Central Coast Watershed Studies

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# Carmel River Large Woody Debris Inventory from San Clemente Dam To the Lagoon Fall 2002

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**Table of Contents**

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## Project Summary

The Carmel River is home to a threatened wild Steelhead Trout population. Large woody debris (LWD) plays a significant role in the life cycle of the Steelhead Trout and the overall biological and physical function of the Carmel River. An inventory of LWD on the Carmel River was conducted in Fall of 2002, focusing on seven sample reaches that represent conditions along the 18 miles of channel between San Clemente Dam and the head of the Carmel Lagoon. The sample reaches cover approximately 8 miles of river channel, or 44% of the total river length downstream of the dam. For each piece of wood, or accumulation of woody debris, we assigned precise geographic coordinates and recorded several kinds of physical and biological data. We give the data only rudimentary analysis in this report, but we provide both the raw data in table form and as a GIS project for further analysis and as a basis for analyzing future trends.

We conclude the following from our brief analysis of the data.

- LWD is quite sparse in the Carmel River, with an average density of only 19 significant pieces, or accumulations in each river mile (12 occurrences/km).
- The density is not evenly distributed, but occurs in clumps, at least locally associated with land-use along the riverbank. Public lands tend to have more wood that private property, and river channels adjacent to undeveloped floodplains tend to have more wood than channels adjacent to floodplains with houses.
- Most LWD pieces are between 15 cm and 45 cm in diameter and 1.5 m to 6 m in length.
- Most wood has no significant impact on bank or bed stability. Of those pieces that have an impact, 91% have a favorable impact, either protecting the banks from scour or fostering pool formation in the bed. Only 9% of the wood was adversely stimulating bank erosion.
- The great majority of naturally occurring woody debris tends to be aligned either parallel with the bank or pointing downstream. Only a small proportion is pointing upstream. There is no obvious correlation between physical function and orientation.
- The channel morphology became more monotonous downstream from Via Mallorca to the head of the lagoon, despite the presence of LWD. The dominance of “run” habitat in this reach coincides with some of the lowest gradient channel and a change to sand-dominated substrate.

## Introduction

Large woody debris (LWD) is a key ingredient for the biological and physical health of rivers (Harmon et al., 1986; Maser and Sedell, 1994). LWD is especially linked to the life cycle of threatened Steelhead Trout (e.g., Flosi et al., 1998**)**. LWD in the Carmel River channel directly benefits wild Steelhead Trout population by providing cover from predators, creating resting-places during winter high flows, and fostering the formation of pools. Other benefits include bank protection, which reduces the input of fine sediment, and gradient control in steeper reaches. LWD also adds general physical complexity to the aquatic and riparian environment (Triska and Cromack, 1980; Franklin et al., 1981; Harmon, et al., 1986). This complexity has two main functions. First it provides hydraulic roughness that helps reduce stream velocity through added turbulence. Second, the physical and hydraulic complexity in the channel and floodplain equates to habitat complexity and greater habitat variety, supporting a broader range of biota at every strophic level, including the benthic macro invertebrates that form a large part of the Steelhead Trout diet.

Although the literature is full of references to the critical role that LWD plays in the survival of Steelhead Trout, there is little agreement on how much is too little, optimum, or too much. There is also interest in understanding the role that LWD plays in stabilizing or destabilizing streambanks and floodplains (Maser and Sedell, 1994). In particular, there are few studies quantifying the relationship between LWD orientation and its influence on bank protection or scour.

The present study provides an inventory of LWD at seven representative reaches of the Carmel River located between San Clemente Dam and the head of the Carmel Lagoon, not far from the mouth of the River (Fig. 1). The total length of the surveyed reaches is eight miles, or about 44% of the full 18 miles between the dam and the mouth. In addition to providing a catalog of each piece of wood, the data provide the opportunity to evaluate the physical function of the LWD in terms of bank protection and producing bed scour holes.

## Methods

In the Fall of 2002 (October 5 – November 20) seven reaches of the Carmel River were surveyed for LWD (Fig 1). From upstream to downstream, these reaches include Stone Pine to Lower Circle, Rosie's Bridge to deDampierre, deDampierre to the Trail and Saddle Club, Garland Park downstream from the main bridge, Scarlett to Robinson Canyon Road , Villa Mallorca Road along the Rancho Canada Golf Course, and from Rancho Canada Golf Course to the head of the Carmel Lagoon. The reaches were selected to be representative of the majority of the river, but do not represent a statistically random sample. Further surveys were planned that would have sampled the entire reach of river below San Clemente Dam, but the study prematurely ended when the first strong winter runoff made access difficult. Along the seven sample reaches, each occurrence of LWD or LWD accumulation was assigned UTM coordinates and several kinds of data were collected (Table 1). Definitions of the data are provided in Appendix A. Sample data sheets are provided in Appendix B.

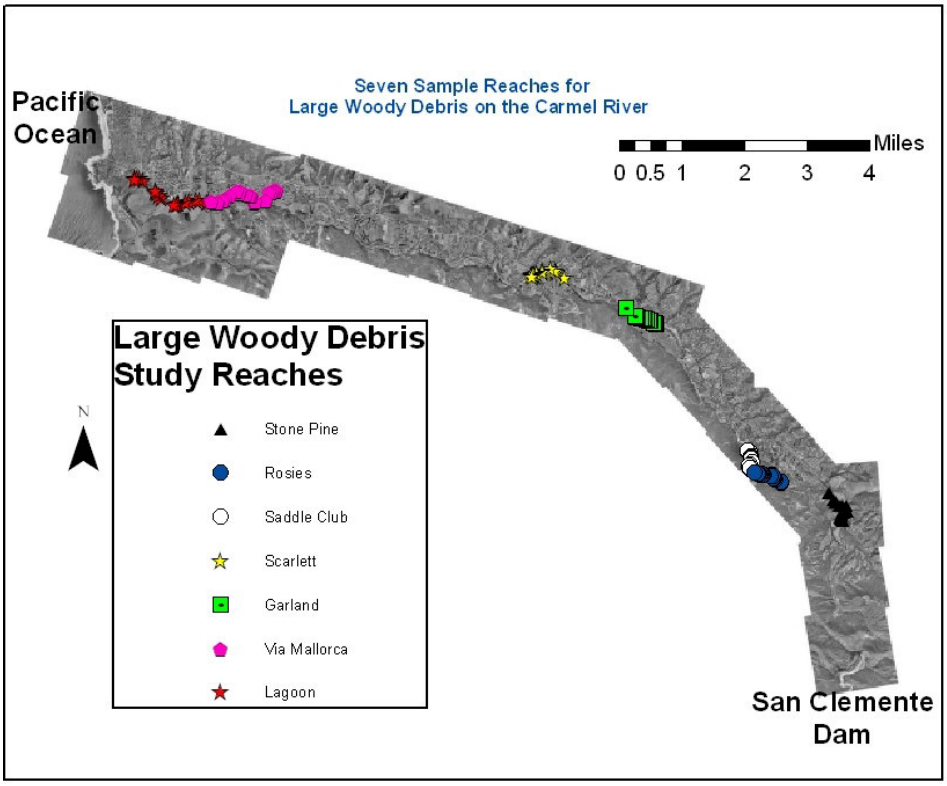


Figure 1: Sample Reaches and Distribution of LWD in Carmel River.

Table 1: Data fields for Carmel LWD

| DATA | BRIEF DESCRIPTION |
|---|---|
| Date and general river reach name | |
| Location | UTM coordinates (NAD 1983 California State Plane, feet) |
| Log type | Single, multiple, +/- rootball |
| Width | Centimeters of diameter (15 cm minimum) |
| Length | Meters (1.5 m minimum) |
| #Pieces | Estimated number of pieces in a multiple log accumulation |
| Mobility | How frequently it might move based upon elevation and embeddedness |
| Influence | Influence on bed and bank protection or scour |
| Condition | Degree of wood decay |
| Embedment | How well anchored the wood is in the bed or bank |
| Orientation | Is the wood pointing upstream, downstream, parallel or perpendicular with respect to the bank? |
| Degrees from bank | A general index of acute angle between bank and log |
| Reach type | Hydraulic habitat (pool, riffle, run, or glide) |
| Projected reach type | Estimated hydraulic habitat at approximately 200 cfs |
| Reach length | Meters of extent of reach type |
| Part of channel | Center, edge of low flow channel, bankfull channel, floodplain |
| Substrate | Visual approximation median grain size category (sand, pebble, cobble, boulder, bedrock.) |
| Species | Species of log |
| Fauna | Animal sightings during survey |
| Comments | |
| Structural size | Approximate dimensions of LWD accumulations and jams |

An ArcMap (v.8.2) GIS project was created that displays each single and multiple LWD occurrence projected on a very high resolution (0.5 ft/pixel), georeferenced aerial photograph provided by the Monterey Peninsula Water Management District (Mussetter, 2002). The attribute table in the GIS project contains all the data from the project as well.

## Results

Figures 2 through 8 are detailed maps showing the extent of each study reach and the precise locations of all LWD in the study. The project data are provided as an excel file in electronic format, and in Appendix C. A simple data summary stratified among the seven reaches is provided in Table 2.

LWD is defined in the present study as any piece of wood with at least 15 cm diameter and 1.5 m length. Approximately 150 instances of single or multiple LWD occurrences were recorded within the eight miles of surveyed river. Most pieces were between 15 cm and 45 cm in diameter and between 1.5 m and 6 m long (Table 2). The highest concentration of large pieces was found between deDampierre and the Saddle club and downstream from Via Mallorca to the head of the lagoon (Table 2).

The average density of LWD in the sampled reaches is 19 occurrences per mile (12 occurrences/km). Another way of expressing that density is one piece or accumulation every 280 feet (85 m) on average; however, the LWD was not evenly distributed along the river. For example, there is a paucity of LWD in the river adjacent to private property just downstream from Garland Park, as compared to the abundance within the Park (Fig. 5). There is a scarcity of multiple pieces of wood in the reach between Scarlet Road and Robinson Canyon, coincident with a golf course.

There is also a difference between the LWD densities found in developed and undeveloped floodplains near Camp Steffani (Fig. 2). Figure 2 illustrates the negative correlation between the density of houses on the floodplain and the density of LWD is the stream corridor. The developed reach along Camp Steffani had been regularly cleared of LWD by local agencies, including MPWMD until 1998. Therefore the reduced density of LWD there may reflect recent management activities.

