Santa Clara River Parkway
Floodplain Restoration Feasibility Study

Riparian Vegetation Mapping and Preliminary Classification for the Lower Santa Clara River and Major Tributaries

Ventura County, California

VOLUME I

FINAL REPORT

August 2007

Prepared for
The California Coastal Conservancy
1330 Broadway, 11th Floor
Oakland, California 94612-2530

Prepared by
Stillwater Sciences
2855 Telegraph Avenue, Suite 400
Berkeley, California 94705

and
URS Corporation
1333 Broadway, Suite 800
Oakland, California 94612

Stillwater Sciences

URS

Acknowledgements

This project was truly a collaborative effort. Funding was provided by the California Coastal Conservancy and the Santa Clara River Trustee Council. Peter Brand supported this project from its inception, and we'd like to thank him for considering this to be a valuable addition to the conservation planning efforts in the watershed. We would also like to thank the Ventura County Planning Division for taking a leading role in advancing this level of vegetation classification and mapping. In particular, Lorraine Rubin and Elizabeth Chattin provided initial help and encouragement in the grant writing process. Many landowners and managers graciously provided access to various parts of the river corridor, which allowed us to conduct field surveys over much more of the mapping area than we had originally anticipated. Todd Keeler-Wolf (California Department of Fish and Game) and Julie Evens (California Native Plant Society) freely gave advice on vegetation classification and mapping, and provided early drafts of recent Southern California vegetation classification reports to help us identify alliances and associations that might be expected to occur along the Santa Clara River.

The project management team included Bruce Orr (Stillwater Sciences) as the principal investigator, Gretchen Coffman (URS) as the field coordinator, and Bill Sears (Stillwater Sciences) as the GIS/database coordinator. Tom Dudley (UCSB), the principal investigator for a project focused on biological control of *Arundo donax* (funded by the Trustee Council) combined forces with our project team to allow for more efficient and comprehensive field mapping of riparian vegetation and the invasive *A. donax* and *Tamarix* species. The field effort would not have been possible without the enthusiastic efforts of Gretchen Coffman, Casey Stewman, Sarah Lewis, Johanna LaClaire, and David Kisner (all from URS); Todd Lemein and Keegan Kennedy (both from UCSB); and Gilda Barboza (CNPS). Data entry and creation of the Access and GIS databases relied on the talents and hard work of Bill Sears, Marie Reil, Wayne Swayne, and Sebastian Araya (Stillwater Sciences), and Todd Lemein (UCSB). The development of vegetation classification scheme and QA/QC of field mapping and typing were conducted by Bruce Orr, Gretchen Coffman, and Bill Sears. The final report could not have been completed without the able assistance of Zooey Diggory, Tami Cosio, Bill McDowell, Rob Thoms, and Sebastian Araya (Stillwater Sciences).

Preferred citation

Stillwater Sciences and URS Corporation. 2007. Riparian Vegetation Mapping and Preliminary Classification for the Lower Santa Clara River and Major Tributaries, Ventura County, California. Volume I. Prepared by Stillwater Sciences and URS Corporation for the California State Coastal Conservancy and the Santa Clara River Trustee Council.

Table of Contents

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

The 116-mile long Santa Clara River flows in a westerly direction from headwaters on the northern slopes of the San Gabriel Mountains in Los Angeles County through the Santa Clara River Valley and the Oxnard Plain in Ventura County, and finally empties into the Pacific Ocean near the City of Ventura (Figure 1). Many large coastal southern California rivers (i.e., the Los Angeles, Santa Ana, and San Gabriel rivers) have been confined to concrete channels in their lower reaches to provide flood protection for surrounding urban areas, dramatically reducing (or eliminating) riparian vegetation and the fluvial geomorphic processes that maintains a functioning river corridor ecological system. The Santa Clara River riparian corridor, however, has retained a significant amount of high quality aquatic and riparian habitat that supports threatened and endangered species including arroyo toad (*Bufo microscaphus californicus*), southwestern willow flycatcher (*Empidonax traillii extimus*), least Bell's vireo (*Vireo bellii pusillus*), and slender-horned spineflower (*Dodecahema leptoceras*).

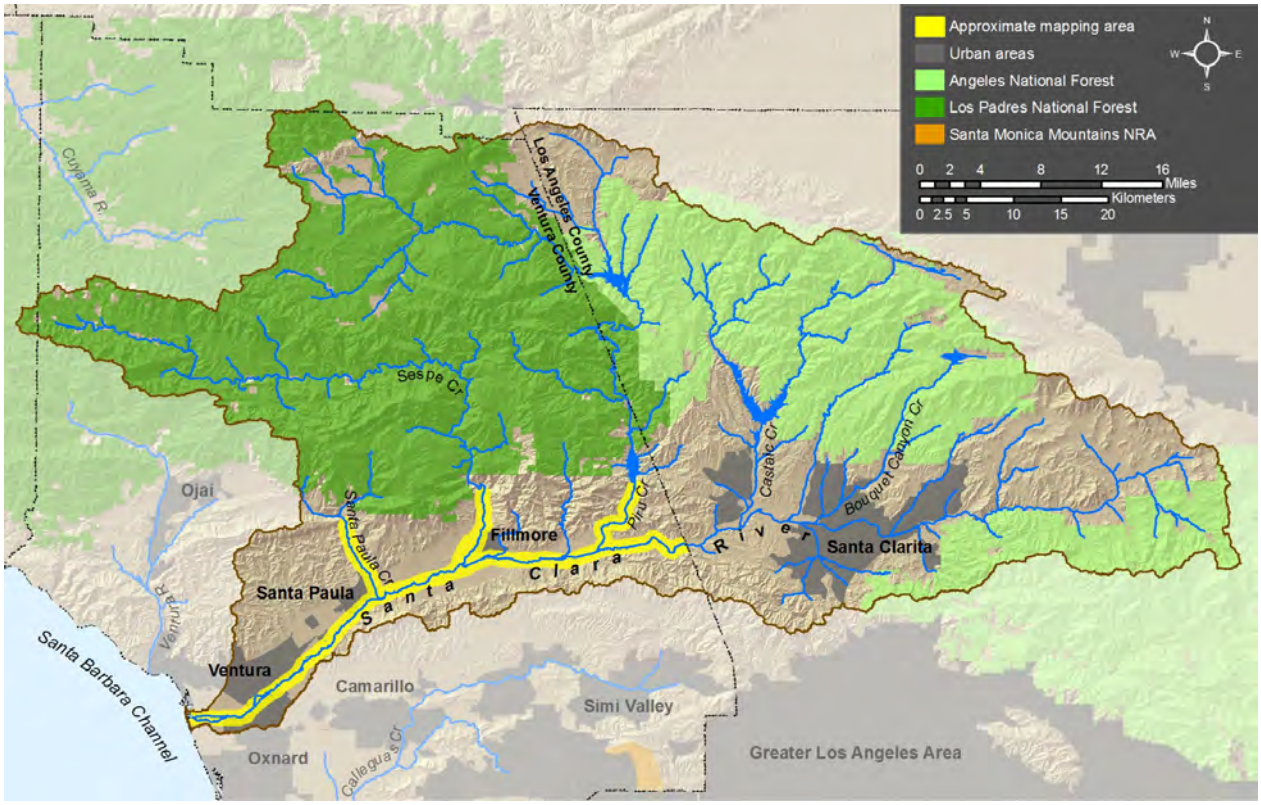

Figure 1. Location of the Santa Clara River watershed and riparian vegetation mapping area covered by this study.

The present-day Santa Clara River is a dynamic semi-arid ecological system driven primarily by periodic short duration, high intensity flood events (Stillwater Sciences 2005). The channel borders between meandering and braided river forms, as defined by the gradient, discharge, and bed material grain size. The result (where natural processes prevail) is an unusual compound channel morphology that is essentially braided at lower flows but more akin to a low sinuosity meandering channel during large flood discharges. The channel morphology is affected primarily by large flood flows rather than by the

moderate discharges frequently used to characterize channel form response in temperate climates. These factors result in a mosaic of riparian vegetation that shifts in extent, structure, and composition in response to deposition, scour, and inundation by large flood flows.

Although the Santa Clara River riparian corridor is relatively intact, flood protection infrastructure, diversions, roads, agriculture, and urbanization have constrained or disrupted natural geomorphic and hydrologic processes, causing riparian and aquatic habitat degradation. While a number of studies and planning efforts have begun on the river to address these issues (e.g., Trustee Council 2002, AMEC 2005, and the Santa Clara River Parkway project), baseline information on existing riparian community types, their extent, and distribution is not available. Since native riparian vegetation provides critical ecosystem services, such as improved flood control and water quality, improved terrestrial and aquatic habitat quality, and increased local biodiversity, managing for healthy riparian vegetation is a central part of river management and restoration. Developing an accurate, current map of riparian vegetation is a crucial first step in river management and restoration planning

This project addresses the need for detailed vegetation information in support of conservation and restoration planning efforts on the lower Santa Clara River within Ventura County. Funding for the project was provided through matching grants by the California State Coastal Conservancy (SCC) and The Santa Clara River Trustee Council (Trustee Council). Riparian vegetation mapping and classification on the mainstem of the upper Santa Clara River and tributaries in Los Angeles County was conducted by Amec Earth and Environmental (2006) and Condor Environmental (2006).

1.1 Objectives

The primary objective of this project is to provide a preliminary vegetation classification and detailed vegetation map for the mainstem Santa Clara River riparian corridor and its three major tributaries within Ventura County. A set of needs and benefits, which this report is designed to address, were identified in the proposal phase of the project, and are discussed below.

1.1.1 Provide baseline data for Santa Clara River Parkway Floodplain Restoration Feasibility Study

The SCC, along with partner organizations The Nature Conservancy (TNC) and Friends of the Santa Clara River (FSCR), has initiated the Santa Clara River Parkway project, an effort involving the acquisition and restoration of a 20 mile-long corridor along the mainstem Santa Clara River, from the river mouth to the Sespe Creek confluence. In support of Parkway planning, the SCC is currently funding a Floodplain Restoration Feasibility Study; the study is designed to assist the SCC and its partners in the identification of opportunities and constraints associated with the acquisition, management, and eventual restoration of the Parkway area. The study will assess the hydrologic, geomorphic, and biological attributes of the Parkway area, and develop a set of recommended restoration strategies. This riparian vegetation mapping and classification effort provides critical baseline information for all of the key biological components of the Feasibility Study, including assessments of potential restoration effects on riparian habitats and associated focal species.

1.1.2 Identify invasive vegetation for eradication efforts

In order to develop an effective invasive plant management strategy, the distribution and extent of known infestations must first be cataloged. Mapping the location of invasive plants is a necessary first step in any invasive plant removal effort, and a number of efforts are underway within the watershed to address this need (Dudley 2004, VCRCD 2006a,). A watershed-wide, programmatic environmental

impact report (EIR) for removal of the invasive giant reed (*Arundo donax*) has been funded (VCRCD 2006b), however the EIR cannot proceed until vegetation mapping has been done so that potential impacts of the removal effort can be addressed (e.g., proximity of infestations to sensitive habitats). This mapping must be conducted at a level of detail that will identify stands of *Arundo donax* and *Tamarix ramosissima*. The Ventura County Resource Conservation District (VCRCD) secured funding to classify and map riparian vegetation in the Los Angeles County portion of the Santa Clara River (Amec 2006, Condor Environmental 2006). The effort described in this report covers the classification and mapping of riparian vegetation in the Ventura County portion of the river corridor (the lower Santa Clara River), including detailed mapping of percent cover of the invasive *Arundo donax* and mapping of the locations of observed *Tamarix* stands and individuals. The classification and mapping effort in the lower Santa Clara River corridor was conducted in collaboration with researchers from the University of California at Santa Barbara who are undertaking invasive plant mapping efforts (focused on biological control of *Arundo donax*) funded by the Trustee Council (Dudley 2004).

1.1.3 Facilitate more effective land use planning

The Ventura County Planning Division is the key regulator of land use adjacent to much of the Santa Clara River in Ventura County. In order to strengthen the effectiveness with which it fulfills its biological resource protection mandates, the Division is undertaking, with grant funding, an ambitious program to inventory sensitive aquatic resources and review County protection policies. The development of mapped data, such as of wetlands, migration corridors, and the habitats of special status species, is central to this effort. The riparian vegetation maps provided with this report will allow County staff and applicants to immediately identify any sensitive resource issues that may exist on a property. The maps will also form the foundation of a GIS (geographic information system) that will allow for analysis and modeling, such as evaluating the potential effects of land use decisions on sensitive species and their habitats. Vegetation maps are an essential tool in pinpointing the habitats and associated species likely to be affected by any given land use decision, to define sensitive riparian areas, to document existing biodiversity, and to assess cumulative impacts to habitat.

1.1.4 Improve local wildlife habitat suitability modeling

During the field component of this mapping effort, supplemental data was gathered about vegetation structure using modified California Native Plant Society (CNPS) Rapid Assessment forms (CNPS Vegetation Committee 2003a). These data can be incorporated into the California Wildlife Habitat Relationship (WHR) database (operated by the California Department of Fish and Game). Collateral data gathered through this project should help improve the utility of the WHR database for modeling species habitat suitability along the Santa Clara River. The vegetation mapping effort itself will provide a solid foundation for future studies of wildlife-habitat relationships in the river corridor, which could be conducted to improve the accuracy and precision of the WHR database for local or regional application.

1.1.5 Advance regional conservation planning

This mapping effort can be combined with adjacent vegetation mapping to provide an important planning tool for biodiversity conservation at the regional scale. Examples include providing information useful for understanding and modeling wildlife corridors, endangered species habitat, and long-term vegetation change. The vegetation map can be used as a baseline for long-term status and trends monitoring in the Santa Clara River corridor and other rivers in the region. The use of a standardized system for the various regional mapping efforts will ensure that the maximum amount of information can be gained by comparing conditions in the different areas and exploring potential natural linkages (e.g.,

wildlife movement corridors). In addition, vegetation can be used as a readily measured indicator of ecosystem function and site quality (Evens and Keeler-Wolf 2003).

1.2 Study Area

The project study area (24,291 acres; 10,033 hectares) encompasses the extent of riparian vegetation along the lower mainstem Santa Clara River in Ventura County, a reach of approximately 38 mi (61 km). The project also includes the extent of riparian vegetation on the three largest tributaries to the mainstem Santa Clara River in Ventura County (Santa Paula, Sespe, and Piru creeks), extending from their confluence with the Santa Clara River upstream for approximately 4 mi (6.4 km). The 500-year floodplain boundary defined the upland limits of the mapping effort (Figures 1 and 2). Elevations in the study area range from 0 to 60 ft (0 to 18 m) above sea level.

2 METHODS

The nature of the Santa Clara River system poses a number of challenges to riparian vegetation mapping. Like the river itself, vegetation in the corridor is dynamic, exhibiting dramatic fluctuations in extent and composition in response to large flood events. In January and February 2005, the Santa Clara River experienced two major floods, with peak flows reaching approximately 136,000 cfs (3,851 m^3s^{-1}) near the river mouth. Significant areas of riparian vegetation within the active channel were removed by the floods, dramatically altering the character and pattern of vegetation within the study area.
The complex and dynamic nature of vegetation communities present within the lower Santa Clara River corridor required modifications to traditional approaches for riparian vegetation mapping; thus, this project utilized a combination of field-based vegetation classification and mapping, and traditional photo-interpretive techniques, as described below. The vegetation classification followed the State of California standard vegetation classification system developed under the auspices of the Vegetation Program of the California Native Plant Society and described in the first edition of A Manual of California Vegetation (Sawyer and Keeler-Wolf 1995), with minor adjustments to match changes being incorporated into the second edition of the Manual, which is currently in preparation (T. Keeler-Wolf, *pers. comm.*, 2005 and 2007).

2.1 Vegetation Classification

Existing information relevant to vegetation and land cover classification and mapping in the region were gathered and reviewed, and then used to generate an initial list of vegetation types (alliances) that were likely to occur in the project area. Primary data sources included:

- Environmental Science Associates (ESA). 2003. McGrath State Beach Natural Resources Management Plan. Prepared for the California Department of Parks and Recreation.
- URS Corporation. 2002. Hedrick Ranch Nature Area Management Plan. Prepared for Friends of the Santa Clara River and the California State Coastal Conservancy.
- California Department of Fish and Game (CDFG) and the California Native Plant Society (CNPS). 2005. Vegetation Classification of the Santa Monica Mountains National Recreation Area and Environs, Ventura and Los Angeles Counties, California. Prepared for the Santa Monica Mountains National Recreation Area.
- Klein, A and J.M. Evens. 2005. Vegetation Classification and Mapping for Western Riverside County, California. California Native Plant Society, Sacramento, CA.
- Evens, J. and S. San. 2005. Vegetation Alliances in the San Dieguito River Park Region, San Diego County, California. California Native Plant Society, Sacramento, CA.

Additional sources of vegetation classification and mapping data considered during development of the classification for the study area included Sawyer and Keeler-Wolf (1995, and in prep), Ferren et al. (1990), DMEC (2001), Condor Environmental (2006), and Amec Earth and Environmental (2006).

2.2 Base Map Imagery and Minimum Mapping Unit

Digital orthophotography (natural color, 1 foot pixel resolution) flown in September 2005 served as the primary data source for generating paper maps for field-based mapping (see Section 2.3) and for onscreen photointerpretation using ESRI ArcGIS (see Section 2.4). Other data sources, including hillshades generated from the Ventura County 2005 LiDAR data, other available photographs and maps, and base features such as roads and levees, were used to aid the photo interpretation and classification process.

Floodplain delineations from the FEMA Q3 dataset and inundation mapping generated from HEC-RAS modeling output were utilized to generate the 500-year floodplain boundaries, which defined the upland limits of the mapping effort.

Based upon the available imagery and the results of field reconnaissance (Section 2.3), a minimum mapping unit (MMU) to be applied in both field-based and photointerpretation efforts for each vegetation type (alliance or alliance group/super-alliance) was derived. The desired target was a 1-acre MMU for most types, with finer resolution (0.50-acre MMU) for more unusual types that were discernable from the aerial photography. A coarser resolution (5-acre MMU) was utilized for upland land cover types such as agriculture and development.

Spatial data from the vegetation maps for McGrath State Park (ESA 2003) and Hedrick Ranch Nature Area (URS Corporation 2002) were incorporated into this mapping effort, after adjustments and field checks for consistency with the minimum mapping units and classification rules.

2.3 Field-based Mapping

A three-day field reconnaissance effort in July 2005 was conducted within the study area to collect data for representative stands of vegetation using a modified version of the CNPS rapid assessment protocol (CNPS Vegetation Committee 2003a). This protocol provided quantitative data that was used to refine the vegetation classification effort. The reconnaissance also provided an opportunity to assess access issues and other considerations for subsequent field-based mapping efforts.

A four-week long field mapping effort was undertaken during the summer of 2005 to provide a detailed characterization of the vegetation for a majority of the study area. Information collected during this field effort was used to refine vegetation type definitions and to modify the initial classification key so that the photo interpretation process (Section 2.4) could proceed more accurately. In general, when a new potential alliance was identified, a modified CNPS vegetation rapid assessment field data form was used to document the occurrence and percent cover of dominant and characteristic plant species present, as well as the occurrence and percent cover of vegetation in three height strata: low (<0.5 m), medium (0.4 – 5 m), and high (> 5 m). These initial survey sites were selected to represent the range of vegetation types identified during the field reconnaissance. As a result, approximately 50 sites total were sampled using the modified rapid assessment protocol.

In addition, a more streamlined data form, modified from the CNPS vegetation reconnaissance field data form (versus the modified CNPS rapid assessment protocol used for the 50 sites described above) was used to document dominant and characteristic plant species at approximately 650 stands (polygons) during the remainder of the four-week main field survey effort in summer 2005, and additional surveys in fall 2005 and summer 2006. This CNPS reconnaissance data form is typically used for ground-truthing or accuracy assessment of polygon classification based on photo interpretation. This effort provided more accurate vegetation data than could be obtained through photo-interpretation, reduced the amount of area that had to be mapped using photo-interpretation (see Section 2.4), and supported further refinement of the classification system. In summary, field data on percent cover of dominant and characteristic species were collected for nearly 700 stands of vegetation during 2005 and 2006 (Appendix A).

Field crews utilized high-resolution maps (11x17 inches, color printed at 600 dpi, 1:4800 scale) to document stands of vegetation observed in the field, using the initial classification as a guide in

delineating mapping units on the hardcopy maps. The field-based mapping classifications were delineated at several scales, including the more broad scale land use types, vegetation alliances (based on dominant species) and more specific vegetation associations (based on dominant and associated species). To standardize the terminology, these field-based classifications are referred to as "mapping units".

To create the digital vegetation map data set, field maps were scanned at 600 dpi and georeferenced in ESRI ArcGIS to the September 2005 source orthophotography in preparation for mapping unit digitization. Field delineated mapping units on the georeferenced field maps were then traced on-screen using a polygon representation, and attributed with the appropriate vegetation or land cover classification from the field data forms.

2.4 Photo-interpretation and Map Development

For areas of riparian vegetation that were inaccessible to field crews during the field mapping effort, and for extensive areas of upland land cover within the 500-year floodplain, on-screen photo interpretation using the September 2005 orthophotography was undertaken using ESRI ArcGIS. A field-experienced photo interpreter delineated and classified each identifiable vegetation stand or land cover area using the MMU and classification procedures discussed above. Delineation was conducted at on-screen scales between 1:1200 and 1:10000.

