Pre-Project Implementation Condition Assessment

Carmel River Floodplain (Carmel, CA)

Summary Report

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TABLE OF CONTENTS

LIST OF TABLES ..... **IV**
LIST OF FIGURES ..... **IV**
ATTACHMENTS ..... **IV**
EXECUTIVE SUMMARY **5**
1.0 INTRODUCTION **6**
2.0 METHODS **6**
2.1 CRAM 6
2.2 BIRD SURVEYS 8
2.3 WATER ELEVATION 8
3.0 RESULTS AND DISCUSSION **11**
3.1 CRAM 11
3.1.1 Riverine Assessments 11
3.1.2 Slope Assessment 13
3.1.3 Bar-built Estuary Assessment 15
3.2 BIRD SURVEYS 18
3.3 WATER ELEVATION 20
4.0 RECOMMENDATIONS **22**

LIST OF TABLES

Table 1. CRAM condition categories and associated index scoring ranges. 7
Table 2. CRAM Metric, Attribute and Index Scores for the two riverine assessment areas. 12
Table 3. CRAM Metric, Attribute and Index Scores for the slope assessment area (AA).....14
Table 4. CRAM Metric, Attribute and Index Scores for the BBE assessment area.....16
Table 5. CRAM Metric, Attribute and Index Scores for five previous assessments in the Carmel River Lagoon. 17
Table 6. List of all bird species observed at the Carmel River Floodplain site.....19

LIST OF FIGURES

Figure 1. CRAM Assessment Area locations for the bar-built estuarine (yellow), slope (green), and riverine (Blue) wetland types. 7
Figure 2. Locations of the Six bird monitoring stations on the Carmel River Floodplain site. ... 8
Figure 3. Location of continuous water level logger and associated vent at the eastern end of the project site. 9
Figure 4. Photos of the installation of the continuous water level logger 10
Figure 5. Photos of the riverine CRAM assessments. 13
Figure 6. Photos of the slope CRAM assessment. 14
Figure 7. Photos of the BBE CRAM assessment. 17
Figure 8. Location of 6 assessment areas in the Carmel River lagoon. 18
Figure 9. (a)Bird species richness by observation date, (b) Number of individuals by observation date, (c) bird spices richness by habitat type, and (d) bird species richness by habitat type and observation date for the Carmel River Floodplain site. 20
Figure 10. Water stage in feet from 2/16/2015 to 8/27/2015, recorded by the continuous logger installed by CCWG at the upstream end of the project site. 21
Figure 11. River discharge in cubic feet per second from 2/16/2015 to 8/27/2015, estimated at the USGS stream gage #11143250 just upstream of the project area. 21

ATTACHMENTS

1 – CRAM data sheets from all assessments

2 – Bird survey data sheets

3 – Continuous water level data from logger

EXECUTIVE SUMMARY

The Central Coast Wetlands Group teamed with Big Sur Land Trust to assist with pre-project implementation monitoring and quality assurance (QA) for their Carmel River Floodplain Restoration and Environmental Enhancement Project (CRFREE) with funding from the USEPA West Coast Estuaries Grant Program.

The California Rapid Assessment Method (CRAM) was used to assess existing vegetation and habitat conditions at four sites in the project area, located east and west of Hwy 1 on the Carmel River floodplain. Bird surveys quantified the species richness, habitat utilization, and bird species abundance. A continuous water depth logger was installed to monitor the water elevation of the river prior to restoration.

Field reconnaissance conducted within the boundary of the project, along with analysis of aerial photography, were used to select CRAM assessment locations within three separate portions of the river valley (classified as three separate wetland types), where to place the bird monitoring locations, and where to place the water level logger.

Wetland condition scores, as quantified using CRAM, can range from a low score of 25 to a high of 100. Within the Carmel River Floodplain Restoration and Environmental Enhancement area, condition scores ranged from a low of 46 (for the slope wetland area) to 69 (for the riverine assessment) near the Hwy 1 Bridge. Condition scores for all sites within the proposed restoration area were lower than more pristine areas up stream. Nearby CRAM assessments on the main stem of the Carmel River, downstream of the San Clemente dam, are more representative of the expected condition once restoration efforts are complete, and showed an Index score range of 64 to 89.

Many anthropogenic stressors were noted to impact the condition of the CRFREE Project site. While not factored into the CRAM scores, information on the presence of stressors provides additional insight on what may be adversely affecting the ecological condition of the river, stream or wetland. Stressors that were routinely observed in the CRFREE Project site include:

- Non-point sources from both agricultural and urban areas;
- Dikes and levees along the river;
- Grading and compaction of soils;
- Mowing and grazing;
- Lack of treatment of invasive plant species in the buffer;
- Landscape stressors including adjacent urban and commercial land use, transportation corridors, and golf courses;
- Ranching and rangeland

The prescribed habitat restoration activities will most likely lead to an improved ecological condition of the Carmel River floodplain. Many of the planned actions will address the stressors listed above.

