FINAL REPORT

COYOTE CREEK WATERSHED HISTORICAL ECOLOGY STUDY

HISTORICAL CONDITION, LANDSCAPE CHANGE, AND RESTORATION POTENTIAL IN THE EASTERN SANTA CLARA VALLEY, CALIFORNIA

SAN FRANCISCO ESTUARY INSTITUTE

PREPARED FOR THE SANTA CLARA VALLEY WATER DISTRICT MAY 2006

MAP LEGEND

- Shallow Bay/Channel
- Tidal Flat
- Tidal Marshland with Channels and Pannes
- Saltgrass-Alkali Meadow | *Salitroso*
- Wet Meadow
- Seasonal Lake | *Laguna Seca* and Perennial Freshwater Wetland | *Tular*
- Perennial Freshwater Pond | *Laguna*
- Willow Grove | *Sausal*
- Sycamore Grove | *Alisal*
- Bars, Islands, and Inset Benches - Sycamore Alluvial Woodland and Riparian Scrub
- Valley Oak Savanna | *Roblar*
- Dry Grassland
- Stream

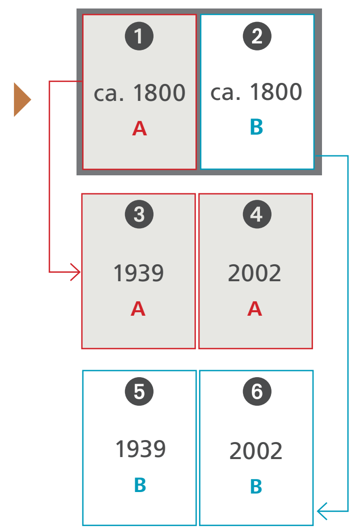
MAP GRAPHICS

To coordinate the presentation of information at different scales, we use **3 standard map scales**.

1) The overview maps showing the full Coyote Creek valley floor area are made at **1: 200,000 scale, or 1 inch equals approximately 3 miles.**

2) Each section in Part III begins with a **six-page 1: 40,000 (1" = 3333')** map series showing the area **circa 1800** (using the project GIS), in **1939** (using the georectified aerial photomosaic), and in **2002** (using a true color photomosaic by AirPhotoUSA).

3) About 20 "zoom-ins" distributed throughout the text focus on half-mile squares at **1: 10,000 (1" = 833').** Features are thus enlarged fivefold and fourfold, sequentially.



COVER MAP FROM U.S. DISTRICT COURT, NORTHERN DISTRICT [184-?]B. LAND CASE MAP E-900. COURTESY THE BANCROFT LIBRARY, UC BERKELEY.

FINAL REPORT MAY 2006

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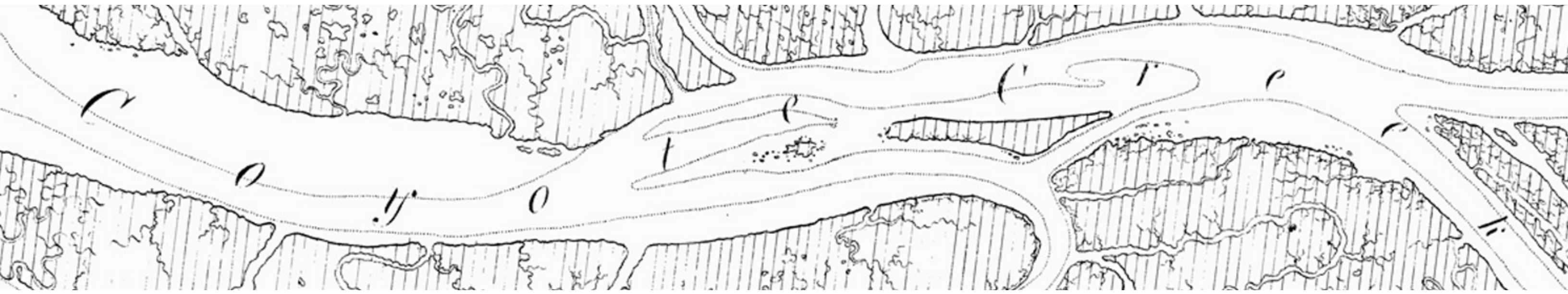

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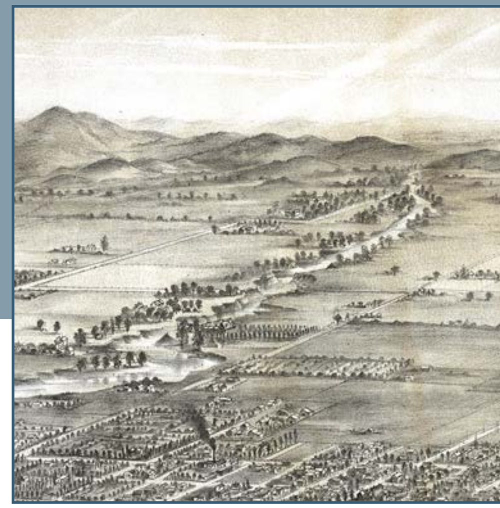
COYOTE CREEK WATERSHED HISTORICAL ECOLOGY STUDY

HISTORICAL CONDITION, LANDSCAPE CHANGE, AND RESTORATION POTENTIAL

IN THE EASTERN SANTA CLARA VALLEY, CALIFORNIA

Prepared for the
Santa Clara Valley Water District

By the San Francisco Estuary Institute



Coyote Creek: 1869 Birdseye View

This report synthesizes historical evidence into a picture of how Coyote Creek looked and functioned before intensive modification. This new view shows how the contemporary landscape was shaped and provides an array of tools for the restoration of watershed functions, natural flood protection, and integrated water management.

STUDY OVERVIEW

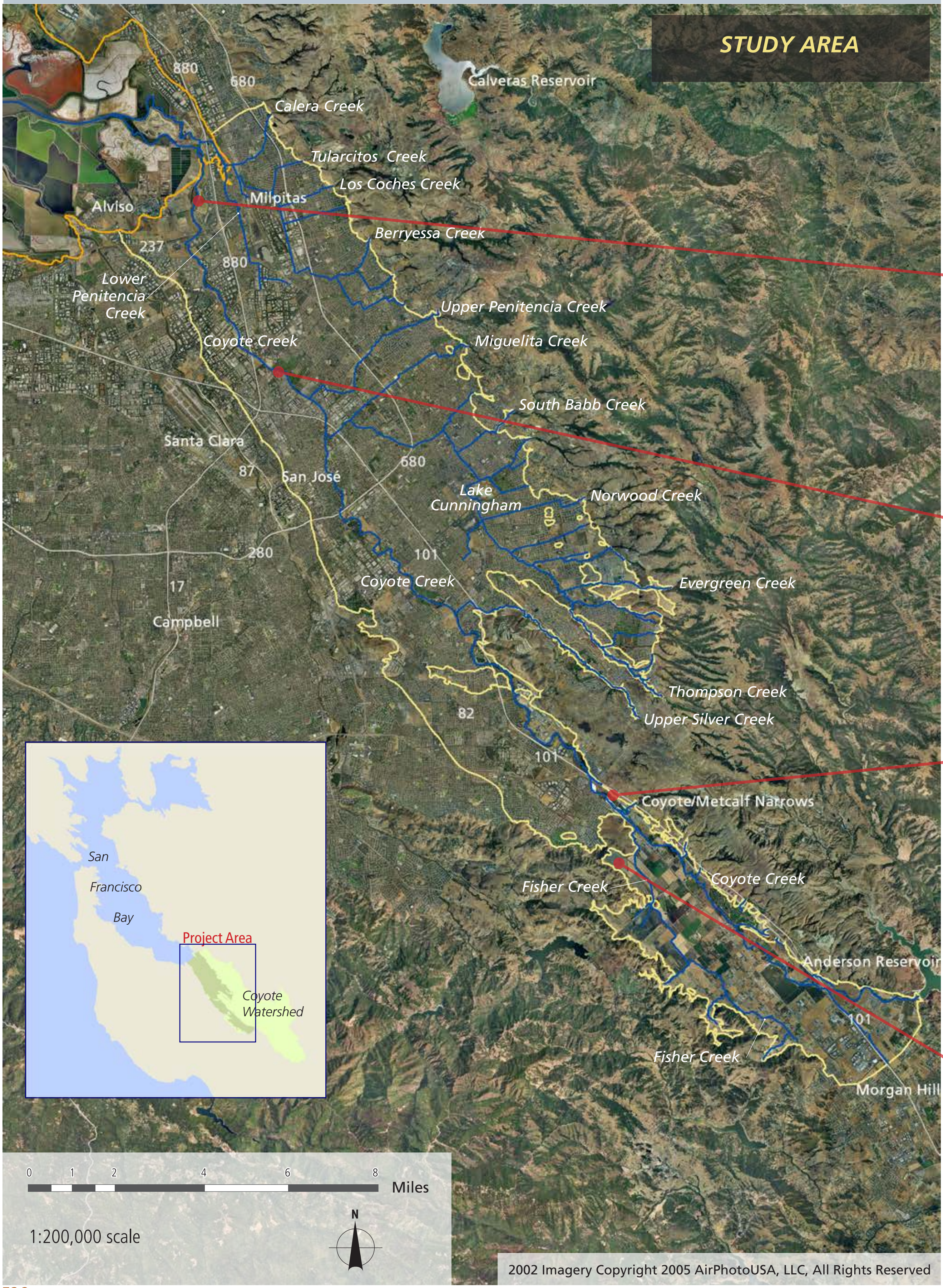
In recent years, a number of environmental research and management efforts in the Santa Clara Valley ("Valley") have recognized the need for a better understanding of historical conditions as a basis for developing locally appropriate habitat goals and guidelines for restoration design. Understanding how habitat patterns and their controlling physical processes have been altered helps determine the relative potential for recovery, and suggests appropriate measures to implement. Fortunately, the Santa Clara Valley has a wealth of historical information which represents an untapped resource for understanding the origins and potential of today's landscape.

HISTORICAL OVERVIEW

Coyote Creek's naturally wide footprint has led to an unusual amount of publicly owned lands along the stream. This imposing morphology — including broad, flood-prone stream benches and long, dynamic braided reaches — tended to restrict streamside development. As a result, there is a relatively high proportion of city and county parkland that could contribute to stream health, through coordinated stream restoration and natural system-based flood protection activities. Additionally, while modified in many ways, Coyote Creek has escaped major straightening. Unlike most Bay Area streams, the channel tends to follow its historical route. These basic aspects of the stream's history contribute to significant present-day restoration potential.

EXECUTIVE SUMMARY CONTENTS

In this study, we mapped historical landscape patterns for the valley floor draining to Coyote Creek – an approximately 100-square-mile area on the eastern side of the Santa Clara Valley. This portion of Santa Clara County includes parts of the cities of San Jose, Milpitas, and Morgan Hill. The aerial photograph below shows the study area in 2002. A sampling of early images illustrates historical habitats mapped on the facing page.



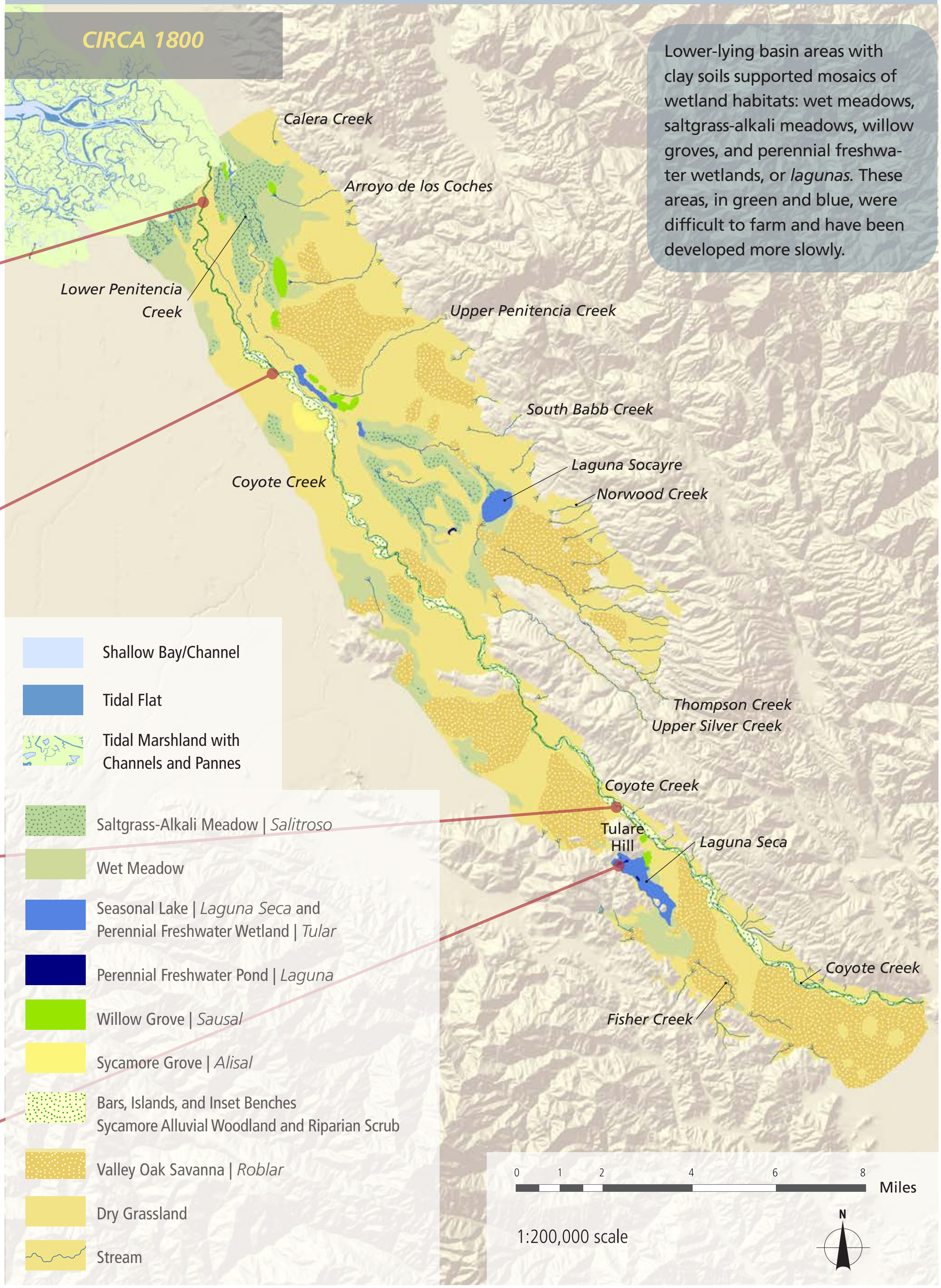

Low gradient, perennial reach.