The principal investigator and a botanist reviewed draft versions of the classification and digital vegetation map to ensure consistency in stand delineation and classification within the study area. Mapping unit boundaries were revised in some cases to better match the September 2005 photographic base map and ensure consistency with the final classification scheme presented in this report. This effort was necessary to ensure that the final vegetation map (GIS coverage) represents an accurate "snapshot" of the dynamic vegetation mosaic as of September 2005. This product, therefore, will provide a good foundation for detecting future changes in riparian vegetation in the study area.

Although a formal accuracy assessment was not conducted due to limited resources, the extensive field-based nature of this effort has been used to the greatest extent possible to provide a highly accurate vegetation map of the lower Santa Clara River riparian corridor.

Plant species nomenclature follows that of The Jepson Manual: Higher Plants of California (Hickman 1993) and does not include official names changes expected in the next edition of The Jepson Manual and of A Manual of California Vegetation.

3 MAPPING UNITS WITHIN THE STUDY AREA

3.1 Detailed Mapping Units

The resulting map of riparian vegetation in the lower Santa Clara River is, perhaps, one of the most field-based and highest resolution vegetation maps in the region. The detailed vegetation map, which presents all 130 mapping units documented during field-based and photo-interpreted mapping (including land use types, vegetation associations, and vegetation alliances), is provided in Volume II of this report. These mapping units are also summarized alphabetically and by area in Appendix A. Appendix A also indicates the sample size (number of stands or polygons surveyed in the field) for each mapping unit. Metadata for the digital spatial data presented in Figures 1-4 of this volume and Volume II, Appendix A, are included in Appendix B.

3.2 Land Use – Land Cover Types

Summarizing the detailed mapping units presented in Volume I and Appendix A into lower-resolution land use cover categories facilitates the identification of land use and general vegetation patterns in the lower watershed. Coarser-scale land use – land cover types are presented in Table 1 and mapped in Figure 2.

Table 1. Land use–land cover types in the Santa Clara River riparian vegetation mapping area.

Land Use - Cover Type	Acres	Hectares	Percent of Mapped Area
Agriculture	8,141	3,295	33%
Developed	6,484	2,624	26%
Riparian Vegetation	7,214	2,919	29%
Riverwash	2,096	848	8%
Open Water	857	347	3%
Total Mapped Area	**24,791**	**10,033**	**100%**

Together riparian vegetation, riverwash, and open water make up 40 % of the riparian vegetation mapping area (Table 1 and Figure 2). This relatively high percentage demonstrates the fairly intact nature of the lower Santa Clara River riparian corridor, particularly in comparison with other southern California rivers that have been channelized. Agriculture, including orchards, irrigated row-crops, and pasture, is the most prevalent land cover type, making up nearly 33 % of the riparian vegetation mapping area (Table 1 and Figure 2). Development, including golf courses, infrastructure, and municipal facilities makes up 26 % of the study area (Table 1 and Figure 2).

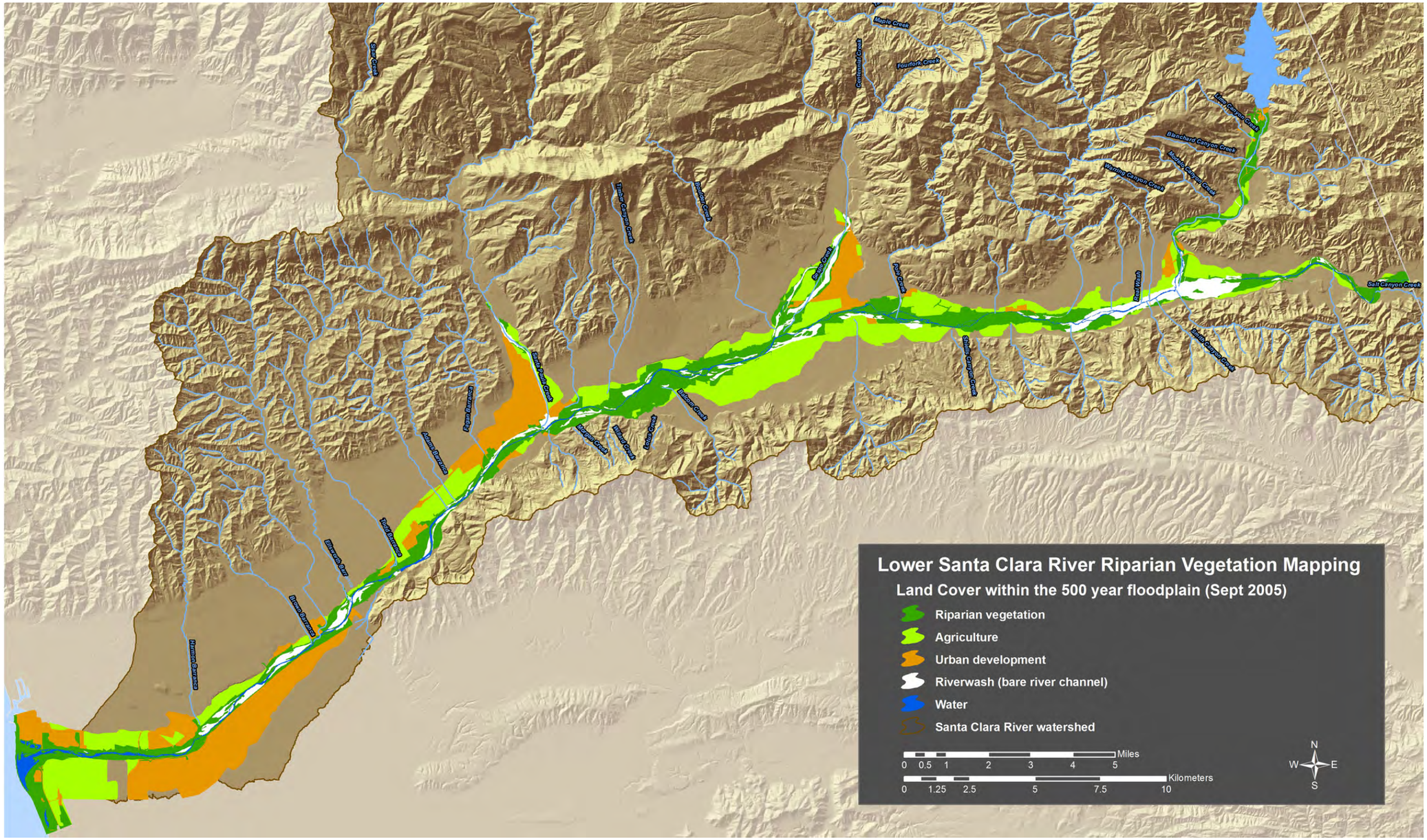

Figure 2. Land use cover types in the Santa Clara River riparian vegetation mapping area (defined by the 500-year floodplain).

4 VEGETATION ALLIANCE DESCRIPTIONS

Consolidating the detailed mapping units described in Section 3 into an alliance-level of detail (see also Appendix A), results in 58 vegetation alliances and super-alliances. These vegetation types are summarized in Table 2 and described in terms of distribution and composition in the sections below (managed land cover types, such as agriculture and developed, that appear in the vegetation map are not described). A comprehensive list of all the plant species recorded in the vegetation alliances is included in Appendix C. The local distribution of each alliance is identified by reach as an indication of longitudinal patterns in vegetation distribution along the river corridor. The extent of these reaches, first defined for the purposes of the Fluvial Sediment Transport and Morphological Change in the Lower Santa Clara River report for the Parkway Floodplain Restoration Feasibility Study (Stillwater Sciences, in progress), is presented in Figure 3.

Table 2. Vegetation alliances in the Santa Clara River riparian vegetation mapping area.

Alliance	Acres	Hectares	Percent of Vegetation in Mapping Area
Riverwash herbaceous	1,355.6	548.6	18.9%
Arundo donax	890.2	360.3	12.4%
Non-native grasses and forbs	556.3	225.1	7.8%
Floodplain wetland	480.5	194.5	6.7%
Salix laevigata	349.2	141.3	4.9%
Mixed willow forest	323.3	130.8	4.5%
Riverwash scrub	294.9	119.4	4.1%
Populus balsamifera	285.0	115.3	4.0%
Salix lasiolepis	249.9	101.1	3.5%
Lepidospartum squamatum	235.3	95.2	3.3%
Artemisia tridentata	215.5	87.5	3.0%
Populus fremontii	205.0	83.0	2.9%
Baccharis salicifolia	187.4	75.8	2.6%
Abronia spp. - *Ambrosia chamissonis*	169.8	68.7	2.4%
Baccharis pilularis	136.1	55.1	1.9%
Salix exigua	133.9	54.2	1.9%
Artemisia californica	113.4	46.8	1.6%
Mixed riparian forest	108.1	43.7	1.5%
Mixed willow scrub	101.9	41.3	1.4%
Mixed riparian scrub	90.0	36.4	1.3%
Salix exigua - Arundo donax	83.3	33.7	1.2%
Quercus agrifolia	72.3	29.3	1.0%
Salix lucida	70.7	28.6	1.0%
Eucalyptus spp.	66.7	27.0	0.9%
Schinus molle	65.0	26.3	0.9%

Alliance	Acres	Hectares	Percent of Vegetation in Mapping Area
Salix exigua - Baccharis salicifolia	40.7	16.5	0.6%
Scirpus spp.	35.5	14.4	0.5%
Mixed scrub	30.7	12.4	0.4%
Eriogonum fasciculatum	23.8	9.6	0.3%
Artemisia californica - Eriogonum fasciculatum	23.7	9.6	0.3%
Carpobrotus spp. *- Mesembryanthemum crystallinum*	17.1	6.9	0.2%
Encelia california	14.1	5.7	0.2%
Olea europaea	12.7	5.1	0.2%
Leymus condensatus	12.3	5.0	0.2%
Tamarix spp.	11.4	4.6	0.2%
Distichlis spicata	10.8	4.4	0.2%
Pluchea sericea	9.9	4.0	0.1%
Nicotiana glauca	8.7	3.5	0.1%
Leymus triticoides	8.5	3.4	0.1%
Sambucus mexicana	8.4	3.4	0.1%
Lessingia filaginifolia	6.6	2.7	0.1%
Lotus scoparius	5.7	2.3	0.1%
Salicornia virginica	5.6	2.3	0.1%
Yucca whipplei	5.5	2.2	0.1%
Atriplex lentiformis	5.3	2.2	0.1%
Salvia mellifera	5.3	2.1	0.1%
Mixed exotic trees	4.0	1.6	0.1%
Platanus racemosa	3.9	1.6	0.1%
Ricinus communis	2.7	1.1	0.04%
Myoporum laetum	2.1	0.9	0.03%
Jaumea carnosa	1.7	0.7	0.02%
Potentilla anserina	1.3	0.5	0.02%
Juglans california	1.2	0.5	0.02%
Myoporum laetum - Arundo donax	1.2	0.5	0.02%
Nicotiana glauca - Artemisia californica	1.2	0.5	0.02%
Ambrosia psilostachya	1.1	0.4	0.02%
Malosma laurina	1.0	0.4	0.01%
Phragmites australis	0.2	0.1	0.003%

4.1 *Abronia* spp.-*Ambrosia chamissonis* (sand verbena-beach bursage) Alliance

This alliance typically has a sparse to moderate cover of perennial forbs in the ground layer, and may occur with grasses and occasional emergent shrubs. It occurs in sandy coastal foredune areas. In our mapping area, the common species are beach bursage (*Ambrosia chamissonis*), red sand-verbena (*Abronia*

maritima), pink sand-verbena (*Abronia umbellata*), coast buckwheat (*Eriogonum parvifolium*), beach evening primrose (*Camissonia cheiranthifolia* ssp. *suffruticosa*), sea rocket (*Cakile maritima*), and lotus (*Lotus junceus*). The description of this alliance is based on the information provided in ESA (2003).

Abronia spp.–*Ambrosia chamissonis* (iceplant) is a proposed association within this alliance. This association is found at McGrath State Beach and includes one or more non-native iceplant species (*Carpobrotus edulis*, *C. chinensis*, and *Mesembryanthemum crystallinum*) as a co-dominant or common component (ESA 2003).

The *Abronia* spp.–*Ambrosia chamissonis* Alliance is found only in the lowest reaches of the Santa Clara River, along the coastal strand on both sides of the mouth of the Santa Clara River (Table 3). This vegetation type was previously mapped in McGrath State Beach (ESA 2003).

Table 3. Distribution of *Abronia* spp.– *Ambrosia chamissonis* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
0	103.0	41.7	2
1	66.8	27	4
TOTAL	**169.8**	**68.7**	**6**

4.2 *Ambrosia psilostachya* (western ragweed) Alliance

The one stand of the *Ambrosia psilostachya* Alliance mapped in the study area has dense (70 %) vegetative cover, with western ragweed (*Ambrosia psilostachya*) (25 % cover) and branching phacelia (*Phacelia ramosissima*) (25 % cover) as co-dominants. Giant reed (*Arundo donax*) occurs at low density (1 % cover) in this stand. To our knowledge, this alliance has not been previously described. Further study is required to determine if this is a valid alliance (or association), or if this stand would better fit under some other herbaceous alliance.

Ambrosia psilostachya is a common species along roadsides and dry fields. The alliance, an upland herbaceous vegetation type, is found only in Reach 4 of the lower Santa Clara River (Table 4). *Ambrosia psilostachya* occurs as a common component in some other herbaceous alliances in the study area, particularly the *Leymus triticoides* Alliance stands found in the Hedrick Ranch Nature Area.

Table 4. Distribution of *Ambrosia psilostachya* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
4	1.1	0.4	1
TOTAL	**1.1**	**0.4**	**1**

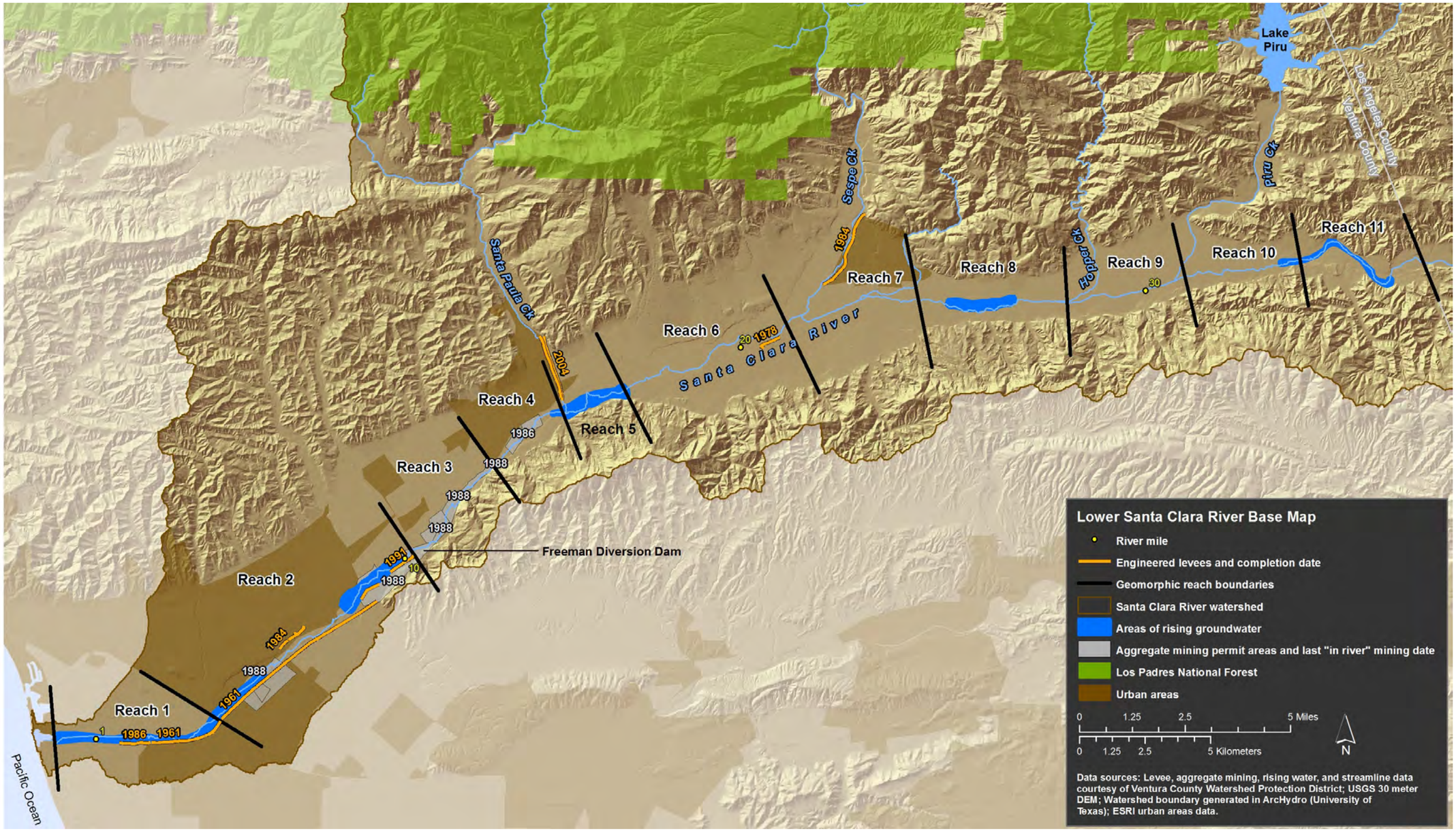

Figure 3. Lower Santa Clara River reaches.

4.3 *Artemisia californica* (California sagebrush) Alliance

This shrub-dominated alliance has open to dense cover (40–80 % total cover), California sagebrush (*Artemisia californica*) (10–75 % cover) as the dominant or co-dominant shrub. Other co-dominant shrubs may include quailbush (*Atriplex lentiformis*), coyote brush (*Baccharis pilularis*), and mulefat (*B. salicifolia*). California buckwheat (*Eriogonum fasciculatum*) is a fairly common sub-dominant species. (Note: stands in which *A. californica* and *E. fasciculatum* are co-dominant are classified under the *Artemisia californica – Eriogonum fasciculatum* Alliance.) Scattered emergent trees are present in some stands. The herbaceous layer tends to be sparse to dense, and is generally dominated by non-native grasses and forbs, especially shortpod mustard (*Hirschfeldia incana*).

This alliance includes the following five map unit types that were identified in the mapping area:

- *Artemisia californica* Alliance – *A. californica* is the sole dominant shrub;
- *Artemisia californica* (Disturbed) Provisional Alliance or Association – a disturbed phase of the main alliance, with non-native species, such as sweet fennel (*Foeniculum vulgare)*, common;
- *Artemisia californica – Atriplex lentiformis* Potential Alliance or Association – an undescribed type in which *A. lentiformis* is co-dominant with *A. californica*;
- *Artemisia californica – Baccharis pilularis* Potential Alliance or Association – an undescribed type in which *B. pilularis* is co-dominant with *A. californica*; and
- *Artemisia californica – Baccharis salicifolia* Potential Alliance or Association – an undescribed type in which *B. salicifolia* is co-dominant with *A. californica*.

The *Artemisia californica* Alliance has been identified by other authors as well (e.g. DMEC 2001, CDFG and CNPS 2005, Evens and San 2005) and is typically found in coastal scrub, coastal chaparral, and dry coastal foothills. It has been mapped throughout the lower Santa Clara River and along its tributaries (Table 5). It is particularly abundant in undeveloped areas in Reach 2 and along Piru Creek.

Table 5. Distribution of *Artemisia californica* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
1	2.7	1.1	2
2	34.4	13.9	6
6	2.3	0.9	1
11	0.8	0.3	1
Piru	69.4	28.1	12
Santa Paula	1.4	1.4	4
Sespe	2.4	1.0	6
TOTAL	**113.4**	**46.8**	**32**

4.4 *Artemisia californica-Eriogonum fasciculatum* (California sagebrush-California buckwheat) Alliance

This alliance is typically co-dominated by California sagebrush (*Artemisia californica*) (15–35 % cover) and California buckwheat (*Eriogonum fasciculatum*) (10–15 % cover) in the shrub layer, with a sparse to moderate understory (5–20 % cover). Other shrub species that commonly occur in the alliance include

scalebroom (*Lepidospartum squamatum)*, black sage (*Salvia mellifera*), California aster (*Lessingia filaginifolia var. filaginifolia*), and deerweed (*Lotus scoparius*). Non-native herbaceous species dominate the understory.

The *Artemisia californica-Eriogonum fasciculatum* Alliance occurs in coastal scrub habitats throughout Southern California, including the Santa Monica Mountains, Western Riverside County, and San Dieguito Creek (San Diego County) (CDFG and CNPS 2005, Klein and Evans 2005, Evans and San 2005). This alliance was mapped at three different sites along the Santa Clara River; on dry terraces in Reach 2 and along Sespe Creek (Table 6).