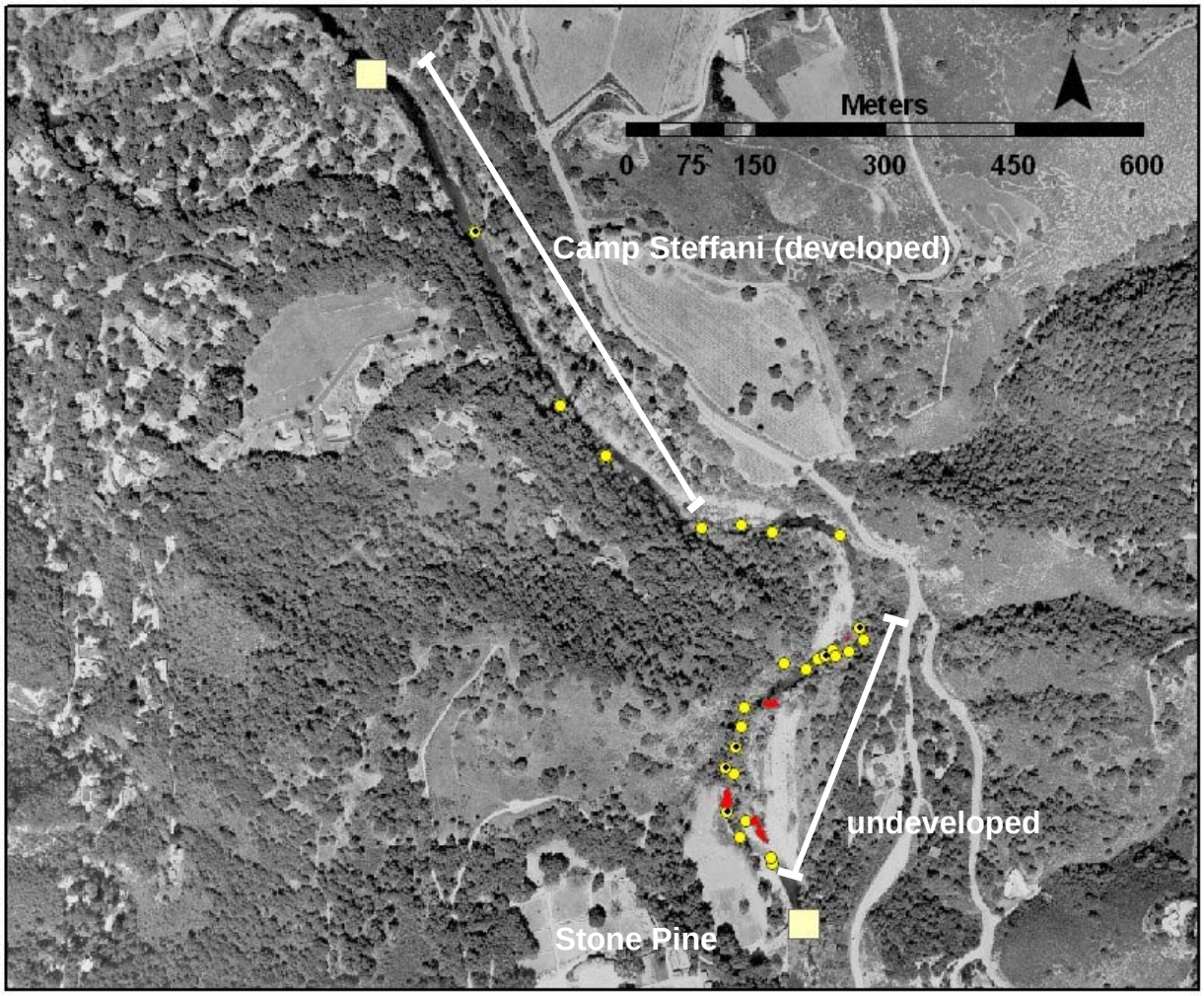


Figure 2: Details of LWD density near Camp Steffani nd Stone Pine. Dots are single pieces of wood. Concentric dots are multiple pieces of wood. Red regions are large accumulations of wood. Boxes show the ends of the survey reach.

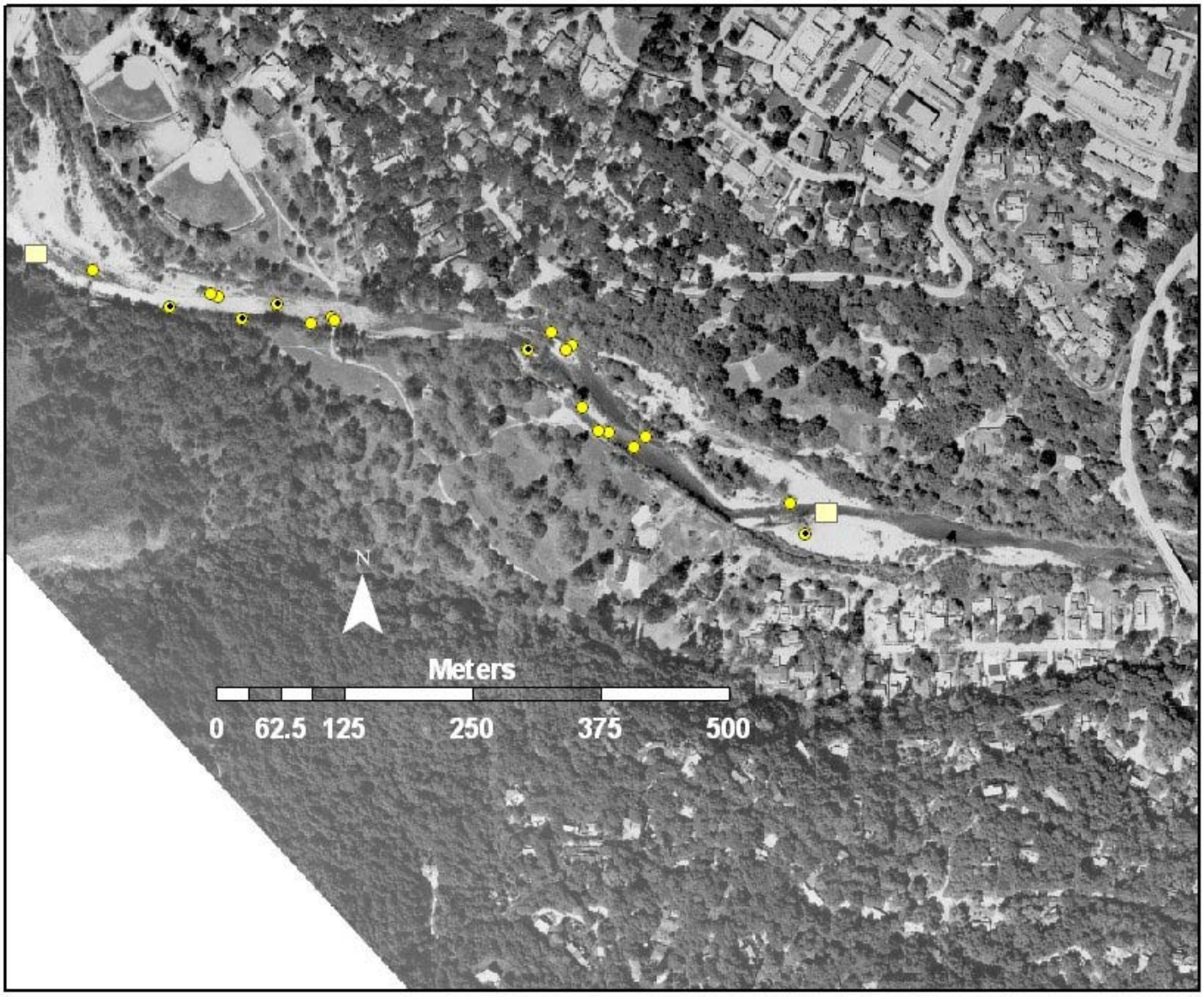


Figure 3: Details of LWD density between Rosies Bridge and deDampierre. Dots are single pieces of wood. Concentric dots are multiple pieces of wood. Boxes show the ends of the survey reach.


Figure 4: Details of LWD density along deDampierre. Dots are single pieces of wood. Concentric dots are multiple pieces of wood. Boxes show the ends of the survey reach.

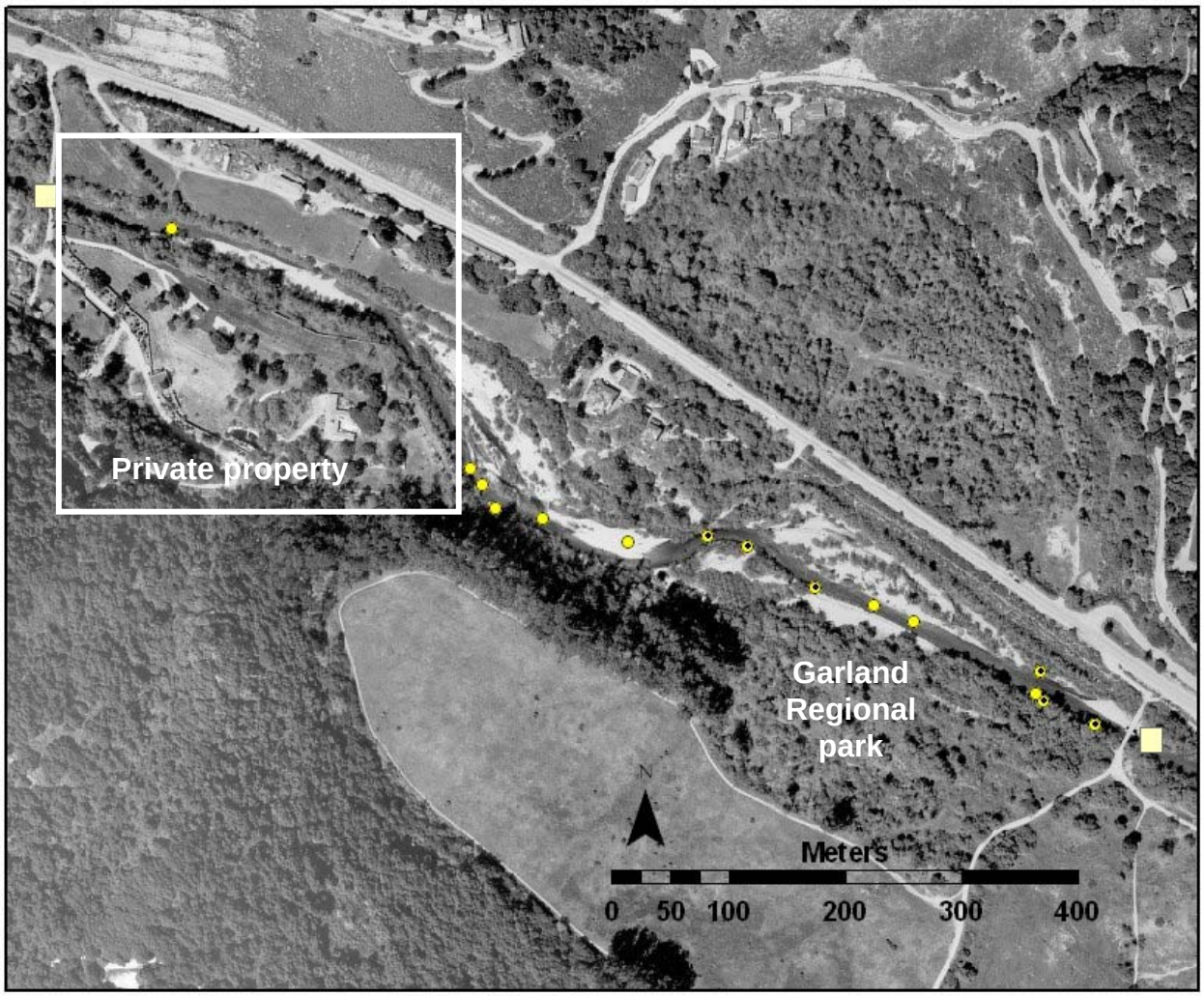


Figure 5: Details of LWD density between near downstream edge of Garland Regional Park. Dots are single pieces of wood. Concentric dots are multiple pieces of wood. Boxes show the ends of the survey reach.

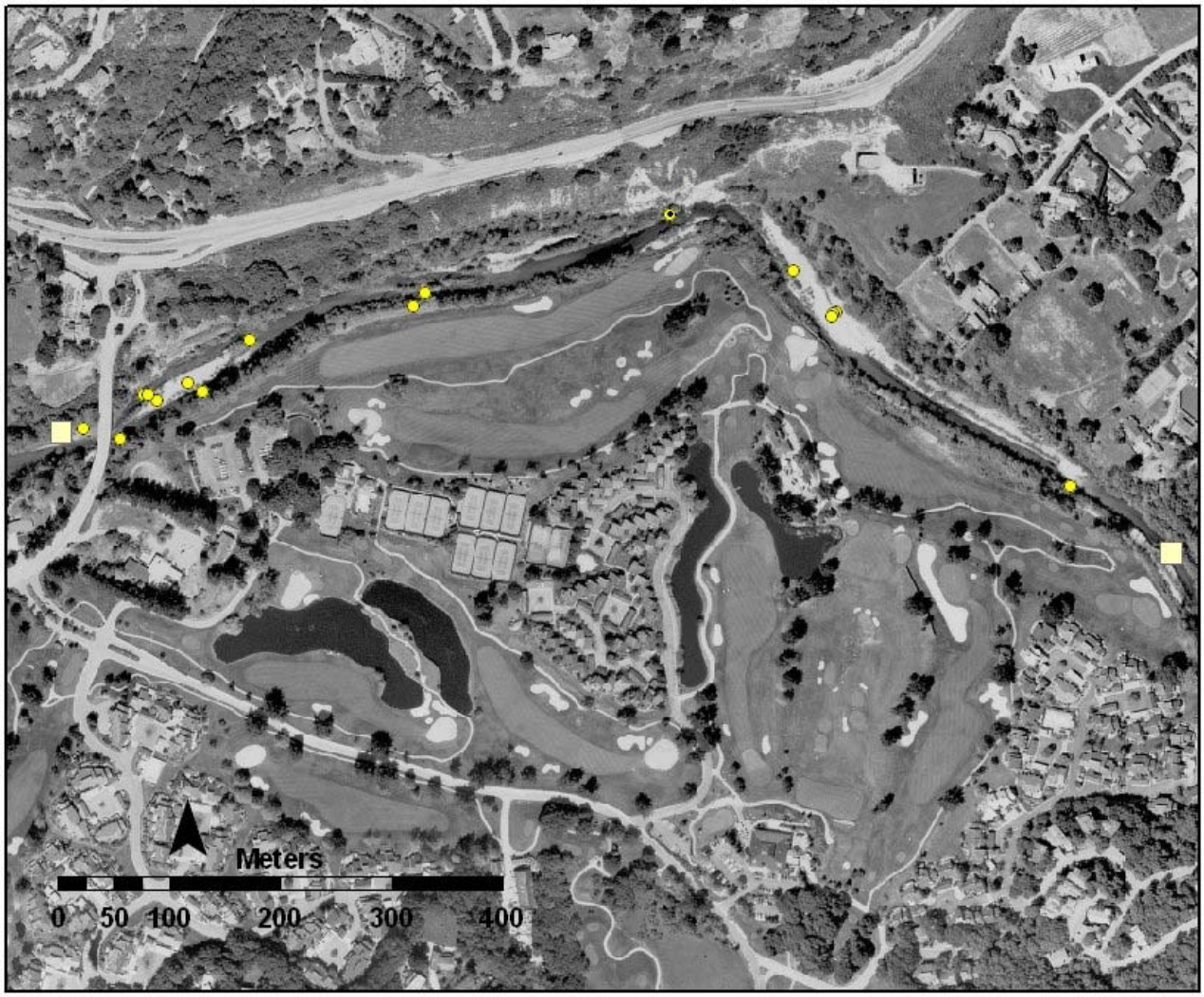


Figure 6: Details of LWD density between Scarlett Road and Robinson Canyon. Dots are single pieces of wood. Concentric dots are multiple pieces of wood. Boxes show the ends of the survey reach.