Narrow reach with perennial water and gravel bars.


Broad, gravelly, intermittent Coyote stream bed.

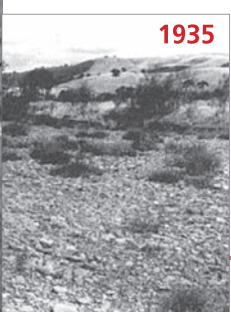

Laguna Seca: tules and ponds.

Before the modifications of the 19th and 20th centuries, the lands along Coyote Creek supported a remarkably diverse mosaic of habitats. Native grasslands and the celebrated valley oak savannas occupied the well-drained alluvial fans and natural levees along Coyote Creek. These areas (in yellow and orange on the map) became the most productive agricultural lands, primarily fruit orchards.



Courtesy The Bancroft Library, UC Berkeley.

Courtesy History San José.



Courtesy Cooper Ornithological Society.

Courtesy the Santa Clara Valley Water District.

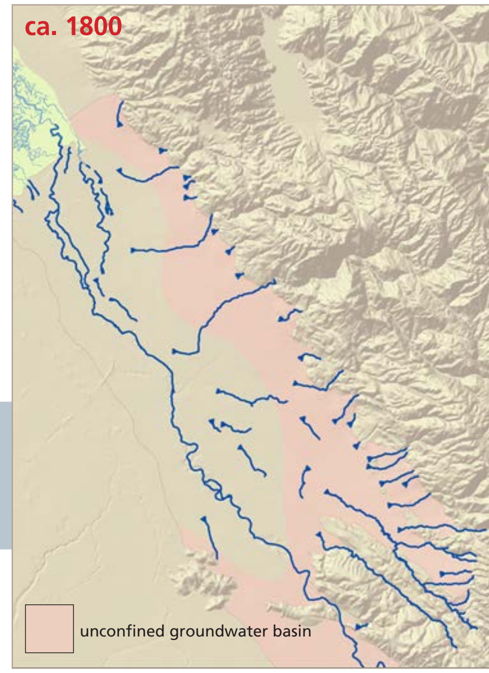
UNDERSTANDING LANDSCAPE CHANGE

Many changes are easily overlooked, yet have significant present-day ramifications.

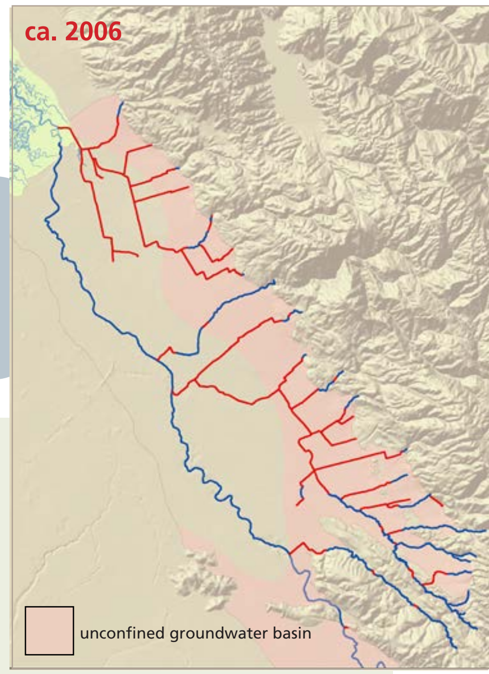
DRAINAGE INTENSIFICATION

Today nearly 50% of the valley floor water courses draining into Coyote Creek are constructed channels. These channels convey runoff across areas that previously had no surface drainage. The natural drainage network was highly discontinuous, supporting groundwater recharge on the coarse alluvial fans and wetlands in the valley bottomlands.

Before modification, most stream channels were discontinuous…they spread out on the valley floor.



The construction of drainage ditches and channels, which took place largely prior to 1900, has increased the density of drainage to Coyote Creek by about 40%. Furthermore, the expansion of the underground storm drain network has resulted in nearly a tenfold increase in drainage density. Over 20 miles of artificial channel and 120 miles of large, concrete storm drains now convey water from the unconfined groundwater zone that would otherwise contribute to recharge.



Drainage density has increased dramatically… resulting in reduced infiltration and more rapid delivery of stormwater to Coyote Creek.

RIPARIAN RECOVERY In this set of aerial photographs, riparian forest along Upper Penitencia Creek – heavily impacted by agriculture in the 1930s – has significantly expanded with the creation of a protective land use buffer.

Trajectories of change vary substantially from place to place… and there are some positive examples.

SPATIAL VARIABILITY

While riparian forest has been lost along many creeks, a few reaches have shown notable improvement during the past few decades. Some streams have incised greatly, while others show almost no change over the past 150 years. We can look to these sites that have beneficial, positive trajectories as contemporary models for watershed protection and recovery.

MANAGING WATERSHED FUNCTIONS AND PROCESSES

Historical information provides a starting point for setting appropriate local goals.

RIPARIAN HABITAT: ONE SIZE DOESN'T FIT ALL.

While we tend to think of riparian habitat as a dense, closed canopy forest, this was not the dominant riparian type on Coyote Creek, where open savanna/woodland, riparian scrub, and large, unvegetated gravel bars were all important riparian components. Given that these habitat types have been disproportionately lost, watershed management efforts should consider their restoration at appropriate sites.

SYCAMORES AND NIGHTHAWKS: INTERMITTENT IS NOT NECESSARILY BAD.

Under natural conditions, most of Coyote Creek was seasonally dry (see center spread). The combination of intermittent reaches and perennial reaches (which were limited to the top and bottom of the valley), supported a wide range of native species, including the Lesser Nighthawk, which once nested in the gravelly creek beds but is no longer a breeding resident species.

SYCAMORE ALLUVIAL WOODLAND: THE CHARACTERISTIC HABITAT OF COYOTE CREEK

Historical evidence indicates that Coyote Creek's dominant riparian habitat was Sycamore alluvial woodland. Now mostly eliminated along the creek (and throughout the state), this habitat of episodic, gravel-dominated Central Coast streams had a relatively open tree canopy with widely-spaced sycamores — in contrast to the densely wooded contemporary conditions.

RIPARIAN CONVERSION: COTTONWOOD FOREST REPLACES SYCAMORE WOODLAND

Since the construction of Coyote Dam in 1936, peak flows from most of the upper watershed have been reduced, while summer flows have increased. As a result, trees have invaded the active channel, largely eliminating unvegetated bars and open riparian habitat, and converting one riparian habitat type to another. While clearly possessing riparian value, these new habitats should probably be assessed for long-term viability and ecological function.

RIPARIAN HABITAT CONVERSION in the vicinity of Cottonwood Lake.

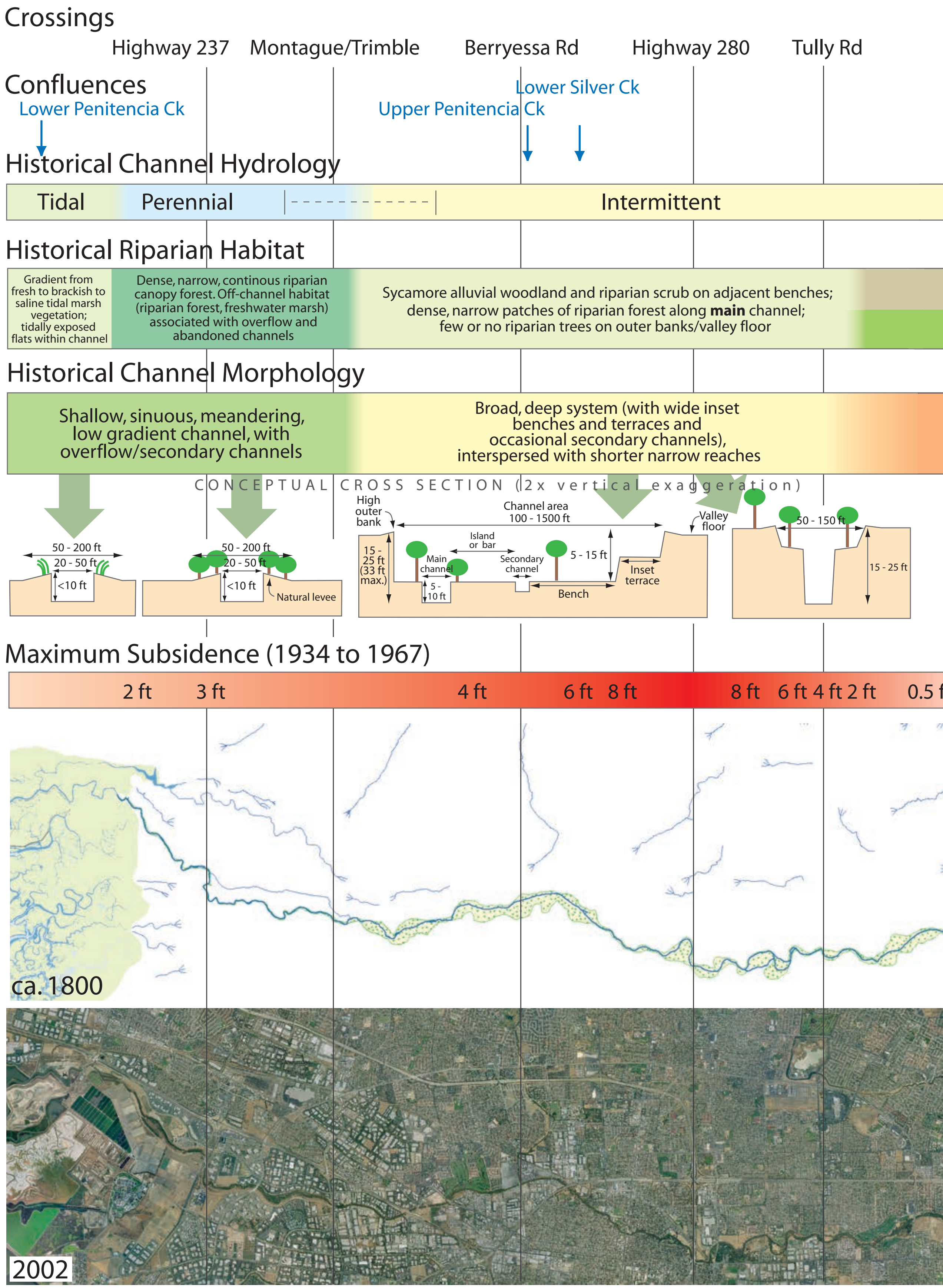
"...whose course is marked with groups of giant sycamores, their trunks gleaming like silver through masses of glossy foliage..."