Table 6. Distribution of *Artemisia californica-Eriogonum fasciculatum* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
2	17.4	7.0	2
Sespe	6.3	2.6	1
TOTAL	**23.7**	**9.6**	**3**

4.5 *Artemisia tridentata* (big sagebrush) Alliance

In the local version of this alliance, one subspecies of big sagebrush (*Artemisia tridentata* ssp. *parishii*) is dominant or co-dominant with fourwing saltbush (*Atriplex canescens)*, mulefat (*Baccharis salicifolia)*, California buckwheat (*Eriogonum fasciculatum),* or black sage (*Salvia mellifera)*. Emergent trees may occasionally be present. Shrub canopy < 2 m is continuous, intermittent or open, with *A. tridentata* cover typically around 10–15 % (ranging from 5–40 %). The herbaceous understory layer is sparse to intermittent or grassy, with ripgut brome (*Bromus diandrus)*, shortpod mustard (*Hirschfeldia incana)*, and yellow sweetclover (*Melilotus alba)* as the most common components.

This alliance includes the following five map unit types that were identified in the mapping area, none of which appear to have been previously described:

- *Artemisia tridentata* ssp. *parishii* Provisional Alliance – *A. tridentata* ssp. *parishii* is the dominant shrub;
- *Artemisia tridentata* ssp. *parishii – Atriplex canescens* Provisional Association – *A. tridentata*. ssp. *parishii* is the co-dominant with *A. canescens*;
- *Artemisia tridentata* ssp. *parishii – Baccharis salicifolia* Provisional Association – *A. tridentata*. ssp. *parishii* is the co-dominant with *B. salicifolia*;
- *Artemisia tridentata* ssp. *parishii – Eriogonum fasciculatum* Provisional Association – *A. tridentata*. ssp. *parishii* is the co-dominant with *E. fasciculatum*; and
- *Artemisia tridentata* ssp. *parishii – Salvia mellifera* Provisional Association – *A. tridentata*. ssp. *parishii* is the co-dominant with *S. mellifera.*

The *Artemisia tridentata* Alliance has been previously described by various authors. Sawyer and Keeler-Wolf (in prep) indicate that this should be considered a placeholder alliance since there is much genetic variation in this species and the habitats of some subspecies of *Artemisia tridentata* are sufficiently different in the intermountain West to recognize separate alliances at the subspecies level. In California most studies have not identified subspecies of sagebrush, making it difficult at present to make alliance-level distinctions among the five subspecies. The stands of this vegetation type along the Santa Clara

River warrant further study to determine if the *Artemisia tridentata* ssp. *parishii* and related map units listed above are sufficiently distinct to justify recognition at the alliance or association level.
This alliance occurs only in the upper half of the mapping area in Reaches 6-11 and along Sespe Creek, with the greatest extents in Reaches 9 and 11 (Table 7).

Table 7. Distribution of *Artemisia tridentata* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
6	0.8	0.3	1
7	14.5	5.9	6
8	4.9	2.0	6
9	56.4	23.1	7
10	12.6	5.1	5
11	123.9	50.2	6
Sespe	2.3	0.9	7
TOTAL	**215.5**	**87.5**	**38**

4.6 *Arundo donax* (giant reed) Alliance

The *Arundo donax* Alliance includes stands where giant reed (*Arundo donax)* dominates (>50 % relative cover, and often >50 % total cover). Stands of this alliance have a dense, continuous herbaceous layer, typically 2-5 m tall. Woody shrubs when present are interspersed or present in smaller inclusions within the stand, but never at cover levels sufficient to be co-dominant with *Arundo donax*. If any shrub species co-dominates the middle stratum (0.5-5 m), the stand would be assigned to a provisional co-dominant alliance (see list below). Trees may occur as emergents (< 10 % cover) at 10-15 m tall, including primarily cottonwoods and willows.

Although *Arundo donax* is herbaceous, it commonly reaches heights of 4-5 m along the Santa Clara River (and occasionally extends up to 6 m). Because of its height, dense growth pattern, and general physical structure it commonly dominates the middle stratum (0.5-5 m, also known as the shrub stratum), or co-dominates with woody shrubs. In cases where *Arundo donax* co-dominates with native shrubs, we have treated it as a "shrub" in terms of defining new alliances with the co-dominant species (see list below). Although *Arundo donax* occasionally extends into the tree stratum (>5 m), we have followed standard convention and do not include the herbaceous *Arundo donax* as a co-dominant when naming tree-dominated alliances. However, because of the importance of this invasive non-native species in river corridor management and restoration planning, we recorded a visual estimate of the percent cover of *Arundo donax* for every mapped polygon in the project area regardless of the assigned vegetation or cover type.

In addition to the *Arundo donax*-dominated alliances described here, *Arundo donax* is also co-dominant in the following vegetation alliances and associations:

- *Baccharis salicifolia – Arundo donax* Provisional Alliance
- Mixed riparian scrub – *Arundo donax* Provisional Alliance
- Mixed willow scrub – *Arundo donax* Provisional Alliance
- *Salix exigua – Arundo donax* Alliance

- *Myoporum laetum – Arundo donax* Provisional Alliance
- *Salix laevigata* Alliance:
    - *Salix laevigata /Arundo donax* Association
- *Salix lasiolepis* Alliance:
    - *Salix lasiolepis /Arundo donax* Association
    - *Salix lasiolepis/ Salix exigua – Arundo donax* Association

The *Arundo donax* Alliance occurs throughout the study area (Table 8). *Arundo donax* is listed as one of the most invasive and widespread wildland pest plants in California (Cal-IPC 2007). Its great extent in the Santa Clara River watershed, rate of spread and impacts to the ecology of riparian areas have made it the focus of a large-scale eradication effort in the upper watershed (VCRCD 2006). The extent and density of *Arundo donax* infestations in the lower Santa Clara River are mapped in Figure 4, and includes both *Arundo donax*-dominated and co-dominated alliances and those where *Arundo donax* is a sub-dominant or component species.

Table 8. Distribution of *Arundo donax* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
0	22.5	9.1	6
1	29.7	12.0	9
2	58.9	23.8	10
3	55.6	22.5	11
4	142.1	57.5	9
5	21.5	8.7	4
6	98.4	39.8	18
7	239.2	96.8	23
8	107.1	43.3	15
9	25.0	10.1	5
10	75.2	30.4	17
11	15.2	6.2	13
TOTAL	**890.2**	**360.3**	**140**

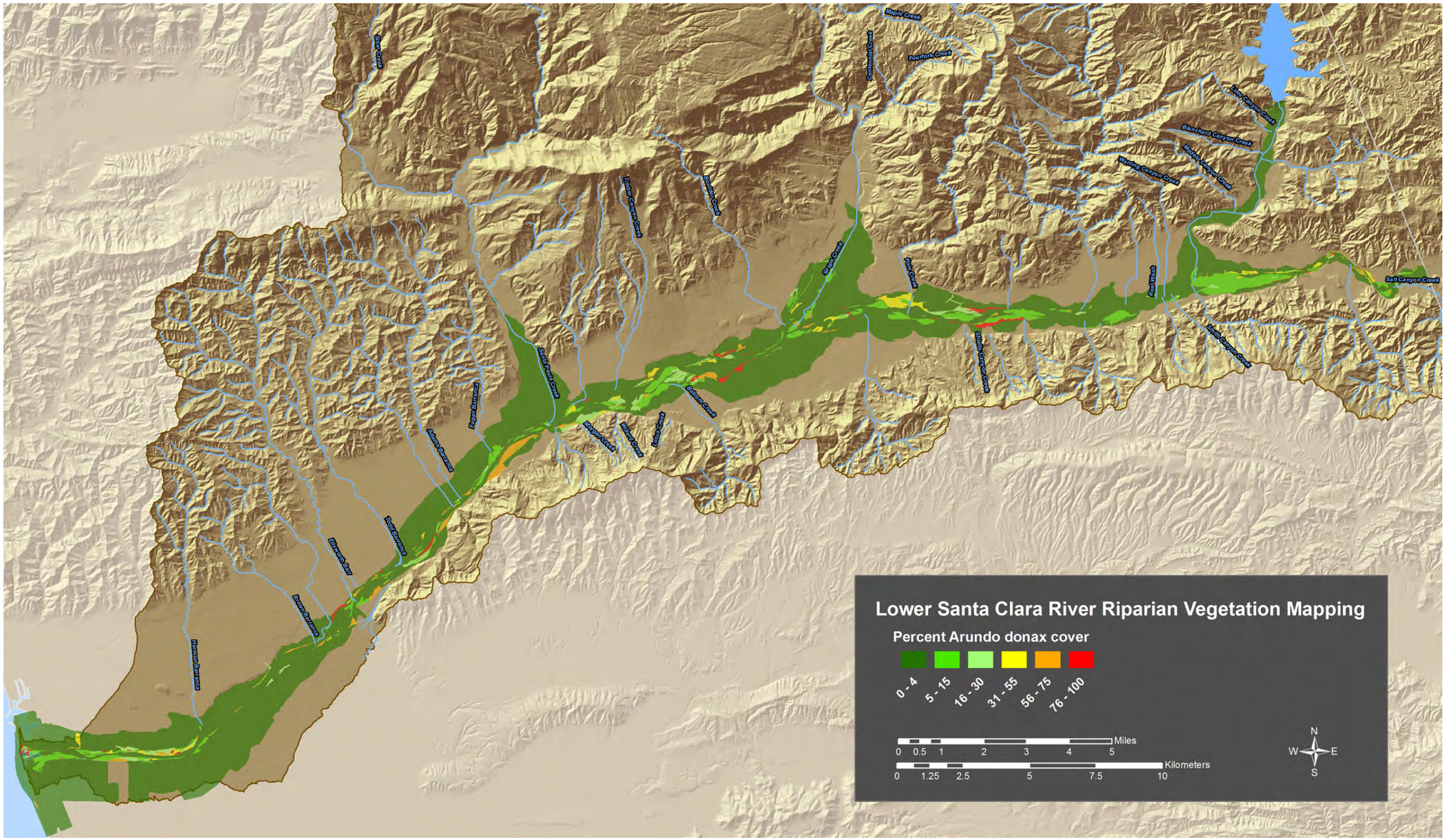

Figure 4. Extent of *Arundo donax* in the Santa Clara River riparian vegetation mapping area.

4.7 *Atriplex lentiformis* (big saltbush) Alliance

This alliance is shrub-dominated (30–50 % cover), with a sparse herbaceous understory (0–20 % cover). In the study area, big saltbush (*Atriplex lentiformis*) typically has 20–30 % cover with shortpod mustard (*Hirschfeldia incana*) as a frequently co-occurring species (3–28 % cover) in the herbaceous understory. Other common species in the alliance include mulefat (*Baccharis salicifolia*) and coyote brush (*Baccharis pilularis*).

Five stands of the *Atriplex lentiformis* Alliance were mapped in the study area. The alliance, which is found generally in alkaline or saline washes and scrub habitat, occurs as a few small patches in the upper reaches of the riparian vegetation mapping area (Table 9).

Table 9. Distribution of *Atriplex lentiformis* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
9	3.9	1.6	2
10	1.4	0.6	3
TOTAL	**5.3**	**2.2**	**5**

4.8 *Baccharis pilularis* (coyote brush) Alliance

This alliance has a moderate cover of shrubs (30–50 % cover), dominated by coyote brush (*Baccharis pilularis*) (5–50 % cover), with a generally sparse herbaceous understory (0–19 % cover). Mulefat (*Baccharis salicifolia*) may also be present and is sometimes co-dominant (0–20 % cover). Giant reed (*Arundo donax*) is found at five of the eight sites (3–10 % cover).

This alliance includes three map unit types that were identified in the mapping area:

- *Baccharis pilularis* Alliance;
- *Baccharis pilularis-Baccharis salicifolia* Provisional Alliance or Association; and
- *Baccharis pilularis-Artemisia californica* Provisional Alliance or Association.

The *Baccharis pilularis* Alliance, which is found from coastal bluffs to woodlands, occurs in the mid and lower reaches of the riparian vegetation mapping area, and is particularly prevalent near the coast in Reach 1 and Reach 0 (Table 10).

Table 10. Distribution of *Baccharis pilularis* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
0	31.0	12.5	3
1	84.9	34.4	7
3	13.5	5.5	1
6	0.4	0.2	2
7	6.2	2.5	2
TOTAL	**136.1**	**55.1**	**15**

4.9 *Baccharis salicifolia* (mulefat) Alliance

This alliance typically has moderate to dense cover of shrubs (25–60 % cover), dominated by mulefat (*Baccharis salicifolia*), and low to moderate herbaceous cover (3–45 % cover). Trees are only rarely present in the alliance. In addition to *Baccharis salicifolia*, giant reed (*Arundo donax*) is frequently found in the alliance, although with variable cover when present (1–40 % cover). Tamarisk (*Tamarix ramosissima*), arrowweed (*Pluchea sericea*), and tree tobacco (*Nicotiana glauca*) are sometimes present in the shrub layer. The following species are common in the understory: salt grass (*Distichlis spicata*), shortpod mustard (*Hirschfeldia incana*), ripgut grass (*Bromus diandrus*), and milkthistle (*Silybum marianum*).

This alliance includes five map unit types that were identified in the mapping area:

- *Baccharis salicifolia* Alliance;
- *Baccharis salicifolia - Arundo donax* Provisional Alliance;
- *Baccharis salicifolia - Pluchea sericea* Provisional Alliance;
- *Baccharis salicifolia - Tamarix ramosissima* Provisional Alliance; and
- *Baccharis salicifolia* (Disturbed) Provisional Association .

The *Baccharis salicifolia* Alliance often occurs as thickets in canyon bottoms, seasonally inundated floodplains and stream channels, and in irrigation ditches. This alliance is prevalent throughout the lower Santa Clara River and its tributaries (Table 11). It is particularly abundant in Reach 6, a gaining reach with a shallow groundwater table, and along Piru Creek.

Table 11. Distribution of *Baccharis salicifolia* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
02	9.1	3.7	5
03	15.1	6.1	9
04	8.4	3.4	1
05	6.3	2.6	1
06	39.6	16.0	12
07	0.4	0.2	3
09	9.8	4.0	2
10	0.8	0.3	1
11	2.4	1.0	3
Piru	87.2	35.3	4
Santa Paula	1.9	0.8	1
Sespe	6.4	2.6	6
TOTAL	**187.4**	**75.8**	**48**

4.10 *Carpobrotus* spp.-*Mesembryanthemum crystallinum* (sea fig-common iceplant) Alliance

This herbaceous alliance contains one or more of three low-growing (<0.5 m), succulent iceplant species: *Carpobrotus edulis*, *C. chilensis*, and *Mesembryanthemum crystallinum*. Other species commonly found in this alliance at McGrath State Beach include sand verbena (*Abronia umbellata)*, silver bur ragweed (*Ambrosia*

chamissonis), and cliff buckwheat (*Eriogonum parvifolium)*. Shrubs and trees are generally absent. The description of this alliance is based on the information provided in ESA (2003).

Iceplant species are listed as moderate to highly invasive in coastal California habitats, particularly sand dunes (Cal-IPC 2007). The *Carpobrotus* spp.–*Mesembryanthemum crystallinum* Alliance, which generally occurs on coastal bluffs and dunes throughout California, is found along the beach and Santa Clara River estuary in or near McGrath State Beach in the lowest reaches (Table 12).

Table 12. Distribution of *Carpobrotus* spp. –*Mesembryanthemum crystallinum* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
00	0.2	0.1	1
01	16.9	6.8	3
TOTAL	**17.1**	**6.9**	**4**

4.11 *Distichlis spicata* (saltgrass) Alliance

Distichlis spicata Alliance stands in our study area typically have only a dense herbaceous layer (70 % cover), although shrubs occasionally occur. The dominant species is salt grass (*Distichlis spicata*) (35 % cover), with curly dock (*Rumex crispus*) (20 % cover) and cocklebur (*Xanthium strumarium*) (20 % cover) as common co-occurring species. Mulefat (*Baccharis salicifolia*) seedlings and saplings can occur but are not common.

The *Distichlis spicata* Alliance, which may occur in areas subject extended periods of inundation by brackish water and in saline soils, is sparsely distributed along the lower Santa Clara River, occurring along the estuary in tidal marsh habitat (Reach 0 and 1) and in Reach 6 in the riparian floodplain zone on or near the Hedrick Ranch Nature Area (Table 13).

Table 13. Distribution of *Distichlis spicata* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
0	1.1	0.4	1
1	0.005	0.002	1
6	9.7	3.9	2
TOTAL	**10.8**	**4.4**	**4**

4.12 *Encelia californica* (California encelia) Alliance

Encelia californica Alliance, in our study area, is typically dominated by California encelia or brittlebush (*Encelia californica*) (20 % cover) and giant rye (*Leymus condensatus*) (20 % cover). Coyote brush (*Baccharis pilularis*), California or coastal sagebrush (*Artemisia californica*), and purple sage (*Salvia leucophylla*) are also typically present in low densities (<5 % cover).

In the lower Santa Clara River riparian vegetation mapping area, the *Encelia californica* Alliance, an upland vegetation type generally found in coastal scrub habitats, occurs only along Sespe Creek (Table 14).

Table 14. Distribution of *Encelia californica* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
Sespe	14.1	5.7	3
TOTAL	**14.1**	**5.7**	**3**

4.13 *Eriogonum fasciculatum* (California buckwheat) Alliance

The *Eriogonum fasciculatum* Alliance in the study area is characterized by a sparse to dense shrub canopy (20 – 70 % cover) and a typically sparse herbaceous layer. California buckwheat (*Eriogonum fasciculatum*) is dominant (generally 10 – 40 % cover), with California encelia (*Encelia californica)* as the most common co-occurring shrub species.

The *Eriogonum fasciculatum* Alliance, which is primarily an upland vegetation type, occurs primarily along Sespe Creek, although one small patch is found in Reach 10 (Table 15).

Table 15. Distribution of *Eriogonum fasciculatum* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
10	2.1	0.9	1
Sespe	21.7	8.8	5
TOTAL	**23.8**	**9.6**	**6**

4.14 Eucalyptus Alliance

This alliance includes at least one species of eucalyptus (*Eucalyptus* sp., *E. globulus,* or *E. camaldulensis*) in the tree layer (5–85 % cover) and is typically moderately to densely vegetated (40–100 % total cover). Giant reed (*Arundo donax*) is generally present and is occasionally the dominant understory species in terms of percent cover (which can reach 60–70 %).

The Eucalyptus Alliance, which is generally found in disturbed areas, occurs as small patches but is distributed widely throughout the lower Santa Clara River and along the three mapped tributaries (Table 16).

Table 16. Distribution of Eucalyptus Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
01	1.0	0.4	1
03	3.9	1.6	5
04	6.8	2.8	1
05	8.3	3.4	3
06	5.7	2.3	4
07	9.9	4.0	2
08	1.2	0.5	1
10	4.7	1.9	3
11	0.5	0.2	2
Piru	10.7	4.3	1
Santa Paula	1.8	0.7	1
Sespe	12.3	5.0	3
TOTAL	**66.7**	**27.0**	**27**

4.15 Mixed Exotic Trees Alliance

This alliance contains two or more non-native tree species that co-dominate in the tree canopy. In our study area, the most common tree species in this alliance are blue gum (*Eucalyptus globulus)* or other *Eucalyptus* species and Peruvian peppertree (*Schinus molle)*. The understory is highly variable, presumably depending largely on site disturbance history, and ranges from native shrubs to non-native grasses and forbs. Both of the two sites in the study area with this vegetation alliance have moderate cover (35-44%), and have canopies where *Eucalyptus* sp. is the most common. At one of the sites *Schinus moll*) is a subdominant canopy species (5% cover) and castor bean (*Ricinus communis*) is the most abundant understory plant (20% total cover).

The Mixed Exotic Trees Alliance is found as small patches along Sespe Creek and downstream of Sespe Creek on the lower Santa Clara River (Table 17).

Table 17. Distribution of Mixed Exotic Trees Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
07	1.2	0.5	4
Sespe	2.8	1.1	5
TOTAL	**4.0**	**1.6**	**9**

4.16 Floodplain Wetland Super-Alliance

The Floodplain Wetland Super-Alliance is a mapping unit of convenience that includes a variety of riverine and palustrine wetland alliances and associations. The majority of the area mapped under this super-alliance was bare riverwash following the large floods in January and February 2005. At the time of

the field surveys in summer 2005 and 2006, these areas were dominated by a mixture of herbaceous species such as barnyard grass (*Echinochloa crus-galli)*, sprangletop (*Leptochloa uninervia)*, white sweetclover (*Melilotus alba)*, knotweed (*Polygonum* spp.), annual rabbitsfoot grass (*Polypogon monspeliensis)*, watercress (*Rorippa nasturtium-aquaticum)*, and water speedwell (*Veronica anagallis-aquatica)* that had established in wet or moist sandy substrates near the summer low-flow main channel and perennial side channels or tributary channels. In some sites, large numbers of woody seedlings were present, primarily willow species (*Salix* spp.) and mulefat (*Baccharis salicifolia)*, indicating that within a few years the stand would likely transition to a Willow Scrub Alliance. In other cases, usually where surface water appeared to be more perennial and disturbance from the 2005 flood was likely less severe, cattail (*Typha* spp.) was dominant or co-dominant. This vegetation type includes much fine-scale variation in some areas that could not adequately be captured in our mapping effort. More detailed sampling of vegetation within this super-alliance would undoubtedly lead to identification of a number of different wetland alliances and associations in the study area.

Arundo donax was typically present at low density (0–2 % cover) in stands of this super-alliance in 2005, although observations in summer 2006 suggested that *A. donax* cover was increasing in this and other riverwash vegetation and cover types. Cohorts of newly recruited tamarisk (*Tamarix ramosissima*) seedlings were observed in some stands of this super-alliance in both summer 2005 and 2006, suggesting a strong recruitment potential downstream of the few mature stands of *T. ramosissima* that were observed in lower Santa Clara River (all in Reach 11), although future monitoring would be required to determine how many of these seedlings survive to maturity.