The bird surveys noted a wide variety of bird species present on the project site. A total of 65 bird species were observed during all survey dates, with the most species noted during the spring survey.

Finally, the water level logger showed a strong correlation with the USGS gage discharge data located upstream of the project site.

1.0 INTRODUCTION

The Big Sur Land Trust is working through the planning phase to restore natural floodplain function to approximately 90-acres of the Odello East property, on the southern floodplain of the Carmel River. The Carmel River Floodplain Restoration and Environmental Enhancement Project (CRFREE Project) includes removal of a section of the levee, excavation/grading to re-create wetland and floodplain area, and planting/seeding to encourage growth of native vegetation. The CRFREE Project will restore cohesiveness and natural ecological function to what is arguably the most critical section of the Carmel River watershed—the lower floodplain/estuary ecosystem. Improved flood retention and control will also result. This Pre-project condition report reviews the current condition of riverine resources and the potential benefits from the proposed restoration activities.

The floodplain area adjacent to the river supports some of the highest densities of migratory songbirds in California, attracting nearly 100 more bird species than nearby areas such as Elkhorn Slough National Estuarine Reserve. Carmel River State Beach, including the adjacent lagoon and wetland areas, serves as an important refuge for sensitive aquatic species and provides a dynamic interface between marine and freshwater river systems.

The Central Coast Wetlands Group has assisted the Big Sur Land Trust with pre-project implementation monitoring and QA assistance for the CRFREE Project. This document serves as a summary report for pre-project implementation monitoring activities.

2.0 METHODS

2.1 CRAM

The California Rapid Assessment Method for Wetlands (CRAM) is a rapid habitat condition assessment. CRAM is a standardized tool for wetland monitoring, developed with support from the USEPA. The tool enumerates the concept that structure and complexity of a wetland is indicative of its capacity to provide a range of functions and services. CRAM is designed to assess the ambient conditions of wetlands within the context of a watershed, an ecoregion, or throughout the State. CRAM is also used to assess the performance of restoration projects. CRAM requires a team of 2-3 trained practitioners less than 3 hours to assess the condition of a representative wetland area.

CCWG has prepared a QA plan that describes quality assurance procedures employed to complete high quality CRAM assessments and report the condition of the CRFREE Project Site over time. The USEPA approved this QA plan in August 2015 for use to ensure consistent methodologies are in place for all assessment results included in this report.

CRAM is composed of four attributes of condition: 1) Buffer and Landscape Context, 2) Hydrology, 3) Physical Structure and 4) Biotic Structure. These four attributes are consistent for all wetland modules of CRAM. However, the metrics that are used to quantify attribute condition differ between wetland types. The four attribute scores are averaged to generate an Index score. The CRAM wetland condition Index Score ranges from 25 to 100 points. The scale of condition categories presented in Table 1 is appropriate for the purposes of evenly distributing CRAM results into quartiles.

Table 1. CRAM condition categories and associated index scoring ranges.

Condition Category	Total CRAM Index Score Range
Excellent	82-100
Good	63-81
Fair	44-62
Poor	25-43

CCWG conducted four CRAM assessments in collaboration with HT Harvey and BSLT staff in November 2014 and April 2015 (Figure 1). Three classes of wetland were assessed in the project area, including riverine, slope and bar-built estuarine.

Figure 1. CRAM Assessment Area locations for the bar-built estuarine (yellow), slope (green), and riverine (Blue) wetland types.

All scores will be uploaded to the statewide database with approval from the landowner.

2.2 Bird Surveys

CCWG partnered with Rick Fournier, a local bird expert, to obtain data on the species and abundance of birds in the project area. The survey used a point count methodology. This methodology is one of the most widely used quantitative approaches for measuring avian/habitat relationships.

Three bird surveys were conducted: one in winter 2015, one in spring 2015, and one in fall 2015. Each survey included six monitoring stations where bird numbers and species were enumerated using a point count protocol, spaced evenly throughout a project area (Figure 2). Detections at each station lasted 10 minutes. Between point counts, while walking, Rick conducted a supplemental count to assess any activity not detected during the point counts.

Each point count identified:

- Activities (feeding, resting, nesting, or singing)
- How Detected (visual or auditory)
- Habitat Use (grasslands, riparian, oak woodlands)

Figure 2. Locations of the Six bird monitoring stations on the Carmel River Floodplain site.

2.3 Water Elevation

Following the recommendations of a previously approved USEPA QA Plan written by 2nd Nature (also for the West Coast Estuaries grant), CCWG installed an InSitu Leveltroll 500 (15psi-G) at the upper end of the project site to measure surface water elevation (ft.) every 15 minutes (Figure 3). The logger was installed on February 16th, 2015 and data were downloaded on August 27th, 2015. The logger is continuing to collect data.

Figure 3. Location of continuous water level logger and associated vent at the eastern end of the project site.

The logger was installed on the edge of the river at the upstream end of the project site. Leveltroll 500 is a vented system that accounts for changes in air pressure, we constructed a very long PVC tube from the river up to high ground to house and protect the logger and its vent tube. The vent tube keeps the vent from getting inundated during high flows (Figure 4). The tube was attached to both living tree trunks and t-stakes to prevent it from washing away during large flow events.