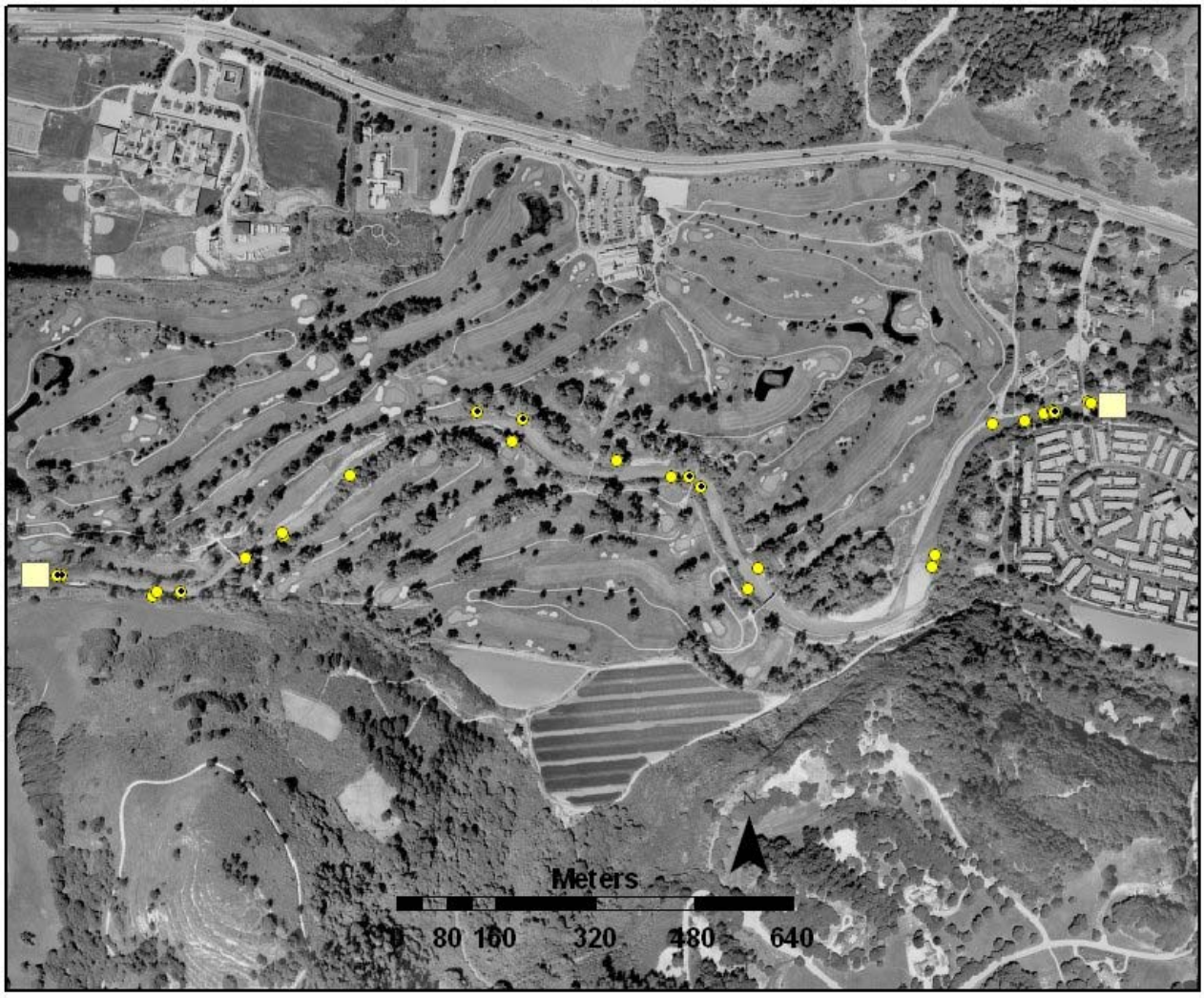


Figure 7: Details of LWD density along Rancho Canada Golf Course. Dots are single pieces of wood. Concentric dots are multiple pieces of wood. Boxes show the ends of the survey reach.

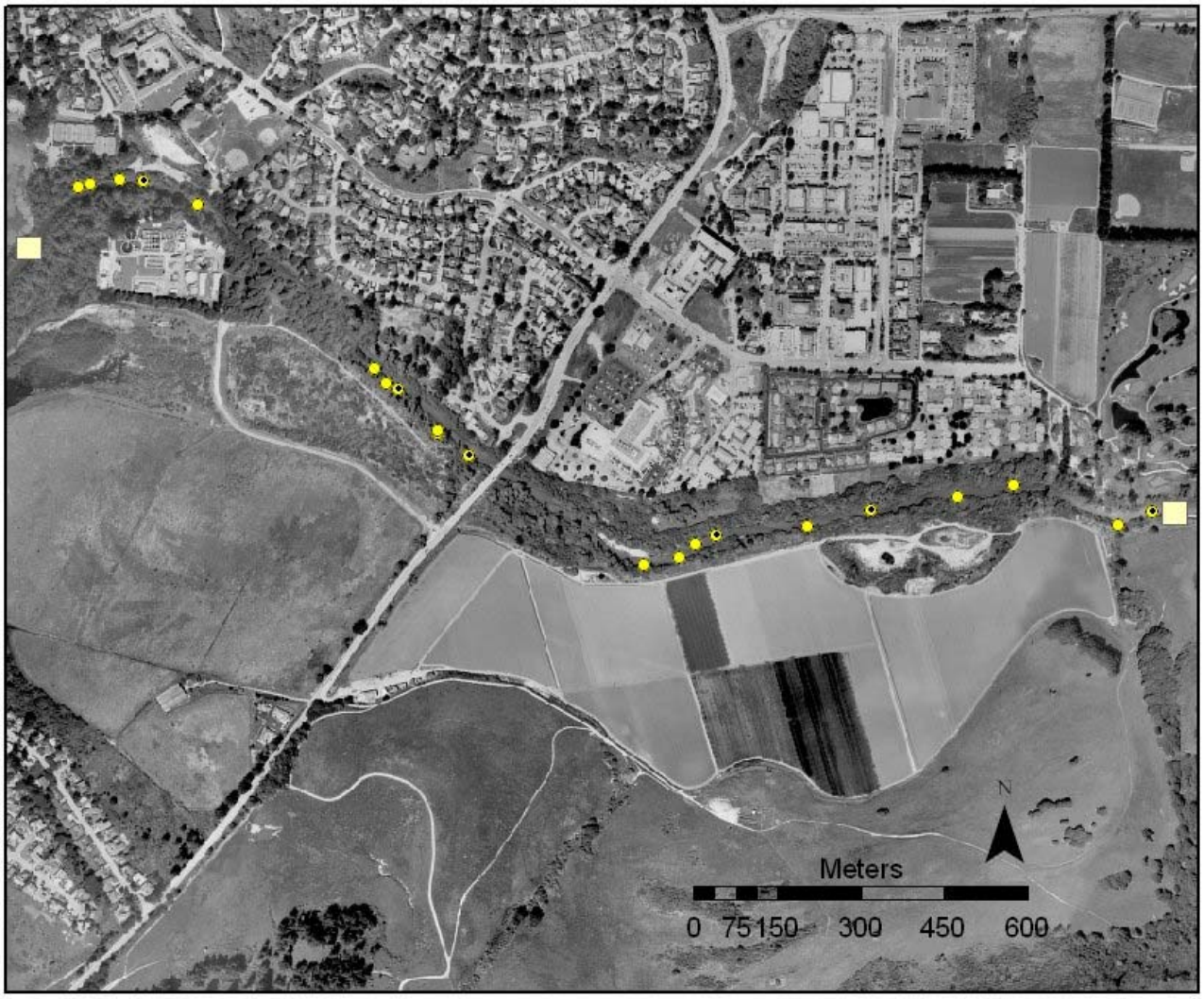


Figure 8: Details of LWD density Between the Carmel Lagoon and Rancho Canada Golf Course. Dots are single pieces of wood. Concentric dots are multiple pieces of wood. Boxes show the ends of the survey reach.

Of the approximately 150 occurrences of LWD, 33% appeared to have a morphological impact on the bank or bed (Fig. 9). Of those pieces that had a physical impact, 58% were protecting the bank, 36% were fostering pool habitat, and only 9% were inducing bank scour. The majority of LWD providing bank protection was oriented parallel to the flow or pointing downstream, in roughly equal amounts. In fact the overall data set suggests, with few exceptions, that wood naturally accumulates parallel to the bank or with the stem pointing downstream (Table 2). There is no clear relationship between the positive or negative influence on the bank and LWD orientation or angle from the bank (Appendix C). The highest incidence of bank scour was found in the two reaches downstream from Via Mallorca (Table 2). This also corresponds to the change from gravel substrate to sandy substrate and a more homogeneous hydraulic habitat (mainly "run" reach type; Table 2).

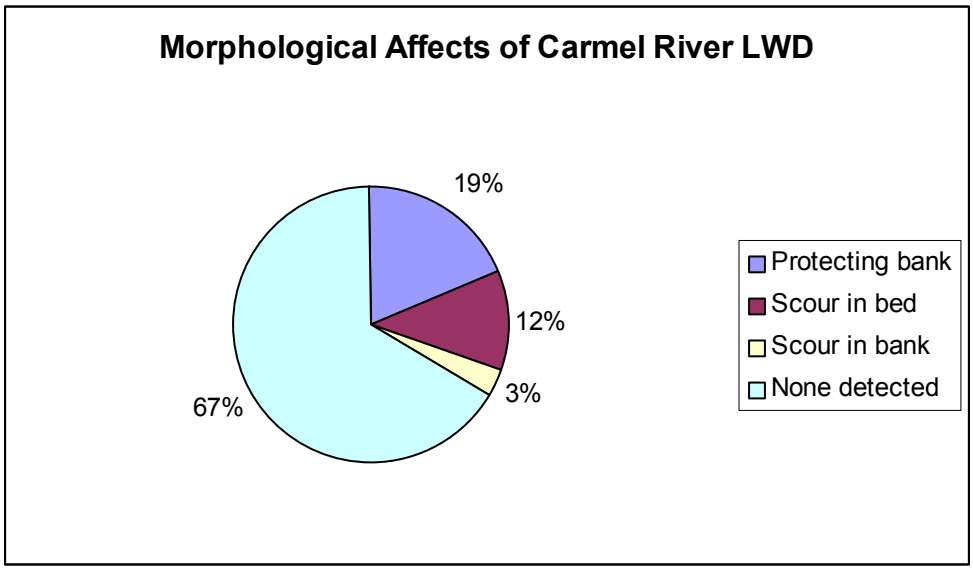


Figure 9: Morphologic Impact of LWD in the Carmel River

Fauna sightings were very sparse (Table 2). Frogs were most abundant just below Robinson Canyon Bridge. Fish were sparse in part because some of the reaches were dry. One Steelhead Trout was noted during the survey.