The Floodplain Wetland Super-alliance is prevalent throughout the lower Santa Clara River and sparsely distributed along Sespe Creek (Table 18). It is particularly abundant in Reach 8, a gaining reach with a shallow groundwater table suitable to support wetland plant species.

Table 18. Distribution of Floodplain Wetland Super-alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
01	1.3	0.5	1
02	38.2	15.5	6
03	19.4	7.8	11
04	16.2	6.5	10
05	23.6	9.5	4
06	96.2	38.9	32
07	58.5	23.7	15
08	145.4	58.9	24
09	34.4	13.9	5
10	22.0	8.9	3
11	24.8	10.0	9
Sespe	0.6	0.3	1
TOTAL	**480.5**	**194.5**	**121**

4.17 *Jaumea carnosa* (marsh jaumea) Alliance

The *Jaumea carnosa* Alliance is a low-growing (<0.5 m), densely vegetated (>90 % total cover), herbaceous vegetation type. Marsh jaumea (*Jaumea carnosa*) is the dominant species (approximately 70 % cover). Western ragweed (*Ambrosia psilostachya*), bristly ox tongue (*Picris echioides*), and salt grass (*Distichlis spicata*) are the three most common co-occurring species, although they all have relatively low percent cover (<10 % cover) in the alliance. Other wetland species are present at low densities (1 % cover), including common pickleweed (*Salicornia virginica*) and curly dock (*Rumex crispus*). A small amount of perennial pepperweed (*Lepidium latifolium*), a non-native invasive species, was observed in this stand in August 2005. This species is invading wetlands throughout much of California and should be targeted for eradication, if feasible, or control as part of any weed control or vegetation management program that includes McGrath State Beach (Young et al. 1998, Cal-IPC 2007).

The *Jaumea carnosa* Alliance, which is typically associated with saline or alkaline wetland environments, is found along the estuary in tidal marsh habitat (Table 19). This vegetation type was previously mapped in McGrath State Beach (ESA 2003).

Table 19. Distribution of *Jaumea carnosa* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
00	1.7	0.7	1
TOTAL	**1.7**	**0.7**	**1**

4.18 *Juglans californica* (southern California walnut) Alliance

In the study area this alliance is generally moderately vegetated (55 % cover), with a mix of tree, shrub, and herbaceous species. At the site where this alliance was sampled and mapped, the tree layer is co-dominated by red willow (*Salix laevigata*) and southern California walnut (*Juglans californica*) (13 and 10 % cover, respectively), with mulefat (*Baccharis salicifolia*) common in the shrub layer (15 % cover). Giant reed (*Arundo donax*) is also found at this site, although in very low densities (1 % cover).

The *Juglans californica* Alliance generally occurs on slopes in canyons and valleys, and along riparian corridors in the outer coast zone of southern Central California and Southern California. In the study area, it is found along Sespe Creek (Table 20). California walnut is listed as having a limited distribution and being a relatively rare species in California (CNPS 2007).

Table 20. Distribution of *Juglans californica* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
Sespe	1.2	0.5	1
TOTAL	**1.2**	**0.5**	**1**

4.19 *Lepidospartum squamatum* (scalebroom) Alliance

This alliance typically has a mix of shrubs and herbaceous understory species, with a wide range of total cover (12–70 % cover). This alliance is characterized by the presence of scalebroom (*Lepidospartum squamatum*), although it is not always abundant (generally > 5 % cover, ranging from 2–30 % cover). Some stands contain mulefat (*Baccharis salicifolia*) or black sage (*Salvia mellifera*) as the dominant or co-dominant shrub. California buckwheat (*Eriogonum fasciculatum*) and chaparral yucca (*Yucca whipplei*) are commonly associated sub-dominant shrubs. The herbaceous layer varies from very sparse to moderate cover, often with shortpod mustard (*Hirschfeldia incana*) (3–40 % cover) as the most abundant species. Giant reed (*Arundo donax*) can be present, but typically at low densities (1–5 % cover).

This alliance includes four mapping unit types:

- *Lepidospartum squamatum* Alliance – with scalebroom as the dominant or characteristic shrub;
- *Lepidospartum squamatum - Baccharis salicifolia* Provisional Association – with scalebroom and mulefat as co-dominant shrubs;
- *Lepidospartum squamatum - Salvia mellifera* Provisional Association – with scalebroom and black sage as co-dominant shrubs; and
- *Baccharis salicifolia - Lepidospartum squamatum* Provisional Association – with mulefat as the dominant shrub and scale broom as a characteristic sub-dominant species.

The *Lepidospartum squamatum* Alliance, which generally occurs in sandy and gravelly washes and on stream terraces in arid and semi-arid regions, is found in the mid and upper reaches of the mainstem lower Santa Clara River and along Piru and Sespe creeks (Table 21). Many of these stands show evidence of recent scour or deposition, presumably from the 2005 floods.

Table 21. Distribution of *Lepidospartum squamatum* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
06	43.8	17.7	5
07	7.3	3.0	1
09	3.0	1.2	2
10	52.8	21.4	8
Piru	42.4	17.2	9
Sespe	85.9	34.8	25
TOTAL	**235.3**	**95.2**	**50**

4.20 *Lessingia filaginifolia* (California aster) Alliance

This alliance is sparsely to moderately vegetated (20–35 % total cover), primarily herbaceous vegetation type. A mix of shrub species can be interspersed at low cover (total shrub cover < 10 %). California aster (*Lessingia filaginifolia* ssp. *filaginifolia*) is the dominant species (10–20 % total cover, 30– 40 % relative cover). Common co-occurring species include castor bean (*Ricinus communis*), tocalote (*Centaurea melitensis*), and shortpod mustard (*Hirschfeldia incana*). This alliance has affinities to the non-native grasses and forbs super-alliance, but is distinguished by the dominance of the native California aster.

Lessingia filaginifolia is generally widespread in coastal scrub, oak woodland, grassland habitats. The *Lessingia filaginifolia* Alliance, which to our knowledge has not been previously described, is found sparsely throughout the lower Santa Clara River riparian vegetation mapping area (Table 22).

Table 22. Distribution of *Lessingia filaginifolia* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
01	3.0	1.2	1
07	0.0	0.0	1
09	3.2	1.3	2
Sespe	0.4	0.2	1
TOTAL	**6.6**	**2.7**	**5**

4.21 *Leymus condensatus* (giant wildrye) Alliance

This alliance typically has moderate to dense cover of herbaceous plants, with occasional shrubs. Giant rye (*Leymus condensatus*) is the dominant species (40–70 % cover). No other plant species, besides giant wildrye, are consistently found in the alliance. Common subdominant species include shortpod mustard (*Hirschfeldia incana*), mulefat (*Baccharis salicifolia*), and various non-native annual grasses. Giant reed (*Arundo donax*), is found at two of the three sites, but in very low densities (1–2 % cover).

The *Leymus condensatus* Alliance is found on dry slopes and occurs primarily in Reach 3, a reach dominated by agriculture, of the lower Santa Clara River (Table 23; Figures 2 and 3). This alliance is common in the region, often appearing to represent a seral stage following fires on hill slopes supporting coastal scrub habitats.

Table 23. Distribution of *Leymus condensatus* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
02	0.3	0.1	1
03	12.0	4.9	2
TOTAL	**12.3**	**5.0**	**3**

4.22 *Leymus triticoides* (creeping wildrye) Alliance

This herbaceous alliance is densely vegetated (>90 % cover) with grasses and forbs, although shrubs are occasionally present (<5 % cover). Creeping wildrye (*Leymus triticoides*) is the dominant species, sometimes occurring as a nearly mono-specific stand. Western ragweed (*Ambrosia psilostachya*) and yerba mansa (*Anemopsis californica*) are common co-dominant or sub-dominant species in the study area. This alliance has highly variable species richness, with five species recorded at one site and 24 at another.

This alliance includes two mapping units:

- *Leymus triticoides* Alliance; and
- *Leymus triticoides - Anemopsis californica* Provisional Association.

The *Leymus triticoides* Alliance, generally found in moist or seasonally inundated sites, occurs along the estuary in wetland habitat (Reach 0) and on the Hedrick Ranch Nature Area in Reach 6 (Table 24). Reach 6 supports some of the largest areas of wetland and riparian habitat in the lower watershed (Figures 2 and 3).

Table 24. Distribution of *Leymus triticoides* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
00	2.9	1.2	2
06	5.6	2.3	3
TOTAL	**8.5**	**3.4**	**5**

4.23 *Lotus scoparius* (common deerweed) Alliance

This alliance typically has a moderate cover of shrubs (50–55 % cover) with a sparse herbaceous layer (5–15 % cover). The dominant species is common deerwood (*Lotus scoparius*), which had 40 % cover at all of the sites where it occurred. Co-occurring species are variable, with a different sub-dominant species – California aster (*Lessingia filaginifolia var. filaginifolia*), coyote brush (*Baccharis pilularis*), and shortpod mustard (*Hirschfeldia incana*) – recorded at each of the three mapped stands.

Lotus scoparius generally occurs in chaparral habitats, along roadsides and other disturbed sites, and in coastal scrub, desert slopes, and flat washes. The alliance is sparse in the lower Santa Clara River riparian vegetation mapping area, occurring only as small patches in Reach 2 and along Sespe Creek (Table 25).

Table 25. Distribution of *Lotus scoparius* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
02	5.0	2.0	2
Sespe	0.7	0.3	1
TOTAL	**5.7**	**2.3**	**3**

4.24 *Malosma laurina* (laurel sumac) Alliance

This alliance is represented by one stand in the study area, which has moderate shrub and herbaceous cover (65 % total cover), and laurel sumac (*Malosma laurina*) and California sagebrush (*Artemisia californica*) as the co-dominant shrub species (20 % cover each). Mulefat (*Baccharis salicifolia*) and purple sage (*Salvia leucophylla*) are present but sparse (5 % cover each).

Malosma laurina generally occurs on slopes, canyons, and in chaparral, and is relatively common in the region (CDFG and CNPS 2005, Evens and San 2005, Klein and Evens 2005). Within the lower Santa Clara River riparian vegetation mapping area, the alliance is found only along Santa Paula Creek (Table 26).

Table 26. Distribution of *Malosma laurina* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
Santa Paula	1.0	0.4	1
TOTAL	**1.0**	**0.4**	**1**

4.25 Mixed Riparian Forest Alliance

The Mixed Riparian Forest Alliance includes forest or woodland stands in which two or more of the following native riparian tree species are present as co-dominants: western sycamore (*Platanus racemosa),* black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), Fremont cottonwood (*Populus fremontii* ssp. *fremontii*), coast live oak (*Quercus agrifolia*), and California walnut (*Juglans californicaI).* Other native tree species may also be present, including arroyo willow (*Salix lasiolepis*), red willow (*Salix laevigata*), and blue elderberry (*Sambucus mexicana*). Non-native blue gum and other eucalyptus trees (*Eucalyptus* spp.) and Peruvian peppertree (*Schinus molle*) may also be present. The tree canopy ranges from open to dense (generally 20–60 % cover). Shrub and herbaceous layers are variable, ranging from sparse to moderate (typically 5–60 % cover).

To our knowledge, this alliance has not been previously described. Further study is required to determine which of the provisional associations included in this alliance (or super-alliance) might better be classified under related alliances, such as the *Juglans californica* Alliance, *Platanus racemosa* Alliance, *Populus balsamifera* ssp. *trichocarpa* Alliance, *Populus fremontii* Alliance, or *Quercus agrifolia* Alliance, or if they warrant consideration at the alliance rather than association level. For example, Evens and San (2005) and Klein and Evens (2005) recognize a *Platanus racemosa – Populus fremontii*, although this type will likely be treated conservatively as an association under either the *Platanus racemosa* Alliance or *Populus fremontii* Alliance in the second edition of the Manual of California Vegetation (T. Keeler-Wolf, pers. comm., 2006 and 2007).

The Mixed Riparian Forest Alliance contains eleven mapping units:

- Mixed Riparian Forest Provisional Alliance;
- Mixed Riparian Forest (Disturbed) Provisional Association;
- *Platanus racemosa – Populus fremontii* Provisional Association;
- *Platanus racemosa – Quercus agrifolia* Provisional Association;
- *Platanus racemosa* (Mixed) Provisional Association;
- *Populus balsamifera* ssp. *trichocarpa – Quercus agrifolia* Provisional Association;
- *Populus fremontii – Juglans californica* Provisional Association;
- *Populus fremontii – Quercus agrifolia* Provisional Association;
- *Populus fremontii* (Mixed) Provisional Association;
- *Quercus agrifolia - Platanus racemosa - Populus fremontii* Provisional Association; and
- *Quercus agrifolia* (Mixed) Provisional Association.

The Mixed Riparian Forest Alliance occurs along streambanks, on stabilized stream terraces, and in areas with shallow groundwater. It is found throughout the mainstem lower Santa Clara River and its tributaries (Table 27).

Table 27. Distribution of Mixed Riparian Forest Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
02	4.3	1.8	1
06	4.0	1.6	1
07	19.0	7.7	2
09	2.7	1.1	2
10	4.5	1.8	4
11	29.9	12.1	7
Piru	13.7	5.5	6
Santa Paula	3.1	1.3	1
Sespe	26.8	10.8	7
TOTAL	**108.1**	**43.7**	**31**

4.26 Mixed Riparian Scrub Alliance

This alliance is characterized by a diverse and densely vegetated shrub layer, a well vegetated understory, and some emergent trees. The shrub layer is typically co-dominated by two or more species, including mulefat (*Baccharis salicifolia*), arroyo willow (*Salix lasiolepis*), and red willow (*S. laevigata*). Arroweed (*Pluchea sericea*), coyote brush (*Baccharis pilularis*), and blue elderberry (*Sambucus mexicana*) and other shrubs may be present as sub-dominants . Giant reed (*Arundo donax*) is nearly always present and frequently the dominant species, although it can have a wide range of densities (1–50 % cover). In addition, milkthistle (*Silybum marianum*), western ragweed (*Ambrosia psilostachya*), and shortpod mustard (*Hirschfeldia incana*) are common associated species in the understory. Cottonwood (*Populus* spp.) may be present in both the shrub and tree layers, but typically at low densities (< 10 % cover).

This alliance also includes the Mixed Riparian Scrub-*Arundo donax* Provisional Association or Alliance mapping unit.

The Mixed Riparian Scrub Alliance occurs along streambanks and in sandy and gravelly washes and is found throughout the mainstem lower Santa Clara River (Table 28).

Table 28. Distribution of Mixed Riparian Scrub Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
01	33.4	13.5	4
02	14.7	5.9	3
03	0.8	0.3	1
04	2.9	1.2	1
05	13.5	5.4	2
06	16.5	6.7	2
11	8.3	3.3	4
TOTAL	**90.0**	**36.4**	**17**

4.27 Mixed Scrub Alliance

The Mixed Scrub Alliance is moderately to densely vegetated (35 – 70 % total cover), with an open to moderate shrub canopy (20 – 55 % cover) and sparse to intermittent herbaceous layer (15 – 25 % cover). Instead of a single dominant species, this alliance is characterized by a mix of three or more species in the shrub layer, including mulefat (*Baccharis salicifolia*), coyote brush (*B. pilularis*), black sage (*Salvia mellifera*), California sagebrush (*Artemisia californica*),, quail bush (*Atriplex lentiformis*), and narrowleaf willow (*Salix exigua*). Shortpod mustard (*Hirschfeldia incana*) and white sweetclover (*Melilotus alba*) are common species in the herbaceous understory.

This alliance also includes the Mixed Scrub (Disturbed) Provisional Association mapping unit.

Mixed Scrub Alliance, which generally occurs in more xeric or upland areas than the Mixed Riparian Scrub Alliance (Section 4.26), is found throughout the mainstem lower Santa Clara River (Table 29).

Table 29. Distribution of Mixed Scrub Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
02	4.4	1.8	2
05	9.5	3.8	1
07	1.7	0.7	3
08	2.9	1.2	1
Piru	12.0	4.9	4
Sespe	0.2	0.1	2
TOTAL	**30.7**	**12.4**	**13**

4.28 Mixed Willow Forest Alliance

The Mixed Willow Forest Alliance is characterized by sparse to dense cover (10–70% cover) of willow trees (>5 m tall), with moderate to dense total cover (40 – 90 %). No single tree species is dominant, but typically two or more willow species (red willow [*S. laevigata*], arroyo willow [*S. lasiolepis*], or shining willow [*S. lucida* ssp. *lasiandra*]) dominate the tree layer, and are co-dominants in the shrub layer, along with narrowleaf willow [*Salix exigua*] and mulefat (*Baccharis salicifolia)*. Cottonwood (*Populus* spp.) may occur at low levels in the tree or shrub canopy (generally < 2 % cover). Giant reed (*Arundo donax*) is nearly always present at low to moderate densities (1–40 % cover). Other herbaceous understory cover is variable, but typically sparse.

The Mixed Willow Forest Alliance occurs along streambanks, on stabilized stream terraces, and in areas with shallow groundwater. It is found throughout the mainstem lower Santa Clara River and has a minor occurrence in Sespe Creek (Table 30).

Table 30. Distribution of Mixed Willow Forest Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
00	0.7	0.3	1
01	67.4	27.3	6
02	103.8	42.0	22
03	79.6	32.2	8
04	0.1	0.0	1
05	4.9	2.0	1
06	63.7	25.8	5
09	1.5	0.6	1
11	1.3	0.5	2
Sespe	0.2	0.1	1
TOTAL	**323.3**	**130.8**	**48**

4.29 Mixed Willow Scrub Alliance

The Mixed Willow Scrub Alliance is characterized by sparse to dense cover (15–75 % cover), primarily of shrubs (< 5 m tall). No single shrub species is dominant, but two or more willow species (narrowleaf willow [*Salix exigua*], red willow [*S. laevigata*], arroyo willow [*S. lasiolepis*], or shining willow [*S. lucida* ssp. *lasiandra*]) are co-dominants in the shrub layer. Mulefat (*Baccharis salicifolia)* is also a common co-dominant shrub. Giant reed (*Arundo donax*) is nearly always present at low to moderate densities (1–20 % cover). Salt cedar (*Tamarix ramosissima*) may also be present, but in low abundances (1 % cover or less). Emergent trees may be present, but if the cover of willow species in the tree layer exceeds 10 % the stand would be classified as Mixed Willow Forest Alliance (Section 4.28), or in one of the other tree willow alliances if one willow species dominated the tree canopy.

This alliance also contains the Mixed Willow-*Arundo donax* mapping unit type.

The Mixed Willow Scrub Alliance occurs along streambanks and in sandy and gravelly washes and is found throughout the mainstem lower Santa Clara River and, to a very limited degree, in Sespe Creek (Table 31).

Table 31. Distribution of Mixed Willow Scrub Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
1	16.0	6.5	2
2	35.7	14.5	4
3	13.9	5.6	5
5	11.6	4.7	1
6	15.2	6.2	7
7	5.7	2.3	4
9	2.4	1.0	1
11	0.9	0.4	1
Sespe	0.6	0.2	1
TOTAL	**101.9**	**41.3**	**26**

4.30 *Myoporum laetum* (myoporum) Alliance

This alliance is characterized by an overstory canopy dominated by shrubs or small trees (generally 3-10 m tall) of myoporum (*Myoporum laetum)*, a woody evergreen species native to New Zealand that has become naturalized in many coastal areas in Southern California. In our mapping area, *Myoporum laetum* stands may have an understory of species found in the *Baccharis pilularis* Alliance and Non-native Grasses and Forbs Super-alliance. The description of this alliance is based on the information provided in ESA (2003).

Myoporum laetum is rated as a moderately invasive species in riparian areas in southern coastal California (Cal-IPC 2007). This alliance (and the related *Myoporum laetum – Arundo donax* Alliance, see Section 4.31) occurs only in the coastal strand and estuary zone in the lowest reaches of the mainstem Santa Clara River (Table 32). This vegetation type was previously mapped in McGrath State Beach (ESA 2003).

Table 32. Distribution of *Myoporum laetum* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
0	1.0	0.4	2
1	1.1	0.5	1
TOTAL	**2.1**	**0.9**	**3**

4.31 *Myoporum laetum–Arundo donax* (myoporum-giant reed) Alliance

The *Myoporum laetum–Arundo donax* Alliance is a combination of two invasive species in riparian areas in southern coastal California (Cal-IPC 2007).

Like the *Myoporum laetum* Alliance, the *Myoporum laetum–Arundo donax* Alliance is currently found only in the lowest reaches of the mainstem Santa Clara River (Table 33). This vegetation type was previously mapped in McGrath State Beach (ESA 2003). The description of this alliance is based on the information provided in ESA (2003).

Table 33. Distribution of *Myoporum laetum–Arundo donax* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
1	0.4	0.1	1
TOTAL	**0.4**	**0.1**	**1**

4.32 *Nicotiana glauca* (tree tobacco) Alliance

This alliance has a moderate cover of shrubs (10–50 % cover) and sparse herbaceous layer (0–13 % cover). Tree tobacco (*Nicotiana glauca*) is the dominant species. Giant reed (*Arundo donax*) can occasionally be found in low densities (5 % cover). To our knowledge, this alliance has not yet been previously described, and further study is warranted to determine if this is a valid alliance.