Figure 4. Photos of the installation of the continuous water level logger

3.0 RESULTS AND DISCUSSION

3.1 CRAM

3.1.1 Riverine Assessments

The riverine CRAM assessments of the main channel of the Carmel River found condition scores of 69 (Good) near the Hwy 1 bridge and 57 (Fair) at the upstream end of the project area (Table 2, Figure 5). Six CRAM assessments completed for other purposes in areas on the Carmel River downstream of the San Clemente dam (available on EcoAtlas.org) can be used for comparison of conditions with the assessments conducted for this project. The six upstream sites had Index scores ranging from 64 to 89. Four of the sites that were located along the main stem adjacent to Carmel Valley Road scored from 64 to 76, while two sites slightly higher in the watershed away from main roads scored 82 and 89 (Excellent). All six of the sites exhibit similar or higher Physical Structure and Biotic Structure Attribute scores as compared to the areas assessed at the CRFREE site. This confirms that the Carmel River can achieve good to excellent condition scores for all CRAM attributes and the Index score.

The difference in CRAM Index scores between the two CRFREE riverine sites was driven by large variability in the Buffer and Landscape Context Attribute scores (90 at the bridge and 48 upstream). The condition scores for the stream corridor continuity metric, which looks at the width of the stream corridor upstream and downstream of the assessment area, was most different between the two locations. The assessment area near the bridge received an ‘A’ for continuity while the assessment area at the upstream location received a ‘D’, due to the presence of the golf course within 500 meters of the upstream assessment area. The buffer condition for the two assessment areas were relatively similar, with the bridge site scoring slightly better, due to a wider riparian zone. The upstream site scored slightly better for the buffer width metric. We anticipate that the planned restoration actions of the floodplain will increase all of the Buffer sub-metric scores for both of these assessment areas.

The Hydrology Attribute for the two assessment areas was similar; 58 for the bridge site and 50 for the upstream site. Both sites received the same metric scores for Water Source (C) and Channel Stability (B). The bridge site scored better for hydrologic connectivity due to less incision in the main channel closer to the lagoon. The planned removal of the levees and reconnection for the main channel with the adjacent floodplain will increase the hydrologic connectivity score for this portion of the river.

Both riverine sites included relatively few structural patch types, which resulted in the moderate Physical Structure score of 63. The proposed reconnection of the main channel of the river with the floodplain will enhance dynamic fluvial processes, which will lead to an increase in physical complexity of the floodplain and improve metric scores for both physical patch types and topographic complexity.

For the Biotic Structure Attribute both sites received a score of 67. Both sites had relatively few co-dominant plant species (6 at the bridge and 7 at the upstream site) and low interspersion of unique plant zones. By reconnecting the main channel of the river with the floodplain and by enhancing floodplain topography through the planned grading efforts, a more diverse and dynamic ecosystem will be reestablished. The construction of a more complex moisture gradient and the diversity of plant species included in the planting palate, will result in an increase in the biotic structure and increase Biotic scores.

Table 2. CRAM Metric, Attribute and Index Scores for the two riverine assessment areas.

Project Name	Carmel River Floodplain	Carmel River Floodplain
Site Number	upstream	bridge
Date of Assessment	11/5/14	11/12/14
Assessors	KO, CC, matt quinn, Will Spangler	SSD, CC
Wetland Class	riverine	riverine
Wetland Subclass (conf/nonconf)	non-confined, one sided	non-confined
CRAM Raw Attribute and Metric Scores		
Metric		
Buffer and Landscape Connectivity	**48**	**90**
Stream Corridor Continuity	3	12
Buffer Metrics	8.49	9.67
% of AA with Buffer	12	12
Average Buffer Width	12	9
Buffer Condition	6	9
Hydrology	**50**	**58.3**
Water Source	6	6
Channel Stability	9	9
Hydrologic Connectivity	3	6
Physical Structure	**62.5**	**62.5**
Structural Patch Richnes	6	6
Topographic Complexity	9	9
Biotic Structure	**66.7**	**66.7**
PC: No. of plant layers	9	9
PC: No. of codominants	6	6
PC: Percent Invasion	12	12
Plant Community Metrics	9	9
Interspersion	6	6
Vertical Biotic Structure	9	9
Overall AA Score	**57**	**69**

Figure 5. Photos of the riverine CRAM assessments.

3.1.2 Slope Assessment

The CRAM assessment of the Carmel River floodplain was assessed using the Slope CRAM module and received a condition score of 47 (Table 3, Figure 6). Forty seven is a low CRAM condition score and is driven by low scores for the Buffer and Landscape Connectivity, Physical Structure and Biotic Structure Attributes. The lack of wetlands within 500 meters of the assessment area resulted in a 'D' score for Landscape Connectivity. The area had few physical patch types and low topographic complexity, leading to a low Physical Structure score. These low scores were expected in an area dominated by cattle grazing and other agriculture uses until recently. Few co-dominant plant species, high numbers of invasive plants, poor interspersion of unique plant zones, and poor vertical complexity of plant layers led to a low Biotic Attribute score.