- Bayard Taylor, describing Coyote Creek circa 1850 (in Carroll 1903: 185)

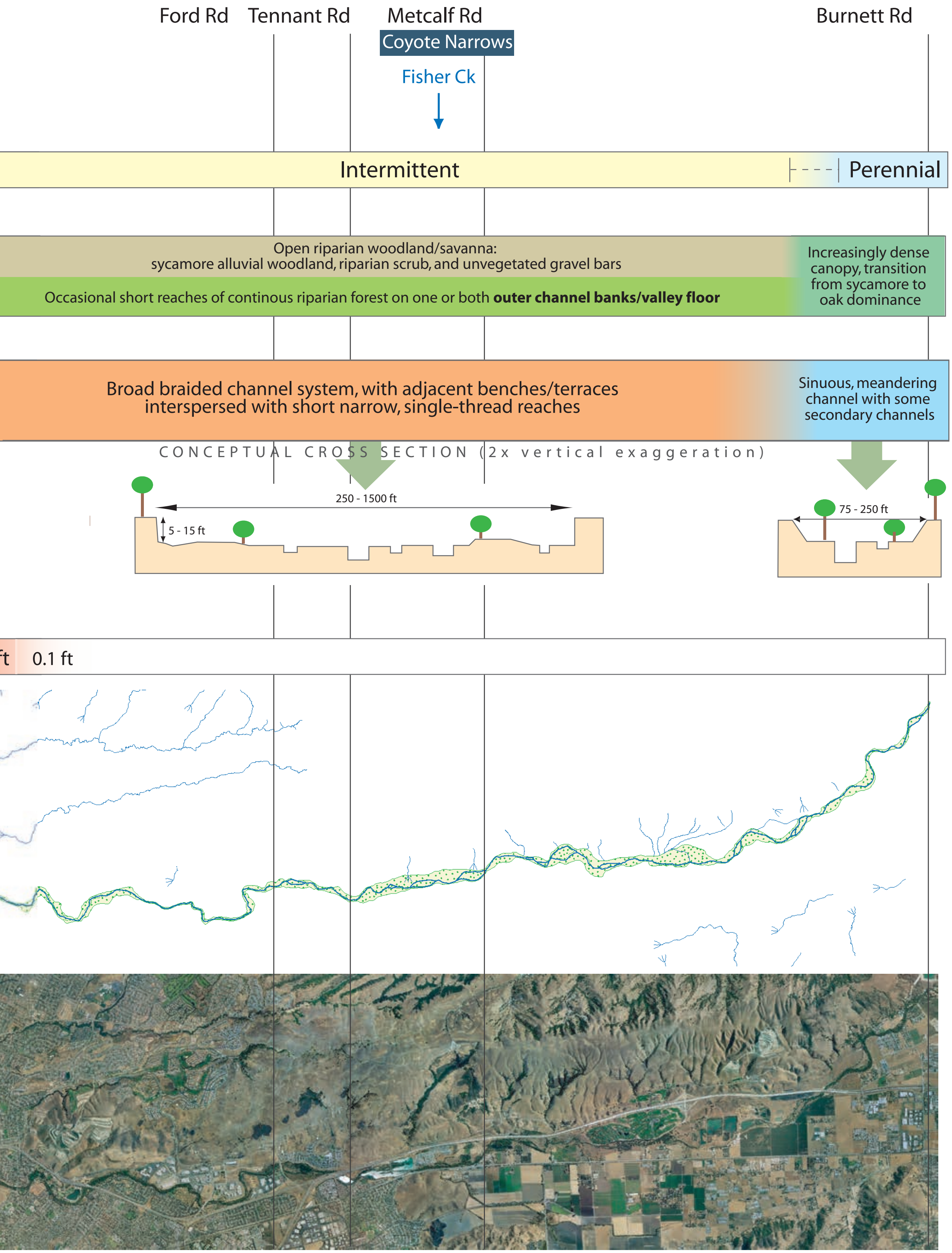
COYOTE VALLEY REACH: RESTORATION AND PRESERVATION OPPORTUNITIES.

Some of the best existing examples of Coyote Creek's pre-modification riparian habitat can be found in Coyote Valley between Sycamore Avenue and Highway 101. This reach maintains fish assemblages with a relatively high proportion of native species and has been recognized as a significant remnant of Central Coast Sycamore Alluvial Woodland. Plans for the long-term viability of this community should consider the potential negative impacts associated with summertime flows and the potential benefits of high flow pulses in the winter. Restoration at Ogier Ponds could contribute significantly to this important reach.

COYOTE CREEK'S HISTORICAL HYDROLOGY, HABITAT, AND MORPHOLOGY



This diagram shows how key attributes of the creek varied naturally by reach. The close relationships between morphology, habitat, and hydrology indicate how physical and ecological processes are interrelated. Transitions between reaches were gradual and varied through time. Cross-sections illustrate reaches based upon historical data (2002 Imagery Copyright 2005 AirPhotoUSA, LLC, All Rights Reserved).

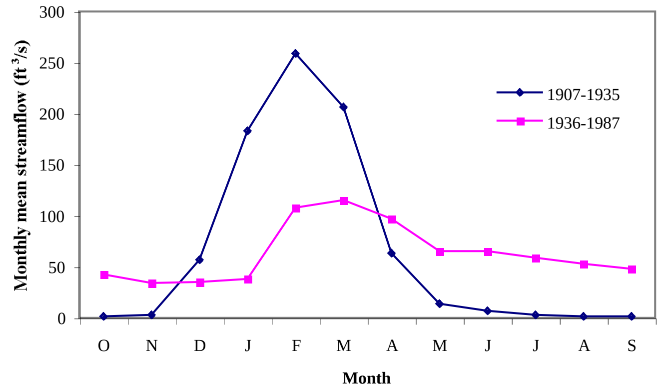


Ford Rd
Tennant Rd
Metcalf Rd
Coyote Narrows
Fisher Ck
Burnett Rd
Intermittent
Perennial
Open riparian woodland/savanna:
sycamore alluvial woodland, riparian scrub, and unvegetated gravel bars
Occasional short reaches of continous riparian forest on one or both **outer channel banks/valley floor**
Increasingly dense canopy, transition from sycamore to oak dominance
Broad braided channel system, with adjacent benches/terraces interspersed with short narrow, single-thread reaches
Sinuous, meandering channel with some secondary channels
CONCEPTUAL CROSS SECTION (2x vertical exaggeration)
250 - 1500 ft
5 - 15 ft
75 - 250 ft
ft
0.1 ft

MANAGING WATERSHED FUNCTIONS AND PROCESSES

CONSIDERING REGULATED FLOWS IN A NATURAL CONTEXT: TOOLS FOR INTEGRATED WATER MANAGEMENT

Strategically modifying regulated flows to more closely mimic natural patterns could benefit native fishes and habitats. It could also help summer water conservation.



CHANGE IN MONTHLY RUNOFF DISTRIBUTION FOR COYOTE CREEK. Since the construction of Coyote Dam in 1936, the creek has received reduced winter flows and greatly increased summer flows. (Gauge location approx. 1.2 mi. downstream of Anderson Dam and 1 mi. upstream of Hwy 101 crossing.)

Greater variability could be important to stream health:

- **Augmentation of stream flows may have unintended effects.** The conversion of most of the stream to perennial flow has significantly altered riparian and aquatic habitats.
- **The braided channel habitats in the vicinity of the Coyote Creek Golf Club have probably maintained their relatively natural character partly because of the Coyote Diversion Canal.** This portion of the stream has been excluded from strong summertime flow increases and has not converted to dense riparian forest. Future alterations to the flow regime should consider potential ecological effects within a temporal context.
- **Historical sites of perennial stream flow and groundwater discharge may be particularly important given future climate uncertainty.** These sites, and their dependent native species, are more likely to persist than areas requiring supplemental water, particularly during extended drought and/or limited summer water supply periods. This information can help better direct the use of water for environmental needs.
- **Controlled high flow releases could have benefits.** Modest but significant pulse flows, particularly with some augmented sediment and gravel supply, could have geomorphic benefit and select for native fishes over non-native species.

COULD THE COYOTE CREEK DELTA BE RESTORED?

A century ago the tidal and lower reaches of Coyote Creek supported natural fresh and brackish tidal marshlands with a fish assemblage largely similar to those found in the Sacramento-San Joaquin Delta. Treated effluent inputs could be used to reestablish these wetland gradients—now a regionally rare habitat type. Restoration of some of these habitats and their fish populations—a miniature delta—could be of regional significance.

These habitats could be linked to other restoration opportunities in the vicinity of the San Jose-Santa Clara Water Pollution Control Plant. Preservation of local agriculture by the City of San Jose has maintained relatively high habitat potential here at the Baylands edge. Wet meadows and saltgrass-alkali meadows as part of the "Artesian Slough Habitat Template" could be part of an integrated restoration plan for this lowest part of the watershed.

HISTORICAL (CA. 1800) BRACKISH MARSHLAND PATTERNS: tidal sloughs and pannes.

OPPORTUNITIES FOR HABITAT RESTORATION

CAN VALLEY OAKS PERSIST WITHIN THE URBAN FRAMEWORK?

Valley oak savanna—grand, widely spaced trees with a grassland understory—was the signature habitat of the Santa Clara Valley. Despite general loss, a surprising number of trees have survived, partly because they have always been recognized for their beauty and shade. But they will need stewardship to survive into the future.

Valley oaks could be restored in elements through coordinated local efforts. The naturally "scattered" distribution of valley oaks means that they can be relatively successfully integrated within the urban framework. Young trees need to be established to maintain this local habitat into the future.

VALLEY OAK ALONG COYOTE ROAD.

Courtesy The Bancroft Library, UC Berkeley.

DEPICTION OF VALLEY OAK SAVANNA showing a grove along Monterey Road (Healy, U.S. Dist. Court 1859, courtesy The Bancroft Library, UC Berkeley).

RESIDUAL VALLEY OAK AMONG PALMS, BLOSSOM HILL DRIVE. This grand tree has been preserved as a landscape centerpiece.

Courtesy History San José.

PART OF THE GREAT VALLEY OAK SAVANNA SOUTH OF LAGUNA SECA, CIRCA 1896 (Shortridge 1896, courtesy History San José).

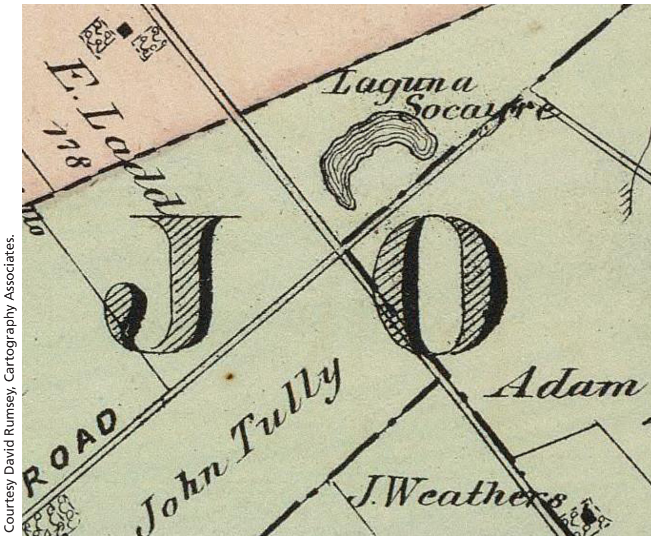
OPPORTUNITIES FOR HABITAT RESTORATION

RESTORING WETLAND MOSAICS IN CONCERT WITH NATURAL PROCESSES

The map of historical landscape patterns reveals sites where topography, soils, and hydrology are likely to support sustainable wetlands.

In Coyote Valley, Laguna Seca offers a rare opportunity to restore natural wetland functions and a diverse wetland habitat mosaic. Laguna Seca restoration would link to existing buffers and have regional significance as a large, natural, valley floor wetland. Successful wetland restoration at Laguna Seca could support a wide range of valued species, including rare plants, amphibians, and water birds.

Identifying and preserving habitat remnants. Strategic preservation and enhancement efforts of the saltgrass meadows at Lake Cunningham Park could improve this rare habitat while coexisting with surrounding recreational activities. There are likely other opportunities for restoration in the vicinity of the historical Laguna Socayre.

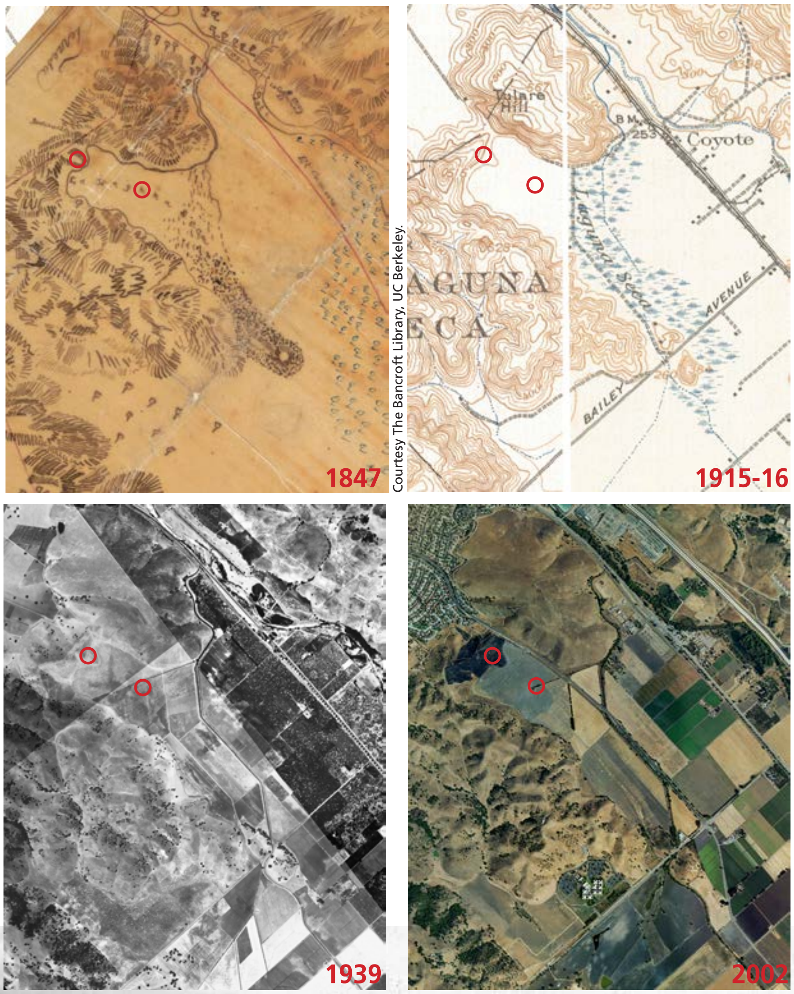


Courtesy David Rumsey, Cartography Associates.