**Acknowledgements**

The large woody debris inventory was funded by the Monterey Peninsula Water Management District (MPWMD). We especially thank Larry Hampson (MPWMD), Beverly Chaney (MPWMD), and Dave Dettman (MPWMD) for collaboration and guidance during the work. We also appreciate the input of Marty Gingras (Calif. Dept. Fish and Game). Thanks to Lisa Grady for providing field assistance early in the project.

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Table 2: Summary Statistics of LWD Data

| | Pieces | | | | Diameter (% of total in cm ranges) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Reach** | **total** | **multiple (%)** | **single (%)** | **rootballs (%)** | **15-30 cm** | **30-45 cm** | **45-60 cm** | **>60 cm** | **unknown** |
| Stone Pine-Lower Circle | 31 | 45 | 48 | 6 | 35 | 52 | 13 | 0 | 0 |
| Rosies Bridge-deDampierre | 20 | 25 | 70 | 5 | 65 | 30 | 5 | 0 | 0 |
| deDampierre-Saddle Club | 15 | 40 | 60 | 0 | 40 | 46 | 7 | 7 | 0 |
| Garland-Scarlet | 15 | 33 | 67 | 0 | 67 | 33 | 0 | 0 | 0 |
| Scarlet-Robinson | 16 | 6 | 94 | 0 | 62 | 25 | 12 | 0 | 0 |
| Via Mallorca along R. Canada | 32 | 22 | 78 | 0 | 34 | 34 | 0 | 25 | 6 |
| Rancho Canada-Lagoon | 21 | 38 | 62 | 0 | 33 | 43 | 5 | 19 | 0 |
| **Total** | **150** | **31** | **70** | **2** | **47** | **40** | **6** | **9** | **1** |

Table 2 (continued)

| | Length (% of total in m ranges) | | | | | | | Physical function (% of total with function) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **reach** | **1.5-3 m** | **3-4.5 m** | **4.5-6 m** | **6-7.5 m** | **7.5-9 m** | **>9 m** | **unknown** | **bank prot. (%)** | **bank scour (%)** | **bed scour (%)** | **no influence (%).** |
| S.P.-L.C. | 26 | 42 | 29 | 0 | 0 | 0 | 3 | 23 | 0 | 0 | 77 |
| R.B.-deD. | 15 | 15 | 30 | 30 | 5 | 5 | 0 | 20 | 0 | 0 | 80 |
| deD.-S.C. | 47 | 20 | 13 | 0 | 0 | 20 | 0 | 13 | 7 | 13 | 67 |
| G.-S. | 27 | 67 | 0 | 0 | 6 | 0 | 0 | 7 | 13 | 7 | 73 |
| S.-R. | 19 | 56 | 6 | 12 | 0 | 6 | 0 | 12 | 0 | 0 | 88 |
| V.M.-R.C. | 28 | 25 | 6 | 6 | 6 | 22 | 6 | 12 | 0 | 9 | 78 |
| R.C.-L. | 0 | 10 | 29 | 14 | 14 | 33 | 0 | 29 | 24 | 38 | 9 |
| **Total** | **23** | **33** | **18** | **10** | **5** | **13** | **2** | **18** | **5** | **9** | **71** |

Table 2 (continued)

| | Fauna present (% of total with fauna) | | | | | Environment (% of total in specific hydraulic habitat) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **reach** | **crayfish** | **steelhead** | **other fish** | **Frog** | **none** | **riffle (%)** | **run (%)** | **pool (%)** | **glide (%)** | **unknown** | **N/A** |
| S.P.-L.C. | 0 | 0 | 0 | 0 | 100 | 19 | 42 | 23 | 3 | 3 | 10 |
| R.B.-deD. | 30 | 10 | 10 | 0 | 70 | 15 | 15 | 30 | 0 | 5 | 35 |
| deD.-S.C. | 0 | 0 | 0 | 7 | 93 | 20 | 60 | 13 | 0 | 0 | 7 |
| G.-S. | 0 | 0 | 0 | 0 | 100 | 47 | 33 | 0 | 20 | 0 | 0 |
| S.-R. | 0 | 0 | 12 | 25 | 63 | 38 | 44 | 18 | 0 | 0 | 0 |
| V.M.-R.C. | 0 | 0 | 0 | 0 | 100 | 0 | 100 | 0 | 0 | 0 | 0 |
| R.C.-L. | 0 | 0 | 0 | 0 | 100 | 0 | 100 | 0 | 0 | 0 | 0 |
| **Total** | **5** | **2** | **3** | **3** | **94** | **17** | **61** | **13** | **3** | **1** | **9** |

Table 2 (continued)

| | Part of channel (% of total in specific channel region) | | | | Mobility (% of total with specific mobility) | | |
|---|---|---|---|---|---|---|---|
| **reach** | **center** | **low flow edge** | **bankfull edge** | **floodplain** | **highly** | **peak flows** | **well-embedded** |
| S.P.-L.C. | 13 | 19 | 42 | 26 | 6 | 42 | 52 |
| R.B.-deD. | 20 | 35 | 5 | 40 | 25 | 45 | 30 |
| deD.-S.C. | 20 | 47 | 20 | 13 | 26 | 27 | 47 |
| G.-S. | 0 | 40 | 53 | 7 | 0 | 7 | 93 |
| S.-R. | 13 | 31 | 31 | 25 | 6 | 31 | 63 |
| V.M.-R.C. | 16 | 28 | 44 | 12 | 9 | 34 | 56 |
| R.C.-L. | 0 | 67 | 33 | 0 | 5 | 38 | 57 |
| **Total** | **13** | **37** | **34** | **19** | **11** | **35** | **56** |

**Appendix A: Carmel River LWD Data Sheet Instructions**
2/11/03

In the excel file, there are three tabs of data sheets. One for single pieces, one for multiple pieces, and one for rootballs only. This was done because there are some different questions for each type and they wouldn't all fit on one page.

**General location**: what stretch we were in that day, general river mile, perhaps a cross-street or a bridge we started at.

**Site**: at the top of each column in the gray bar we entered, Pt. 1 (GPS) and the time on the GPS unit so that we could identify the points later in the lab. (using the time on your watch will never quite match up and cause frustration later, we did that once) ex. 1 2:45

**Type of Reach**: P / RN / G / RI
P = pool, RN = run, G = glide, RI = riffle
We recorded both the current type and projected with 2 feet of water since there was some roundtable discussion suggesting that we should imagine the environment at 200 cfs, about 2 feet higher than base flow.

**Estimated reach length (m):** except for the small features, some of which we measured, this was estimated. We never used a laser.

**Part of channel**: LB/RB
LB = left bank, RB = right bank (looking down river)

**Type of substrate**: S / G / C / B / BR
S = sand, G = gravel, C = cobble, B = boulders, BR = bedrock
Concentrating on the area around the log, not the whole reach, which was sometimes different.

**Width (cm**): We recorded this diameter in ranges, 15 cm being the smallest possible width.
15-30, 30-45, 45-60, 60-75 …etc.
We used a tape measure at first, and then were able to estimate mostly by sight.
For multiple pieces, a width range that applied to most of the pieces present was estimated. For rootball only sites, we estimated the size, for example, 2x2 m. Since there weren't logs attached to them we didn't measure log length. (If there was a log attached, it would have been recorded on the 'Single Piece' sheet as having a rootball.)

**Length (m):** Also in ranges, 1.5 m each, with 1.5m being the shortest possible.
1.5-3, 3-4.5, 4.5-6, 6-7.5 …etc.
For multiple pieces, a length range that applied to most of the pieces present was estimated.

**Size of entire structure (m)**: Only applies to multiple log sites. For example, estimated 10 x 6m. The true size of some accumulations was stunning. Just classifying as a "jam" couldn't always communicate the true size.

**# pieces greater 15cm diameter**: Only applies to multiple log sites. If it was few enough to count, we counted them. Most importantly we noted accumulation or jam status here.
Accumulation = < 10 logs touching
Jam = > 10 logs touching

**Condition:**
Live = green leaves (this does not include live willows whose roots were still in the bank, only log fragments that appeared to be sprouting in their new locations)
Little or no decomposition = the bark is still on, looks freshly introduced
Partially decomposed = bark missing, looks like been in the river for a while
Significantly decomposed = if we were to step on it, pieces would come off

**Embedment**: qualitative judgment of how well the wood was buried in the bed or bank

**Mobility:**
Highly mobile = we think that the wood will be carried in a low magnitude flow.
Mobile when bed moves = applied to pieces generally stuck in the center of the river
Mobile when vegetation/bank moves = if we lost the bank or bushes it would move
Mobile only on highest flows = it is too high in elevation for anything but a flood to ever move it

**Orientation:**
us = upstream, ds = downstream, pf = parallel to flow

**Degrees off bank:**
< 30 / > 30
This only applies if log is partially on the bank. Is the angle off the bank less than or greater than 30 degrees? Did not apply to multiple pieces since pieces were often pointing in every possible direction. Does not apply to rootballs.

**Influence** on stream morphology: put an X next to each box that you see morphology affected by the LWD.

**Type of wood/species**: we wrote this in by hand. Lack of bark and leaves made this usually unknown.

**Fauna:** put an X next to each fauna type you see. Even though fauna is at the bottom of the sheet, we were always looking for it first as we approached each site since our presence would often scare it away.

**Additional comments**: anything else interesting or identifiable about the site

Note that in some cases, an entry of "N/A" in the data table indicates that the data are not applicable to the LWD occurrence, such as for the orientation of an accumulation of LWD pieces. However, in some cases, technicians used "N/A" to indicate missing data.

## Appendix B: Sample Data Sheets

| DATA SHEET: SINGLE PIECE | | | | | |
|---|---|---|---|---|---|
| **Date:** | | | | | |
| **Surveyors:** | | | | | |
| **General Location:** | | | | | |
| | | | | | |
| **SITE:** | | | | | |
| **Type of reach (currently)** | P / RN / G / RI | P / RN / G / RI | P / RN / G / RI | P / RN / G / RI | P / RN / G / RI |
| **Type of reach (projected 200 cfs)** | P / RN / G / RI | P / RN / G / RI | P / RN / G / RI | P / RN / G / RI | P / RN / G / RI |
| **Estimated reach length (m)** | | | | | |
| **Part of Channel** | | | | | |
| low flow bank | LB / RB | LB / RB | LB / RB | LB / RB | LB / RB |
| floodplain/bench | LB / RB | LB / RB | LB / RB | LB / RB | LB / RB |
| bankfull streambank | LB / RB | LB / RB | LB / RB | LB / RB | LB / RB |
| **Type of Substrate:** | S / G / C / B / BR | S / G / C / B / BR | S / G / C / B / BR | S / G / C / B / BR | S / G / C / B / BR |
| **WOOD DESCRIPTION** | | | | | |
| **Rootball present** | Y / N | Y / N | Y / N | Y / N | Y / N |
| **Width (cm)** | | | | | |
| **Length (m)** | | | | | |
| **Condition** | | | | | |
| live | | | | | |
| little or no decomposition | | | | | |
| partially decomposed | | | | | |
| significantly decomposed | | | | | |
| **Embedment** | | | | | |
| no embedment | | | | | |
| partial to fully in bed | | | | | |
| partial in vegetation/bank | | | | | |
| fully embedded w/veg | | | | | |
| **Mobility Scale** | | | | | |
| 1) highly mobile | | | | | |
| 2) mobile when bed moves | | | | | |
| 3) mobile when veg/bank moves | | | | | |
| 4) mobile only on highest flows | | | | | |
| **Orientation** | us / ds / pf | us / ds / pf | us / ds / pf | us / ds / pf | us / ds / pf |
| **Degrees off bank** | < 30 / > 30 | < 30 / > 30 | < 30 / > 30 | < 30 / > 30 | < 30 / > 30 |
| **Influence on stream morphology** | | | | | |
| none detected | | | | | |
| scour hole in bed | | | | | |
| scour along bank | | | | | |
| protecting bank | | | | | |
| **Type of wood/species:** Oak/ | | | | | |
| Buckeye/Cottonwood/Alder/Pine/ | | | | | |
| Sycamore/Willow/Mix/Unknown | | | | | |
| **Fauna: cf/bf/sh/wpt/rlf/htch/stk/** | | | | | |
| Crayfish | | | | | |
| Bullfrog | | | | | |
| Steelhead | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Western pond turtle | | | | | |
| Red legged frog | | | | | |
| Hitch, Stickleback | | | | | |
| None detected | | | | | |
| Other | | | | | |
| **Additional Comments:** | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