This condition assessment serves as a baseline from which the planned restoration activities on the floodplain can be evaluated. Replicate assessments in the future at the same locations once the restoration and enhancement actions have taken place will help document the change in the condition of the riparian floodplain.

Table 3. CRAM Metric, Attribute and Index Scores for the slope assessment area (AA)

Project Name	Carmel River Floodplain
Site Number	1
Date of Assessment	4/8/15
Assessors	CC, SSD, Sarah hardgrave, Ria
Wetland Class	slope
Wetland Subclass (conf/nonconf)	non-channed wet meadow
CRAM Raw Attribute and Metric Scores	
Buffer and Landscape Connectivity	**48**
Landscape Connectivity	3
Buffer Metrics	8.49
% of AA with Buffer	12
Average Buffer Width	12
Buffer Condition	6
Hydrology	**75**
Water Source	6
Hydroperiod	9
Hydrologic Connectivity (non-channeled)	12
Hydrologic Connectivity Submetric A: Bank Height Ratio	0
Hydrologic Connectivity Submetric B: Percent Dewatered	0
Hydrologic Connectivity Channeled: Avg of Submetrics A and B	0
Physical Structure	**37.5**
Structural Patch Richnes	3
Topographic Complexity	6
Biotic Structure	**27.8**
PC: No. of plant layers	6
PC: No. of codominants	3
PC: Percent Invasion	3
PC: Number of Encroachment Groups	9
Plant Community Metrics	4
Interspersion	3
Vertical Biotic Structure	3
Overall AA Score	**47**

Figure 6. Photos of the slope CRAM assessment.

3.1.3 Bar-built Estuary Assessment

The CRAM assessment of the portion of the Carmel River lagoon located within the project area had a condition score of 63 (Table 4, Figure 7). This score is slightly lower than the average conditions score of 72, based on five other assessments within the Carmel River Lagoon that have been performed since 2011 (Table 5, Figure 8).

The Buffer and Landscape Context Attribute received a score of 56 due to a degraded stream corridor upstream of the estuary and a low abundance of adjacent wetland areas. A new channel that will be built during construction will link the arm of the estuary to the river under Hwy 1, improving stream connectivity, and increasing the amount of adjacent wetlands.

The Hydrology Attribute received a score of 67, which, driven by common up stream water resources, is identical for all assessments in the estuary.

The Physical Attribute received a score of 50 due to a low number of physical patch types observed in the assessment area. We expect this score will improve with the restoration of the floodplain and formation of the new channel under Hwy 1. These proposed changes will provide more biotic and abiotic complexity to the arm of the estuary, leading to and improved Physical Structure attribute score.

The Biotic Attribute received a score of 78. The assessment area scored the maximum points for all metrics except for the number of co-dominant species and unique plant zones. Both of these metrics will be enhanced by the restoration and mitigation actions planned for the site.

Table 4. CRAM Metric, Attribute and Index Scores for the BBE assessment area.

Project Name	**Carmel Floodplain**
Site Name	**Carmel 6**
Date of Assessment	**11/5/14**
Assessors	**KO, CC, Will Spangler, Matt Quinn**
Wetland Class	**Bar-Built Estuary**
open/closed	**closed**

CRAM Attribute and Metric Scores

Buffer and Landscape Connectivity	**56**
Aquatic Area Abundance Metrics	5
Stream Corridor Continuity	3
Adjacent Aquatic Area	3
Marine Connectivitiy	9
Buffer Metrics	8.49
% of AA with Buffer	12
Average Buffer Width	12
Buffer Condition	6
Hydrology	**66.7**
Water Source	6
Hydroperiod	9
Hydrologic Connectivity	9
Physical Structure	**50**
Structural Patch Richnes	3
Topographic Complexity	9
Biotic Structure	**77.8**
PC: No. of plant layers	12
PC: No. of codominants	6
PC: Percent Invasion	12
Plant Community Metrics	10
Interspersion	6
Vertical Biotic Structure	12
Overall AA Score	**63**

Figure 7. Photos of the BBE CRAM assessment.

Table 5. CRAM Metric, Attribute and Index Scores for five previous assessments in the Carmel River Lagoon.