Nicotiana glauca is rated as a moderately invasive species in coastal scrub, grasslands and riparian areas in California (Cal-IPC 2007). The alliance is currently found along Piru Creek and downstream of Piru Creek on the mainstem Santa Clara River in Reach 10 (Table 34). The presence of *Nicotiana glauca* in these upstream areas presents a significant risk for downstream invasion.

Table 34. Distribution of *Nicotiana glauca* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
10	1.0	0.4	2
Piru	7.7	3.1	1
TOTAL	**8.7**	**3.5**	**3**

4.33 *Nicotiana glauca-Artemisia californica* (tree tobacco-California sagebrush) Alliance

This alliance is characterized by a moderate cover of shrubs (34 % cover), with no emergent trees and a sparse herbaceous layer. The co-dominant species are tree tobacco (*Nicotiana glauca*) (20 % cover) and California sagebrush (*Artemisia californica*) (12 % cover). Pigweed (*Chenopodium album*) and shortpod mustard (*Hirschfeldia incana*) are also present, but sparse (<5% cover) in the shrub layer. To our knowledge, this alliance has not yet been previously described, and further study is warranted to determine if this is a valid alliance.

The *Nicotiana glauca–Artemisia californica* Alliance was mapped only in Sespe Creek (Table 35). As such, there is risk for this stand to serve as a source of *Nicotiana glauca* to invade downstream reaches.

Table 35. Distribution of *Nicotiana glauca–Artemisia californica* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
Sespe	1.2	0.5	1
TOTAL	**1.2**	**0.5**	**1**

4.34 Non-native Grasses and Forbs Super-Alliance

The Non-native Grasses and Forbs Super-Alliance is a mapping unit that includes a number of herbaceous alliances and associations. Many stands are dominated by shortpod mustard (*Hirschfeldia incana*) or by non-native bromes (*Bromus* spp.). In other sites, these two species are co-dominants. White sweetclover (*Melilotus alba*) and tocolote (*Centaurea melitensis*) are common associated species. Emergent shrubs and trees may be present but at low levels (< 10 % cover). A few stands, particularly in Reach 6 in the vicinity of the Hedrick Ranch Nature Area, are dominated by non-native perennial grasses, such as red fescue (*Festuca arundinacea*) and bermuda grass (*Cynodon dactylon*).

The Non-native Grasses and Forbs Super-Alliance is abundant and widespread throughout the riparian vegetation mapping area (Table 36).

Table 36. Distribution of Non-native Grasses and Forbs Super-alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
00	22.8	9.2	2
01	29.8	12.1	7
02	43.3	17.5	16
03	109.8	44.4	12
04	46.0	18.6	6
05	11.0	4.4	1
06	113.1	45.8	20
07	83.5	33.8	19
08	1.2	0.5	1
09	30.8	12.5	8
10	10.7	4.3	5
11	5.0	2.0	3
Piru	26.2	10.6	6
Santa Paula	5.5	2.2	1
Sespe	17.6	7.1	13
TOTAL	**556.3**	**225.1**	**120**

4.35 *Olea europaea* (olive) Alliance

This alliance typically has moderate to dense cover with a mix of shrubs and herbaceous species. It is characterized by the dominance of the cultivated olive (*Olea europaea*) in the tree layer, with 20–30 % cover at the two mapped stands. Shortpod mustard (*Hirschfeldia incana*) and grasses are common co-occurring species (with <20 % cover). Salt cedar (*Tamarix ramosissima*) is present at one of the sites in low densities (3 % cover).

Olea europaea is listed as a limited invasive plant species in disturbed places in California (Cal-IPC 2007). Two occurrences of the *Olea europaea* Alliance are found along Piru Creek (Table 37). It is possible that these two occurrences represent remnant orchards rather than fully naturalized stands.

Table 37. Distribution of *Olea europaea* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
Piru	12.7	5.1	2
TOTAL	**12.7**	**5.1**	**2**

4.36 *Phragmites australis* (common reed) Alliance

This alliance typically has a dense herbaceous layer (65 % cover) dominated by common reed (*Phragmites australis*) (60 % cover). Mulefat (*Baccharis salicifolia*)(8 % cover) and yerba mansa (*Anemopsis californica*)(5 % cover) are the most abundant co-occurring species in the one stand of this type that was sampled.

One small stand of the *Phragmites australis* Alliance, a wetland vegetation type oftern subjected to extended periods of inundation, is found in the Hedrick Ranch Nature Area in Reach 6 of the lower Santa Clara River (Table 38).

Table 38. Distribution of *Phragmites australis* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
06	0.2	0.1	1
TOTAL	**0.2**	**0.1**	**1**

4.37 *Platanus racemosa* (California sycamore) Alliance

This alliance typically has moderate to high vegetative cover (50–95 % cover) in the tree layer with generally 10 % cover from western sycamore (*Platanus racemosa*), and California black walnut (*Juglans californica*) and Peruvian peppertree (*Schinus molle*) as common co-occurring tree species. Mulefat (*Baccharis salicifolia*) and red willow (*Salix laevigata*) are common in the shrub layer, and giant reed (*Arundo donax*) can be found at low densities (< 15 % cover).

This alliance includes three mapping units types identified in the mapping area:

- *Platanus racemosa* Alliance;
- *Platanus racemosa - Salix laevigata* Provisional Association; and
- *Platanus racemosa* (Disturbed) Provisional Association.

There are several small, scattered stands of the *Platanus racemosa* Alliance, which generally occurs along streams and canyon bottoms, on the lower Santa Clara River and along Sespe Creek (Table 39).

Table 39. Distribution of *Platanus racemosa* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
2	1.2	0.5	1
7	0.1	0.0	1
Sespe	2.7	1.1	5
TOTAL	**3.9**	**1.6**	**7**

4.38 *Pluchea sericea* (arrowweed) Alliance

This alliance typically has a moderate to densely vegetated shrub layer (60–95 % cover), with occasional shrubs. No emergent trees were observed, although saplings of black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) were present in one stand. Arrowweed (*Pluche. sericea*) is dominant with 40 to 85 % cover. Other species that may be present at low levels (< 10 % cover) include narrowleaf willow (*Salix exigua*), mulefat (*Baccharis salicifolia*), and giant reed (*Arundo donax*).

The *Pluchea sericea* Alliance can occur as thickets in stream bottoms, washes, canyons, and around springs. It can also develop in saline areas. Several stands of the *Pluchea sericea* Alliance occur in Reach 11, the upstream-most reach in the lower Santa Clara River riparian vegetation mapping area (Table 40).

Table 40. Distribution of *Pluchea sericea* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
11	9.9	4.0	9
TOTAL	**9.9**	**4.0**	**9**

4.39 *Populus balsamifera* ssp. *trichocarpa* (black cottonwood) Alliance

This alliance has an open to dense tree canopy (10–75 % cover), with black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) as the sole dominate or co-dominant with willows (*Salix laevigata, S. lasiolepis*, or *S. lucida* spp. *lasiandra*) in the tree layer. The shrub layer is typically sparse to dense, with willow and cottonwood saplings as co-dominants. The herbaceous layer is typically absent or sparse, with the exception of giant reed (*Arundo donax*), which is often present (0–50 % cover).

This alliance includes five mapping units identified in the mapping area, the primary alliance and four associations in which willow species are co-dominant in the tree layer:

- *Populus balsamifera* ssp. *trichocarpa* Alliance – in which black cottonwood is the sole dominant in the tree layer;
- *Populus balsamifera* ssp. *trichocarpa – Salix laevigata* Provisional Alliance – in which black cottonwood and red willow are co-dominants in the tree layer;
- *Populus balsamifera* ssp. *trichocarpa – Salix laevigata* (mixed) Provisional Alliance or Association – in which black cottonwood and red willow are co-dominants in the tree layer, but one or more additional native riparian tree species is present as a sub-dominant;

- *Populus balsamifera* ssp. *trichocarpa – Salix lasiolepis* Provisional Alliance – in which black cottonwood and arroyo willow are co-dominants in the tree layer; and
- *Populus balsamifera* ssp. *trichocarpa – Salix lucida* ssp. *lasiandra* Provisional Alliance – in which black cottonwood and shining willow are co-dominants in the tree layer.

A related vegetation type, the *Populus balsamifera* ssp. *trichocarpa – Quercus agrifolia* Association, has black cottonwood and coast live oak as co-dominants in the tree layer. This provisional association is considered to be part of the Mixed Riparian Forest Alliance (see Section 4.25).

The *Populus balsamifera* ssp. *trichocarpa* Alliance is typically found along streams and in alluvial floodplain areas. In our mapping area it is found along Sespe and Santa Paula creeks, and in the middle and lower reaches of the mainstem Santa Clara River (Table 41). It overlaps somewhat with, but is largely replaced by, the *Populus fremontii* Alliance (Section 4.40) in the upper reaches. The moderating influence of coastal fog on summer temperatures and plant water stress may account for the prevalence of this species and vegetation type in the lower half of the study area and its general absence further inland where summer conditions tend to be hotter and drier.

Table 41. Distribution of *Populus balsamifera* ssp. *trichocarpa* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
0	20.1	8.1	2
1	62.3	25.2	8
2	0.5	0.2	1
3	1.2	0.5	1
4	2.0	0.8	1
5	11.2	4.5	4
6	174.9	70.8	17
7	8.0	3.2	1
Santa Paula	3.7	1.5	4
Sespe	1.1	0.5	1
TOTAL	**285.0**	**115.3**	**40**

4.40 *Populus fremontii* (Fremont cottonwood) Alliance

This alliance has an open to dense tree canopy (10–95 % cover), with Fremont cottonwood (*Populus fremontii* ssp. *fremontii*) as the sole dominate or co-dominant with willows (*Salix laevigata, S. lasiolepis*, or *S. lucida* spp. *lasiandra*) in the tree layer. The shrub layer is typically sparse to dense, with willow and cottonwood saplings as co-dominants. The herbaceous layer is typically absent or sparse, with the exception of giant reed (*Arundo donax*), which is often present (0–50 % cover).

This alliance includes six mapping units, the primary alliance and four associations in which willow species are co-dominant in the tree layer:

- *Populus fremontii* ssp. *fremontii* Alliance – in which Fremont cottonwood is the sole dominant in the tree layer;

- *Populus fremontii* ssp. *fremontii – Salix laevigata* Provisional Alliance – in which Fremont cottonwood and red willow are co-dominants in the tree layer;
- *Populus fremontii* ssp. *fremontii – Salix laevigata* (mixed) Provisional Alliance – in which Fremont cottonwood and red willow are co-dominants in the tree layer, but one or more additional native riparian tree species is present as a sub-dominant;
- *Populus fremontii* ssp. *fremontii – Salix lasiolepis* Provisional Alliance – in which Fremont cottonwood and arroyo willow are co-dominants in the tree layer;
- *Populus fremontii* ssp. *fremontii* – Mixed Willow Provisional Alliance – in which Fremont cottonwood and two or more tree willows (red, arroyo, and shining willow) are co-dominants in the tree layer; and
- *Populus fremontii* ssp. *fremontii*/*Sambucus mexicana* Provisional Association – in which Fremont cottonwood is dominant in the overstory and blue elderberry is the dominant tree in the subcanopy layer.

Three related mapping unit types are considered to be part of the Mixed Riparian Forest Alliance (see Section 4.25):

- *Populus fremontii* ssp. *fremontii – Quercus agrifolia* Provisional Association – in which Fremont cottonwood and coast live oak are co-dominants in the tree layer;
- *Populus fremontii* ssp. *fremontii* (Mixed) Provisional Association – in which Fremont cottonwood has two or more native riparian tree species as co-dominants in the tree layer.

The *Populus fremontii* Alliance is widespread throughout the southwestern United States, where it typically occurs along in alluvial areas along streams and rivers with fairly reliable groundwater available year-round at depths of less than 3–4 m. In our study area, this alliance occurs primarily in the upper reaches of the mainstem Santa Clara River and along Piru Creek (Table 42). The *Populus fremontii* Alliance occurs in the upper reaches of the lower Santa Clara River, which tend to be warmer and drier, while the *Populus balsamifera* ssp. *trichocarpa* Alliance is primarily found in the lower, cooler, wetter reaches (see Section 4.39). The distribution patterns of the two *Populus* species may be strongly influenced by the general extent of the coastal fog zone during the summer months.

Table 42. Distribution of *Populus fremontii* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
02	5.1	2.1	1
03	1.4	0.6	1
06	13.9	5.6	4
07	17.3	7.0	3
08	1.6	0.6	1
09	7.3	3.0	4
10	4.2	1.7	6
11	99.8	40.4	26
Piru	54.4	22.0	9
TOTAL	**205.0**	**83.0**	**55**

4.41 *Potentilla anserina* (Pacific silverweed) Alliance

This alliance has a dense herbaceous vegetation type, primarily composed of pacific silverweed (*Potentilla anserina* ssp. *pacifica*) (75 % cover). Curly dock (*Rumex crispus*) and alkali bulrush (*Scirpus maritimus*) are present but sparse (1 % cover) in the one stand of this alliance that was sampled.

One stand of the *Potentilla anserina* Alliance was found in estuarine wetland habitat in McGrath State Beach, near the mouth of the Santa Clara River (Table 43). This vegetation type was previously mapped in McGrath State Beach (ESA 2003).

Table 43. Distribution of *Potentilla anserina* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
0	1.3	0.5	1
TOTAL	**1.3**	**0.5**	**1**

4.42 *Quercus agrifolia* (California live oak) Alliance

This alliance generally includes herbaceous, shrub, and tree layers. Coast live oak (*Quercus agrifolia*) is the dominant or co-dominant species (3–80 % cover). Other tree species generally co-occur in the alliance, but the particular co-occurring species can vary, ranging from non-native Peruvian peppertree (*Schinus molle*) to native red willow (*Salix laevigata*) and western sycamore (*Platanus racemosa*). Shrub species also vary. Giant reed (*Arundo donax*) is nearly always present with low percent cover (<1–2 % cover). Non-native herbs and grasses dominate the understory.

The *Quercus agrifolia* Alliance includes the following mapping units:

- *Quercus agrifolia* Alliance;
- *Quercus agrifolia* (Disturbed) Provisional Association; and
- *Quercus agrifolia - Salix laevigata* Provisional Association.

The *Quercus agrifolia* Alliance is generally found throughout much of coastal California on slopes and in valleys with woodland habitats, and in various riparian habitats. It occurs on terraces in the middle and upper reaches of the lower Santa Clara River and in all three mapped tributaries (Table 44).

Table 44. Distribution of *Quercus agrifolia* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
05	14.9	6.0	1
06	2.1	0.8	1
07	0.0	0.0	1
10	4.3	1.7	1
11	6.0	2.4	2
Piru	23.6	9.5	3
Santa Paula	19.2	7.8	4
Sespe	2.2	0.9	2
TOTAL	**72.3**	**29.3**	**15**

4.43 *Ricinus communis* (castorbean) Alliance

Castor bean (*Ricinus communis*) is the dominant species in the shrub layer. Shortpod mustard (*Hirschfeldia incana*) and ripgut grass (*Bromus diandrus*) are common co-occurring species in the understory. Giant reed (*Arundo donax*) is uncommon (0-1 % cover).

Widespread in southern California, *Ricinus communis* is identified as a limited invasive plant species in coastal scrub and riparian areas (Cal-IPC 2007). Two fairly small stands of the alliance are found in Reaches 7 and 9 (Table 45). The species also occurs elsewhere in the study area, where it is a relatively common associated species in some disturbed sites, including many of the barrancas (small tributary streams) that cross agricultural zones.

Table 45. Distribution of *Ricinus communis* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
07	0.6	0.2	1
09	2.2	0.9	1
TOTAL	**2.7**	**1.1**	**2**

4.44 Riverwash Herbaceous Super-Alliance

The Riverwash Herbaceous Super-Alliance is a mapping unit of convenience that includes a variety of riparian alliances and associations. The majority of the area mapped under this super-alliance was bare riverwash following the large floods in January and February 2005. At the time of the field surveys in summer 2005 and 2006, these areas were typically dominated by white sweetclover (*Melilotus alba*), generally ranging from 10 – 35 % cover. In many areas, seedlings of willows (*Salix exigua, S. laevigata, S. lucida* ssp. *lasiandra,* and *S. lasiolepis*) and mulefat (*Baccharis salicifolia*), and occasionally Fremont cottonwood (*Populus fremontii*), were common (at up to 10 % cover). In addition, low levels of giant reed (*Arundo donax*) were oftern present (at up to 10 % cover). This suggests that the dominance of these stands by herbaceous vegetation is likely to be short-lived, with transformation into willow-dominated or

Arundo-dominated stands likely occurring within a few years unless another large flood scours out the established vegetation and resets these areas.

Many stands have wetter margins near the summer low flow channel that support a greater diversity of herbaceous species more common in the Floodplain Wetland Super-Alliance, including barnyard grass (*Echinochloa crus-galli)*, sprangletop (*Leptochloa uninervia)*, knotweed (*Polygonum* spp.), annual rabbitsfoot grass (*Polypogon monspeliensis)*, watercress (*Rorippa nasturtium-aquaticum)*, and water speedwell (*Veronica anagallis-aquatica)*. This vegetation type includes much fine-scale variation in some areas that could not adequately be captured in our mapping effort. More detailed sampling of vegetation within this super-alliance would undoubtedly lead to identification of a number of different alliances and associations in the study area.

The Riverwash Herbaceous Super-Alliance is abundant and widespread throughout all reaches of the lower Santa Clara River (Table 46). It is not found in any mapped tributaries, which do not contain the wide swaths of riverwash that support this alliance.

Table 46. Distribution of Riverwash Herbaceous Super-Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
0	16.5	6.7	3
1	170.0	68.8	12
2	183.6	74.3	29
3	6.2	2.5	4
4	28.0	11.3	6
5	13.3	5.4	4
6	320.9	129.9	24
7	108.6	43.9	21
8	310.5	125.7	21
9	100.3	40.6	11
10	57.7	23.3	6
11	39.9	16.2	10
TOTAL	**1355.6**	**548.6**	**151**

4.45 Riverwash Scrub Super-Alliance

The Riverwash Scrub Super-Alliance is a mapping unit of convenience that includes a variety of shrub-dominated riparian alliances and associations. The majority of the area mapped under this super-alliance appears to have been heavily disturbed (by scour or deposition) during the large floods in January and February 2005. This disturbance likely removed substantial amounts of woody vegetation that had established prior to 2005, leaving a sparse to intermittent shrub canopy (generally 10 – 25 % shrub cover). At the time of the field surveys in summer 2005 and 2006, these areas were typically dominated by willows (*Salix exigua, S. laevigata, S. lucida* ssp. *lasiandra,* and *S. lasiolepis*) and mulefat (*Baccharis salicifolia*), and occasionally Fremont cottonwood (*Populus fremontii*). Giant reed (*Arundo donax*) was a common co-dominant (at upo to 10 % cover) in many stands. As these stands recover from the flood disturbance of 2005, it is expected that shrub, and in some cases tree, canopy density will increase and the more mature

vegetation would be better classified in one of the willow or cottonwood alliances. Trees are generally absent and herbaceous cover is variable, but typically sparse in this super-alliance. Herbaceous species, when present, are typically those found in the Riverwash Herbaceous Super-Alliance. Scattered or isoloated salt cedar (*Tamarix ramosissima*) shrubs were observed in a few stands. This vegetation type includes fine-scale variation in some areas that could not adequately be captured in our mapping effort. More detailed sampling of vegetation within this super-alliance would undoubtedly lead to identification of a number of different alliances and associations in the study area.

The Riverwash Scrub Super-Alliance is abundant and widespread throughout the lower Santa Clara River, occurring in nearly all reaches (Table 47). It is also found along Sespe Creek.

Table 47. Distribution of Riverwash Scrub Super-Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
01	2.3	0.9	1
02	78.0	31.6	4
03	9.5	3.8	1
04	16.7	6.8	6
05	71.9	29.1	9
06	39.3	15.9	5
07	13.2	5.3	6
09	4.1	1.7	2
10	7.6	3.1	2
11	51.1	20.7	14
Sespe	1.3	0.5	1
TOTAL	**294.9**	**119.4**	**51**

4.46 *Salicornia virginica* (pickleweed) Alliance

The *Salicornia virginica* Alliance is a low-growing (<0.5 m), densely vegetated (typically 90 - 100 % cover) herbaceous vegetation type. Pickleweed (*Salicornia virginica*) is the dominant and typically only species in the alliance, with percent cover typically > 90 %. Common associated species can include salt grass (*Distichlis spicata*), marsh jaumea (*Jaumea carnosa*), and alkali heath (*Frankenia salina*). The description of this alliance is based on the information provided in ESA (2003).

The *Salicornia virginica* Alliance, which is tolerant of tidal inundation and moderately saline water, is found along the estuary in tidal marsh habitat (Table 48). This vegetation type was previously mapped in McGrath State Beach (ESA 2003).

Table 48. Distribution of *Salicornia virginica* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
00	5.6	2.3	2
TOTAL	**5.6**	**2.3**	**2**

4.47 *Salix exigua* (narrowleaf willow) Alliance

This alliance is characterized by a moderate shrub layer (approximately 50 % cover), with a sparse herbaceous understory (10–25 % cover) and generally no trees. Narrowleaf willow (*Salix exigua)* is the dominant shrub species (approximately 75 % cover). Mulefat (*Baccharis salicifolia*) and giant reed (*Arundo donax*) are common but sparse (<5 % cover) in the shrub layer. Ripgut brome (*Bromus diandrus)* is the dominant herbaceous species.