| **DATA SHEET: MULTIPLE PIECES** | | | | | |
|---|---|---|---|---|---|
| **Date:** | | | | | |
| **Surveyors:** | | | | | |
| **General Location:** | | | | | |
| | | | | | |
| **SITE:** | | | | | |
| **Type of reach (currently)** | P / RN / G / RI | P / RN / G / RI | P / RN / G / RI | P / RN / G / RI | P / RN / G / RI |
| **Type of reach (projected 200 cfs)** | P / RN / G / RI | P / RN / G / RI | P / RN / G / RI | P / RN / G / RI | P / RN / G / RI |
| **Estimated reach length (m)** | | | | | |
| **Part of Channel** | | | | | |
| low flow bank | LB / RB | LB / RB | LB / RB | LB / RB | LB / RB |
| floodplain/bench | LB / RB | LB / RB | LB / RB | LB / RB | LB / RB |
| bankfull streambank | LB / RB | LB / RB | LB / RB | LB / RB | LB / RB |
| **Type of Substrate:** | S / G / C / B / BR | S / G / C / B / BR | S / G / C / B / BR | S / G / C / B / BR | S / G / C / B / BR |
| **WOOD DESCRIPTION** | | | | | |
| **Rootballs present** | Y / N | Y / N | Y / N | Y / N | Y / N |
| **Avg width of pieces (cm)** | | | | | |
| **Avg length of pieces (m)** | | | | | |
| **Size of entire structure (m)** | | | | | |
| **# pieces > 15 cm wide** | | | | | |
| **Condition** | | | | | |
| live | | | | | |
| little or no decomposition | | | | | |
| partially decomposed | | | | | |
| significantly decomposed | | | | | |
| **Embedment** | | | | | |
| no embedment | | | | | |
| partial to fully in bed | | | | | |
| partial in vegetation/bank | | | | | |
| fully embedded w/veg | | | | | |
| **Mobility Scale** | | | | | |
| 1) highly mobile | | | | | |
| 2) mobile when bed moves | | | | | |
| 3) mobile when veg/bank moves | | | | | |
| 4) mobile only on highest flows | | | | | |
| **Influence on stream morphology** | | | | | |
| none detected | | | | | |
| scour hole in bed | | | | | |
| scour along bank | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| protecting bank | | | | | |
| **Type of wood/species:** Oak/ | | | | | |
| Buckeye/Cottonwood/Alder/Pine/ | | | | | |
| Sycamore/Willow/Mix/Unknown | | | | | |
| **Fauna: cf/bf/sh/wpt/rlf/htch/stk/** | | | | | |
| Crayfish | | | | | |
| Bullfrog | | | | | |
| Steelhead | | | | | |
| Western pond turtle | | | | | |
| Red legged frog | | | | | |
| Hitch, Stickleback | | | | | |
| None detected | | | | | |
| Other | | | | | |
| **Additional Comments:** | | | | | |

| **DATA SHEET: ROOTBALL ONLY** | | | | | |
|---|---|---|---|---|---|
| **Date:** | | | | | |
| **Surveyors:** | | | | | |
| **General Location:** | | | | | |
| | | | | | |
| **SITE:** | | | | | |
| **Type of reach (currently)** | P / RN / G / RI | P / RN / G / RI | P / RN / G / RI | P / RN / G / RI | P / RN / G / RI |
| **Type of reach (projected 200 cfs)** | P / RN / G / RI | P / RN / G / RI | P / RN / G / RI | P / RN / G / RI | P / RN / G / RI |
| **Estimated reach length (m)** | | | | | |
| **Part of Channel** | | | | | |
| low flow bank | LB / RB | LB / RB | LB / RB | LB / RB | LB / RB |
| floodplain/bench | LB / RB | LB / RB | LB / RB | LB / RB | LB / RB |
| bankfull streambank | LB / RB | LB / RB | LB / RB | LB / RB | LB / RB |
| **Type of Substrate:** | S / G / C / B / BR | S / G / C / B / BR | S / G / C / B / BR | S / G / C / B / BR | S / G / C / B / BR |
| **WOOD DESCRIPTION** | | | | | |
| **Width / Length (m)** | | | | | |
| **Condition** | | | | | |
| live | | | | | |
| little or no decomposition | | | | | |
| partially decomposed | | | | | |
| significantly decomposed | | | | | |
| **Embedment** | | | | | |
| no embedment | | | | | |
| partial to fully in bed | | | | | |
| partial in vegetation/bank | | | | | |
| fully embedded w/veg | | | | | |
| **Mobility Scale** | | | | | |
| 1) highly mobile | | | | | |
| 2) mobile when bed moves | | | | | |
| 3) mobile when veg/bank moves | | | | | |
| 4) mobile only on highest flows | | | | | |
| **Influence on stream morphology** | | | | | |
| none detected | | | | | |
| scour hole in bed | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| scour along bank | | | | | |
| protecting bank | | | | | |
| **Type of wood/species:** Oak/ | | | | | |
| Buckeye/Cottonwood/Alder/Pine/ | | | | | |
| Sycamore/Willow/Mix/Unknown | | | | | |
| **Fauna: cf/bf/sh/wpt/rlf/htch/stk/** | | | | | |
| Crayfish | | | | | |
| Bullfrog | | | | | |
| Steelhead | | | | | |
| Western pond turtle | | | | | |
| Red legged frog | | | | | |
| Hitch, Stickleback | | | | | |
| None detected | | | | | |
| Other | | | | | |
| **Additional Comments:** | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**Appendix C: 2002 LWD Data (See Appendix A for data definitions)**

| | **Stone Pine Reach of the Carmel River** | | | | | | **Nov. 6, 2002** |
|---|---|---|---|---|---|---|---|
| Pt # | LOG TYPE | WIDTH(CM) | LENGTH(M) | # PIECES | MOBILITY | INFLUENCE | CONDITION |
| 1 | single | 30-45 | 3-4.5 | N/A | highest flows | none detected | little/no decomp |
| 2 | single | 15-30 | 3-4.5 | N/A | veg/bank moves | none detected | part decomp |
| 3 | single | 30-45 | 4.5-6 | N/A | veg/bank moves | none detected | little/no decomp |
| 4 | multiple | 30-45 | 3-4.5 | 3 | highest flows | none detected | little/no decomp |
| 5 | multiple w/rb | 45-60 | 4.5-6 | 10+ | highest flows | none detected | part decomp |
| 6 | multiple | 30-45 | 4.5-6 | 10+ | highest flows | none detected | part decomp |
| 7 | multiple w/rb | 15-30 | 4.5-6 | 3 | veg/bank moves | protect bank | little/no decomp |
| 8 | multiple | 30-45 | 4.5-6 | 2 | veg/bank moves | none detected | little/no decomp |
| 9 | single | 15-30 | 1.5-3 | N/A | veg/bank moves | none detected | little/no decomp |
| 10 | multiple | 15-30 | 1.5-3 | 8 | highest flows | none detected | part decomp |
| 11 | multiple w/rb | 15-30 | 3-4.5 | unknown | veg/bank moves | none detected | little/no decomp |
| 12 | single | 15-30 | 1.5-3 | N/A | highly mobile | none detected | little/no decomp |
| 13 | rootball | 15-30 | 1.5-3 | N/A | when bed moves | protect bank | part decomp |
| 14 | single | 15-30 | 1.5-3 | N/A | highly mobile | none detected | part decomp |
| 15 | multiple | 15-30 | 1.5-3 | 4 | veg/bank moves | none detected | part decomp |
| 16 | single | 45-60 | 4.5-6 | N/A | highest flows | protect bank | little/no decomp |
| 17 | multiple w/rb | 15-30 | 4.5-6 | 6 | veg/bank moves | protect bank | live |
| 18 | rootball | 45-60 | 1.5-3 | N/A | highest flows | none detected | little/no decomp |
| 19 | single | 30-45 | 4.5-6 | N/A | veg/bank moves | protect bank | live |
| 20 | single | 30-45 | 3-4.5 | N/A | veg/bank moves | none detected | part decomp |
| 21 | single w/rb | 30-45 | 3-4.5 | N/A | veg/bank moves | none detected | little/no decomp |
| 22 | single | 45-60 | 3-4.5 | N/A | highest flows | none detected | little/no decomp |
| 23 | single w/rb | 30-45 | 3-4.5 | N/A | highest flows | protect bank | little/no decomp |
| 24 | single w/rb | 15-30 | 3-4.5 | N/A | veg/bank moves | none detected | little/no decomp |
| 25 | single w/rb | 30-45 | 3-4.5 | N/A | highest flows | none detected | part decomp |
| 26 | multiple | 30-45 | 3-4.5 | 4 | veg/bank moves | protect bank | little/no decomp |
| 27 | single | 30-45 | 1.5-3 | N/A | when bed moves | none detected | little/no decomp |
| 28 | multiple | 30-45 | | unknown | highest flows | none detected | part decomp |
| 29 | multiple | 30 | 5 | 30+ | highest flows | none detected | part decomp |
| 30 | multiple | 30 | 3 | 10+ | highest flows | none detected | part decomp |
| 31 | multiple | 30 | 4 | 10+ | veg/bank moves | none detected | part decomp |

| | **Stone Pine Reach of the Carmel River (continued)** | | | | | | |
|---|---|---|---|---|---|---|---|
| Pt # | EMBEDMENT | ORIENTATION | DEG OFF BANK | REACH_TYPE | PROJECTED(200CFS) | REACH LENGTH (M) | PART OF CHANNEL |
| 1 | part/full bed | N/A | N/A | riffle | riffle | 30 | center |
| 2 | part veg/bank | pf | 0 | riffle | riffle | 30 | RB low flow bank |
| 3 | part veg/bank | pf | 0 | pool | pool | 20 | LB bankfull streambank |
| 4 | no embed | N/A | N/A | unknown | unknown | N/A | RB bankfull streambank |
| 5 | part veg/bank | N/A | N/A | pool | pool | N/A | LB bankfull streambank |
| 6 | fully w/veg | N/A | N/A | riffle | riffle | 100 | RB floodplain/bench |
| 7 | part veg/bank | N/A | N/A | run | run | 100+ | LB low flow bank |
| 8 | part veg/bank | N/A | N/A | run | run | 100+ | LB bankfull streambank |
| 9 | no embed | ds | unknown | run | run | 100+ | RB bankfull streambank |
| 10 | part veg/bank | N/A | N/A | run | run | 100+ | LB bankfull streambank |
| 11 | part veg/bank | N/A | N/A | pool | pool | 100+ | LB bankfull streambank |
| 12 | no embed | pf | 0 | pool | pool | 100+ | center |
| 13 | part/full bed | N/A | N/A | pool | pool | 100+ | RB low flow bank |
| 14 | no embed | perp | 90 | glide | glide | 10 | center |
| 15 | part veg/bank | N/A | N/A | riffle | riffle | 15 | LB bankfull streambank |
| 16 | part veg/bank | N/A | N/A | riffle | riffle | 10 | RB bankfull streambank |
| 17 | part/full bed | N/A | N/A | run | run | 20 | RB bankfull streambank |
| 18 | part/full bed | N/A | N/A | run | run | 50 | RB low flow bank |
| 19 | part veg/bank | ds | unknown | run | run | 50 | LB low flow bank |
| 20 | part veg/bank | ds | unknown | pool | pool | 150 | RB low flow bank |
| 21 | part veg/bank | ds | unknown | riffle | riffle | 10 | LB floodplain/bench |
| 22 | no embed | pf | 0 | N/A | N/A | N/A | RB floodplain/bench |
| 23 | part veg/bank | pf | 0 | run | run | N/A | RB floodplain/bench |
| 24 | part veg/bank | pf | 0 | run | run | 100 | LB bankfull streambank |
| 25 | fully w/veg | N/A | N/A | run | run | 100 | LB floodplain/bench |
| 26 | fully w/veg | N/A | N/A | run | run | 50 | LB bankfull streambank |
| 27 | part/full bed | perp | 90 | run | run | 300+ | center |
| 28 | part veg/bank | N/A | N/A | N/A | N/A | N/A | RB floodplain/ bench |
| 29 | part veg/bank | N/A | N/A | N/A | N/A | N/A | LB floodplain/bench |
| 30 | part veg/bank | N/A | N/A | pool | pool | 100 | RB bankfull streambank |
| 31 | part veg/bank | N/A | N/A | run | run | 20 | LB floodplain/bench |