Project Name	BBE CRAM Development	BBE CRAM Development	BBE Validation fieldwork	BBE Validation fieldwork	2012 BBE CC Ambient Assessment	2012 BBE CC Ambient Assessment	2012 BBE CC Ambient Assessment
Site Name	Carmel 1	Carmel 4	Carmel 1	Carmel 5	Carmel 1	Carmel 2	Carmel 3
Date of Assessment	8/11/11	8/11/11	7/2/12	7/2/12	10/18/12	10/18/12	10/18/12
Assessors	CC, SSD	CC, SSD	CC, SR	SSD, KO	SSD, CC, Daniel	SSD, CC, Daniel	SSD, CC, Daniel
Wetland Class	Bar-Built Estuary	Bar-Built Estuary	Bar-Built Estuary	Bar-Built Estuary	BBE	BBE	BBE
open/closed					closed	closed	closed
CRAM Attribute and Metric Scores							
Buffer and Landscape Connectivity	**83**	**69**	**83**	**77**	**83**	**83**	**61**
Aquatic Area Abundance Metrics	8	7	8	8	8	8	5
Stream Corridor Continuity	3	3	3	3	3	3	3
Adjacent Aquatic Area	12	9	12	12	12	12	3
Marine Connectivitiy	9	9	9	9	9	9	9
Buffer Metrics	12.00	9.67	12.00	10.39	12.00	12.00	9.67
% of AA with Buffer	12	12	12	12	12	12	12
Average Buffer Width	12	9	12	12	12	12	9
Buffer Condition	12	9	12	9	12	12	9
Hydrology	**66.7**	**66.7**	**66.7**	**66.7**	**66.7**	**66.7**	**66.7**
Water Source	6	6	6	6	6	6	6
Hydroperiod	9	9	9	9	9	9	9
Hydrologic Connectivity	9	9	9	9	9	9	9
Physical Structure	**100**	**75**	**87.5**	**75**	**75**	**37.5**	**50**
Structural Patch Richnes	12	9	9	9	6	3	3
Topographic Complexity	12	9	12	9	12	6	9
Biotic Structure	**91.7**	**80.6**	**94.4**	**97.2**	**97.2**	**63.9**	**83.3**
PC: No. of plant layers	12	12	9	12	9	9	12
PC: No. of codominants	12	9	9	12	12	3	12
PC: Percent Invasion	12	12	12	9	12	12	12
Plant Community Metrics	12	11	10	11	11	8	12
Interspersion	12	9	12	12	12	3	6
Vertical Biotic Structure	9	9	12	12	12	12	12
Overall AA Score	**85**	**73**	**83**	**79**	**81**	**63**	**65**

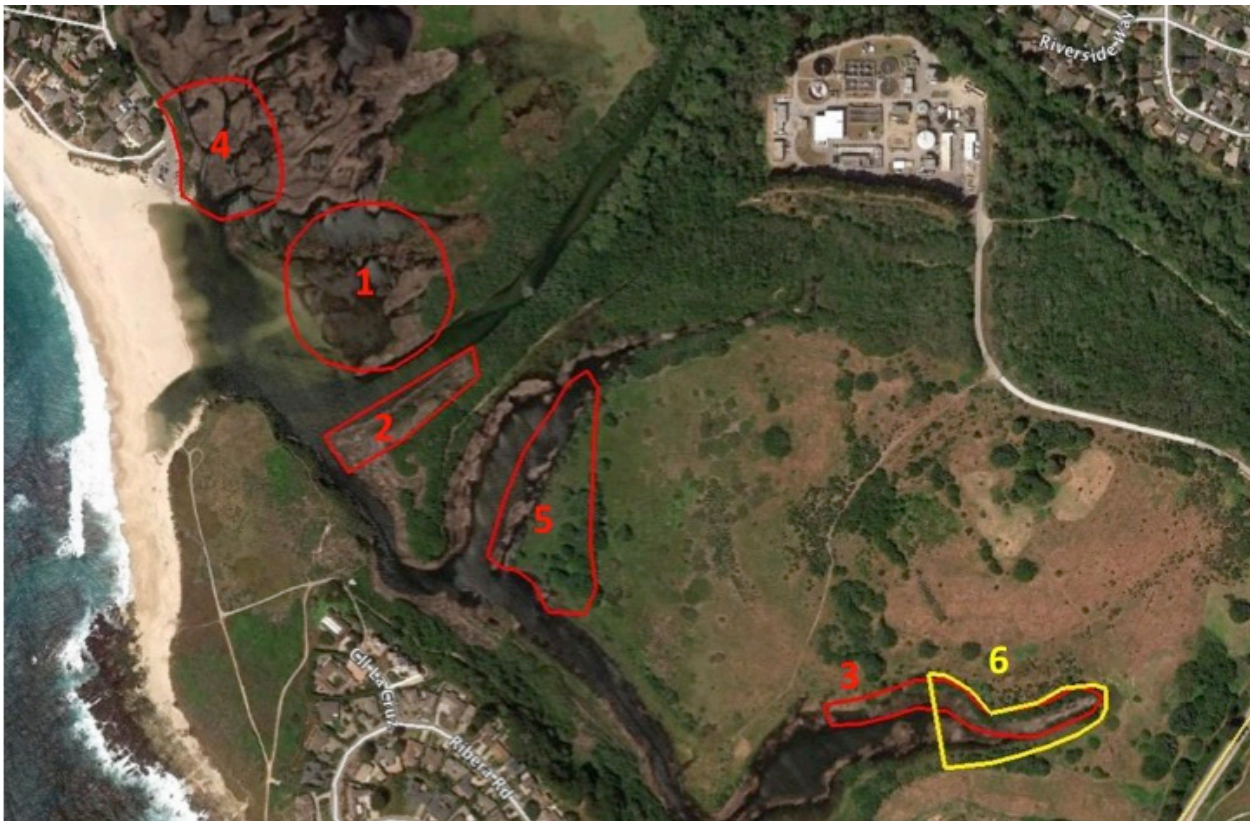

Figure 8. Location of 6 assessment areas in the Carmel River lagoon.