SMALL PERENNIAL POND OF THE LAGUNA SOCAYRE COMPLEX, 1876 (Thompson and West 1876, courtesy David Rumsey, Cartography Associates).

LAGUNA SECA, 1916. Looking southeast across the northern end of the *laguna:* tall tules, open water ponds, Tulare Hill at left (letters on photographs refer to photographer's notes; red circle at extreme left in Laguna Seca map series above shows photographer location).

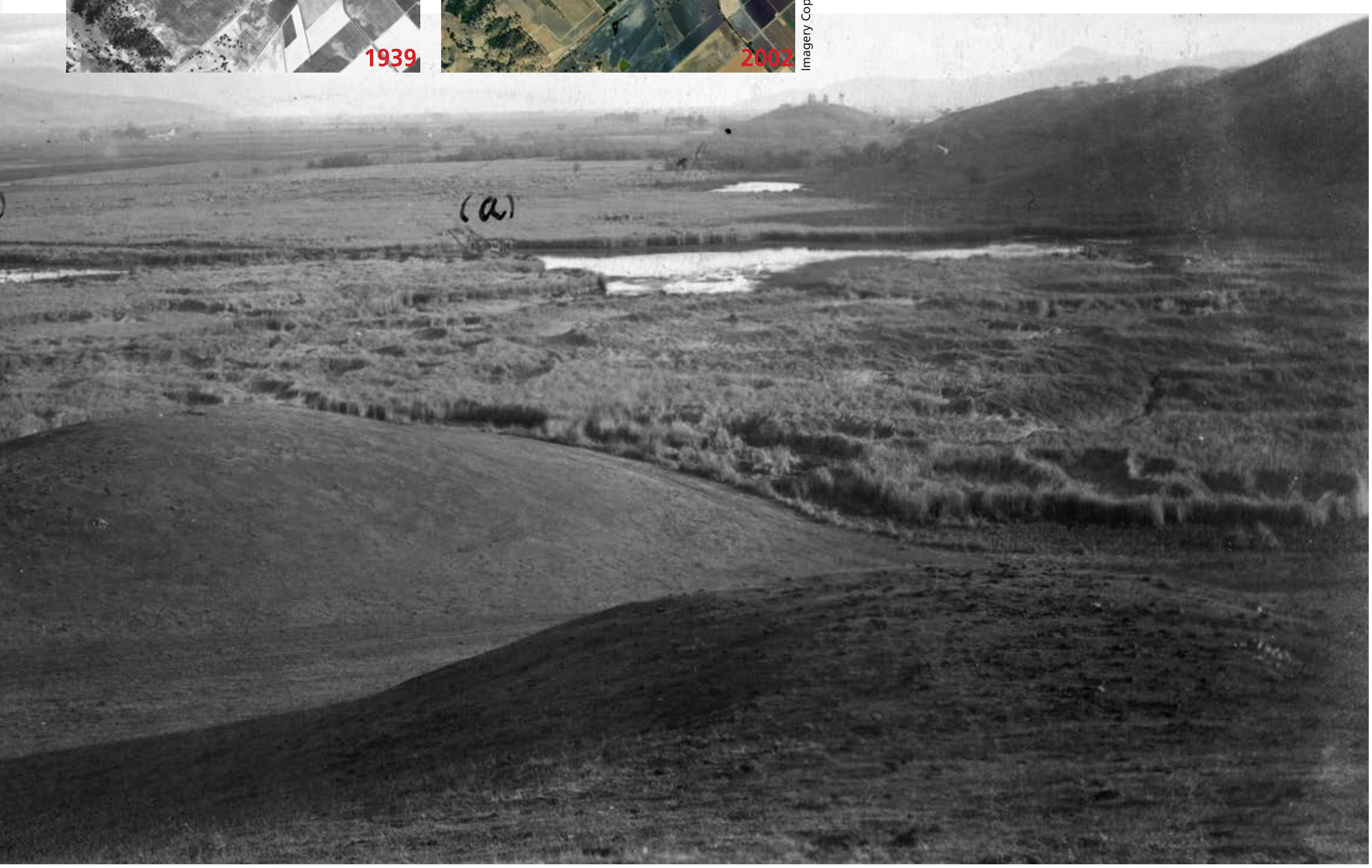
LAGUNA SECA THROUGH TIME



In the center and deepest part tall tules rise many feet above one's head, and in these numbers of Tule Wrens build their deceptive nests. A great many Coots breed here, and I am told our Bitterns also nest in the dense tules…

Along the shore in many places… marsh grass grows and along the edges of this thick clusters of clover thrive, which offer favorable sites for Ducks' nests...

- Fred Schneider 1893



Courtesy The Bancroft Library, UC Berkeley.

BERRYESSA CREEK SPREADS INTO A WILLOW GROVE, CIRCA 1840. U.S. District Court 1870 [Land Case Map D-494], courtesy The Bancroft Library, UC Berkeley.

TOOLS FOR NATURAL FLOOD PROTECTION

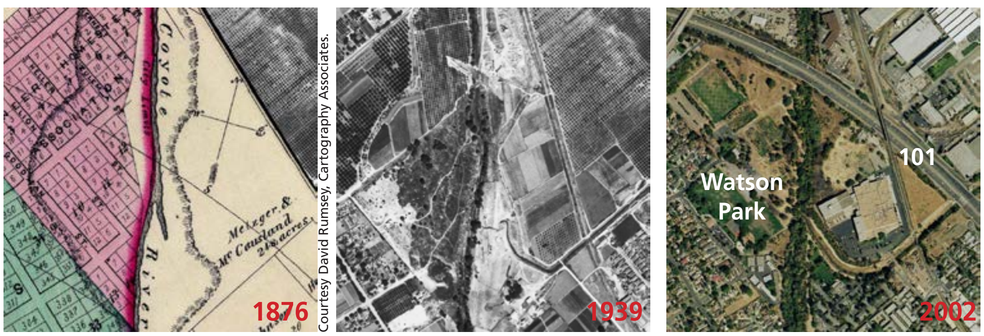
Historical data help identify places where natural approaches can be used to reduce flood risk.

INFILTRATION VERSUS DRAINAGE—REDESIGNING THE WAY WATER MOVES THROUGH THE VALLEY

The dramatic increase in constructed drainage tends to decrease groundwater recharge while increasing flood peaks downstream. Reducing drainage connectivity through off-site storage, swales, and neighborhood-scale infiltration projects will be important to both flood protection and water supply, especially given predicted climatic changes and increased impervious surfaces.

Restoration of natural hydrogeomorphology of Laguna Seca and the Fisher Creek drainage network could provide significant off-site flood peak attenuation as well as wetland habitat for a range of native species.

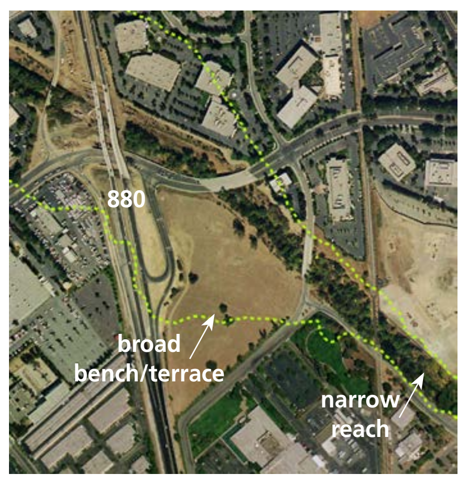
IDENTIFYING FLOODPLAIN RESTORATION OPPORTUNITIES—NATURALLY WIDE VERSUS NARROW REACHES



Courtesy David Rumsey, Cartography Associates.

A ONCE-BROAD CHANNEL AREA with wide inset stream benches becomes a city landfill and then Watson Park.

(BELOW) DOTTED LINE IDENTIFIES AREAS OCCUPYING FORMER STREAM BENCHES.



Coyote Creek displayed a natural pattern of long, broad reaches with adjacent inset benches and terraces interspersed with narrow, more confined reaches. This pattern suggests appropriate places for flood-plain restoration projects to increase flood capacity.

STREAM BENCHES—COYOTE CREEK'S NATURAL MORPHOLOGY REVEALS FLOOD PROTECTION OPPORTUNITIES

Existing flood-prone benches provide potential flood capacity. In the Mid-Coyote reach, there are many broad stream benches still subject to flooding. A number of these areas remain in public ownership, some of which could be designed to support and benefit from occasional flooding.

This publication is the Executive Summary from the report:

Coyote Creek Watershed Historical Ecology Study: Historical Condition, Landscape Change, and Restoration Potential in the Eastern Santa Clara Valley, California. Grossinger et al. 2006. Contribution No. 426, San Francisco Estuary Institute, Oakland, California.

For more information please see the full report, available at *www.sfei.org* or from the Santa Clara Valley Water District.

Santa Clara Valley Water District

THIS REPORT WAS PREPARED FOR THE SANTA CLARA VALLEY WATER DISTRICT
BOARD OF DIRECTORS:
Rosemary Kamei • Joe Judge • Richard P. Santos • Larry Wilson, Chair • Gregory Zlotnick • Tony Estremera, Vice Chair • Sig Sanchez

A NOTE ABOUT USING HISTORICAL INFORMATION //

A historical landscape perspective is important not for sentimental or idealistic reasons, but because it helps us understand the contemporary landscape and its future potential.

Historical information is not directly predictive of the future. Controlling factors, including land use and climate, can change. Historical analysis helps recognize the controlling factors affecting local habitats and how they have changed, or stayed the same.

Reaching the past through restoration is not practical in all places. The past does not inherently represent what is needed now or in the future. It helps identify restoration and management options — ones well-calibrated to local landscape processes and history. It can reveal the resiliency and potential of the landscape. It shows how the pieces fit together.

What has been changed by the hands of people is not necessarily wrong. Landscapes need to be modified to meet the needs of people. But priorities are always changing. The landscape 100 years from now will be very different from today, based on our decisions.

Knowing the past helps us know how the present has evolved — the roles of human and natural history in shaping the present landscape. It helps identify where sustainable natural processes still persist and how to support them. It helps recognize both opportunities and constraints.

This knowledge yields options about how to move forward. It provides a basis for making informed decisions to maintain and improve the health of the local landscape.

ACKNOWLEDGEMENTS //

This project builds upon previous and related efforts by a number of local institutions, several of which we would like to mention specifically. Many staff of the Santa Clara Valley Water District (SCVWD) contributed their time, expertise, archives, and previous research on Coyote Creek. Mike Rigney and other staff of the former Coyote Creek Riparian Station were involved in early research efforts. Staff of the Environmental Services Department of the City of San José have also contributed to local historical landscape mapping efforts. The Santa Clara University Environmental Studies Institute, including Amy Shachter, Lisa Kealhofer, Russ Skowronek, Elianna Strode, and Shana Weber, has been an indispensable partner in reestablishing local historical ecology studies. We would also like to recognize the pioneering research done by Dr. Alan K. Brown, which has been inspirational.

As described below, the Coyote Creek Watershed Historical Ecology Study is part of a coordinated effort by a number of organizations and individuals to establish a foundation of historical landscape understanding for local environmental management. This effort has been funded through several related but distinct projects. We would like to thank those project managers for their help in producing a seamless set of products with long-term value: Rick Morat of the United States Fish and Wildlife Service San Francisco Bay Program, Christopher Richard of the Oakland Museum of California, Sarah Young of the SCVWD, and Luisa Valiela of the US Environmental Protection Agency Region IX. The project has also benefited from interactions with our partners on the SCVWD Watershed Stewardship Project, including Andy Collison of Philip Williams and Associates, Lucy Buchan of Eisenberg, Oliveri, and Associates (EOA), David Early and Isabelle Minn of Design, Community, and Environment, and team leader Clayton Creager of Tetra Tech.