| | Stone Pine Reach of the Carmel River (continued) | | | | |
|---|---|---|---|---|---|
| Pt # | SUBSTRATE | SPECIES | FAUNA | COMMENTS | STRUC SIZE(M) |
| 1 | cobble | unknown | none | | N/A |
| 2 | cobble | unknown | none | | N/A |
| 3 | cobble | unknown | none | | N/A |
| 4 | cobble | cottonwood | none | | 5 |
| 5 | cobble | cottonwood | none | | 3 x 10 |
| 6 | sand | unknown | none | | 5 x 10 |
| 7 | cobble | cottonwood | none | | 2 x 6 |
| 8 | boulder | cottonwood | none | | 1 x 6 |
| 9 | sand | alder | none | angled70-80 ds | N/A |
| 10 | boulder | unknown | none | | 3 x 5 |
| 11 | sand | cottonwood | none | | 2 x 5 |
| 12 | N/A | unknown | none | | N/A |
| 13 | cobble | unknown | none | | N/A |
| 14 | cobble | alder | none | creating pool | N/A |
| 15 | cobble | unknown | none | | 1 x 4 |
| 16 | sand | unknown | none | root complex | N/A |
| 17 | cobble | willow | none | creating pool | 2 x 8 |
| 18 | cobble | cottonwood | none | | N/A |
| 19 | sand | alder | none | | N/A |
| 20 | cobble | unknown | none | | N/A |
| 21 | cobble | cottonwood | none | | N/A |
| 22 | cobble | sycamore | none | | N/A |
| 23 | cobble | sycamore | none | | N/A |
| 24 | cobble/sand | unknown | none | | N/A |
| 25 | cobble | unknown | none | | N/A |
| 26 | cobble | unknown | none | | 2 x 6 |
| 27 | gravel | unknown | none | | N/A |
| 28 | cobble | mixed | none | very large | unknown |
| 29 | cobble | mixed | none | | 6 x 10 m |
| 30 | cobble | unknown | none | | unknown |
| 31 | cobble | unknown | none | | unknown |

| | **Rosies Bridge to deDampierre Reach of the Carmel River** | | | | | | **Oct. 5, 2002** |
|---|---|---|---|---|---|---|---|
| Pt # | LOG TYPE | WIDTH(CM) | LENGTH(M) | # PIECES | MOBILITY | INFLUENCE | CONDITION |
| 1 | multiple w/rb | 45-60 | 1.5-3 | 10+ | highest flows | none detected | little/no decomp |
| 2 | single | 15-30 | 4.5-6 | N/A | highly mobile | none detected | little/no decomp |
| 3 | single w/rb | 30-45 | 9-10.5 | N/A | veg/bank moves | protecting bank | little/no decomp |
| 4 | single | 15-30 | 6-7.5 | N/A | highly mobile | none detected | little/no decomp |
| 5 | single | 30-45 | 6-7.5 | N/A | highest flows | none detected | partially decomp |
| 6 | single | 15-30 | 6-7.5 | N/A | highest flows | none detected | little/no decomp |
| 7 | multiple w/rb | 30-45 | 3-4.5 | 4 | highest flows | none detected | partially decomp |
| 8 | multiple w/rb | 15-30 | 4.5-6 | 10+ | veg/bank moves | none detected | little/no decomp |
| 9 | single | 15-30 | 6-7.5 | N/A | veg/bank moves | none detected | little/no decomp |
| 10 | multiple w/rb | 15-30 | 4.5-6 | 2 | highest flows | none detected | partially decomp |
| 11 | single w/rb | 15-30 | 4.5-6 | N/A | highest flows | none detected | partially decomp |
| 12 | single | 15-30 | 6-7.5 | N/A | veg/bank moves | none detected | little/no decomp |
| 13 | rootball | 30-45 | 1.5-3 | N/A | highest flows | protecting bank | live |
| 14 | single | 15-30 | 7.5-9 | N/A | highly mobile | none detected | little/no decomp |
| 15 | single | 15-30 | 3-4.5 | N/A | highly mobile | none detected | partially decomp |
| 16 | single | 30-45 | 4.5-6 | N/A | when bed moves | protecting bank | little/no decomp |
| 17 | single | 15-30 | 6-7.5 | N/A | highest flows | none detected | partially decomp |
| 18 | multiple | 15-30 | 3-4.5 | 10+ | highest flows | none detected | partially decomp |
| 19 | single | 30-45 | 4.5-6 | N/A | veg/bank moves | protecting bank | little/no decomp |
| 20 | single | 15-30 | 1.5-3 | N/A | highly mobile | none detected | signif decomp |

| | **Rosies bridge to deDampierre Reach of the Carmel River (continued)** | | | | | | |
|---|---|---|---|---|---|---|---|
| Pt # | EMBEDMENT | ORIENTATION | DEG OFF BANK | REACH_TYPE | PROJECTED(200CFS) | REACH LENGTH (M) | PART OF CHANNEL |
| 1 | no embedment | N/A | N/A | N/A | N/A | N/A | LB floodplain/bench |
| 2 | no embedment | ds | >30 | riffle | run | 300+ | RB bankfull streambank |
| 3 | partial veg/bank | pf | 0 | riffle | riffle | 15 | RB low flow bank |
| 4 | no embedment | pf | 0 | riffle | riffle | 15 | center |
| 5 | no embedment | unknown | unknown | N/A | N/A | N/A | LB floodplain/bench |
| 6 | no embedment | unknown | unknown | N/A | N/A | N/A | LB floodplain/bench |
| 7 | no embedment | N/A | N/A | N/A | N/A | N/A | LB floodplain/bench |
| 8 | fully embed w/veg | N/A | N/A | pool | pool | 50 | RB low flow bank |
| 9 | fully embed w/veg | ds | <30 | run | run | 30 | RB low flow bank |
| 10 | fully embed w/veg | N/A | N/A | unknown | unknown | unknown | center |
| 11 | fully embed w/veg | ds | N/A | pool | run | N/A | LB floodplain/bench |
| 12 | no embedment | N/A | N/A | pool | pool | 12 | center |
| 13 | partial/fully in bed | N/A | N/A | pool | pool | 2 | LB low flow bank |
| 14 | no embedment | perp | 90 | run | run | 100 | center |
| 15 | no embedment | pf | 0 | N/A | N/A | N/A | RB floodplain/bench |
| 16 | partial/fully in bed | ds | 30 | run | run | 150 | LB low flow bank |
| 17 | no embedment | N/A | N/A | N/A | N/A | N/A | RB floodplain/bench |
| 18 | fully embed w/veg | N/A | N/A | N/A | N/A | N/A | RB floodplain/bench |
| 19 | partial veg/bank | pf | 0 | pool | run | 300+ | LB low flow bank |
| 20 | partial veg/bank | pf | 0 | pool | run | 300+ | RB low flow bank |

| | **Rosies bridge to deDampierre Reach of the Carmel River (continued)** | | | | |
|---|---|---|---|---|---|
| Pt # | SUBSTRATE | SPECIES | FAUNA | COMMENTS | STRUC SIZE(M) |
| 1 | cobble/boulder | unknown | none | ouside of active channel | N/A |
| 2 | cobble/boulder | alder | crayfish, steelhead | | N/A |
| 3 | cobble | sycamore | none | | N/A |
| 4 | cobble | unknown | none | | N/A |
| 5 | cobble | sycamore | none | | N/A |
| 6 | cobble | unknown | none | | N/A |
| 7 | cobble/boulder | unknown | none | | 10 |
| 8 | cobble | unknown | crayfish | | 10 |
| 9 | cobble | willow | crayfish | | N/A |
| 10 | cobble | unknown | none | up on mound in center | 7 |
| 11 | cobble | unknown | none | | N/A |
| 12 | gravel | unknown | crayfish | in pool behind mound | N/A |
| 13 | cobble/sand | willow | crayfish,stickleback,steelhead | wedged under girlscout bridge | N/A |
| 14 | gravel | unknown | none | perpendicular to entire stream | N/A |
| 15 | cobble | unknown | none | | N/A |
| 16 | unknown | unknown | none | | N/A |
| 17 | cobble | unknown | none | | N/A |
| 18 | cobble | unknown | none | | 6 x 8 |
| 19 | cobble | unknown | crayfish, stickleback | | N/A |
| 20 | cobble | unknown | none | | N/A |

| | **deDampierre to Saddle Club Reach of the Carmel River** | | | | | | **Oct. 14, 2002** |
|---|---|---|---|---|---|---|---|
| Pt # | LOG TYPE | WIDTH(CM) | LENGTH(M) | # PIECES | MOBILITY | INFLUENCE | CONDITION |
| 1 | multiple | 15-30 | 1.5-3 | 2 | veg/bank moves | none detected | partially decomp |
| 2 | single | 30-45 | 1.5-3 | N/A | highly mobile | none detected | partially decomp |
| 3 | multiple | 30-45 | 1.5-3 | 4 | veg/bank moves | none detected | partially decomp |
| 4 | multiple | 30-45 | 3-4.5 | 2 | veg/bank moves | none detected | little/no decomp |
| 5 | single | 30-45 | 3-4.5 | N/A | veg/bank moves | protecting bank | little/no decomp |
| 6 | single | 30-45 | 1.5-3 | N/A | highly mobile | none detected | partially decomp |
| 7 | single | 15-30 | 4.5-6 | N/A | veg/bank moves | none detected | partially decomp |
| 8 | single | 15-30 | 1.5-3 | N/A | highly mobile | none detected | little/no decomp |
| 9 | single w/rb | 15-30 | 1.5-3 | N/A | highly mobile | none detected | partially decomp |
| 10 | multiple w/rb | 30-45 | 1.5-3 | 10+ | highest flows | scour along bank | partially decomp |
| 11 | multiple w/rb | 30-45 | 4.5-6 | 10+ | highest flows | protecting bank | partially decomp |
| 12 | multiple w/rb | 15-30 | 3-4.5 | 5 | veg/bank moves | scour hole in bed | little/no decomp |
| 13 | single w/rb | 150 | 13.5-15 | N/A | highest flows | scour hole in bed | little/no decomp |
| 14 | single w/rb | 15-30 | 9-10.5 | N/A | veg/bank moves | none detected | little/no decomp |
| 15 | single w/rb | 45-60 | 9-10.5 | N/A | highest flows | none detected | partially decomp |

| | **deDampierre to Saddle Club Reach of the Carmel River (continued)** | | | | | |
|---|---|---|---|---|---|---|
| Pt # | EMBEDMENT | ORIENTATION | DEG OFF BANK | REACH_TYPE | PROJECTED(200CFS) | REACH LENGTH (M) |
| 1 | fully embed w/veg | N/A | N/A | run | run | 300+ |
| 2 | no embedment | upstream | >30 | run | run | 300+ |
| 3 | fully embed w/veg | N/A | N/A | run | run | unknown |
| 4 | partial veg/bank | N/A | N/A | run | run | unknown |
| 5 | partial veg/bank | upstream | 30 | run | run | 300+ |
| 6 | no embedment | N/A | N/A | run | run | 300+ |
| 7 | partial veg/bank | parallel to flow | 0 | run | run | 300+ |
| 8 | no embedment | downstream | N/A | run | run | 300+ |
| 9 | partial/fully in bed | perpendicular | 90 | run | run | 300+ |
| 10 | fully embed w/veg | N/A | N/A | riffle | riffle | 5 |
| 11 | fully embed w/veg | N/A | N/A | riffle | riffle | unknown |
| 12 | partial/fully in bed | N/A | N/A | pool | pool | 10 |
| 13 | partial veg/bank | perpendicular | 90 | pool | run | 15 |
| 14 | partial veg/bank | parallel to flow | 0 | riffle | pool | 5 |
| 15 | no embedment | N/A | N/A | N/A | N/A | N/A |