3.2 Bird Surveys

A total of 65 bird species were observed at the Carmel River Floodplain site representing a wide variety of riparian, grassland, and oak woodland species (Table 6).

The highest species richness was observed in early spring (Figure 9a), while the highest number of individuals was observed in late winter (Figure 9b). The grassland and riparian habitat types showed significantly higher species richness than the oak woodland habitat. However, there is very little oak woodland habitat on the site, so this is not surprising.

The species richness in both the grassland and riparian habitats showed similar responses to the change in seasons with the highest number of species being observed in the early spring.

Table 6. List of all bird species observed at the Carmel River Floodplain site.

Acorn Woodpecker	Lazuli Bunting
Allen's Hummingbird	Lesser Goldfinch
American Crow	Lincoln's Sparrow
American Goldfinch	Loggerhead Shrike
American Kestrel	Mallard
American Robin	Mourning Dove
Anna's Hummingbird	Northern Flicker (Red-shafted)
Band-tailed Pigeon	Northern Rough-winged Swallow
Barn Swallow	Nuttall's Woodpecker
Belted Kingfisher	Olive-sided Flycatcher
Bewick's Wren (Pacific)	Pacific-slope Flycatcher
Black Phoebe	Red-shouldered Hawk
Black-headed Grosbeak	Red-tailed Hawk
Blue-gray Gnatcatcher	Red-winged Blackbird
Brown-headed Cowbird	Red-winged Blackbird (California Bicolored)
California Quail	Savannah Sparrow
California Thrasher	Sharp-shinned Hawk
California Towhee	Song Sparrow (California)
Canada Goose	Spotted Towhee
Chestnut-backed Chickadee	Steller's Jay
Cliff Swallow	Tree Swallow
Common Yellowthroat	Violet-green Swallow
Downy Woodpecker (Pacific)	Warbling Vireo
European Starling	Western Bluebird
Grasshopper Sparrow (Western)	Western Kingbird
Great Blue Heron	Western Meadowlark
Great Egret	Western Scrub-Jay (Coastal)
Hairy Woodpecker (Pacific)	Western Tanager
Hermit Thrush	White-crowned Sparrow
House Finch	White-crowned Sparrow (Puget Sound)
hummingbird sp.	Wilson's Warbler
Hutton's Vireo	Wrentit
Lark Sparrow	