This project owes great thanks to the Board members of the Silicon Valley Pollution Prevention Center, who made the overall historical ecology effort possible with a donation to SFEI: Andrew Gere, Bill Whitmer (President), Gail Brownell, Linda LeZotte, Margaret Bruce, Michael Stanley-Jones, Robin Brack, Robin Saunders, Rosemary Kamei, Tim Chow, and Trish Mulvey.

Historical research depends upon the careful preservation, stewardship and knowledge of original data sources by numerous experts working in diverse institutions. We are particularly grateful to the many archivists and researchers who generously assisted this project:

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John Creaser and Fatemah Van Buren, Earth Sciences and Map Library, UC Berkeley

Charlene Duval, Sourisseau Academy, San José State University

Gwen Gee, Office of the County Surveyor, Santa Clara County

Lynn Huntsinger, Department of Environmental Science, Policy, and Management, UC Berkeley

Eric Jacobsen, Coyote Creek Golf Club

Cynthia Jahns and Laura Campbell, Map Room, Science & Engineering Library, UC Santa Cruz

Bob Johnston, California Room, San José Public Library

Carolyn Jones, Map and Imagery Laboratory, Davidson Library, UC Santa Barbara

Kent Lightfoot, Archaeological Research Facility, UC Berkeley

Ed Luby and Clayton Drescher, Museum Studies Program, San Francisco State University

Beatrice Misa, Manila, Philippines

Cary Mock, University of South Carolina

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William Reed, Natural Resources Conservation Service

Kenn Reiller, Santa Clara Valley Water District [Ret.]

Paul Rogers, San José Mercury News

David Ruiz, Pacific Aerial Surveys, Oakland, CA

David Rumsey, San Francisco, CA

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Susan Snyder, James Eason, David Kessler, and Jack Von Euw, Bancroft Library, UC Berkeley

Janet Sowers, William Lettis & Associates

David Stahle, University of Arkansas

Diana Stickler, San José Mercury News

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Karla Tanner, San Francisco Bay National Wildlife Refuge

Robert Leidy contributed to the fish assemblages section in Part IV. Invaluable guidance was provided by the members of the Technical Advisory Group – Todd Keeler-Wolf, Rob Leidy, Laurel Collins, Ken Lajoie, Josh Collins, Andy Collison, Lester McKee, and Charlene Duval – who generously contributed time and expertise to the project, and comment on the draft report. Helpful comments on the draft report were also provided by Paul Amato of the San Francisco Bay Regional Water Quality Control Board, Trish Mulvey, EOA staff, Rainer Hoenicke of SFEI, Christopher Richard, and Marc Klemencic, George Fowler, Zhen Shao, Kevin Sibley, Sarah Young, and Melissa Moore of SCVWD.

We would like to extend particular appreciation to the insightful, committed Mid-Coyote project team at the Santa Clara Valley Water District, who helped make this project happen: Kevin Sibley, Zhen Shao, George Fowler, and Marc Klemencic. Project Manager Kevin Sibley went out of his way to make useful information available and provided a remarkable amount of expertise about Coyote Creek. Marc Klemencic contributed extensive and valuable comment on the draft report. Finally, Trish Mulvey catalyzed the initiation of a Historical Ecology Project for the Santa Clara Valley and has been an indispensable source of advice, comment, and guidance every step of the way.

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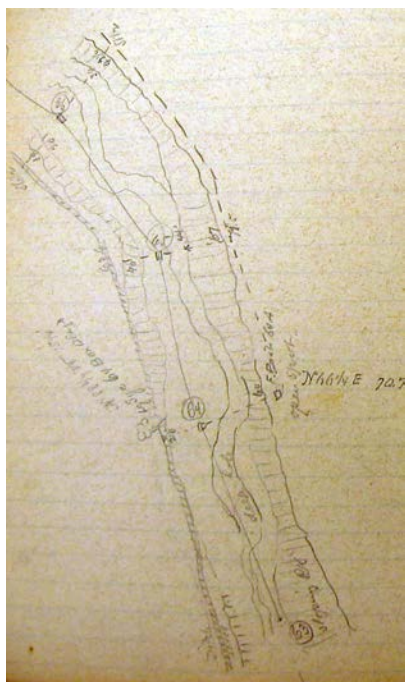
PART I //

INTRODUCTIONS AND METHODS

In Part I, we describe the context for the project and provide an overview of the methodologies used in data collection, compilation, and interpretation.



Herrmann 1874a: Survey Notes of June 24 [Coyote Book 3]

INTRODUCTION

In recent years, a number of environmental research and management efforts in the Santa Clara Valley ("the Valley") have recognized the need for a better understanding of historical conditions. Historical information is an essential tool for setting specific, locally appropriate habitat goals and developing specifications for restoration design. Understanding how the different habitats that comprise the Valley have been altered through sequential modifications helps determine their relative potential for recovery and appropriate measures to take. Fortunately, the Santa Clara Valley has a wealth of historical information, representing an untapped resource for understanding the origins and restoration potential of the present-day landscape.

The Coyote Creek Watershed Historical Ecology Study was designed by Santa Clara Valley Water District (SCVWD) staff, the San Francisco Estuary Institute (SFEI), and other interested parties as a stand-alone yet integrated component of a larger Santa Clara Valley Historical Ecology Project. This coordinated regional effort includes, in addition to the Coyote Creek Study, work carried out by SFEI as part of the SCVWD Watershed Stewardship Project, the Historical Tidal Marsh Maps Project, the Oakland Museum *Baylands and Creeks of the South San Francisco Bay* map, and the Silicon Valley Pollution Prevention Center-sponsored Santa Clara Valley Historical Ecology Project. The work presented here benefits directly from these efforts.

The Study, including this report and the associated Geographic Information System (GIS) database, is intended to support the development of a more integrated and synergistic vision for the diverse environmental management activities taking place in the Coyote Creek Watershed. It is designed to be used in the Mid-Coyote Flood Protection Project for the identification of restoration opportunities and the application of natural flood protection principles. The Study is also made available for use by other stream management and regional planning efforts such as the Santa Clara County Habitat Conservation Plan/Natural Community Conservation Plan (HCP/NCCP), Coyote Creek Parkway Master Plan project, and others.

This report is structured as follows. In **PART I**, we describe the project context, contributors, sources of information, and general methodology. **PART II** describes Historical Conditions at the Watershed Scale, summarizing conditions along the Coyote Creek Valley floor and defines landscape and habitat types. This section establishes a landscape framework for the subsequent sections, while explaining how we identified and mapped historical features. **PART III**, Historical Conditions at the Local Scale, describes early conditions in the Coyote Creek watershed in more detail, by dividing the valley floor portion of the watershed into four geographic areas. In **PART IV**, Landscape Change, we summarize key aspects of the complex human history that has shaped the watershed, assess how different components of the landscape have changed , and discuss the implications for restoration and management.

METHODOLOGY

This methodology section describes the general methods used to acquire, interpret, and synthesize historical data into technical products. More information about the interpretation of specific landscape features and processes is presented throughout the report in the relevant sections.

DATA COLLECTION & INTERPRETATION

While many environmental research projects still assess historical landscape change using only a few relatively recent historical documents, the dataset potentially available to researchers is actually remarkably extensive. It can be time-consuming to access these data, but neglecting the wealth of early information risks erroneous interpretations about natural condition and the origins of present-day environmental issues (Grossinger and Askevold 2005). To develop as strong a historical dataset as possible, we acquired materials from a wide variety of institutions. Inevitably, additional historical resources still exist to be found, and will likely reveal new and relevant information. For this reason we carefully documented the sources used in the GIS. We also note some potentially valuable sources of information that we were not fully able to assess in the course of this project.

We collected information about historical conditions from an array of sources. These included materials produced by federal and local agencies, individuals, Spanish/Mexican-era residents, professional and non-professional cartographers, photographers, writers, and engineers. Since these materials were produced for divergent reasons using a range of techniques, we developed substantial background scholarship to guide accurate interpretation. This process involved understanding three key aspects of historical document context: the technical methods or techniques, the social/personal context that determined why the document was created, and the document's timing in relation to contemporary and prior land use (Grossinger and Askevold 2005; **FIGURE I-1**). The use of multiple, complementary documents to compare and calibrate historical data sources, in combination with source scholarship, allows the maximum value of data to be acquired from a given data source (**FIGURE I-2**). To record variations in confidence level associated with different mapped features in the project GIS, we used a system of certainty levels (Grossinger 2001).

While describing the hundreds of historical data sources used in this project in detail is beyond the scope of this report, in the following section we briefly review several of the most important sources. These examples illustrate both the impressive skills of some of these early documentarians of the landscape and the diverse range of information sources that can be useful to a historical ecology study. Recognizing the different purposes and origins of historical documents improves the likelihood of accurate interpretation.

We also attempt to incorporate in the report, to the extent practical, a selection of historical imagery — both to illustrate the landscape and to provide a sampling of the graphic data available to future research efforts on related topics. These images represent just a small portion of the historical record for the region.

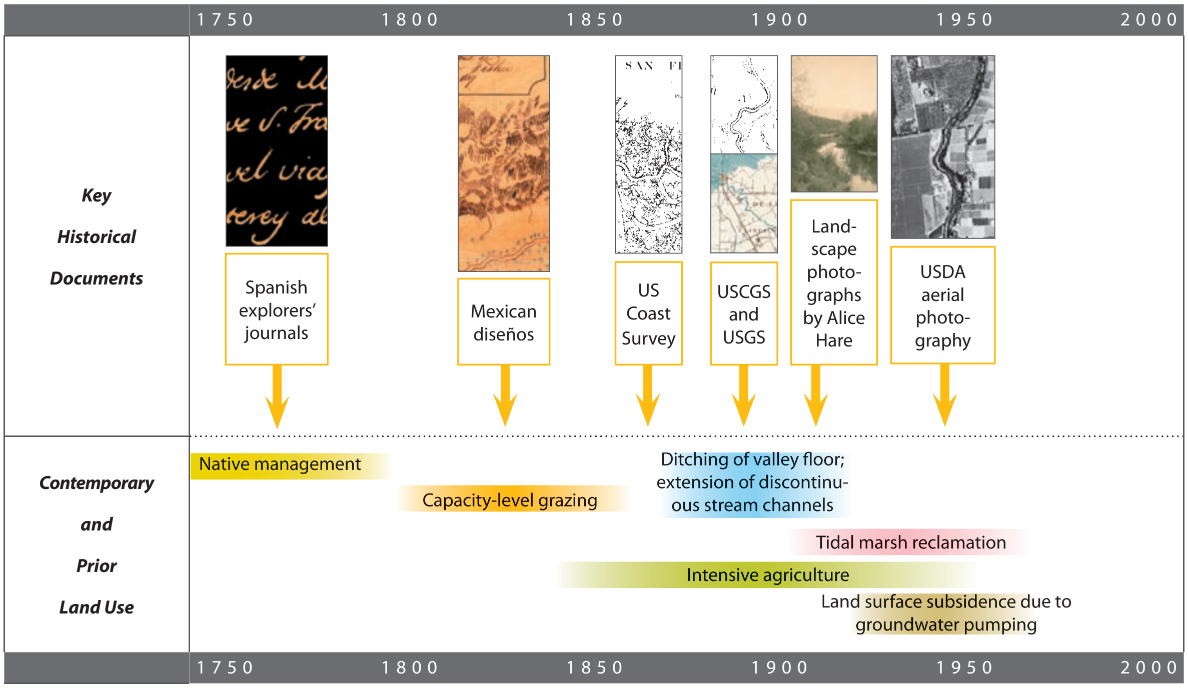


FIGURE I-1. DOCUMENT TIMING IN RELATION TO LAND USE HISTORY. Historical documents should be examined with an understanding of the prior land uses that have shaped a given site (from Grossinger and Askevold 2005).