| | **deDampierre to Saddle Club Reach of the Carmel River (continued)** | | | | | |
|---|---|---|---|---|---|---|
| Pt # | PART OF CHANNEL | SUBSTRATE | SPECIES | FAUNA | COMMENTS | STRUC SIZE(M) |
| 1 | RB low flow bank | cobble | unknown | none | | 4 |
| 2 | LB low flow bank | cobble | unknown | none | | N/A |
| 3 | RB bankfull streambank | cobble | unknown | none | | 4 |
| 4 | RB bankfull streambank | cobble | unknown | none | wooden pillar | 4 |
| 5 | RB low flow bank | gravel | unknown | none | | N/A |
| 6 | center | gravel | unknown | none | | N/A |
| 7 | RB low flow bank | gravel | unknown | none | | N/A |
| 8 | LB floodplain/bench | gravel | willow | none | | N/A |
| 9 | RB low flow bank | sand | unknown | none | | N/A |
| 10 | LB bankfull streambank | cobble | unknown | none | | 6 x 10 |
| 11 | center | cobble | unknown | none | | 5 x 10 |
| 12 | LB low flow bank | cobble | unknown | frog | | 5 |
| 13 | center | cobble | oak | none | very large piece | N/A |
| 14 | LB low flow bank | cobble | bay | none | | N/A |
| 15 | LB floodplain/bench | cobble | oak | none | | N/A |

| | **Garland to Scarlet Road Reach of the Carmel River** | | | | | | **Nov. 13, 2002** |
|---|---|---|---|---|---|---|---|
| Pt # | LOG TYPE | WIDTH(CM) | LENGTH(M) | # PIECES | MOBILITY | INFLUENCE | CONDITION |
| 1 | multiple | 15-30 | 3-4.5 | 2 | veg/bank moves | none detected | part decomp |
| 2 | single | 30-45 | 1.5-3 | N/A | when bed moves | none detected | part decomp |
| 3 | single | 15-30 | 1.5-3 | N/A | when bed moves | none detected | part decomp |
| 4 | single | 30-45 | 7.5-9 | N/A | veg/bank moves | none detected | part decomp |
| 5 | single | 15-30 | 3-4.5 | N/A | veg/bank moves | none detected | part decomp |
| 6 | single | 15-30 | 3-4.5 | N/A | veg/bank moves | none detected | part decomp |
| 7 | single | 15-30 | 3-4.5 | N/A | veg/bank moves | none detected | part decomp |
| 8 | multiple w/rb | 15-30 | 3-4.5 | 3 | veg/bank moves | none detected | signif decomp |
| 9 | multiple | 30-45 | 3-4.5 | 7 | highest flows | scour bank | part decomp |
| 10 | single | 15-30 | 3-4.5 | N/A | when bed moves | bed scour | part decomp |
| 11 | multiple w/rb | 15-30 | 3-4.5 | 3 | veg/bank moves | none detected | part decomp |
| 12 | single | 15-30 | 3-4.5 | N/A | veg/bank moves | none detected | part decomp |
| 13 | single | 30-45 | 1.5-3 | N/A | veg/bank moves | none detected | part decomp |
| 14 | multiple w/rb | 30-45 | 3-4.5 | 5 | veg/bank moves | scour bank | little/no decomp |
| 15 | single | 15-30 | 1.5-3 | N/A | when bed moves | protect bank | part decomp |

| | **Garland to Scarlet Road Reach of the Carmel River (continued)** | | | | | |
|---|---|---|---|---|---|---|
| Pt # | EMBEDMENT | ORIENTATION | DEG OFF BANK | REACH_TYPE | PROJECTED(200CFS) | REACH LENGTH (M) |
| 1 | part veg/bank | N/A | N/A | run | run | 50 |
| 2 | part/full bed | pf | 0 | run | run | 50 |
| 3 | part/full bed | pf | 0 | run | run | 50 |
| 4 | part veg/bank | ds | 30 | glide | glide | 10 |
| 5 | part veg/bank | perp | 90 | riffle | riffle | 50 |
| 6 | part veg/bank | ds | <30 | riffle | riffle | 50 |
| 7 | part veg/bank | ds | <30 | riffle | riffle | 50 |
| 8 | fully w/veg | N/A | N/A | run | run | 100 |
| 9 | fully w/veg | N/A | N/A | run | run | 100 |
| 10 | part/full bed | pf | 0 | riffle | riffle | 60 |
| 11 | fully w/veg | N/A | N/A | glide | glide | 10 |
| 12 | part veg/bank | ds | >30 | riffle | riffle | 100 |
| 13 | part veg/bank | ds | <30 | riffle | riffle | 100 |
| 14 | part veg/bank | N/A | N/A | riffle | riffle | 100 |
| 15 | part/full bed | us | <30 | glide | glide | 10 |

| | | **Garland to Scarlet Road Reach of the Carmel River (continued)** | | | | |
|---|---|---|---|---|---|---|
| Pt # | PART OF CHANNEL | SUBSTRATE | SPECIES | FAUNA | COMMENTS | STRUC SIZE(M) |
| 1 | LB low flow bank | gravel | willow | none | | 2 X 7 |
| 2 | LB bankfull streambank | sand | unknown | none | | N/A |
| 3 | LB low flow bank | gravel | unknown | none | | N/A |
| 4 | RB bankfull streambank | sand | willow | none | | N/A |
| 5 | RB bankfull streambank | cobble | unknown | none | | N/A |
| 6 | RB bankfull streambank | cobble | unknown | none | | N/A |
| 7 | LB bankfull streambank | cobble | alder | none | | N/A |
| 8 | LB bankfull streambank | cobble | willow | none | | 3 X 10 |
| 9 | RB low flow bank | gravel | unknown | none | | 8 X 8 |
| 10 | RB floodplain/bench | cobble | willow | none | | N/A |
| 11 | RB bankfull streambank | cobble | unknown | none | | 4 X 6 |
| 12 | LB bankfull streambank | cobble | willow | none | | N/A |
| 13 | LB low flow bank | cobble | unknown | none | | N/A |
| 14 | RB low flow bank | cobble | unknown | none | | 3 X 4 |
| 15 | LB low flow bank | sand | unknown | none | | N/A |

| | **Garland to Scarlet Road Reach of the Carmel River** | | | | | **Nov. 20, 2002** | |
|---|---|---|---|---|---|---|---|
| Pt # | LOG TYPE | WIDTH(CM) | LENGTH(M) | # PIECES | MOBILITY | INFLUENCE | CONDITION |
| 1 | single w/rb | 15-30 | 3-4.5 | N/A | veg/bank moves | protect bank | part decomp |
| 2 | single | 15-30 | 6-7.5 | N/A | highest flows | none detected | signif decomp |
| 3 | single | 15-30 | 3-4.5 | N/A | highest flows | none detected | part decomp |
| 4 | single | 15-30 | 3-4.5 | N/A | highest flows | none detected | signif decomp |
| 5 | single w/rb | 15-30 | 6-7.5 | N/A | highest flows | none detected | little/no decomp |
| 6 | single | 15-30 | 3-4.5 | N/A | veg/bank moves | none detected | part decomp |
| 7 | single | 15-30 | 3-4.5 | N/A | veg/bank moves | none detected | part decomp |
| 8 | single w/rb | 45-60 | 3-4.5 | N/A | highest flows | none detected | little/no decomp |
| 9 | multiple w/rb | 15-30 | 3-4.5 | 5 | veg/bank moves | none detected | part decomp |
| 10 | single | 30-45 | 4.5-6 | N/A | veg/bank moves | protect bank | part decomp |
| 11 | single | 30-45 | 1.5-3 | N/A | veg/bank moves | none detected | signif decomp |
| 12 | single w/rb | 30-45 | 3-4.5 | N/A | veg/bank moves | none detected | part decomp |
| 13 | single w/rb | 15-30 | 3-4.5 | N/A | when bed moves | none detected | part decomp |
| 14 | single | 15-30 | 1.5-3 | N/A | when bed moves | none detected | part decomp |
| 15 | single | 45-60 | 9-10.5 | N/A | when bed moves | none detected | part decomp |
| 16 | single | 30-45 | 1.5-3 | N/A | highly mobile | none detected | part decomp |

| | Garland to Scarlet Road Reach of the Carmel River (continued) | | | | | |
|---|---|---|---|---|---|---|
| Pt # | EMBEDMENT | ORIENTATION | DEG OFF BANK | REACH_TYPE | PROJECTED(200CFS) | REACH LENGTH (M) |
| 1 | part veg/bank | ps | 0 | pool | pool | 30 |
| 2 | no embed | perp | 90 | run | run | unknown |
| 3 | no embed | ps | 0 | run | run | unknown |
| 4 | no embed | pf | 0 | run | run | unknown |
| 5 | no embed | pf | 0 | run | run | unknown |
| 6 | part veg/bank | ds | >30 | riffle | riffle | 30 |
| 7 | part veg/bank | ds | <30 | riffle | riffle | 75 |
| 8 | part veg/bank | pf | 0 | riffle | riffle | 75 |
| 9 | part veg/bank | N/A | N/A | riffle | riffle | 30 |
| 10 | part veg/bank | pf | 0 | run | run | 100 |
| 11 | part veg/bank | perp | 90 | run | run | 100 |
| 12 | part veg/bank | us | unknown | run | run | 100+ |
| 13 | part/full bed | pf | 0 | pool | pool | 25 |
| 14 | part/full bed | unknown | >30 | pool | pool | 25 |
| 15 | part/full bed | pf | 0 | riffle | riffle | 50 |
| 16 | no embed | us | >30 | riffle | riffle | 50 |

| | **Via Mallorca along Rancho Canada Reach of the Carmel River (continued)** | | | | | | **Nov. 18, 2002** |
|---|---|---|---|---|---|---|---|
| Pt # | LOG TYPE | WIDTH(CM) | LENGTH(M) | # PIECES | MOBILITY | INFLUENCE | CONDITION |
| 1 | single | 30-45 | 1.5-3 | N/A | when bed moves | none detected | little/no decomp |
| 2 | single | 15-30 | 3-4.5 | N/A | highly mobile | none detected | little/no decomp |
| 3 | single | 30-45 | 1.5-3 | N/A | when bed moves | none detected | little/no decomp |
| 4 | single | 60-75 | 1.5-3 | N/A | when bed moves | none detected | little/no decomp |
| 5 | single | 30-45 | 15-16.5 | N/A | veg/bank moves | none detected | little/no decomp |
| 6 | single | 30-45 | 6-7.5 | N/A | highest flows | none detected | live |
| 7 | single w/rb | 60-75 | 1.5-3 | N/A | highest flows | none detected | part decomp |
| 8 | single | 75-90 | 3-4.5 | N/A | highest flows | none detected | little/no decomp |
| 9 | multiple w/rb | 60-75 | 3-4.5 | 2 | when bed moves | bed scour | live |
| 10 | single | 15-30 | 1.5-3 | N/A | highest flows | none detected | part decomp |
| 11 | single | 15-30 | 1.5-3 | N/A | highest flows | none detected | part decomp |
| 12 | single | 30-45 | 3-4.5 | N/A | veg/bank moves | none detected | part decomp |
| 13 | single | 15-30 | 3-4.5 | N/A | veg/bank moves | none detected | little/no decomp |
| 14 | single w/rb | 30-45 | 9-10.5 | N/A | highest flows | none detected | little/no decomp |
| 15 | single w/rb | 30-45 | 3-4.5 | N/A | when bed moves | none detected | little/no decomp |
| 16 | multiple w/rb | unknown | unknown | 10+ | veg/bank moves | none detected | part decomp |
| 17 | single w/rb | unknown | unknown | N/A | highly mobile | none detected | little/no decomp |
| 18 | multiple w/rb | 30-45 | 7.5-9 | 5 | highest flows | bed scour | part decomp |
| 19 | single | 30-45 | 3-4.5 | N/A | highly mobile | none detected | signif decomp |
| 20 | single | 15-30 | 9-10.5 | N/A | veg/bank moves | none detected | part decomp |
| 21 | single w/rb | 15-30 | 1.5-3 | N/A | when bed moves | protect bank | part decomp |
| 22 | single w/rb | 100+ | 9-10.5 | N/A | highest flows | protect bank | part decomp |
| 23 | single | 15-30 | 9-10.5 | N/A | veg/bank moves | protect bank | part decomp |
| 24 | single | 15-30 | 1.5-3 | N/A | when bed moves | none detected | part decomp |
| 25 | multiple | 15-30 | 3-4.5 | 4 | veg/bank moves | none detected | part decomp |
| 26 | multiple | 15-30 | 7.5-9 | 10+ | veg/bank moves | none detected | signif decomp |
| 27 | single w/rb | 15-30 | 1.5-3 | N/A | when bed moves | none detected | part decomp |
| 28 | single w/rb | 60-75 | 6-7.5 | N/A | highest flows | none detected | part decomp |
| 29 | single | 60-75 | 4.5-6 | N/A | veg/bank moves | none detected | part decomp |
| 30 | single | 60-75 | 4.5-6 | N/A | highest flows | protect bank | signif decomp |
| 31 | multiple | 30-45 | 15 | unknown | highest flows | bed scour | little/no decomp |
| 32 | multiple | 30-45 | 10 | unknown | veg/bank moves | none detected | part decomp |