The *Salix exigua* Alliance is found along streams and in washes. It occurs throughout the mainstem lower Santa Clara River, and is most abundant in Reaches 6 and 7 (Table 49).

Table 49. Distribution of *Salix exigua* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
03	1.8	0.7	1
05	0.1	0.0	1
06	69.3	28.1	8
07	48.4	19.6	7
09	6.7	2.7	1
11	7.6	3.1	1
TOTAL	**133.9**	**54.2**	**19**

4.48 *Salix exigua–Arundo donax* (narrowleaf willow-giant reed) Alliance

This alliance typically has a moderate (average 50 % cover) shrub layer, rarely with emergent trees (< 5 % cover). Giant reed (*Arundo donax)* generally has the highest percent cover (average 10–50 % cover), followed by narrowleaf willow (*Salix exigua)* (8–20 % cover). Arroyo willow (*Salix lasiolepis)* and mulefat (*Baccharis salicifolia)* may also be present as sub-dominants (<10 % cover).

The *Salix exigua–Arundo donax* Alliance, found along streams and in washes, occurs throughout the mainstem lower Santa Clara River (Table 50).

Table 50. Distribution of *Salix exigua–Arundo donax* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
04	3.9	1.6	1
05	64.6	26.1	3
06	4.0	1.6	3
09	10.4	4.2	2
11	0.4	0.2	1
TOTAL	**83.3**	**33.7**	**10**

4.49 *Salix exigua-Baccharis salicifolia* (narrowleaf willow-mulefat) Alliance

The *Salix exigua–Baccharis salicifolia* Alliance has a moderate to dense shrub layer (25–85 % cover), with sparse understory and tree layers. Narrowleaf willow (*Salix exigua)* (8–35 % cover) and mulefat (*Baccharis salicifolia)* (5–40 % cover) are the co-dominant species in this alliance. A variety of annual grasses and introduced herbs are generally present (typically ranging from 5–50 % cover), as well as giant reed (*Arundo donax)* (< 20 % cover).

The *Salix exigua–Baccharis salicifolia* Alliance generally occurs along streams and in washes. It has a patchy distribution in the riparian vegetation mapping area, where it is found as far downstream as Reach 1 and as far upstream as Piru Creek (Table 51).

Table 51. Distribution of *Salix exigua–Baccharis salicifolia* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
1	7.7	3.1	3
3	19.1	7.7	4
7	7.2	2.9	5
Piru	0.1	0.0	1
Sespe	6.5	2.6	4
TOTAL	**40.7**	**16.5**	**17**

4.50 *Salix laevigata* (red willow) Alliance

The *Salix laevigata* Alliance is typically densely vegetated (50-90 % total cover), with all three strata generally present, although in a few cases total vegetative cover is sparser (15-50 % cover). Red willow (*Salix laevigata*) is the most frequent species in the tree and shrub layers. It is the dominant or co-dominant species (10–60 % cover) in the tree layer, which is typically 5–10 m high. Other willow (*Salix*) and cottonwood (*Populus*) species may occur in the tree layer, although the percent cover of these species can range widely. The shrub layer is typically shared with, and can be dominated by, giant reed (*Arundo donax*), other willow (*Salix*) species, and mulefat (*Baccharis salicifolia*). In several occurrences, the *Salix laevigata* Alliance appears to represent an earlier successional stage of the Mixed Riparian Forest Alliance, with cottonwood (*Populus* spp.) seedlings and saplings prevalent in the shrub layer. The composition and structure of the understory is highly variable, with some stands sparsely vegetated and other with a diverse mix of species.

The *Salix laevigata* Alliance includes the following mapping units:

- *Salix laevigata* Alliance;
- *Salix laevigata* (Disturbed) Provisional Association;
- *Salix laevigata/Leymus condensatus* Provisional Association;
- *Salix laevigata/Baccharis salicifolia* Provisional Association.

The *Salix laevigata* Alliance, typically found along streams and in seeps, is abundant and widespread in the riparian vegetation mapping area, occurring in nearly all reaches of the mainstem lower Santa Clara River and in all mapped tributaries (Table 52). It is particularly abundant in Reach 8, a gaining reach

with a shallow groundwater table that supports one of the greatest stands of riparian vegetation in the lower watershed (Figures 2 and 3).

Table 52. Distribution of *Salix laevigata* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
02	10.2	4.1	2
04	13.8	5.6	4
05	21.9	8.8	4
06	69.4	28.1	14
07	21.5	8.7	8
08	104.0	42.1	7
09	1.3	0.5	1
10	0.6	0.3	1
11	7.6	3.1	8
Piru	94.2	38.1	15
Santa Paula	0.6	0.2	1
Sespe	4.1	1.7	6
TOTAL	**349.2**	**141.3**	**71**

4.51 *Salix lasiolepis* (arroyo willow) Alliance

Vegetation coverage in this alliance is highly variable but generally ranging from sparse to dense in the shrub (5–90 % cover) and tree layers (0–80 % cover), with generally little to no cover in the ground layer (<5 % cover). Arroyo willow (*Salix lasiolepis*) is the dominant species in the tree layer and is dominant or co-dominant in the shrub layer. Giant reed (*Arundo donax)* and narrowleaf willow (*Salix exigua*) are common co-dominant or sub-dominant components of the shrub layer. Poison oak (*Toxicodendron diversilobum*) and mulefat (*Baccharis salicifolia*) are also common species in the shrub layer. Cottonwood (*Populus* spp.) trees are often present in the tree layer but generally have low abundance (<5 % cover).

The *Salix lasiolepis* Alliance includes the following mapping units:

- *Salix lasiolepis* Alliance;
- *Salix laevigata/Arundo donax* Provisional Association.

The *Salix lasiolepis* Alliance, found generally in moist meadows, seeps, and marshes, occurs in the mid to lower reaches of the mainstem lower Santa Clara River and in Sespe Creek (Table 53). It is particularly abundant in Reach 1, a gaining reach with a shallow groundwater table (Figure 3).

Table 53. Distribution of *Salix lasiolepis* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
00	65.8	26.6	12
01	157.1	63.6	18
03	7.0	2.8	2
04	2.6	1.0	2
05	2.1	0.9	1
06	14.9	6.0	5
Sespe	0.4	0.2	1
TOTAL	**249.9**	**101.1**	**41**

4.52 *Salix lucida* ssp. *lasiandra* (shining willow) Alliance

This alliance can have a highly variable but generally with a sparse to dense shrub (0–75 % cover) and tree canopy (0–75 % cover), and a sparse understory (<5 % cover) in the ground layer. Shining willow (*Salix lucida* ssp. *lasiandra*) is dominant (20–75 % cover). In wetter sites, cattail species (*Typha* spp.) (20–50 % cover) may occur in the understory. Other species of willow (*S. lasiolepis* and *S. exigua*) are common components of the shrub and/or tree layers and *Arundo donax* is present, but generally not abundant (<10 % cover).

The *Salix lucida* ssp. *lasiandra* Alliance occurs in wet places in the mid to lower reaches of the mainstem lower Santa Clara River (Table 54). It is most abundant in Reach 6, which supports one of the largest stands of riparian vegetation in the lower watershed (Figures 2 and 3).

Table 54. Distribution of *Salix lucida* ssp. *lasiandra* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
01	0.7	0.3	1
02	23.4	9.5	2
04	3.5	1.4	1
05	0.2	0.1	1
06	43.0	17.4	12
TOTAL	**70.7**	**28.6**	**17**

4.53 *Salvia mellifera* (black sage) Alliance

This alliance typically has a moderate to dense shrub layer dominated by black sage (*Salvia mellifera)* (50–75 % cover), with purple sage (*Salvia leucophylla)* and California sagebrush (*Artemisia californica)* (10–15 % cover) as common sub-dominants.

Salvia mellifera Alliance, an upland vegetation type found in coastal scrub and chaparral habitats, occurs primarily along Piru Creek, in the upper reaches of the riparian vegetation mapping area, with one small patch along Sespe Creek (Table 55).

Table 55. Distribution of *Salvia mellifera* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
Piru	4.7	1.9	2
Sespe	0.5	0.2	1
TOTAL	**5.3**	**2.1**	**3**

4.54 *Sambucus mexicana* (blue elderberry) Alliance

This alliance typically has moderate to very dense (33–97 %) vegetative cover in all three strata, with the shrub layer generally more pronounced (30 % cover in the ground layer, 13–78 % in the shrub layer, and <20 % in the tree layer). Blue elderberry (*Sambucus mexicana)* is consistently present (averaging 25 % cover) and dominant in the shrub or tree layers. Other prominent species are ripgut brome (*Bromus diandrus),* Italian thistle *(Carduus pycnocephalus)* and shortpod mustard *(Hirschfeldia incana),* each of which may have 10–30 % cover. In more disturbed sites, Peruvian peppertree (*Schinus molle)* is generally present. Giant reed (*Arundo donax)* may comprise up to 10% of the vegetative cover.

Sambucus mexicana Alliance occurs generally along stream banks and in open areas in woodlands. It is found in Reaches 5 and 6 of the mainstem Santa Clara River, which support one of the largest continuous stands of riparian vegetation in the lower watershed (Figures 2 and 3). It also occurs along Sespe Creek (Table 56).

Table 56. Distribution of *Sambucus mexicana* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
05	3.7	1.5	1
06	0.9	0.4	1
Sespe	3.8	1.5	2
TOTAL	**8.4**	**3.4**	**4**

4.55 *Schinus molle* (Peruvian peppertree) Alliance

This alliance generally includes herbaceous, shrub, and tree layers and has a moderate level of vegetative cover (30–75 % total cover). Peppertree (*Schinus molle*) generally composes at least 10 % cover, and dominates the tree layer. Native species, such as mulefat (*Baccharis salicifolia*), California sagebrush (*Artemisia californica*), California encelia (*Encelia californica*), and black sage (*Salvia mellifera*) tend to dominate the shrub layer, while non-native herbs and grasses dominate the understory.

The *Schinus molle* Alliance includes the following mapping units:

- *Schinus molle* Alliance;

- *Schinus molle/Lepidospartum squamatum* Provisional Association; and
- *Schinus molle/Lepidospartum squamatum-Salvia mellifera* Provisional Association.

Schinus molle is listed as a limited invasive species, with a currently unknown population in California (Cal-IPC 2007). It occurs generally in washes, on slopes, and in dry fields. The alliance is found in small patches in the middle to upper reaches of the mainstem lower Santa Clara River and mapped tributaries (Table 57). A fairly large patch occurs along Piru Creek, which has the potential to transport *Schinus molle* propagules into downstream reaches and increase the current extent of the species.

Table 57. Distribution of *Schinus molle* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
7	0.1	0.0	2
10	1.4	0.6	1
Piru	51.3	20.8	7
Santa Paula	0.4	0.1	1
Sespe	11.8	4.8	6
TOTAL	**65.0**	**26.3**	**17**

4.56 *Scirpus* spp. (bulrush) Alliance

The *Scirpus* Alliance is a densely vegetated alliance dominated by bulrush species (*Scirpus* spp.) (47–99 % cover). A tree layer is absent and the associated low (<0.5 m) herbaceous understory is generally sparse (<5 % cover). One of several bulrush species (*Scirpus americanus, S. californicus,* and *S. acutus*) typically dominates the alliance. A variety of other species, including *Arundo donax*, can be present but are generally low in abundance(<5 % cover).

The *Scirpus* Alliance, which is typically occurs in sites experiencing extended periods of inundation by fresh or brackish water, is found primarily in tidal marsh habitat along the estuary (Reach 0) and in the freshwater wetland habitat in Reach 6 (Table 58). It also occurs as a few small patches in Reach 1. This vegetation type was previously mapped in McGrath State Beach (ESA 2003) and the Hedrick Ranch Nature Area (URS Corporation 2002).

Table 58. Distribution of *Scirpus* spp. Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
00	12.9	5.2	11
01	3.4	1.4	5
06	19.2	7.8	14
TOTAL	**35.5**	**14.4**	**30**

4.57 *Tamarix* spp. (tamarisk) Alliance

This alliance typically has a dense shrub layer (70–100 % cover), with little understory . A few emergent trees may be present. Tamarisk (*Tamarix ramosissima)* is the dominant species (70–80 % cover), with giant reed (*Arundo donax)* typically present but not abundant (<5 % cover). Mulefat (*Baccharis salicifolia)* and arroyo willow (*Salix lasiolepis)* may also compose a small amount of the vegetative cover (<10 % cover) in the shrub layer.

Tamarix spp. is listed as one of the most invasive and widespread wildland pest plants by the California Invasive Pest Plant Council (Cal-IPC 2007). Its extent in the upper Santa Clara River watershed, rate of spread and impacts to the ecology of riparian areas have made it the focus of a large-scale eradication effort, along with *Arundo donax*, in the upper watershed (VCRCD 2006). *Tamarix* spp. Alliance is currently sparse in the lower watershed, with only three patches in Reaches 0 and 11 (Table 59). It is must abundant, however, in Reach 11, the upstream-most reach in the riparian vegetation mapping area, presenting a great risk of further infestation in downstream reaches. Cohorts of newly recruited tamarisk (*Tamarix ramosissima*) seedlings were observed in some stands of this super-alliance in both summer 2005 and 2006, suggesting a strong recruitment potential downstream of the few mature stands of *T. ramosissima* currently established in Reach 11, although future monitoring would be required to determine how many of these seedlings survive to maturity.

Table 59. Distribution of *Tamarix* spp. Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
00	1.7	0.7	2
11	9.6	3.9	1
TOTAL	**11.4**	**4.6**	**3**

4.58 *Yucca whipplei* (chaparral yucca) Alliance

This alliance typically has sparse to moderate cover in the shrub layer (30–40 % cover), sparse cover in the ground layer (2–18 % cover), and generally no tree layer. Chaparral yucca (*Yucca whipplei)* is the most common species in the alliance and typically accounts for approximately 50 % of the vegetation cover in the shrub layer. California buckwheat (*Eriogonum fasciculatum),* scale-broom (*Lepidospartum squamatum*), California aster (*Lessingia filaginifolia* var. *filaginifolia*), and several *Opuntia* species are common co-occurring shrub species in the one stand of this alliance that was sampled and mapped. Giant reed (*Arundo donax*) is present but not abundant (<5 % cover).

Yucca whipplei is typically an upland species, generally found in coastal scrub and chaparral habitats. One patch of the *Yucca whipplei* Alliance occurs in the upper portion of the riparian vegetation mapping area (Table 60).

Table 60. Distribution of *Yucca whipplei* Alliance in the Santa Clara River riparian vegetation mapping area.

Reach	Acres	Hectares	Polygons
09	5.5	2.2	1
TOTAL	**5.5**	**2.2**	**1**

5 LITERATURE CITED

Amec Earth & Environmental. 2005. Santa Clara River enhancement and management plan (SCREMP). Prepared for the Ventura County Watershed Protection District, Los Angeles County Department of Public Works, and SCREMP Project Steering Committee.

Amec Earth & Environmental. 2006. Upper Santa Clara River Watershed Arundo/Tamarisk removal plan. Prepared for the Ventura County Resource Conservation District, Somis, CA.

CDFG (California Department of Fish and Game) and CNPS (California Native Plant Society). 2005. Vegetation classification of the Santa Monica Mountains National Recreation Area and environs, Ventura and Los Angeles Counties, California. Prepared for the Santa Monica Mountains National Recreation Area.

Cal-IPC (California Invasive Plant Council). 2007. California invasive plant inventory (2006) and 2007 update. Online database. Accessed at: http://portal.cal-ipc.org/weedlist

CNPS (California Native Plant Society). 2007. Inventory of rare and endangered plants, 7th edition. Online database. Accessed at: http://cnps.web.aplus.net/cgi-bin/inv/inventory.cgi

CNPS (California Native Plant Society) Vegetation Committee. 2003a. Vegetation rapid assessment protocol (November 5, 2001, Revised February 5, 2003). Protocol and field forms available online at http://www.cnps.org/vegetation/protocol.htm.

CNPS (California Native Plant Society) Vegetation Committee. 2003b. California Native Plant Society releve protocol. CNPS Vegetation Committee, Revised February 5, 2003. Protocol and field forms available online at http://www.cnps.org/vegetation/protocol.htm.

Condor Environmental Planning Services, Inc . 2006. Vegetation of the tributaries of the Upper Santa Clara River, Los Angeles County, California. Prepared by E. Gevirtz, J. Jackson, and N. Martins. Prepared for Amec Earth & Environmental, Santa Barbara, and the Ventura County Resource Conservation District, Somis, CA.

DMEC (David Magney Environmental Consulting). 2001. Natural vegetation of the Ventura River. Prepared for Aspen Environmental Group, Agoura Hills, CA.

Dudley, T. 2004. Biological control of invasive giant reed (*Arundo donax*). Proposal submitted to the Santa Clara River Trustee Council Restoration Projects Grant Program (2005-2007), prepared by Univerity of California, Santa Barbara.

ESA (Environmental Science Associates). 2003. McGrath State Beach natural resources management plan. Prepared for the California Department of Parks and Recreation.

Evens, J.M. and S. San. 2005. Vegetation Alliances in the San Dieguito River Park Region, San Diego County, California. California Native Plant Society, Sacramento, CA

Evens, J.M., and T. Keeler-Wolf. 2003. Importance of vegetation in regional conservation planning. The Sampler (CNPS Vegetation Committee Newsletter), Volume 5, December 2003, pp. 10-15.

Ferren, W.R., M.H. Capelli, A. Parikh, D.L. Magney, K. Clark, and J. R. Haller. 1990. Botanical resources at Emma Wood State Beach and the Ventura River Estuary, California: inventory and management. Report to the State of California, Department of Parks and Recreation. Environmental Research Team, The Herbarium, Department of Biological Sciences, University of California, Santa Barbara, Environmental Report No. 15.

Hickman, J.C. (editor). 1993. The Jepson Manual: higher plants of California. University of California Press, Berkeley, CA.

Klein, A and J.M. Evens. 2005. Vegetation Classification and Mapping for Western Riverside County, California. California Native Plant Society, Sacramento, CA.

Sawyer, J.O. and T. Keeler-Wolf. 1995. A manual of California vegetation. California Native Plant Society, Sacramento, CA.

Stillwater Sciences. *In progress.* Santa Clara River Parkway Floodplain Restoration Feasibility Study: fluvial sediment transport and morphological change in the lower Santa Clara River. Prepared for the California State Coastal Conservancy.

Stillwater Sciences. 2005. Santa Clara River Parkway Floodplain Restoration Feasibility Study: assessment of geomorphic processes. Prepared for the California State Coastal Conservancy. August 2005. Available online: www.santaclarariverparkway.org/wkb/scrbiblio/stillwater2005.

Trustee Council (Santa Clara River Trustee Council). 2002. Final restoration plan and environmental assessment for the Santa Clara River Arco oil spill. Prepared by the Santa Clara River Trustee Council, U.S. Fish and Wildlife Service, and California Department of Fish and Game Office of Spill Prevention and Response.

URS Corporation. 2002. Hedrick Ranch Nature Area management plan. Prepared for Friends of the Santa Clara River and the California State Coastal Conservancy.

VCRCD (Ventura County Resource Conservation District). 2006a. Upper Santa Clara River watershed Arundo and Tamarisk removal program: long-term implementation plan. Ventura County Resource Conservation District, Ventura, CA. Available online: http://www.vcrcd.org/pdfs/SCARP/SCARP_LTIP.pdf

VCRCD (Ventura County Resource Conservation District). 2006b. Upper Santa Clara River watershed Arundo and Tamarisk removal plan: final environmental impact report. Ventura County Resource Conservation District, Ventura, CA. Available online: http://www.vcrcd.org/pages/library.html#EIR

Woodward, R.A. 2003. Use of CNPS vegetation standards in the State Park system. The Sampler (CNPS Vegetation Committee Newsletter), Volume 5, December 2003, pp. 4-5.

Young, A., D.E. Palmquist, and R.R. Blank. 1998. The ecology and control of perennial pepperweed (Lepidium latifolium L.). Weed Technology: 1998.

APPENDIX A: SUMMARY OF MAPPING UNITS IN THE STUDY AREA

Table A-1. Summary statistics on the abundance of the detailed mapping units in the lower Santa Clara River study area, in alphabetical order.