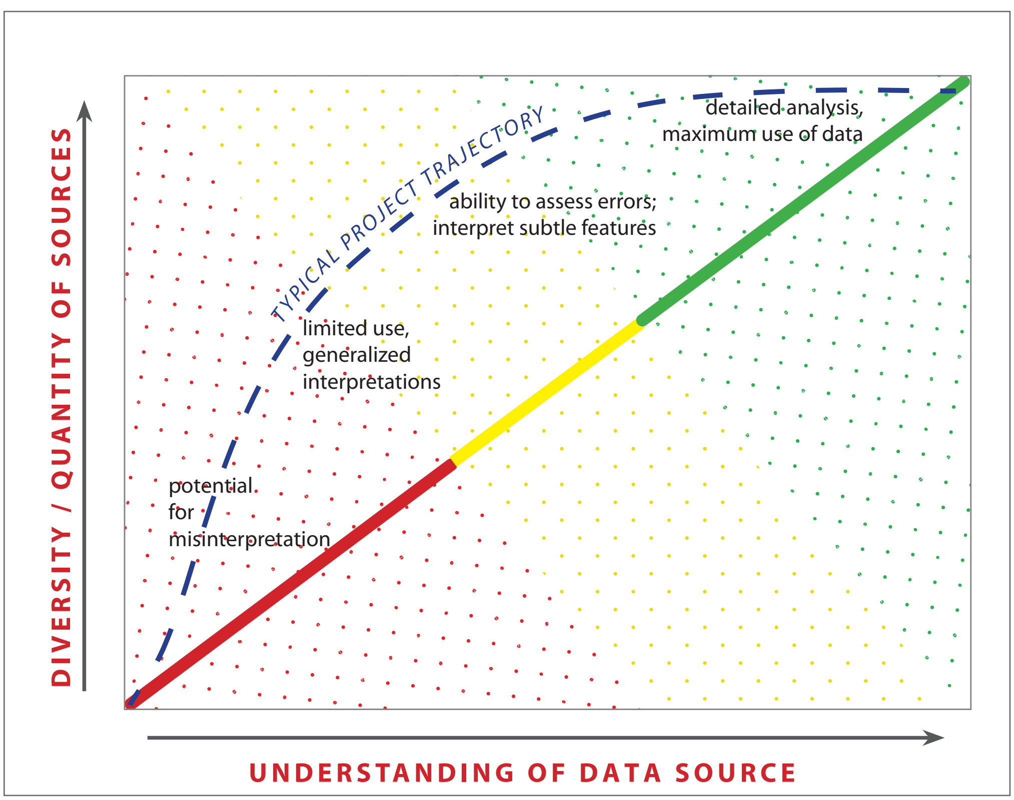


FIGURE I-2. IMPORTANCE OF A LARGE DATA SET AND SOURCE SCHOLARSHIP to accurate interpretation of historical data. In early stages of a project, there are many new sources and relatively little understanding of them. After an aggressive data collection phase, the number of new available documents diminishes and comparative analysis increases source understanding.

MEXICAN LAND GRANT SKETCHES (*DISEÑOS*), 1830s AND 1840s

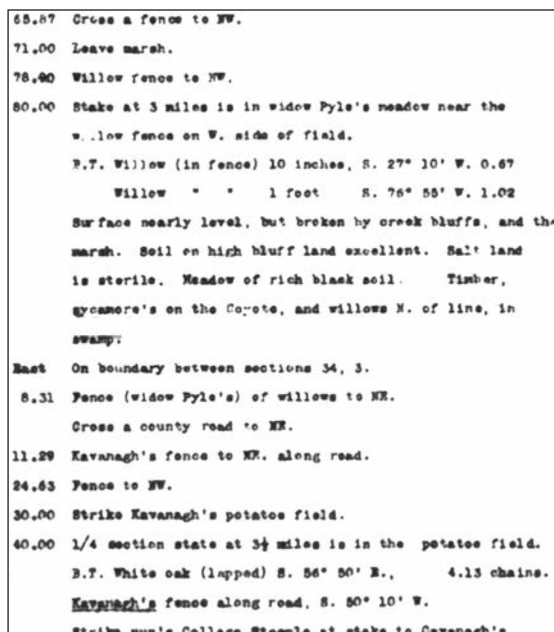
As the Mission system disintegrated, influential Mexican citizens submitted claims to the government for land grants. The accompanying sketches of desired land, generally produced by anonymous, untrained men, show distinctive features of the land such as creeks, wetlands, and woods, often with watercolors, handwritten annotation, and varying systems of symbols and styles. Despite their substantial infomation content, they have been rarely used for environmental research.

US District Court, Northern District [184-?]a. Land Case Map E-900.
Courtesy The Bancroft Library, UC Berkeley.

"THE LONG LINE FOLLOWED GENERALLY THE COURSE OF THE SANJON, BEING A LITTLE WITHOUT IT AT THE SOUTHERN END, AND A LITTLE WITHIN IT AT THE NORTHERN END." (DAY 1852)

PUBLIC LAND SURVEY TRANSECTS, 1850s TO 1870s

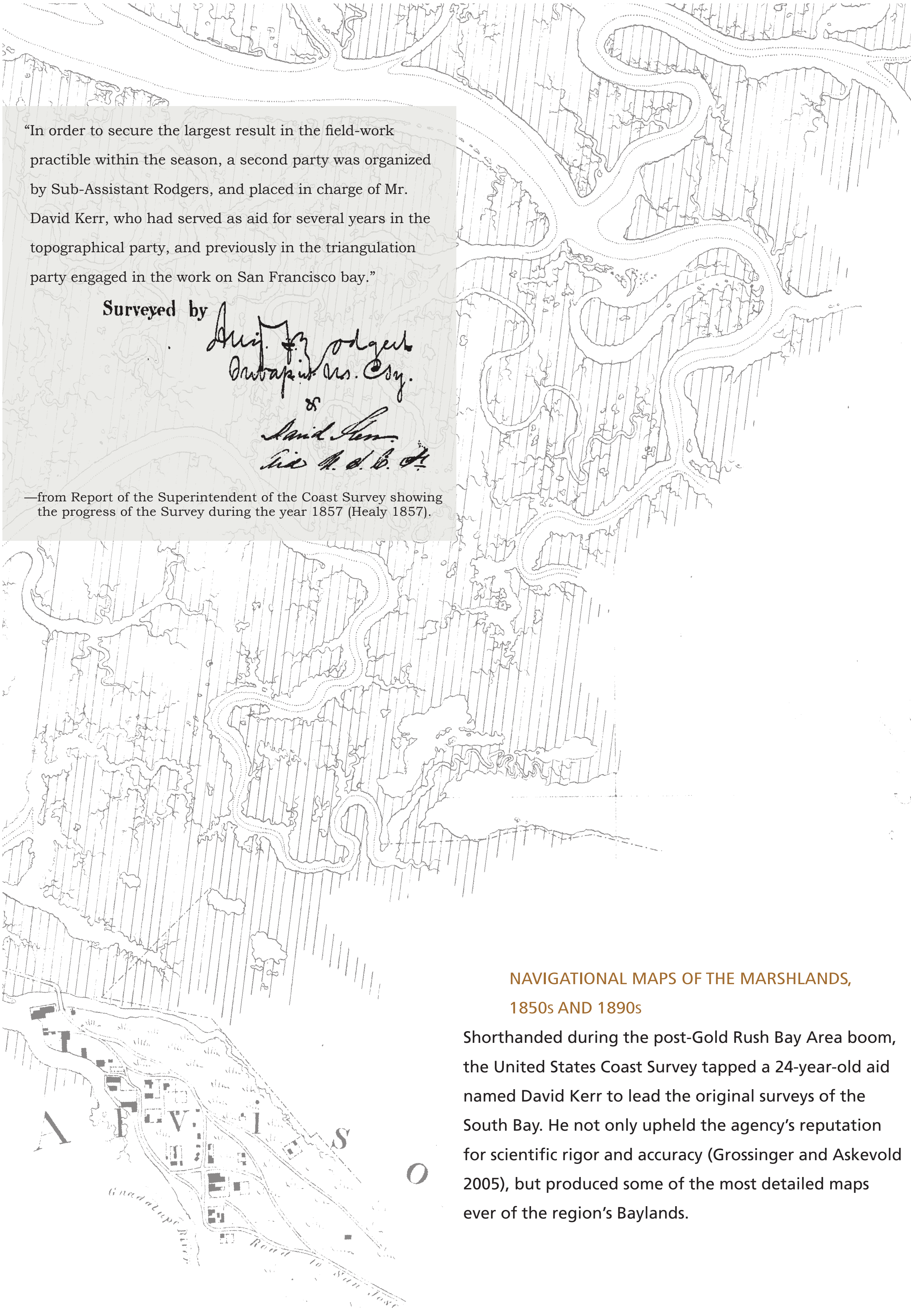
Across the country, Public Land Surveys authorized by the U.S. Surveyor General established the ubiquitous pattern of Township quadrants, each divided into 36 "sections" one square mile in size. In Santa Clara Valley, as in most of California's coastal valleys and plains south of the Russian River, the abstract rectangular grid was broken by the landscape-based Mexican land grants. Official surveys attempted to follow the original grant boundaries, meaning they had to find and map the natural landmarks such as creeks, marshlands, and willow groves, in addition to the standard sectional boundaries.



65.87	Cross a fence to NW.
71.00	Leave marsh.
78.00	Willow fence to NW.
80.00	Stake at 3 miles is in widow Pyle's meadow near the w..low fence on W. side of field.
	B.T. Willow (in fence) 10 inches, S. 27° 10' W. 0.67
	Willow " " 1 foot S. 76° 55' W. 1.02
	Surface nearly level, but broken by creek bluffs, and the marsh. Soil on high bluff land excellent. Salt land is sterile. Meadow of rich black soil. Timber, sycamore's on the Coyote, and willows N. of line, in swamp.
East	On boundary between sections 34, 3.
8.31	Fence (widow Pyle's) of willows to NE.
	Cross a county road to NE.
11.29	Kavanagh's fence to NE. along road.
24.63	Fence to NW.
30.00	Strike Kavanagh's potatoe field.
40.00	1/4 section state at 3½ miles is in the potatoe field.
	B.T. White oak (lapped) S. 56° 50' E., 4.13 chains.
	Kavanagh's fence along road, S. 50° 10' W.
	Strike nun's College Steeple at stake to Cavanagh's

Day 1854. Courtesy the Bureau of Land Management.

“In order to secure the largest result in the field-work practible within the season, a second party was organized by Sub-Assistant Rodgers, and placed in charge of Mr. David Kerr, who had served as aid for several years in the topographical party, and previously in the triangulation party engaged in the work on San Francisco bay.”



—from Report of the Superintendent of the Coast Survey showing the progress of the Survey during the year 1857 (Healy 1857).

Rodgers and Kerr 1857, Courtesy National Ocean Services

NAVIGATIONAL MAPS OF THE MARSHLANDS, 1850s AND 1890s

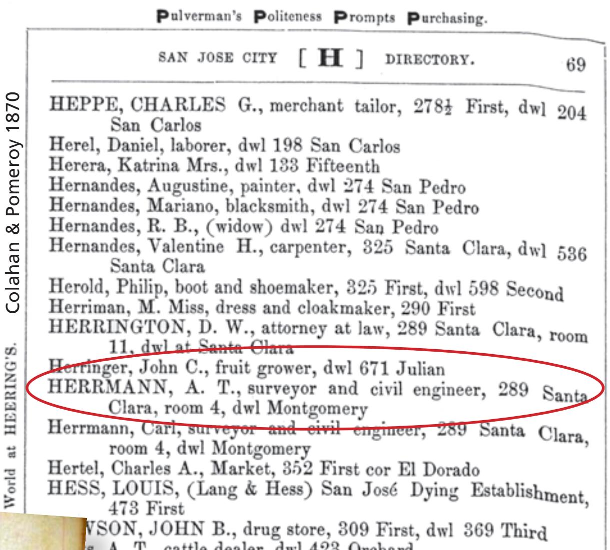
Shorthanded during the post-Gold Rush Bay Area boom, the United States Coast Survey tapped a 24-year-old aid named David Kerr to lead the original surveys of the South Bay. He not only upheld the agency’s reputation for scientific rigor and accuracy (Grossinger and Askevold 2005), but produced some of the most detailed maps ever of the region’s Baylands.

Saunders ca. 1875. Courtesy Sourisseau Academy.

A. T. HERRMANN, SURVEYOR AND ENGINEER, 1870s TO 1920s

A prolific and fastidious professional, Adolph Herrmann produced maps of the Santa Clara Valley for over half a century. He and his brother Carl immigrated from Germany and established the firm Herrmann Bros. Each served as Santa Clara County Surveyor for several years. A descendent saved his extensive field notes, including survey books on Coyote Creek, from being discarded. His maps and field notes now reside at the County Surveyors Office.

Colahan & Pomeroy 1870



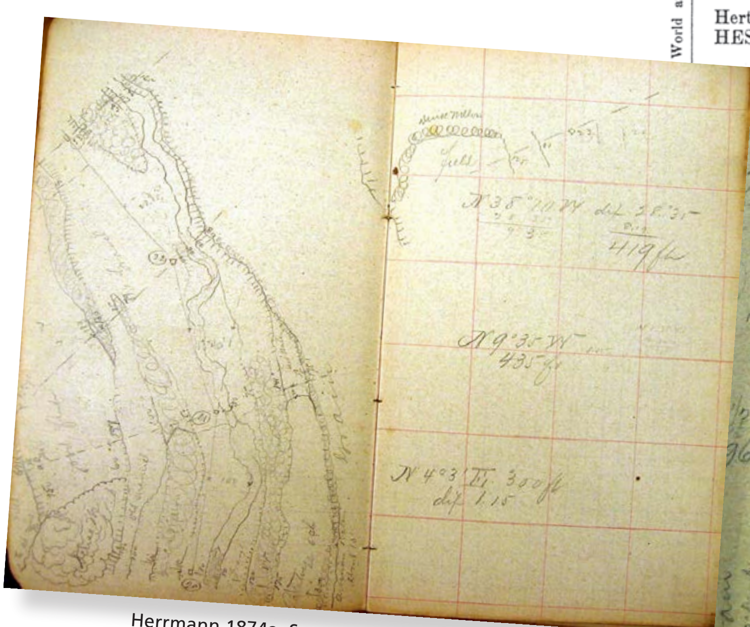
Pulverman's Politeness Prompts Purchasing.

