 2005.

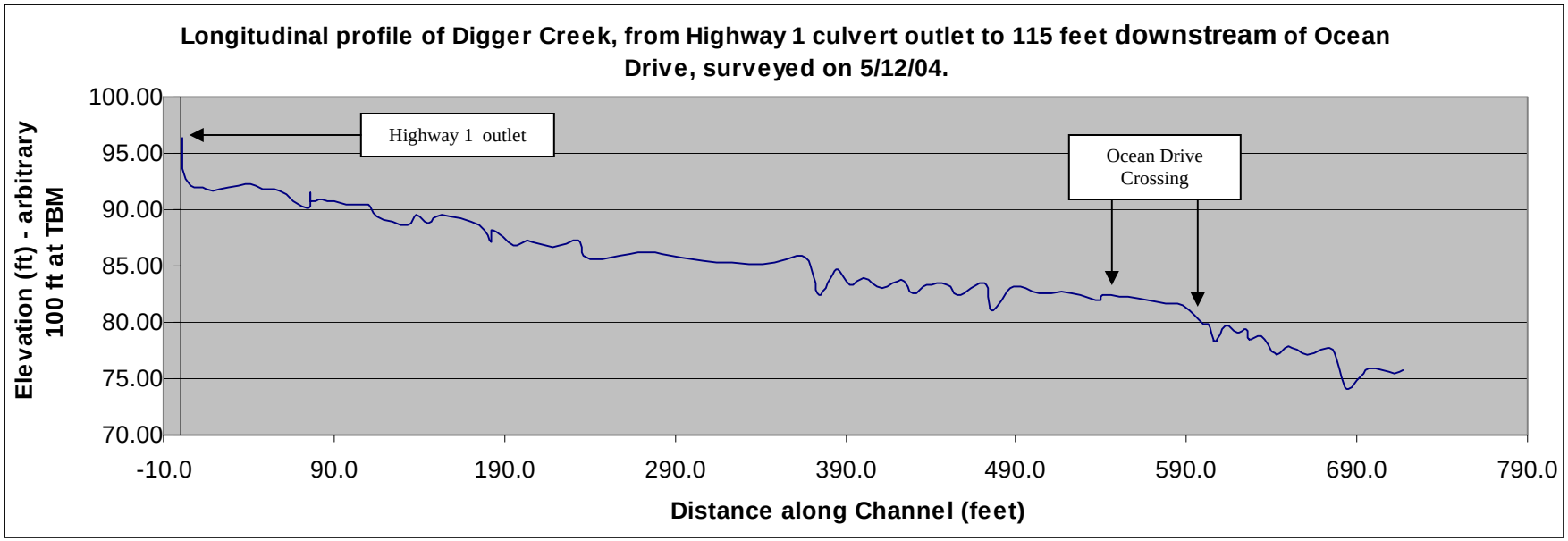

Figure 2. Longitudinal profile of 717 feet of Digger Creek's channel surveyed on May 12, 2004.

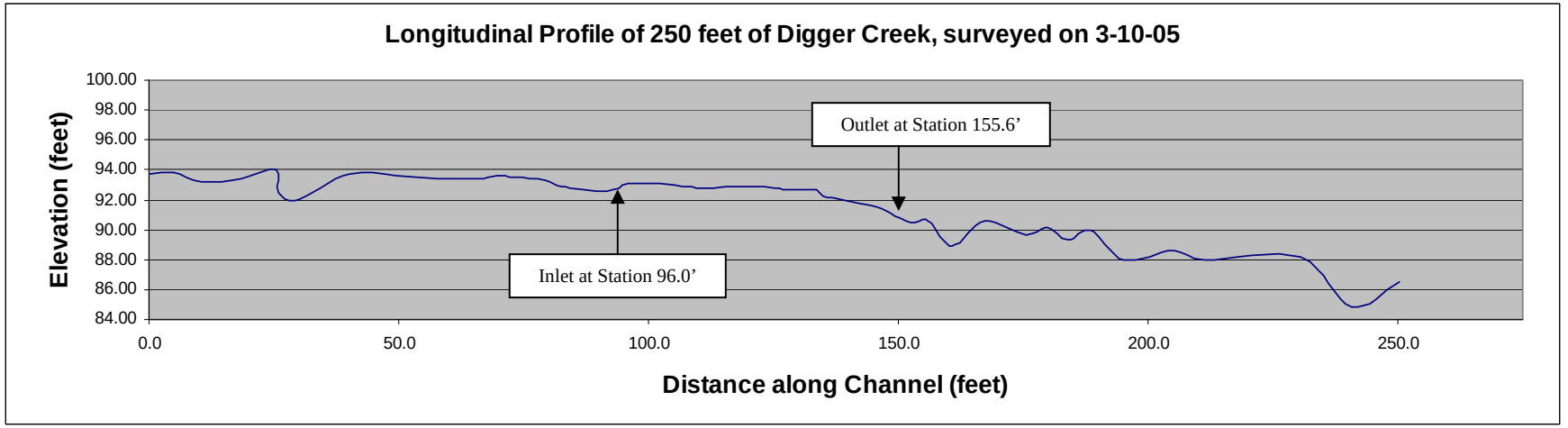

Figure 3. Longitudinal profile of 215 feet of Digger Creek's channel surveyed on March 10, 2005.