| | Via Mallorca along Rancho Canada Reach of the Carmel River (continued) | | | | | |
|---|---|---|---|---|---|---|
| Pt # | EMBEDMENT | ORIENTATION | DEG OFF BANK | REACH_TYPE | PROJECTED(200CFS) | REACH LENGTH (M) |
| 1 | part/full bed | pf | 0 | run | run | 300+ |
| 2 | no embed | perp | 90 | run | run | 300+ |
| 3 | part/full bed | pf | 0 | run | run | 300+ |
| 4 | part/full bed | perp | 90 | run | run | 300+ |
| 5 | part veg/bank | ds | <30 | run | run | 300+ |
| 6 | part veg/bank | pf | 0 | run | run | 300+ |
| 7 | part veg/bank | pf | 0 | run | run | 300+ |
| 8 | part veg/bank | pf | 0 | run | run | 300+ |
| 9 | part/full bed | N/A | N/A | run | run | 300+ |
| 10 | part/full bed | perp | 90 | run | run | 300+ |
| 11 | part/full bed | perp | 90 | run | run | 300+ |
| 12 | no embed | ds | 30 | run | run | 300+ |
| 13 | part veg/bank | ds | 30 | run | run | 300+ |
| 14 | no embed | pf | 0 | run | run | 300+ |
| 15 | no embed | pf | 0 | run | run | 300+ |
| 16 | no embed | N/A | N/A | run | run | 300+ |
| 17 | no embed | ds | >30 | run | run | 300+ |
| 18 | part veg/bank | N/A | N/A | run | run | 300+ |
| 19 | no embed | us | >30 | run | run | 300+ |
| 20 | part veg/bank | ds | <30 | run | run | 300+ |
| 21 | part/full bed | ds | >30 | run | run | 300+ |
| 22 | part veg/bank | ds | <30 | run | run | 300+ |
| 23 | part veg/bank | pf | 0 | run | run | 300+ |
| 24 | part/full bed | pf | 0 | run | run | 300+ |
| 25 | part veg/bank | N/A | N/A | run | run | 300+ |
| 26 | part veg/bank | N/A | N/A | run | run | 300+ |
| 27 | part/full bed | ds | >30 | run | run | 300+ |
| 28 | no embed | us | >30 | run | run | 300+ |
| 29 | part veg/bank | pf | 0 | run | run | 300+ |
| 30 | part veg/bank | ds | >30 | run | run | 300+ |
| 31 | part veg/bank | N/A | N/A | run | run | 300+ |
| 32 | part veg/bank | N/A | N/A | run | run | 300+ |

| | **Via Mallorca along Rancho Canada Reach of the Carmel River (continued)** | | | | | |
|---|---|---|---|---|---|---|
| Pt # | PART OF CHANNEL | SUBSTRATE | SPECIES | FAUNA | COMMENTS | STRUC SIZE(M) |
| 1 | center | cobble | unknown | none | dry, undr brdg | N/A |
| 2 | center | cobble | unknown | none | dry, undr brdg east | N/A |
| 3 | center | cobble | unknown | none | dry, undr brdg west | N/A |
| 4 | center | cobble | unknown | none | dry, undr brdg east | N/A |
| 5 | LB bankfull streambank | sand | cottonwood | none | dry, cut | N/A |
| 6 | LB bankfull streambank | sand | willow | none | dry, cut | N/A |
| 7 | LB bankfull streambank | sand | willow | none | dry, cut | N/A |
| 8 | LB bankfull streambank | sand | unknown | none | dry | N/A |
| 9 | RB low flow bank | sand | willow | none | dry,sprouts,45 ds | 2 x 4 |
| 10 | LB bankfull streambank | sand | unknown | none | dry | N/A |
| 11 | LB bankfull streambank | sand | unknown | none | dry | N/A |
| 12 | LB bankfull streambank | sand | unknown | none | dry | N/A |
| 13 | LB low flow bank | sand | willow | none | dry | N/A |
| 14 | RB floodplain/bench | sand | unknown | none | dry | N/A |
| 15 | center | sand | unknown | none | dry | N/A |
| 16 | LB bankfull streambank | sand | unknown | none | dry, undr brdg,human | 10 x 15 |
| 17 | LB low flow bank | sand | unknown | none | dry, small logs | N/A |
| 18 | RB low flow bank | sand | unknown | none | dry, ds 80 deg | 3 x 12 |
| 19 | RB floodplain/bench | sand | unknown | none | dry | N/A |
| 20 | LB bankfull streambank | sand | unknown | none | dry | N/A |
| 21 | RB low flow bank | sand | unknown | none | dry | N/A |
| 22 | LB bankfull streambank | sand | unknown | none | dry, lrg rootball, cut | N/A |
| 23 | LB low flow bank | sand | willow | none | dry | N/A |
| 24 | LB low flow bank | sand | willow | none | dry | N/A |
| 25 | LB low flow bank | sand | unknown | none | dry | 3 x 6 |
| 26 | RB bankfull streambank | sand | unknown | none | dry | 2 x 15 |
| 27 | LB low flow bank | sand | alder | none | dry, little pieces | N/A |
| 28 | LB floodplain/bench | sand | willow | none | dry, bank erosion | N/A |
| 29 | LB bankfull streambank | sand | unknown | none | dry, cut | N/A |
| 30 | LB bankfull streambank | sand | unknown | none | dry | N/A |
| 31 | LB floodplain/bench | sand | unknown | none | | unknown |
| 32 | LB bankfull streambank | sand | unknown | none | | 10 x 20 m |

| | **Rancho Canada to Head of Lagoon Reach of the Carmel River (continued)** | | | | | | **Nov. 4, 2002** |
|---|---|---|---|---|---|---|---|
| Pt # | LOG TYPE | WIDTH(CM) | LENGTH(M) | # PIECES | MOBILITY | INFLUENCE | CONDITION |
| 1 | single w/rb | 60-75 | 10.5-12 | N/A | highest flows | protect bank | part decomp |
| 2 | multiple | 30-45 | 6-7.5 | 2 | highest flows | scour bank | little/no decomp |
| 3 | single | 60-75 | 9-10.5 | N/A | highest flows | scour bank | part decomp |
| 4 | multiple | 30-45 | 7.5-9 | 2 | highest flows | protect bank | part decomp |
| 5 | single | 60-75 | 9-10.5 | N/A | highest flows | protect bank | part decomp |
| 6 | multiple w/rb | 30-45 | 7.5-9 | 3 | highest flows | bed scour | part decomp |
| 7 | single | 60-75 | 6-7.5 | N/A | highest flows | protect bank | part decomp |
| 8 | single | 30-45 | 4.5-6 | N/A | when bed moves | scour bank | part decomp |
| 9 | single | 30-45 | 15-16.5 | N/A | highest flows | protect bank | part decomp |
| 10 | single | 15-30 | 6-7.5 | N/A | veg/bank moves | scour bank | little/no decomp |
| 11 | single | 30-45 | 9-10.5 | N/A | veg/bank moves | protect bank | part decomp |
| 12 | single | 45-60 | 9-10.5 | N/A | veg/bank moves | scour bank | little/no decomp |
| 13 | multiple | 15-30 | 4.5-6 | 6+ | veg/bank moves | none detected | part decomp |
| 14 | single | 30-45 | 9-10.5 | N/A | veg/bank moves | bed scour | little/no decomp |
| 15 | single | 15-30 | 4.5-6 | N/A | highly mobile | none detected | little/no decomp |
| 16 | multiple | 30-45 | 4.5-6 | 3 | veg/bank moves | bed scour | part decomp |
| 17 | multiple | 15-30 | 3-4.5 | 3 | veg/bank moves | bed scour | part decomp |
| 18 | multiple | 15-30 | 4.5-6 | 6+ | veg/bank moves | bed scour | part decomp |
| 19 | single | 30-45 | 4.5-6 | N/A | when bed moves | bed scour | part decomp |
| 20 | single | 15-30 | 3-4.5 | N/A | when bed moves | bed scour | part decomp |
| 21 | multiple | 15-30 | 7.5-9 | 3 | veg/bank moves | bed scour | part decomp |

| | **Rancho Canada to Head of Lagoon Reach of the Carmel River (continued)** | | | | | |
|---|---|---|---|---|---|---|
| Pt # | EMBEDMENT | ORIENTATION | DEG OFF BANK | REACH_TYPE | PROJECTED(200CFS) | REACH LENGTH (M) |
| 1 | fully w/veg | pf | 0 | run | run | 100+ |
| 2 | part veg/bank | N/A | N/A | run | run | 100+ |
| 3 | part veg/bank | ds | >30 | run | run | 100+ |
| 4 | fully w/veg | N/A | N/A | run | run | 100+ |
| 5 | part veg/bank | pf | 0 | run | run | 100+ |
| 6 | part veg/bank | N/A | N/A | run | run | 100+ |
| 7 | fully w/veg | ds | <30 | run | run | 100+ |
| 8 | part/full bed | ds | <30 | run | run | 100+ |
| 9 | fully w/veg | N/A | N/A | run | run | 100+ |
| 10 | part veg/bank | N/A | N/A | run | run | 100+ |
| 11 | part veg/bank | N/A | N/A | run | run | 100+ |
| 12 | part veg/bank | N/A | N/A | run | run | 50+ |
| 13 | part veg/bank | N/A | N/A | run | run | 100+ |
| 14 | part/full bed | N/A | N/A | run | run | 100+ |
| 15 | no embed | N/A | N/A | run | run | 100+ |
| 16 | part veg/bank | N/A | N/A | run | run | 100+ |
| 17 | part veg/bank | N/A | N/A | run | run | 100+ |
| 18 | part veg/bank | N/A | N/A | run | run | 100+ |
| 19 | no embed | N/A | N/A | run | run | 100+ |
| 20 | part/full bed | N/A | N/A | run | run | 100+ |
| 21 | part veg/bank | N/A | N/A | run | run | 100+ |

| | **Rancho Canada to Head of Lagoon Reach of the Carmel River (continued)** | | | | | |
|---|---|---|---|---|---|---|
| Pt # | PART OF CHANNEL | SUBSTRATE | SPECIES | FAUNA | COMMENTS | STRUC SIZE(M) |
| 1 | LB bankfull streambank | sand | unknown | none | | N/A |
| 2 | LB bankfull streambank | sand | willow | none | | 2 x 10 |
| 3 | RB bankfull streambank | sand | sycamore | none | | N/A |
| 4 | LB bankfull streambank | sand | willow | none | dry | 3 x 10 |
| 5 | RB bankfull streambank | sand | unknown | none | dry | N/A |
| 6 | LB low flow bank | sand | unknown | none | dry | 3 x 10 |
| 7 | RB bankfull streambank | sand | unknown | none | dry | N/A |
| 8 | RB low flow bank | sand | unknown | none | | N/A |
| 9 | LB low flow bank | sand | unknown | none | | N/A |
| 10 | RB low flow bank | sand | willow | none | | N/A |
| 11 | LB low flow bank | sand | unknown | none | | N/A |
| 12 | LB bankfull streambank | sand | cottonwood | none | | N/A |
| 13 | LB low flow bank | sand | unknown | none | | 3 x 10 |
| 14 | LB low flow bank | sand | cottonwood | none | | N/A |
| 15 | LB low flow bank | sand | cottonwood | none | | N/A |
| 16 | LB low flow bank | sand | cottonwood | none | | 2 x 8 |
| 17 | RB low flow bank | sand | unknown | none | | 2 x 8 |
| 18 | RB low flow bank | sand | unknown | none | | 2 x 10 |
| 19 | RB low flow bank | sand | unknown | none | | N/A |
| 20 | RB low flow bank | sand | unknown | none | | N/A |
| 21 | RB low flow bank | sand | unknown | none | | 2 x 10 |