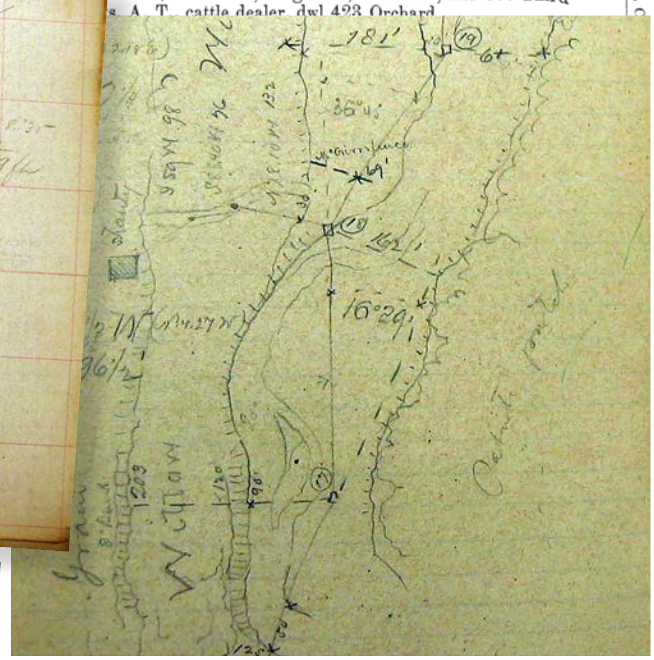
SAN JOSE CITY [H] DIRECTORY. 69

HEPPE, CHARLES G., merchant tailor, 278½ First, dwl 204 San Carlos
Herel, Daniel, laborer, dwl 198 San Carlos
Herera, Katrina Mrs., dwl 133 Fifteenth
Hernandes, Augustine, painter, dwl 274 San Pedro
Hernandes, Mariano, blacksmith, dwl 274 San Pedro
Hernandes, R. B., (widow) dwl 274 San Pedro
Hernandes, Valentine H., carpenter, 325 Santa Clara, dwl 536 Santa Clara
Herold, Philip, boot and shoemaker, 325 First, dwl 598 Second
Herriman, M. Miss, dress and cloakmaker, 290 First
HERRINGTON, D. W., attorney at law, 289 Santa Clara, room 11, dwl at Santa Clara
Herringer, John C., fruit grower, dwl 671 Julian
HERRMANN, A. T., surveyor and civil engineer, 289 Santa Clara, room 4, dwl Montgomery
Herrmann, Carl, surveyor and civil engineer, 289 Santa Clara, room 4, dwl Montgomery
Hertel, Charles A., Market, 352 First cor El Dorado
HESS, LOUIS, (Lang & Hess) San José Dying Establishment, 473 First
...WSON, JOHN B., drug store, 309 First, dwl 369 Third
...s A. T., cattle dealer, dwl 423 Orchard

World at HEERING'S.

C. J. MARTIN & CO., dealers in Dry Goods, C

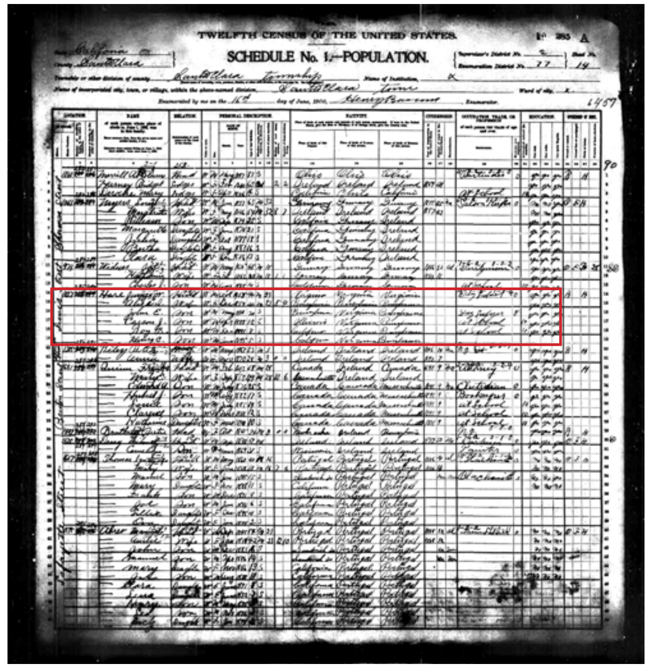




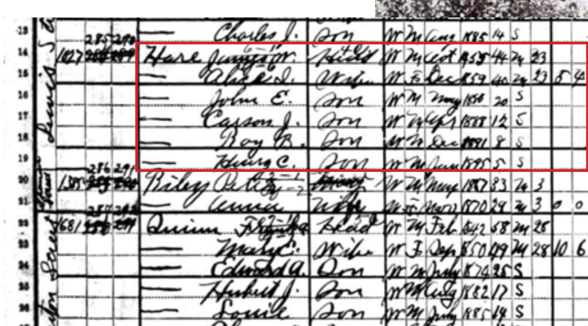
Herrmann 1874a: Survey Notes of June 12 [Coyote Book 3]
Courtesy Santa Clara County Surveyors Office.

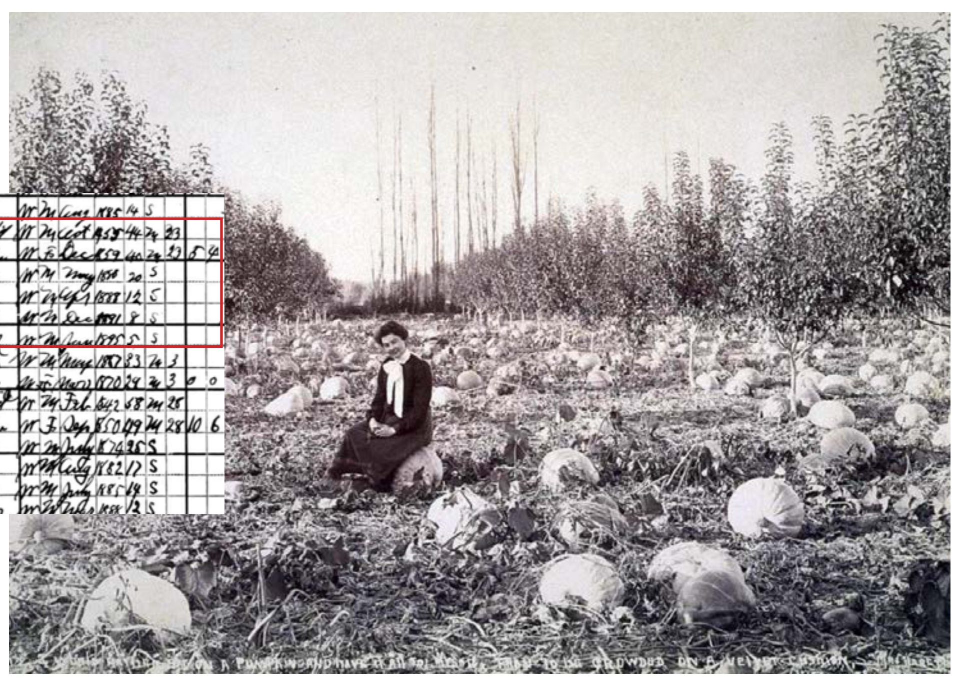
ALICE IOLA HARE, PHOTOGRAPHER, CIRCA 1900

A mother of four, Alice Iola Hare produced some of the earliest photographs of the Santa Clara Valley's natural landscape features, while most people were photographing new buildings. Now recognized as a significant turn-of-the-century body of work, her photographs are stored at the UC Berkeley's Bancroft Library. Photographs by Hare and other anonymous photographers, especially as part of the extravagant photograph expeditions conducted for the San Jose Mercury's centennial publication (Shortridge 1896), together provide a set of early creek images in which we can often identify channel depth, riparian vegetation, and fish habitat.

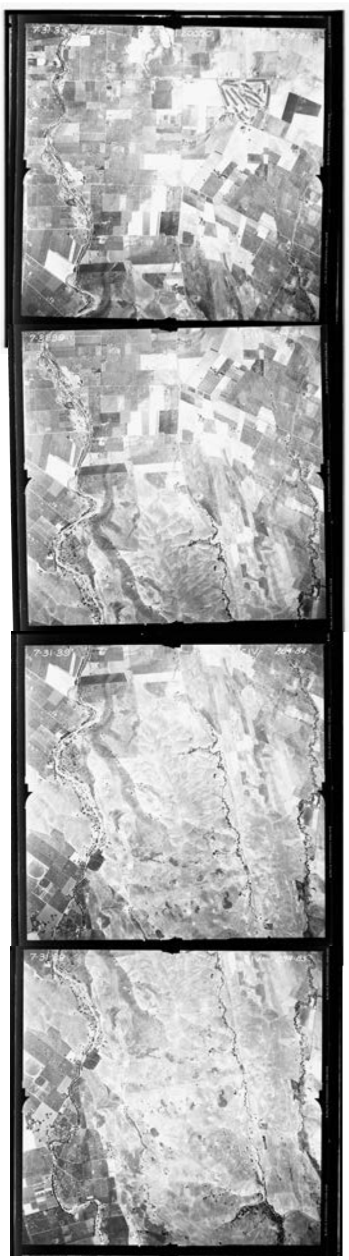

TWELFTH CENSUS OF THE UNITED STATES.
SCHEDULE No. 1.—POPULATION.

U.S. Census 1900


Hare James Jr. Head
Alice Iola Wife
John E. Son
Carson J. Son
Roy R. Son
Harry C. Son



Hare ca. 1905c. Courtesy The Bancroft Library, UC Berkleley.



AAA 1939

AGRICULTURAL ADJUSTMENT ADMINISTRATION AERIAL PHOTOGRAPHY, 1939

Following the Depression, the government turned to aerial photography to develop an organized approach to managing crop production. Hundreds of images taken from 20,000 feet over the Santa Clara Valley in the summer of 1939 created the first comprehensive photography of the region. Details from the photomosaic we created are used throughout the report.

HISTORICAL REFERENCE DATABASE

To track the voluminous historical data set involved in this type of study, bibliographic software and methods must be chosen carefully and well in advance of the onset of data collection. Given the many obscure sources we use, standardized citation formats often were not available, so we developed formats and adapted the software to maintain consistency and transparency throughout the data gathering process. This process was undertaken with the goal of not only reporting the materials gleaned from historical sources, but making the user aware of their existence, recommending their expanded use, and presenting our citations in a manner that will lead the reader easily to those resources.

We customized the database software Endnote to fit the project needs. Documents were input into the database and physically labeled with a record number corresponding to the database. With records such as Land Case testimonies, each witness referred to in the report becomes the "reporter" and was given an independent record number, with the entire record for the Land Case duplicated for each witness. A similar approach was used with the various maps and survey notes recovered from Santa Clara County's Surveyor's Office and the Bureau of Land Management.

MAPPING METHODOLOGY

MAP BOUNDARY

The study area for this project is the valley floor portion of the Coyote Creek watershed, downstream from Anderson Dam. We used the most recent regional mapping of bedrock-alluvial soils contacts to define the edge of the Valley floor (Knudsen et al. 2000). Since the modern watershed boundary between Coyote Creek and Guadalupe River follows storm drain catchments, we defined a generalized historical boundary between the two streams based upon topography. In concert with the Historical Tidal Marsh Mapping Project, the historical picture was extended into the Baylands. In defining the Coyote Creek watershed mapping area through the Baylands, tidal sloughs directly connecting to the tidal portion of Coyote Creek were included, but not the entire watersheds draining to those areas (which would have included Guadalupe River and a number of Alameda County watersheds).

TARGET TIME PERIOD

We use a wide variety of source materials to document prevailing conditions prior to significant Euro-American modification. Because landscape modification occurs heterogeneously and over time, information sources from the time of European contact through to the present can provide evidence of "time of contact" conditions. Documents are examined in the context of the contemporary activities and climate to identify relatively pristine features or, in more modified areas, evidence for prior condition.

Landscape conditions change through time naturally, even prior to the extreme modifications following colonization. While recognizing that the landscape is dynamic, we aim to map prevailing or average conditions in the decades surrounding initial Euro-American occupation, circa 1769-1850. We map features that tend to persist over several centuries or more — such as stream channels, topographically controlled wetlands, oak woodlands — controlled by geomorphic and climatic processes that have been relatively stable in the western United States for the past several hundred years (e.g. Meko et al. 2001). The mapped condition reflects the best available evidence for habitat type, size, and location prior to significant Euro-American modification.