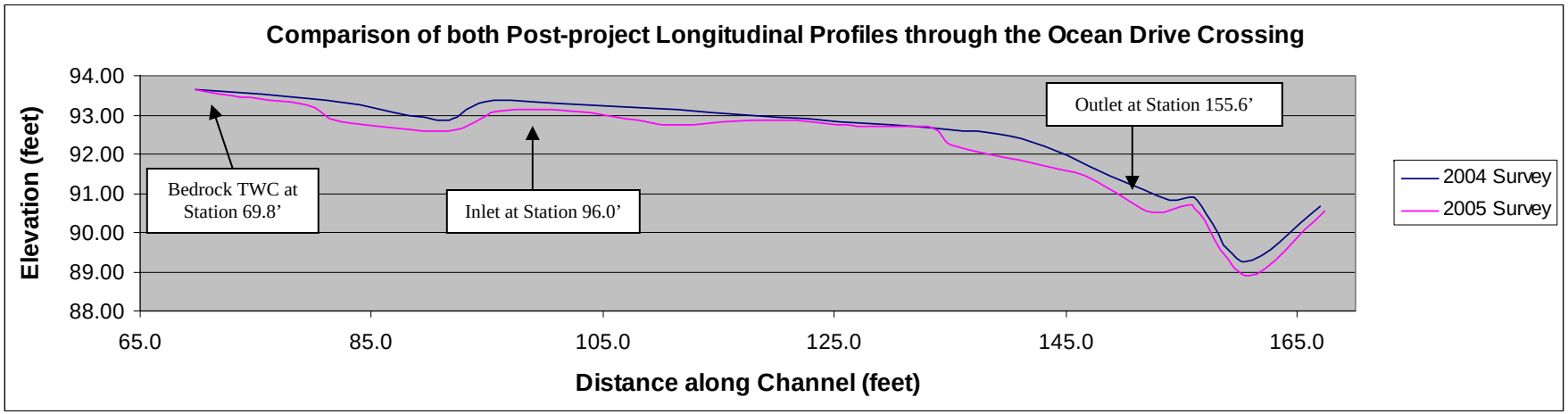

Figure 4. Longitudinal profiles of Digger Creek through the Ocean Drive open-bottom arch, surveyed on 5/12/04 and 3/10-05.

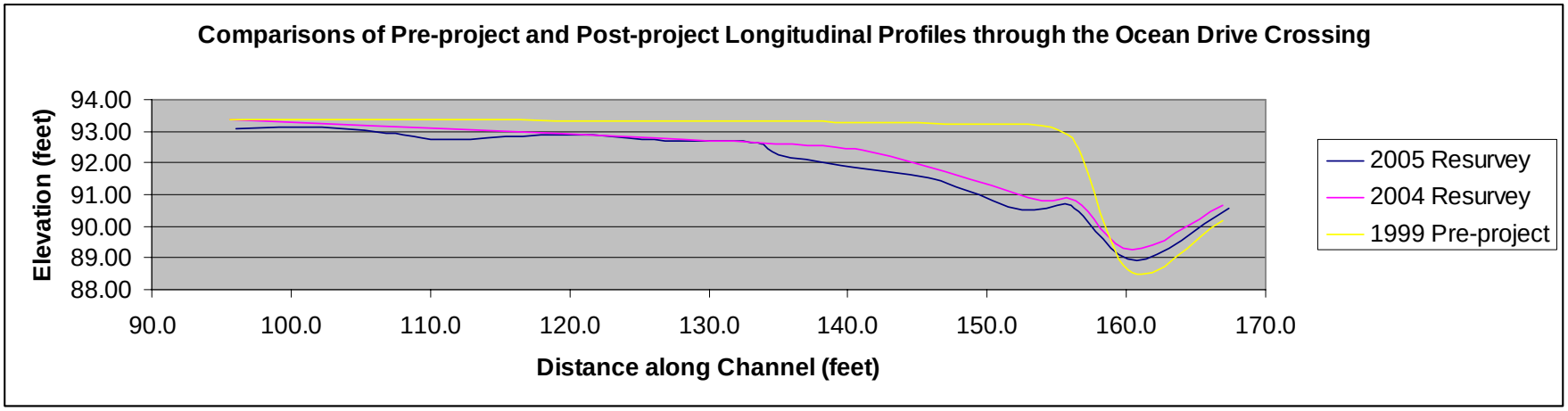

Figure 5. Comparisons of longitudinal profiles of Digger Creek through the Ocean Drive; pre-project survey from 1999 through the perched arch culvert and post-project surveys from 2004 and 2005 through the open-bottom arch.

Conclusions and Recommendations

The new crossing is a significant improvement in both fish passage and storm flow conveyance in contrast to the old culvert. Currently, the slope through the new crossing is still a bit steep at the downstream end. However, this over-steepened section has already re-adjusted during 2004-05 winter storm flows and has decreased in slope when compared to the initial post-project survey.

The channel experienced an additional small amount of down-cutting as a result of the open-bottom arch installation. The hard-point of natural bedrock located about 30 feet upstream of Ocean Drive that was exposed when the stream channel elevation dropped has curtailed any down-cutting from extending upstream past this point. If funds are available through the Five-Counties, additional surveys will be conducted in 2006 to assess if any continued adjustments of the Digger Creek channel occur.

Literature Cited

Taylor, R. N. 2001. Coastal Mendocino County culvert inventory and fish passage evaluation. Final report for CDFG agreement #FG 8072 WR. 43 p and appendices.