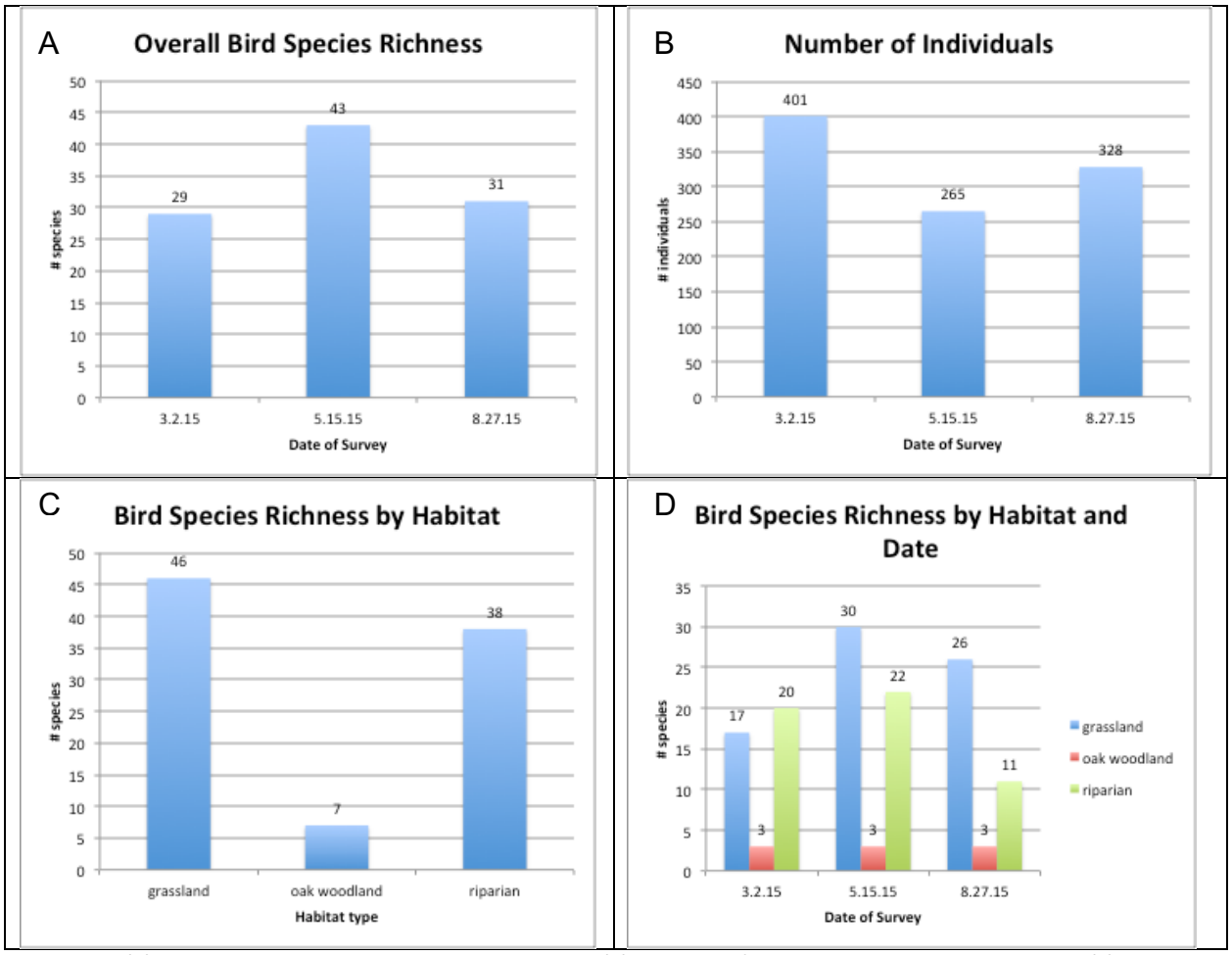

Figure 9. (a)Bird species richness by observation date, (b) Number of individuals by observation date, (c) bird spices richness by habitat type, and (d) bird species richness by habitat type and observation date for the Carmel River Floodplain site.

3.3 Water Elevation

The water logger installed by CCWG staff recorded the highest water elevation (1.53 feet) when it was first installed on February 16th, 2015 (Figure 10). After that date, the water elevation decreased consistently, with the exception of a few increases during small rain events. The data suggest that the river went dry at the upstream end of the project site around June 1st.

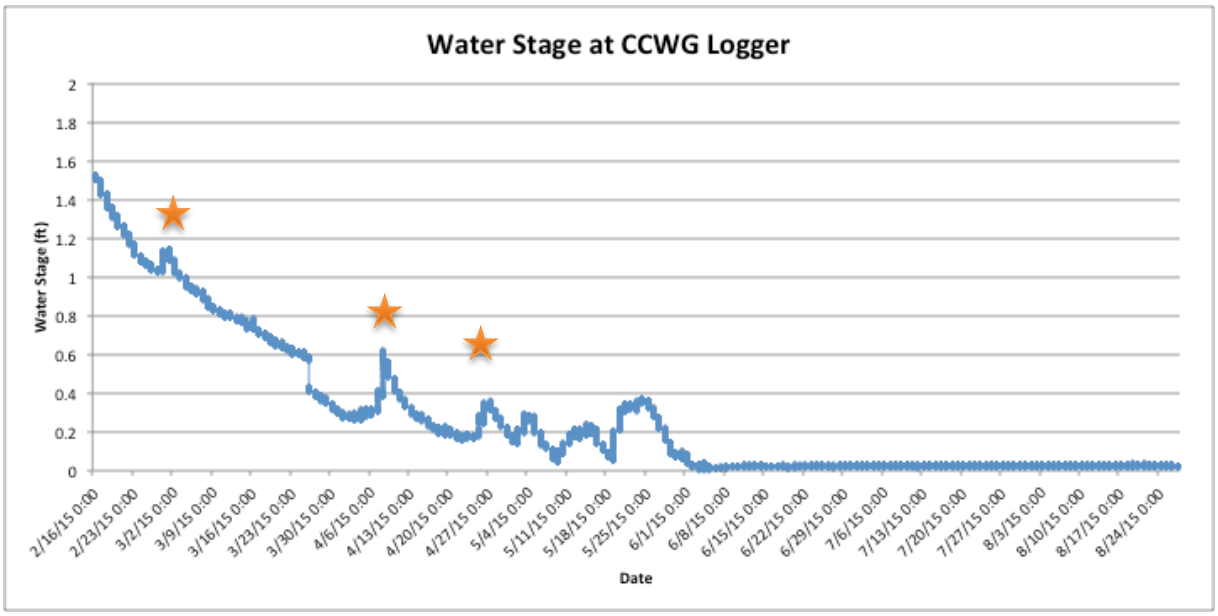

Figure 10. Water stage in feet from 2/16/2015 to 8/27/2015, recorded by the continuous logger installed by CCWG at the upstream end of the project site.