Mapping Units	Acres	Hectares	Percent of Study Area	No. of Stands Sampled
Abronia spp. - *Ambrosia chamissonis*	169.76	68.7	0.68%	0*
Agriculture	8,141.09	3,294.45	32.84%	n/a
Ambrosia psilostachya	1.1	0.45	0.00%	1
Artemisia californica	95.53	38.66	0.39%	12
Artemisia californica - Atriplex lentiformis	0.63	0.25	0.00%	1
Artemisia californica - Baccharis pilularis	8.75	3.54	0.04%	3
Artemisia californica - Baccharis salicifolia	8.33	3.37	0.03%	3
Artemisia californica - Eriogonum fasciculatum	23.74	9.61	0.10%	3
Artemisia californica (disturbed)	2.28	0.92	0.01%	2
Artemisia tridentata	33.01	13.36	0.13%	10
Artemisia tridentata - Atriplex canescens	39.39	15.94	0.16%	1
Artemisia tridentata - Baccharis salicifolia	1.35	0.55	0.01%	2
Artemisia tridentata - Eriogonum fasciculatum	16.94	6.85	0.07%	5
Artemisia tridentata - Salvia mellifera	1.51	0.61	0.01%	1
Arundo donax	890.24	360.25	3.59%	75
Atriplex lentiformis	5.33	2.16	0.02%	5
Baccharis pilularis	44.63	18.06	0.18%	2
Baccharis pilularis - Artemisia californica	12.93	5.23	0.05%	2
Baccharis pilularis - Baccharis salicifolia	20.88	8.45	0.08%	3
Baccharis pilularis (disturbed)	57.63	23.32	0.23%	1
Baccharis salicifolia	162.25	65.66	0.65%	21
Baccharis salicifolia - Arundo donax	18.29	7.4	0.07%	5
Baccharis salicifolia - Lepidospartum squamatum	1.68	0.68	0.01%	2
Baccharis salicifolia - Pluchea sericea	0.97	0.39	0.00%	1
Baccharis salicifolia - Tamarix ramosissima	0.9	0.37	0.00%	2
Baccharis salicifolia (disturbed)	4.97	2.01	0.02%	2
Beach	102.38	41.43	0.41%	n/a
Carpobrotus spp. - *Mesembryanthemum crystallinum*	17.09	6.92	0.07%	0*
Developed	6,484.48	2,624.07	26.16%	n/a
Distichlis spicata	10.79	4.37	0.04%	1
Disturbed	59.63	24.13	0.24%	n/a

Mapping Units	Acres	Hectares	Percent of Study Area	No. of Stands Sampled
Encelia californica - Eriogonum fasciculatum	14.11	5.71	0.06%	3
Eriogonum fasciculatum	23.84	9.65	0.10%	5
Eucalyptus spp.	66.75	27.01	0.27%	7
Eucalyptus spp. - *Schinus molle*	2.45	0.99	0.01%	2
Eucalyptus spp. - Schinus molle - Lepidospartum squamatum	1.51	0.61	0.01%	1
Floodplain wetland	480.55	194.46	1.94%	38
Jaumea carnosa	1.72	0.7	0.01%	1
Juglans californica - Salix laevigata	1.17	0.47	0.00%	1
Lepidospartum squamatum	207.73	84.06	0.84%	31
Lepidospartum squamatum - Baccharis salicifolia	23.95	9.69	0.10%	2
Lepidospartum squamatum - Salvia mellifera	1.95	0.79	0.01%	2
Lessingia filaginifolia	6.56	2.66	0.03%	3
Leymus condensatus	12.35	5	0.05%	3
Leymus triticoides	5.36	2.17	0.02%	2
Leymus triticoides - Anemopsis californica	3.15	1.28	0.01%	1
Lotus scoparius	5.67	2.29	0.02%	3
Malosma laurina - Artemisia californica	1	0.41	0.00%	1
Mixed riparian forest	30.08	12.17	0.12%	1
Mixed riparian forest (disturbed)	13.76	5.57	0.06%	4
Mixed riparian scrub	46.46	18.8	0.19%	9
Mixed riparian scrub - *Arundo donax*	43.59	17.64	0.18%	3
Mixed scrub	27.8	11.25	0.11%	5
Mixed scrub (disturbed)	2.89	1.17	0.01%	1
Mixed willow - *Arundo donax*	8.67	3.51	0.03%	3
Mixed willow forest	161.6	65.4	0.65%	4
Mixed willow scrub	93.28	37.75	0.38%	11
Myoporum laetum	2.12	0.86	0.01%	1
Myoporum laetum - Arundo donax	0.36	0.15	0.00%	0*
Nicotiana glauca	8.68	3.51	0.04%	2
Nicotiana glauca - Artemisia californica	1.44	0.58	0.01%	1
Non-native grasses and forbs	528.4	213.83	2.13%	57
Non-native grasses and forbs (iceplant)	27.93	11.3	0.11%	0*
Olea europaea	12.66	5.12	0.05%	2
Open water	856.48	346.59	3.45%	n/a
Phragmites australis	0.19	0.08	0.00%	1
Platanus racemosa	1.39	0.56	0.01%	1

Mapping Units	Acres	Hectares	Percent of Study Area	No. of Stands Sampled
Platanus racemosa - Populus fremontii	6.78	2.74	0.03%	3
Platanus racemosa - Quercus agrifolia	0.48	0.2	0.00%	1
Platanus racemosa - Salix laevigata	0.62	0.25	0.00%	1
Platanus racemosa (disturbed)	1.92	0.77	0.01%	2
Platanus racemosa (mixed)	6.51	2.63	0.03%	1
Pluchea sericea	9.93	4.02	0.04%	4
Populus balsamifera	72.48	29.33	0.29%	9
Populus balsamifera - Quercus agrifolia	3.13	1.27	0.01%	1
Populus balsamifera - Salix laevigata	101.67	41.14	0.41%	10
Populus balsamifera - Salix laevigata (disturbed)	1.15	0.46	0.00%	1
Populus balsamifera - Salix lasiolepis	98.76	39.97	0.40%	7
Populus balsamifera - Salix lucida	10.9	4.41	0.04%	1
Populus fremontii	61.85	25.03	0.25%	10
Populus fremontii - Juglans californica	1.02	0.41	0.00%	1
Populus fremontii - Quercus agrifolia	25.25	10.22	0.10%	3
Populus fremontii - Salix laevigata	122.21	49.45	0.49%	26
Populus fremontii - Salix laevigata (mixed)	15.22	6.16	0.06%	1
Populus fremontii - Salix lasiolepis	2.79	1.13	0.01%	2
Populus fremontii - Sambucus mexicana	0.41	0.17	0.00%	1
Populus fremontii (mixed willow)	2.54	1.03	0.01%	1
Populus fremontii (mixed)	8.15	3.3	0.03%	1
Potentilla anserina	1.28	0.52	0.01%	1
Quercus agrifolia	57.4	23.23	0.23%	5
Quercus agrifolia - Platanus racemosa - Populus fremontii	2.63	1.06	0.01%	1
Quercus agrifolia - Salix laevigata	1.76	0.71	0.01%	1
Quercus agrifolia (disturbed)	13.13	5.31	0.05%	2
Quercus agrifolia (mixed/disturbed)	10.31	4.17	0.04%	1
Restoration site	3.84	1.55	0.02%	n/a
Ricinus communis	2.74	1.11	0.01%	2
Riverwash	2,095.83	848.12	8.45%	30
Riverwash herbaceous	1,355.62	548.58	5.47%	40
Riverwash scrub	294.94	119.35	1.19%	10
Salicornia virginica	1.48	0.6	0.01%	0*
Salicornia virginica (disturbed)	4.11	1.66	0.02%	0*
Salix exigua	133.86	54.17	0.54%	14
Salix exigua - Arundo donax	83.28	33.7	0.34%	9

Mapping Units	Acres	Hectares	Percent of Study Area	No. of Stands Sampled
Salix exigua - Baccharis salicifolia	40.71	16.47	0.16%	10
Salix laevigata	229.89	93.03	0.93%	30
Salix laevigata - Arundo donax	1.43	0.58	0.01%	1
Salix laevigata - Baccharis salicifolia	94.37	38.19	0.38%	4
Salix laevigata - Leymus condensatus	14.65	5.93	0.06%	1
Salix laevigata - Salix exigua	4.34	1.76	0.02%	3
Salix laevigata - Salix lasiolepis	141.18	57.13	0.57%	11
Salix laevigata - Salix lasiolepis - Scirpus spp. *- Typha* spp.	2.72	1.1	0.01%	1
Salix laevigata - Salix lucida	11.26	4.56	0.05%	2
Salix laevigata - Scirpus spp. *- Typha* spp.	4.85	1.96	0.02%	1
Salix laevigata (disturbed)	3.96	1.6	0.02%	2
Salix lasiolepis	247.34	100.09	1.00%	11
Salix lasiolepis - Arundo donax	2.58	1.04	0.01%	1
Salix lasiolepis - Salix exigua	5.35	2.17	0.02%	1
Salix lasiolepis - Salix exigua - Arundo donax	2.35	0.95	0.01%	1
Salix lasiolepis - Salix lucida	0.67	0.27	0.00%	1
Salix lucida - Typha spp.	1.82	0.74	0.01%	1
Salix lucida ssp. *lasiandra*	68.9	27.88	0.28%	11
Salvia mellifera	5.28	2.14	0.02%	2
Sambucus mexicana	4.65	1.88	0.02%	1
Sambucus mexicana (disturbed)	3.8	1.54	0.02%	2
Schinus molle	55.71	22.54	0.22%	7
Schinus molle - Lepidospartum squamatum	4.7	1.9	0.02%	1
Schinus molle - Lepidospartum squamatum - Salvia mellifera	4.54	1.84	0.02%	1
Scirpus californicus	10.08	4.08	0.04%	1
Scirpus spp.	25.44	10.29	0.10%	1
Tamarix ramosissima	11.36	4.6	0.05%	1
Yucca whipplei	5.54	2.24	0.02%	1
TOTAL	**24,791.53**	**10,032.38**	**100%**	**692**

* not sampled as part of this study; based on ESA (2003) mapping at McGrath State Beach

Table A-2. Summary statistics on the abundance of the detailed mapping units in the lower Santa Clara River study area, ranked in descending order by area.

Mapping Units	Acres	Hectares	Percent of Study Area	No. of Stands Sampled
Agriculture	8,141.09	3,294.45	32.84%	n/a
Developed	6,484.48	2,624.07	26.16%	n/a
Riverwash	2,095.83	848.12	8.45%	30
Riverwash herbaceous	1,355.62	548.58	5.47%	40
Arundo donax	890.24	360.25	3.59%	75
Open water	856.48	346.59	3.45%	n/a
Non-native grasses and forbs	528.4	213.83	2.13%	57
Floodplain wetland	480.55	194.46	1.94%	38
Riverwash scrub	294.94	119.35	1.19%	10
Salix lasiolepis	247.34	100.09	1.00%	11
Salix laevigata	229.89	93.03	0.93%	30
Lepidospartum squamatum	207.73	84.06	0.84%	31
Abronia spp. - *Ambrosia chamissonis*	169.76	68.7	0.68%	0*
Baccharis salicifolia	162.25	65.66	0.65%	21
Mixed willow forest	161.6	65.4	0.65%	4
Salix laevigata - Salix lasiolepis	141.18	57.13	0.57%	11
Salix exigua	133.86	54.17	0.54%	14
Populus fremontii - Salix laevigata	122.21	49.45	0.49%	26
Beach	102.38	41.43	0.41%	n/a
Populus balsamifera - Salix laevigata	101.67	41.14	0.41%	10
Populus balsamifera - Salix lasiolepis	98.76	39.97	0.40%	7
Artemisia californica	95.53	38.66	0.39%	12
Salix laevigata - Baccharis salicifolia	94.37	38.19	0.38%	4
Mixed willow scrub	93.28	37.75	0.38%	11
Salix exigua - Arundo donax	83.28	33.7	0.34%	9
Populus balsamifera	72.48	29.33	0.29%	9
Salix lucida ssp. *lasiandra*	68.9	27.88	0.28%	11
Eucalyptus spp.	66.75	27.01	0.27%	7
Populus fremontii	61.85	25.03	0.25%	10
Disturbed	59.63	24.13	0.24%	n/a
Baccharis pilularis (disturbed)	57.63	23.32	0.23%	1
Quercus agrifolia	57.4	23.23	0.23%	5
Schinus molle	55.71	22.54	0.22%	7
Mixed riparian scrub	46.46	18.8	0.19%	9
Baccharis pilularis	44.63	18.06	0.18%	2

Mapping Units	Acres	Hectares	Percent of Study Area	No. of Stands Sampled
Mixed riparian scrub - *Arundo donax*	43.59	17.64	0.18%	3
Salix exigua - Baccharis salicifolia	40.71	16.47	0.16%	10
Artemisia tridentata - Atriplex canescens	39.39	15.94	0.16%	1
Artemisia tridentata	33.01	13.36	0.13%	10
Mixed riparian forest	30.08	12.17	0.12%	1
Non-native grasses and forbs (iceplant)	27.93	11.3	0.11%	0*
Mixed scrub	27.8	11.25	0.11%	5
Scirpus spp.	25.44	10.29	0.10%	1
Populus fremontii - Quercus agrifolia	25.25	10.22	0.10%	3
Lepidospartum squamatum - Baccharis salicifolia	23.95	9.69	0.10%	2
Eriogonum fasciculatum	23.84	9.65	0.10%	5
Artemisia californica - Eriogonum fasciculatum	23.74	9.61	0.10%	3
Baccharis pilularis - Baccharis salicifolia	20.88	8.45	0.08%	3
Baccharis salicifolia - Arundo donax	18.29	7.4	0.07%	5
Carpobrotus spp. *- Mesembryanthemum crystallinum*	17.09	6.92	0.07%	0*
Artemisia tridentata - Eriogonum fasciculatum	16.94	6.85	0.07%	5
Populus fremontii - Salix laevigata (mixed)	15.22	6.16	0.06%	1
Salix laevigata - Leymus condensatus	14.65	5.93	0.06%	1
Encelia californica - Eriogonum fasciculatum	14.11	5.71	0.06%	3
Mixed riparian forest (disturbed)	13.76	5.57	0.06%	4
Quercus agrifolia (disturbed)	13.13	5.31	0.05%	2
Baccharis pilularis - Artemisia californica	12.93	5.23	0.05%	2
Olea europaea	12.66	5.12	0.05%	2
Leymus condensatus	12.35	5	0.05%	3
Tamarix ramosissima	11.36	4.6	0.05%	1
Salix laevigata - Salix lucida	11.26	4.56	0.05%	2
Populus balsamifera - Salix lucida	10.9	4.41	0.04%	1
Distichlis spicata	10.79	4.37	0.04%	1
Quercus agrifolia (mixed/disturbed)	10.31	4.17	0.04%	1
Scirpus californicus	10.08	4.08	0.04%	1
Pluchea sericea	9.93	4.02	0.04%	4
Artemisia californica - Baccharis pilularis	8.75	3.54	0.04%	3
Nicotiana glauca	8.68	3.51	0.04%	2
Mixed willow - *Arundo donax*	8.67	3.51	0.03%	3
Artemisia californica - Baccharis salicifolia	8.33	3.37	0.03%	3
Populus fremontii (mixed)	8.15	3.3	0.03%	1

Mapping Units	Acres	Hectares	Percent of Study Area	No. of Stands Sampled
Platanus racemosa - Populus fremontii	6.78	2.74	0.03%	3
Lessingia filaginifolia	6.56	2.66	0.03%	3
Platanus racemosa (mixed)	6.51	2.63	0.03%	1
Lotus scoparius	5.67	2.29	0.02%	3
Yucca whipplei	5.54	2.24	0.02%	1
Leymus triticoides	5.36	2.17	0.02%	2
Salix lasiolepis - Salix exigua	5.35	2.17	0.02%	1
Atriplex lentiformis	5.33	2.16	0.02%	5
Salvia mellifera	5.28	2.14	0.02%	2
Baccharis salicifolia (disturbed)	4.97	2.01	0.02%	2
Salix laevigata - Scirpus spp. - *Typha* spp.	4.85	1.96	0.02%	1
Schinus molle - Lepidospartum squamatum	4.7	1.9	0.02%	1
Sambucus mexicana	4.65	1.88	0.02%	1
Schinus molle - Lepidospartum squamatum - Salvia mellifera	4.54	1.84	0.02%	1
Salix laevigata - Salix exigua	4.34	1.76	0.02%	3
Salicornia virginica (disturbed)	4.11	1.66	0.02%	0*
Salix laevigata (disturbed)	3.96	1.6	0.02%	2
Restoration site	3.84	1.55	0.02%	n/a
Sambucus mexicana (disturbed)	3.8	1.54	0.02%	2
Leymus triticoides - Anemopsis californica	3.15	1.28	0.01%	1
Populus balsamifera - Quercus agrifolia	3.13	1.27	0.01%	1
Mixed scrub (disturbed)	2.89	1.17	0.01%	1
Populus fremontii - Salix lasiolepis	2.79	1.13	0.01%	2
Ricinus communis	2.74	1.11	0.01%	2
Salix laevigata - Salix lasiolepis - Scirpus spp. - *Typha* spp.	2.72	1.1	0.01%	1
Quercus agrifolia - Platanus racemosa - Populus fremontii	2.63	1.06	0.01%	1
Salix lasiolepis - Arundo donax	2.58	1.04	0.01%	1
Populus fremontii (mixed willow)	2.54	1.03	0.01%	1
Eucalyptus spp. - *Schinus molle*	2.45	0.99	0.01%	2
Salix lasiolepis - Salix exigua - Arundo donax	2.35	0.95	0.01%	1
Artemisia californica (disturbed)	2.28	0.92	0.01%	2
Myoporum laetum	2.12	0.86	0.01%	1
Lepidospartum squamatum - Salvia mellifera	1.95	0.79	0.01%	2
Platanus racemosa (disturbed)	1.92	0.77	0.01%	2

Mapping Units	Acres	Hectares	Percent of Study Area	No. of Stands Sampled
Salix lucida - Typha spp.	1.82	0.74	0.01%	1
Quercus agrifolia - Salix laevigata	1.76	0.71	0.01%	1
Jaumea carnosa	1.72	0.7	0.01%	1
Baccharis salicifolia - Lepidospartum squamatum	1.68	0.68	0.01%	2
Artemisia tridentata - Salvia mellifera	1.51	0.61	0.01%	1
Eucalyptus spp. - Schinus molle - Lepidospartum squamatum	1.51	0.61	0.01%	1
Salicornia virginica	1.48	0.6	0.01%	0*
Nicotiana glauca - Artemisia californica	1.44	0.58	0.01%	1
Salix laevigata - Arundo donax	1.43	0.58	0.01%	1
Platanus racemosa	1.39	0.56	0.01%	1
Artemisia tridentata - Baccharis salicifolia	1.35	0.55	0.01%	2
Potentilla anserina	1.28	0.52	0.01%	1
Juglans californica - Salix laevigata	1.17	0.47	0.00%	1
Populus balsamifera - Salix laevigata (disturbed)	1.15	0.46	0.00%	1
Ambrosia psilostachya	1.1	0.45	0.00%	1
Populus fremontii - Juglans californica	1.02	0.41	0.00%	1
Malosma laurina - Artemisia californica	1	0.41	0.00%	1
Baccharis salicifolia - Pluchea sericea	0.97	0.39	0.00%	1
Baccharis salicifolia - Tamarix ramosissima	0.9	0.37	0.00%	2
Salix lasiolepis - Salix lucida	0.67	0.27	0.00%	1
Artemisia californica - Atriplex lentiformis	0.63	0.25	0.00%	1
Platanus racemosa - Salix laevigata	0.62	0.25	0.00%	1
Platanus racemosa - Quercus agrifolia	0.48	0.2	0.00%	1
Populus fremontii - Sambucus mexicana	0.41	0.17	0.00%	1
Myoporum laetum - Arundo donax	0.36	0.15	0.00%	0*
Phragmites australis	0.19	0.08	0.00%	1
TOTAL	**24,791.53**	**10,032.38**	**100%**	**692**

* not sampled as part of this study; based on ESA (2003) mapping at McGrath State Beach

APPENDIX B: METADATA

An ESRI geodatabase was developed to house the digital spatial data associated with this project. The polygon layer representing the vegetation and land cover mapping data contains several fields, defined below.

- **ReachNum:** The reach number, derived from reach delineations developed as part of geomorphology studies conducted by Stillwater Sciences (Stillwater Sciences 2005). The reaches were used to characterize local distribution of vegetation for the purposes of this report (see Figure 3).
- **PolyNumber:** The polygon number, used to link field-based mapping units with the associated field reconnaissance data form.
- **Arundo_Cov:** Percent *Arundo donax* cover for the mapping unit.
- **MapUnit:** The vegetation or land cover classification for each mapping unit. See Section 3 for a description of the mapping unit types and Appendix A for summary statistics on each type.
- **MUSource:** The source from which the mapping unit delineation and classification call were derived: "field data" indicates the mapping unit was derived from the field-based mapping efforts, "PhotoInterp" indicates a photo-interpretation based delineation and classification call. Mapping units with an MUSource of "ESA 2003" were modified from mapping conducted by ESA (2003) in McGrath State Park and mapping units with an MUSource of "URS Corporation 2002" were derived from mapping efforts at Hedrick Ranch conducted by URS Corporation (2002).
- **Shape_Length:** The length of a polygon shape, in feet.
- **Shape_Area:** The area of a polygon shape, in square feet.
- **Polycount:** A count field used to derive numbers of polygons or stands for each vegetation type.

The data are projected in California State Plane V, NAD 83, in U.S. feet, with the following standard parameters:

- Projected Coordinate System: NAD_1983_StatePlane_California_V_FIPS_0405_Feet
- Projection: Lambert_Conformal_Conic
- False_Easting: 6561666.66666667
- False_Northing: 1640416.66666667
- Central_Meridian: -118.00000000
- Standard_Parallel_1: 34.03333333
- Standard_Parallel_2: 35.46666667
- Latitude_Of_Origin: 33.50000000
- Linear Unit: Foot_US

APPENDIX C: PLANT SPECIES LIST FOR THE LOWER SANTA CLARA RIVER RIPARIAN VEGETATION MAPPING AREA

Table C-1. Plant species observed in the lower Santa Clara River riparian vegetation mapping area.