DEVELOPMENT OF EARLY AERIAL PHOTOGRAPHY PHOTOMOSAIC

Relatively early black and white aerial photography exists for the entire project area, and most of the Coyote Creek watershed is covered by three continuous flight lines from 1939. For the remaining areas not covered by the 1939 flight lines — in the south portion of Coyote Valley — eleven additional aerial photographs were acquired, including imagery flown in 1940, 1948, and 1950. Digital images of the aerial photographs were acquired from a wide variety of sources, including the Santa Clara Valley Water District, the U.S. Geological Survey in Menlo Park, and the University of California at Santa Barbara, Santa Cruz, and Berkeley. We used digital versions when available but otherwise scanned the images at 600 pixels per inch (ppi) using SFEI's in-house large format flatbed scanner (Microtek ScanMaker 9800XL). Because considerable overlap exists between each photo — approximately 15% overlap between each photo along the flight line and 25% overlap on each side — we were able to ensure that only the most accurate part of the photo were used.

Each photo was processed for georectification using the Leica Photogrammetry Suite module of ERDAS Imagine 8.7. Both vertical and horizontal reference data were used to georectify the photographs. Aerial imagery from 2002 was used as the horizontal reference to tie the historical photograph to geographic space, and 30-meter digital elevation model data was used as the vertical reference to adjust the photographs for vertical displacement.

The aerial photographs were linked to an already georeferenced image by finding corresponding points between the historical aerial image and the contemporary image. Ten to fifteen points were located for each photo, and these were used by the software to generate additional points through an automatic tie point generating process. These were then used as control points in the triangulation process, which places each photograph in geographic space.

Locating corresponding points was not always an easy task given the highly altered landscape. Road intersections or railroad crossings were commonly used, though this was tempered by the knowledge that roads on the modern photography have usually been widened or re-engineered, possibly changing the absolute location and certainly the width of the road. In the undeveloped hills, oaks that persisted could be found. Again, these had to used carefully, as the tree's crown shape could change significantly.

Once individual photographs were georectified, they were used to create a continuous photomosaic of the study area. Whenever possible, only the center of the individual photograph was used. Because of the various sources of the images, differences in tone and occasionally in image quality can be seen in the mosaic, especially at the very south end of the watershed. Additionally, the resulting imagery more closely corresponds spatially to contemporary georectified imagery in flatter rather than hillier areas. As such, alignment agreement ranges from 0 to 15 meters in relatively flat areas, to 15 to 30 meters in the hilly areas.

HISTORICAL MAP GEOREFERENCING

Through the data collection process, we acquired a wide variety of historical maps. Each of these maps was evaluated for their potential usefulness as georeferenced sources. Georeferencing a map — linking features on the historical map to corresponding points in an already georeferenced source — allows the historical map to be used in a GIS.

Each map was evaluated for its suitability for inclusion in the GIS. Factors considered include: the potential of the map to be effectively georeferenced (i.e. were suitable control points available for georeferencing?); the quality of the information available on the map (i.e. does the map contain critical data?); and are the features on the map not available on an already georeferenced source (i.e. would georeferencing duplicate an already captured source?). If the map met these criteria, it was georeferenced.

Steps taken to complete this process were as follows:

- High resolution scans of paper maps were imported into ArcGIS;
- Ground control points were located on both the historical map and on georeferenced contemporary aerial photography (called the reference data);
- Using a georeferencing tool, links were added to tie the point on the historical map to the reference data for each ground control point;
- The historical map was evaluated for how well it corresponded to the reference data by measuring the difference between features that occur on both historical and modern sources. When the best possible fit was obtained, the georeferencing was finalized.

GIS DEVELOPMENT

ArcMap GIS software was used to collect, catalog, analyze, and display the spatial components of the study area. Georeferencing historical maps and early aerial photographs allowed us to compare historical layers to each other and to contemporary aerial photography and maps. We were able to essentially look through time by assembling maps from different time periods, which allowed us to both assess the different data sources and to better understand change. Additionally, the georeferenced maps could be used as means to geographically locate textual information gathered from surveyor notes, early explorers' journals, travelers' accounts, and newspaper articles.

The GIS was also used to create a synthesis of the historical landscape as GIS vector layers. By synthesizing selected data from georeferenced maps and photographs combined with narrative sources, we constructed a composite map representing the historical landscape. Polygons, lines, and point layers were developed to depict features in the historical landscape.

Polygon features include wet meadow, saltgrass-alkali meadows *(salitroso),* seasonal lake *(laguna seca),* perennial freshwater ponds and wetlands *(lagunas/tular),* willow grove *(sausal),* sycamore grove *(alisal)*, valley oak savanna *(roblar),* and dry grassland. Historical creeks and their distributaries were captured as linear features. The Coyote Creek channel was depicted as both a single line and as a wider polygon area. The riparian area of Coyote Creek—bars, islands, and regularly flooded inset benches—was created as a polygon feature. The tidal marsh area was developed from detailed maps created by the U.S. Coast Survey in 1853 and 1897 and Herrmann (1874c), and shows the many pannes and complex network of channels and tidal flats.

ATTRIBUTION OF MAPPED FEATURES

To record the variations in source data and confidence level associated with different features on the map, we developed a set of feature attributes used in the project GIS. The use of attributes on a feature-by-feature basis allows the GIS to serve as a catalogue of information sources and a basis for a range of practical uses in the future (Grossinger 2001). Using this report and the GIS, users can assess the accuracy of different parts of the map and identify the original sources. Certainty definitions are described below and in **TABLE I-1**. A sample from the GIS attribute table is presented as **TABLE I-2**. Additional technical specifications about the GIS are available in the metadata.

CERTAINTY OF INTERPRETATION

The following certainty level codes are used in the coverage attribute "InterpCert":

High (H): Feature definitely representative of conditions circa 1769-1850.

Medium (M): Feature probably representative of conditions circa 1769-1850.

Low (L): Feature possibly representative of conditions circa 1769-1850.

CERTAINTY OF SIZE AND SHAPE

The following certainty level codes are used in the coverage attribute "Shape_Cert":

High (H): Accurate source material that probably closely follows actual shape; estimated to be correct to within 10% of actual area.

Medium (M): Less accurate source material that probably generally follows actual shape; estimated to be correct to within 50% of actual area.

Low (L): Not necessarily representative of actual shape/size.

CERTAINTY OF LOCATION

The following certainty level codes are used in the coverage attribute "Loc_Cert":

Very High (XH): Expected maximum horizontal displacement less than 15 meters.

High (H): Expected maximum horizontal displacement less than 50 meters.

Medium (M): Expected maximum horizontal displacement less than 150 meters.

Low (L): Expected maximum horizontal displacement less than 500 meters.

Very Low (XL): Expected maximum horizontal displacement less than 2500 meters.

SOURCE

The major source materials used to map the feature are listed using, to the extent possible, standard textual citation form. Full bibliographic information can be obtained from the corresponding record in the bibliographic database and/or report bibliography.

	INTERPRETATION	SIZE	LOCATION
EXTRA HIGH *(Location only)* *"Definite"*	–	–	Expected maximum horizontal displacement less than 15 meters.
HIGH *"Definite"*	Feature definitely representative of conditions circa 1769-1850.	Accurate source material that probably closely follows actual shape; estimated to be correct to within 10% of actual area.	Expected maximum horizontal displacement less than 50 meters.
MEDIUM *"Probable"*	Feature probably representative of conditions circa 1769-1850.	Less accurate source material that probably generally follows actual shape; estimated to be correct to within 50% of actual area.	Expected maximum horizontal displacement less than 150 meters.
LOW *"Possible"*	Feature possibly representative of conditions circa 1769-1850.	Not necessarily representative of actual shape/size.	Expected maximum horizontal displacement less than 500 meters.
EXTRA LOW *(Location only)* *"Possible"*	–	–	Expected maximum horizontal displacement less than 2500 meters.

TABLE I-1. CERTAINTY LEVELS for historical landscape synthesis. Standards can vary depending on scale and emphasis.

ID	Habitat_Type	Primary_Source	Secondary_Source	Interp. Certainty	Shape Certainty	Location Certainty
1	Sausal	SCVWD 1916 photos: 116, 130, 132, 137	USGS Morgan Hill 1917	M	M	M
2	Laguna Seca	Lyman 1847	USGS Morgan Hill 1917, USGS Los Gatos 1919, Thompson and West 1876, SCVWD Vault 1917 photos: 104, 105, 108	H	M	H
3	Tular	USGS Morgan Hill 1917	Lyman 1847	H	M	M
4	Laguna	SCVWD 1916-18 photos: 64-65, 97, 146	AAA 1939	H	M	M
5	Laguna	Thompson and West Map Sheet Five 1876		H	H	M
6	Laguna	SCVWD Vault 1916-18 photos: 64-65, 97, 146	AAA 1939	H	M	M
7	Laguna	SCVWD Vault 1916-18 photos: 58-59, 64-65, 97, 146	AAA 1939	H	M	M
8	Sausal	Palou 1774 in Bolton 1933		H	L	M
9	Tular	USGS San Jose 1899, Thompson 1866: 511	U.S. District Court 1859a. (Yerba Buena), Thompson and West 1876	M	M	M
10	Laguna Seca	USGS San Jose 1899, Thompson 1866: 511	U.S. District Court 1859a. (Yerba Buena), Thompson and West 1876	H	M	M
11	Sausal	Westdahl 1897, Houghton 1860, Pico 1860, Pomeroy 1860		L	H	XH
12	Sausal	Westdahl 1897, Houghton 1860, Pico 1860, Pomeroy 1860		L	H	L
13	Sausal	Wallace 1859, Brewster 1999 (Land Case sketches)	Healy 1860, Houghton 1860, Pomeroy 1860	H	L	L
14	Sausal	Wallace 1859, Brewster 1999 (Land Case sketches)	Healy 1860, Houghton 1860, Pomeroy 1860	H	L	L
15	Sausal	Wallace 1859, Brewster 1999 (Land Case sketches)	Healy 1860, Houghton 1860, Pomeroy 1860	H	L	L
16	Sausal	Wallace 1859, Brewster 1999 (Land Case sketches)	Healy 1860, Houghton 1860, Pomeroy 1860	H	L	L
17	Sausal	Wallace 1859, Brewster 1999 (Land Case sketches)	Healy 1860, Houghton 1860, Pomeroy 1860	H	L	L
18	Tular	Westdahl 1897	AAA 1939	M	M	XH
19	Tular	Westdahl 1897	AAA 1939	M	M	XH
20	Tular	Westdahl 1897		M	M	XH
21	Tular	Gardner et al. 1958, AAA 1939		H	H	H
22	Sausal	Day 1851, U.S. District Court 1870b. (Los Tularcitos)	USGS Milpitas 1980 (topography)	H	M	XL
23	Sausal	Day 1851, U.S. District Court 1870b. (Los Tularcitos)	USGS Milpitas 1980 (topography)	H	M	XL
24	Laguna Seca	Day 1854: 507	AAA 1939	H	L	H
25	Sausal	Day 1851, Stratton 1862a: 159, Stratton 1862b (map), Thompson 1857a: 51, Thompson 1857b (map)	U.S. District Court 1870b. (Rancho Tularcitos), U.S. District Court [184-?]b. (Pueblo Lands of San Jose)	H	M	H

TABLE I-2. DATA RECORDED IN THE LANDSCAPE SYNTHESIS GIS. This sample shows some of the fields used to track source and certainty level, allowing the GIS to serve as a supporting database for future research. See text at left for certainty level definitions, Table II-1 and Glossary for Habitat Type definitions.

TECHNICAL ADVISORY GROUP

A group of experts provided advice and guidance about specific project methodologies and interpretations as well as general comment and review (**TABLE I-3**). Because of the diverse areas of expertise represented, we held focused meetings between Technical Advisory Group members and the project team dedicated to individual topical areas (e.g. interpretation of plant communities, fluvial geomorphology). Technical Advisory Group members also provided review of the draft report. While the Technical Advisory Group contributed substantially to the project, technical findings and conclusions are solely the responsibility of the report authors.

Advisor	Affiliation	*Expertise*
Josh Collins, Ph.D.	Wetlands Science Program Director, San Francisco Estuary Institute	*Wetland classification and geomorphology*
Laurel Collins, B.S.	Principal, Watershed Sciences	*Fluvial geomorphology*
Andrew Collison, Ph.D.	Associate Principal, Philip Williams and Associates	*Fluvial geomorphology*
Charlene Duval, M.A.	Sourisseau Academy for State and Local History, San Jose State University	*Santa Clara Valley history*
Todd Keeler-Wolf, Ph.D.	Senior Vegetation Ecologist, CA Department of Fish and Game	*Vegetation classification*
Ken Lajoie, Ph.D.	US Geological Survey [Ret.]	*Geology*
Robert Leidy, Ph.D.	US Environmental Protection Agency, Region IX	*Stream fish habitat*
Lester McKee, Ph.D.	Watershed Science Program Director, San Francisco Estuary Institute	*Watershed hydrology*

TABLE I-3. TECHNICAL ADVISORY GROUP MEMBERS.