The water elevation logger installed by CCWG shows a strong correlation with the river discharge volume estimates provided by the USGS at gage #11143250, just upstream of the project site (Figure 11). Both river gages document a similar downward trajectory in flow/water elevation, including several periodic increases following small rain events. The USGS gage reports the river running dry on 6/18/15 whereas the CCWG logger reports no water present 17 days earlier on 6/1/15. Yellow stars on both graphs represent rain events of greater than 1/10 inch logged at Moss Landing Marine Labs.

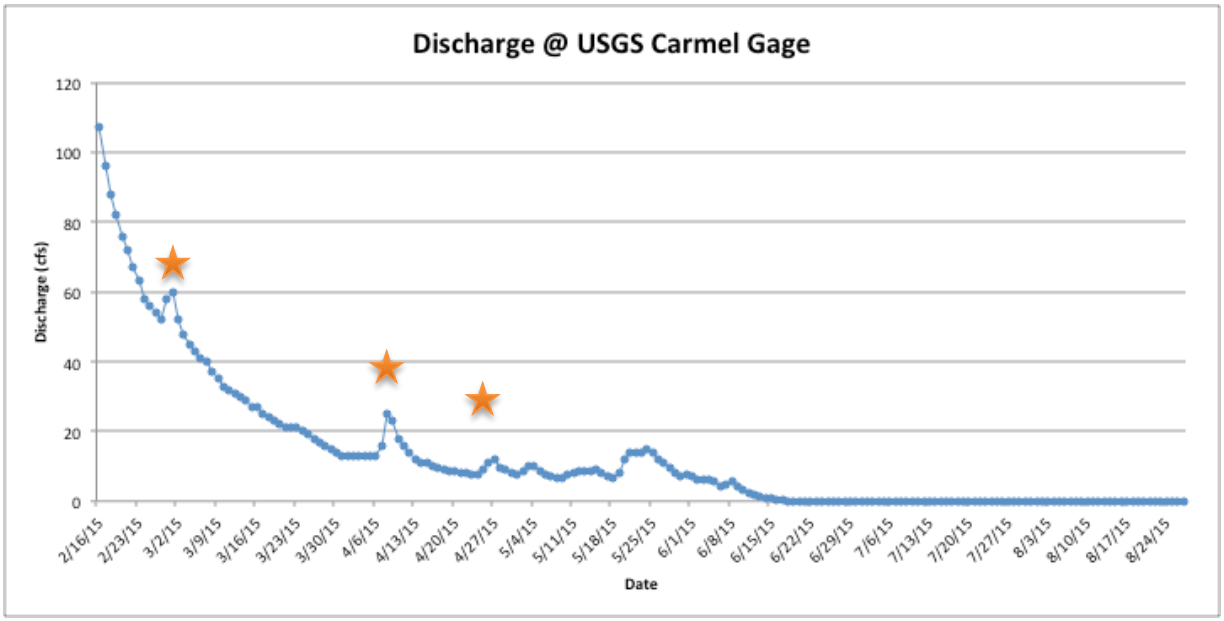

Figure 11. River discharge in cubic feet per second from 2/16/2015 to 8/27/2015, estimated at the USGS stream gage #11143250 just upstream of the project area.

4.0 RECOMMENDATIONS

Additional pre- and post-project monitoring may include:

1. A second year of bird monitoring- Because 2015 represented the fourth year of a serious drought for California, the monitoring results of the bird surveys may be skewed. Repeating the bird surveys for 2016 or 2017 may reveal different patterns in bird species distribution and abundance on the project site and will aid comparisons with post project surveys. Continued bird survey results will aid the development of proposed adaptive management procedures for the floodplain restoration project.
2. Riparian area assessments using the newly developed California Riparian Rapid Assessment Method- CCWG has finalized the development of a Riparian Rapid Assessment Method for the central coast of California (RipRAM). We recommend using this riparian specific, cost effective assessment method to track changes to the CRFREE site following project implementation in comparison with reference locations throughout the watershed. Such a survey will quantify the resultant improvements in riparian heal in context with background changes within the watershed.
3. Monitoring of the benthic infauna in the south arm of the Carmel River lagoon- The planned construction of a second channel for the Carmel River to flow under HWY 1 will lead to flood flows entering the south arm of the Carmel River Lagoon. Currently this area is a backwater that does not receive fluvial action from the river. The current benthic community is likely more similar to a pond than an estuary. Future flood flows will most likely have a significant effect on the benthic infauna community which may increase invertebrate community complexity. Tracking this change before and after restoration efforts occurs will be informative and document important changes in estuarine food web complexity.
4. Quantify Sedimentation rates of South Arm of Carmel River Lagoon- The planned construction of a second channel for the Carmel River to flow under HWY 1 will lead to flood flows entering the south arm of the Carmel River Lagoon. Currently this area is a backwater that does not receive fluvial action or large quantities of sediment from the river. Future flood flows will most likely lead to changes in sedimentation rates to the south arm channel and flood plain, leading to changes in sediment transport processes and community complexity. Tracking changes in sediment accumulation in the southern lagoon before and after restoration efforts occurs will be informative and document important changes in estuarine sedimentation processes.