Scientific Name	Common Name	Family	Native/ Non-native
Adenostoma fasciculatum	Chamise	Rosaceae	Native
Agrostis viridis	European bentgrass	Poaceae	Non-native
Allophyllum gilioides	Dense false-gilia	Polemoniaceae	Native
Allophyllum glutinosum	Sticky false-gilia	Polemoniaceae	Native
Alnus rhombifolia	White alder	Betulaceae	Native
Amaranthus sp.	Amaranth	Amaranthaceae	0*
Ambrosia acanthicarpa	Flatspine burr ragweed	Asteraceae	Native
Ambrosia chamissonis	Silver beach burr	Asteraceae	Native
Ambrosia confertiflora	Weakleaf burr ragweed	Asteraceae	Native
Ambrosia psilostachya	Western ragweed	Asteraceae	Native
Anagallis arvensis	Scarlet pimpernel	Primulaceae	Non-native
Anaphalis margaritacea	Pearly everlasting	Asteraceae	Native
Anemopsis californica	Yerba mansa / Lizard tail	Saururaceae	Native
Anthemis cotula	Mayweed/ Stinkweed/ Dog-fennel	Asteraceae	Non-native
Apiastrum angustifolium	Wild celery	Apiaceae	Native
Apium graveolens	Celery	Apiaceae	Non-native
Arctostaphylos glauca	Big berry manzanita	Ericaceae	Native
Artemisia californica	Coastal sagebrush, California sagebrush	Asteraceae	Native
Artemisia douglasiana	Mugwort	Asteraceae	Native
Artemisia tridentata ssp. *parishii*	Big sagebrush	Asteraceae	Native
Arundo donax	Giant reed	Poaceae	Non-native
Aster subulatus var. *lingulatus*	Slim aster	Asteraceae	Native
Astragalus trichopodus var. *phoxus*	Santa Barbara locoweed	Fabaceae	Native
Atriplex canescens	Fourwing saltbush / Shad-scale	Chenopodiaceae	Native
Atriplex lentiformis ssp. *breweri*	Quailbush	Chenopodiaceae	Native
Atriplex lentiformis ssp. *lentiformis*	Big saltbush	Chenopodiaceae	Native
Atriplex leucophyla	Beach saltbush	Chenopodiaceae	Native
Atriplex triangularis	Spearscale/ Fat hen	Chenopodiaceae	Native
Avena barbata	Slender wild oat	Poaceae	Non-native
Baccharis douglasii	Saltmarsh baccharis	Asteraceae	Native
Baccharis pilularis	Coyote bush	Asteraceae	Native
Baccharis salicifolia	Mulefat / Water wally	Asteraceae	Native
Brassica nigra	Black mustard	Brassicaceae	Non-native

Scientific Name	Common Name	Family	Native/ Non-native
Brickellia californica	California brickellbush	Asteraceae	Native
Bromus carinatus	California brome	Poaceae	Native
Bromus catharticus	Rescue grass	Poaceae	Non-native
Bromus diandrus	Ripgut grass	Poaceae	Non-native
Bromus hordeaceus	Soft chess	Poaceae	Non-native
Bromus madritensis ssp. *rubens*	Red brome / Foxtail chess	Poaceae	Non-native
Cakile maritima	Sea rocket	Brassicaceae	Non-native
Calystegia macrostegia	Morning-glory	Convolvulaceae	Native
Camissonia bistorta	Sun-cup	Onagraceae	Native
Camissonia micrantha	Small evening primrose	Onagraceae	Native
Carduus pycnocephalus	Italian thistle	Asteraceae	Non-native
Carex praegracilis	Field sedge	Cyperaceae	Native
Carex sp.	Sedge	Cyperaceae	Native
Castilleja exerta	Purple owl's-clover	Scrophulariaceae	Native
Castilleja stenantha	Annual paintbrush	Scrophulariaceae	Native
Ceanothus crassifolius	Hoaryleaf ceonothus	Rhamnaceae	Native
Ceanothus cuneatus	Buckbrush	Rhamnaceae	Native
Ceanothus oliganthus	Hairy-leaf ceanothus	Rhamnaceae	Native
Centaurea melitensis	Tocalote	Asteraceae	Non-native
Centaurea solstitialis	Yellow star thistle	Asteraceae	Non-native
Centaurium venustum	Canchalagua	Gentianaceae	Native
Cercocarpus montanus	Mountain mahogany	Rosaceae	Native
Chenopodium album	Pigweed / Lamb's quarters	Chenopodiaceae	Non-native
Chenopodium ambrosioides	Mexican tea	Chenopodiaceae	Non-native
Chenopodium californicum	Goosefoot / Pigweed	Chenopodiaceae	Native
Cichorium intybus	Chicory	Asteraceae	Non-native
Cirsium vulgare	Bullthistle	Asteraceae	Non-native
Clarkia unguiculata	Elegant clarkia	Onagraceae	Native
Conium maculatum	Poison hemlock	Apiaceae	Non-native
Convolvulus arvensis	Orchard morning-glory	Convolvulaceae	Native
Conyza canadensis	Horseweed / Mare's tail	Asteraceae	Native
Cortaderia jubata	Pampas grass	Poaceae	Non-native
Cotula coronopifolia	Brass buttons	Asteraceae	Non-native
Croton californicus	Croton	Euphorbiaceae	Native
Cryptantha intermedia	Clearwater catseye	Boraginaceae	Native
Cryptantha micromeres	Minute-flowered forget-me-not	Boraginaceae	Native
Cucurbita foetidissima	Calabazilla	Cucurbitaceae	Native
Cupressus arizonica ssp. *arizonica*	Arizona cypress	Cupressaceae	Native**
Cuscuta californica	California dodder	Cuscutaceae	Native
Cuscuta salina	Saltmarsh dodder	Cuscutaceae	Native

Scientific Name	Common Name	Family	Native/ Non-native
Cynodon dactylon	Bermuda grass	Poaceae	Non-native
Cyperus eragrostis	Netsedge/ Umbrella sedge	Cyperaceae	Native
Cyperus erythrorhizos	Redroot flatsedge	Cyperaceae	Native
Cyperus involucratus	Umbrella sedge	Cyperaceae	Non-native
Cyperus strigosus	False nutsedge	Cyperaceae	Native
Datura wrightii	Sacred datura	Solanaceae	Native
Delairea odorata	Cape ivy / German ivy	Asteraceae	Non-native
Distichlis spicata	Salt grass	Poaceae	Native
Dudleya pulverulenta	Chalk dudleya	Crassulaceae	Native
Echinochloa crus-galli	Barnyard grass	Poaceae	Non-native
Ehrharta sp.	Veldt grass	Poaceae	Non-native
Eleocharis acicularis	Spikerush	Cyperaceae	Native
Eleocharis macrostachya	Common spikerush	Cyperaceae	Native
Eleocharis parishii	Spikerush	Cyperaceae	Native
Elymus glaucus	Blue wildrye / Western rye	Poaceae	Native
Emmenanthe penduliflora	Whispering bells	Hydrophyllaceae	Native
Encelia californica	California encelia	Asteraceae	Native
Encelia farinosa	Brittlebrush	Asteraceae	Native
Encelia virginensis	Virgin River brittlebrush	Asteraceae	Native
Epilobium canum	California fuschia	Onagraceae	Native
Epilobium ciliatum	Willow herb / Fireweed	Onagraceae	Native
Equisetum arvense	Scouring rush / Common horsetail	Equisetaceae	Native
Equisetum giganteum	Giant horsetail	Equisetaceae	Native
Equisetum laevigatum	Smooth horsetail	Equisetaceae	Native
Eremocarpus setigerus	Turkey mullein	Euphorbiaceae	Native
Eriastrum densifolium ssp. *elongatum*	Perennial wool star	Polemoniaceae	Native
Eriastrum sp.	Woolystar	Polemoniaceae	Native
Ericameria sp.	Goldenbush	Asteraceae	Native
Eriodictylon crassifolium var. *crassifolium*	Yerba santa	Hydrophyllaceae	Native
Eriogonum fasciculatum	California buckwheat	Polygonaceae	Native
Eriogonum sp.	Buckwheat	Polygonaceae	Native
Eriophyllum confertiflorum	Golden yarrow	Asteraceae	Native
Erodium cicutarium	Red-stemmed filaree / Storksbill	Geraniaceae	Non-native
Eucalyptus camaldulensis	River red gum	Myrtaceae	Non-native
Eucalyptus globulus	Blue gum	Myrtaceae	Non-native
Eucrypta chrysanthemifolia	Eucrypta	Hydrophyllaceae	Native
Euthamia occidentalis	Western goldenrod	Asteraceae	Native
Festuca arundinacea	Tall fescue	Poaceae	Non-native

Scientific Name	Common Name	Family	Native/ Non-native
Festuca pratensis	Meadow fescue	Poaceae	Native
Filago californica	Cottonrose / California filago	Asteraceae	Native
Foeniculum vulgare	Sweet fennel	Apiaceae	Non-native
Gnaphalium californicum	California everlasting	Asteraceae	Native
Gnaphalium canescens	Slender everlasting	Asteraceae	Native
Gnaphalium luteo-album	Weedy cudweed	Asteraceae	Non-native
Gnaphalium palustre	Everlasting / Woolly cudweed	Asteraceae	Native
Gnaphalium stramineum	Cudweed	Asteraceae	Native
Hazardia squarrosa var. *grindelioides*	Saw-toothed goldenbrush	Asteraceae	Native
Helianthus annuus	Common sunflower	Asteraceae	Native
Heliotropium curassavicum	Salt heliotrope	Boraginaceae	Native
Hemizonia fitchii	Tarweed	Asteraceae	Native
Heteromeles arbutifolia	Toyon	Rosaceae	Native
Heterotheca grandiflora	Telegraph weed	Asteraceae	Native
Heterotheca sessiliflora ssp. *echioides*	Hairy-golden aster	Asteraceae	Native
Hirschfeldia incana	Hirschfeldia / Shortpod mustard	Brassicaceae	Non-native
Hoita macrostachya	Leather root	Fabaceae	Native
Hordeum murinum ssp. *leporinum*	Mediterranean barley	Poaceae	Non-native
Hordeum vulgare	Common barley	Poaceae	Non-native
Jaumea carnosa	Marsh jaumea	Asteraceae	Native
Juglans californica	California black walnut	Juglandaceae	Native
Juglans regia	European walnut	Juglandaceae	Non-native
Juncus acuminatus	Rush	Juncaceae	Native
Juncus acutus	Leopold's rush	Juncaceae	Native
Juncus acutus ssp. *leopoldii*	Spiny rush	Juncaceae	Native
Juncus balticus	Baltic rush	Juncaceae	Native
Juncus bufonius var. *congestus*	Toad rush	Juncaceae	Native
Juncus dubius	Rush	Juncaceae	Native
Juncus mexicanus	Rush	Juncaceae	Native
Juncus phaeocephalus var. *paniculatus*	Brown-headed rush	Juncaceae	Native
Juncus phaeocephalus var. *phaeocephalus*	Brown-headed rush	Juncaceae	Native
Juncus textilis	Rush	Juncaceae	Native
Juncus torreyi	Torrey's rush	Juncaceae	Native
Juncus xiphioides	Irisleaf rush	Juncaceae	Native
Lactuca serriola	Prickly lettuce / Wild lettuce	Asteraceae	Non-native
Lemna sp.	Duckweed	Lemnaceae	Native
Lepidium latifolium	Perennial pepperweed	Brassicaceae	Non-native
Lepidium sp.	Pepperweed	Brassicaceae	Native

Scientific Name	Common Name	Family	Native/ Non-native
Lepidospartum squamatum	Scale-broom	Asteraceae	Native
Leptochloa uninervia	Mexican sprangletop	Poaceae	Non-native
Lessingia filaginifolia var. *filaginifolia*	California aster	Asteraceae	Native
Leymus condensatus	Giant rye	Poaceae	Native
Leymus triticoides	Creeping wild rye / Alkalai rye	Poaceae	Native
Lolium multiflorum	Italian ryegrass	Poaceae	Non-native
Lotus corniculatus	Lotus / Birdfoot trefoil	Fabaceae	Non-native
Lotus junceus ssp. *bioletti*	Bioletti's lotus	Fabaceae	Native
Lotus purshianus	Spanish clover	Fabaceae	Native
Lotus salsuginosis		Fabaceae	Native
Lotus scoparius	California broom / Deerweed	Fabaceae	Native
Ludwigia peploides ssp. *peploides*	Yellow water-weed	Onagraceae	Native
Lupinus hirsutissimus	Stinging lupine	Fabaceae	Native
Lupinus nanus	Sky lupine	Fabaceae	Native
Lupinus succulentus	Arroyo lupine	Fabaceae	Native
Malacothamnus fasciculatus	Chaparral mallow	Malvaceae	Native
Malacothrix saxatilis var. *tenuifolia*	Cliff malacothrix	Asteraceae	Native
Malosma laurina	Laurel sumac	Anacardiaceae	Non-native
Malva nicaeensis	Bull mallow	Malvaceae	Non-native
Malva parviflora	Cheeseweed / Little mallow	Malvaceae	Non-native
Marah macrocarpus	Wild cucumber	Cucurbitaceae	Native
Marrubium vulgare	Horehound	Lamiaceae	Non-native
Medicago polymorpha	California burclover	Fabaceae	Non-native
Medicago sativa	Alfalfa / Lucerne	Fabaceae	Non-native
Melilotus alba	White sweetclover	Fabaceae	Non-native
Melilotus indica	Sour-clover / Yellow sweet clover	Fabaceae	Non-native
Mimulus aurantiacus	Sticky monkey flower	Scrophulariaceae	Native
Mimulus cardinalis	Scarlet monkey flower	Scrophulariaceae	Native
Mimulus gutattus	Creek monkey flower	Scrophulariaceae	Native
Myoporum laetum	Myoporum / Ngaio tree	Myoporaceae	Non-native
Nicotiana glauca	Tree tobacco	Solanaceae	Non-native
Oenothera californica ssp. *californica*	Evening primrose	Onagraceae	Native
Oenothera deltoides	Dune primerose	Onagraceae	Native
Oenothera elata	Hooker's evening primrose	Onagraceae	Native
Olea europaea	Olive	Oleaceae	Non-native
Opuntia basilaris	Beavertail cactus	Cactaceae	Native
Opuntia ficus-indica	Indian fig / Nopal / Tuna	Cactaceae	Non-native
Opuntia littoralis	Coast prickly pear	Cactaceae	Native
Opuntia oricola	Chaparral prickly pear	Cactaceae	Native

Scientific Name	Common Name	Family	Native/ Non-native
Opuntia parryi	Cane cholla	Cactaceae	Native
Opuntia prolifera	Coastal cholla	Cactaceae	Native
Paspalum dilatatum	Dallis grass	Poaceae	Non-native
Pennisetum clandestinum	Kikuyu grass	Poaceae	Non-native
Pennisetum setaceum	Fountain grass	Poaceae	Non-native
Petalonyx thurberi	Sandpaper plant	Loasaceae	Native
Phacelia cicutaria	Caterpillar phacelia	Hydrophyllaceae	Native
Phacelia douglasii	Douglas' phacelia	Hydrophyllaceae	Native
Phacelia ramosissima	Branching phacelia	Hydrophyllaceae	Native
Phalaris arundinacea	Reed canary grass	Poaceae	Non-native
Phoradendron macrophyllum	Big-leaved mistletoe	Viscaceae	Native
Phoradendron villosum ssp. *villosum*	Oak mistletoe	Viscaceae	Native
Phragmites australis	Common reed	Poaceae	Native
Phytolacca octandra	Ink weed	Phytolaccaceae	Native
Picris echioides	Bristly ox tongue	Asteraceae	Non-native
Pinus sp.	Pine	Pinaceae	0*
Piptatherum miliaceum	Smilo grass	Poaceae	Non-native
Plagiobothrys sp.	Popcorn flower	Boraginaceae	Native
Plantago lanceolata	English plantain	Plantaginaceae	Non-native
Plantago major	Common plantain	Plantaginaceae	Non-native
Platanus racemosa	Western sycamore	Platanaceae	Native
Pluchea odorata	Marsh fleabane	Asteraceae	Native
Pluchea sericea	Arrowweed	Asteraceae	Native
Poa pratensis	Kentucky bluegrass	Poaceae	Non-native
Polygonum arenastrum	Common knotweed / Prostate knotweed	Polygonaceae	Non-native
Polygonum lapathifolium	Willow smartweed	Polygonaceae	Native
Polygonum punctatum	Dotted smartweed	Polygonaceae	Native
Polypogon interruptus	Ditch beard grass	Poaceae	Non-native
Polypogon monspeliensis	Rabbitfoot grass	Poaceae	Non-native
Populus balsamifera ssp. *trichocarpa*	Black cottonwood	Salicaceae	Native
Populus fremontii ssp. *fremontii*	Fremont cottonwood	Salicaceae	Native
Portulaca oleracea	Common purslane	Portulaceae	Non-native
Potentilla anserina ssp. *pacifica*	Silverweed	Rosaceae	Native
Prunus ilicifolia	Hollyleaf cherry	Rosaceae	Native
Quercus agrifolia	Coast live oak	Fagaceae	Native
Quercus lobata	Valley oak	Fagaceae	Native
Raphanus sativus	Wild radish	Brassicaceae	Non-native
Rhus integrifolia	Lemonade berry	Anacardiaceae	Native
Ricinus communis	Castor bean	Euphorbiaceae	Non-native

Scientific Name	Common Name	Family	Native/ Non-native
Rorippa nasturtium-aquaticum	Water cress	Brassicaceae	Non-native
Rosa californica	California wild rose	Rosaceae	Native
Rubus ursinus	California blackberry	Rosaceae	Native
Rumex conglomeratus	Clustered dock	Polygonaceae	Non-native
Rumex crispus	Curly dock	Polygonaceae	Non-native
Rumex salicifolius var. *transitorius*	Willow dock	Polygonaceae	Native
Salicornia virginica	Common pickleweed	Chenopodiaceae	Native
Salix exigua	Sandbar willow/ Narrow-leaf willow	Salicaceae	Native
Salix laevigata	Red willow	Salicaceae	Native
Salix lasiolepis	Arroyo willow	Salicaceae	Native
Salix lucida ssp. *lasiandra*	Shining willow	Salicaceae	Native
Salsola tragus	Russian thistle	Chenopodiaceae	Non-native
Salvia apiana	White sage	Lamiaceae	Native
Salvia leucophylla	Purple sage	Lamiaceae	Native
Salvia mellifera	Black sage	Lamiaceae	Native
Sambucus mexicana	Blue elderberry	Brassicaceae	Native
Schinus molle	Peppertree	Anacardiaceae	Non-native
Scirpus acutus	Hardstem bulrush	Cyperaceae	Native
Scirpus americanus	American bulrush / Olney's bulrush	Cyperaceae	Native
Scirpus californicus	Southern bulrush/ Giant bulrush	Cyperaceae	Native
Scirpus maritimus	Alkali bulrush	Cyperaceae	Native
Scirpus microcarpus	Panicled bulrush	Cyperaceae	Native
Scirpus robustus	Salt-marsh bulrush	Cyperaceae	Native
Scrophularia californica	California bee plant	Scrophulariaceae	Native
Senecio flaccidus var. *douglasii*	Threadleaf ragwort / Bush groundsel	Asteraceae	Native
Silybum marianum	Milk thistle	Asteraceae	Non-native
Solanum douglasii	Douglas' nightshade	Solanaceae	Native
Solanum xanti	Purple nightshade	Solanaceae	Native
Sonchus asper	Prickly sow-thistle	Asteraceae	Non-native
Sonchus oleraceus	Common sow-thistle	Asteraceae	Non-native
Spartium junceum	Spanish broom	Fabaceae	Non-native
Spergula arvensis	Stickwort / Corn spurry	Caryophyllaceae	Non-native
Spergularia bocconii	Sand spurrey	Caryophyllaceae	Non-native
Stachys albens	White hedge nettle	Lamiaceae	Native
Stephanomeria virgata	Wand chicory	Asteraceae	Native
Tamarix ramosissima	Salt cedar/Tamarisk	Tamaricaeae	Non-native
Tamarix parviflora	Salt cedar/Tamarisk	Tamaricaeae	Non-native
Toxicodendron diversilobum	Poison oak	Anacardiaceae	Native

Scientific Name	Common Name	Family	Native/ Non-native
Tribulus terrestris	Puncture vine/Caltrop	Zygophyllaceae	Non-native
Trifolium sp.	Clover	Fabaceae	Native
Typha domingensis	Southern cattail	Typhaceae	Native
Typha latifolia	Broad-leaved cattail	Typhaceae	Native
Urtica dioica ssp. holosericea	Stinging nettle	Urticaceae	Native
Verbascum blattaria	Moth mullein	Scrophulariaceae	Native
Verbena lasiostachys	Verbena	Verbenaceae	Native
Veronica anagallis-aquatica	Speedwell	Scrophulariaceae	Non-native
Vitis sp.	Grape	Vitaceae	0*
Vulpia myuros	Rat tail fescue	Poaceae	Non-native
Washingtonia filifera	California fan palm	Arecaceae	Native**
Xanthium spinosum	Spiny cocklebur	Asteraceae	Native
Xanthium strumarium	Cocklebur	Asteraceae	Native
Yucca whipplei	Chaparral yucca	Liliaceae	Native

*Unable to make this determination at the species level.
**Native to California, but not to this study area.