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

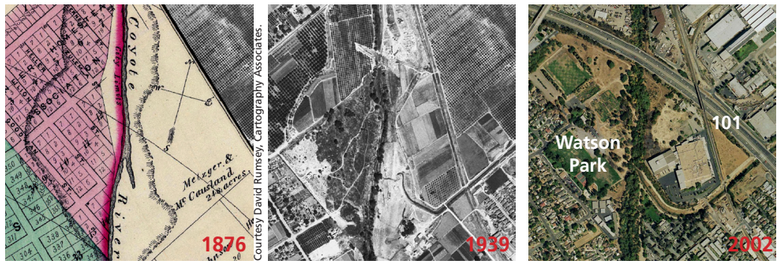
Historical data help identify places where natural approaches can be used to reduce flood risk.

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

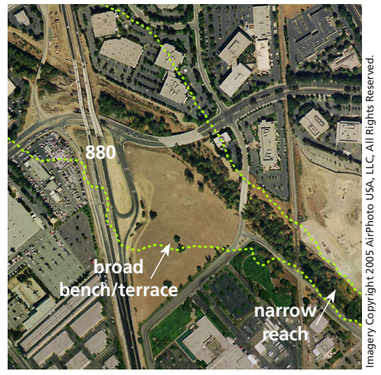
A ONCE-BROAD CHANNEL AREA with wide inset stream benches becomes a city landfill and then Watson Park.

(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.



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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

EXECUTIVE SUMMARY

COYOTE CREEK WATERSHED HISTORICAL ECOLOGY STUDY

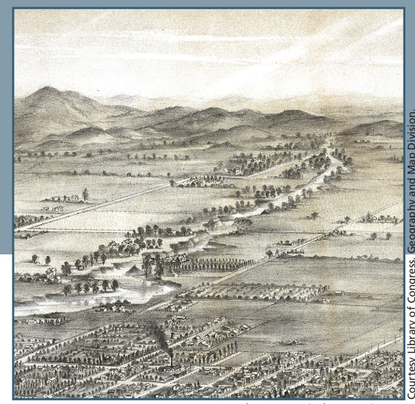
HISTORICAL CONDITION, LANDSCAPE CHANGE, AND RESTORATION POTENTIAL

IN THE EASTERN SANTA CLARA VALLEY, CALIFORNIA

Prepared for the
Santa Clara Valley Water District

By the San Francisco Estuary Institute

Santa Clara Valley Water District



Courtesy Library of Congress, Geography and Map Division.

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

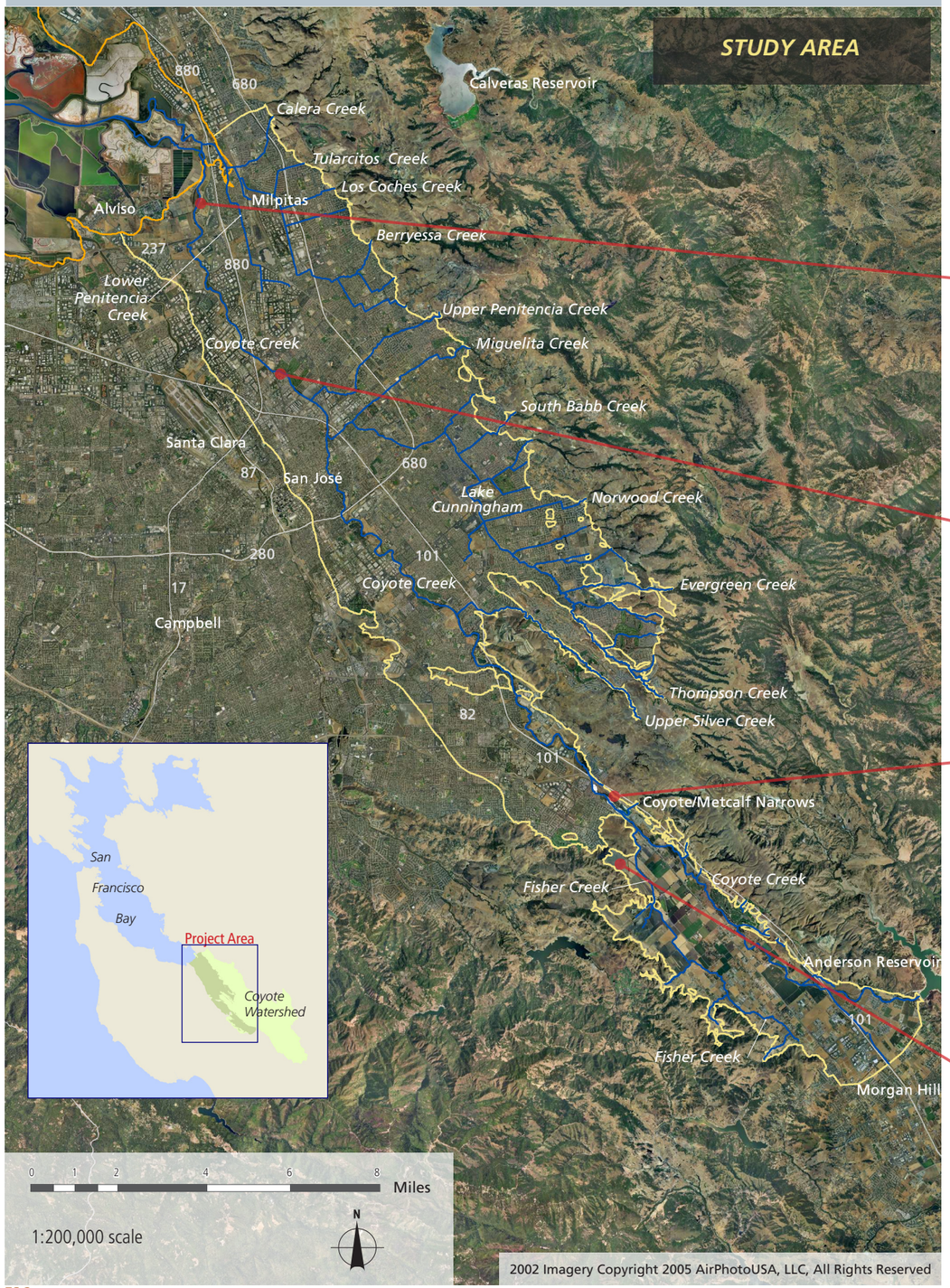
In recent years, a number of environmental research and management efforts in the Santa Clara Valley ("Valley") have recognized the need for a better understanding of historical conditions as a basis for developing locally appropriate habitat goals and guidelines for restoration design. Understanding 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.

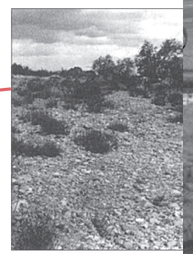
EXECUTIVE SUMMARY CONTENTS

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.



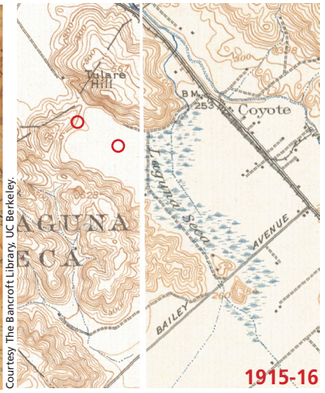

Low gradient, perennial reach.


Narrow reach with perennial water and gravel bars.


Broad, gravelly, intermittent Coyote stream bed.


Laguna Seca: tules and ponds.

LAGUNA SECA THROUGH TIME



Courtesy The Bancroft Library, UC Berkeley.

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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

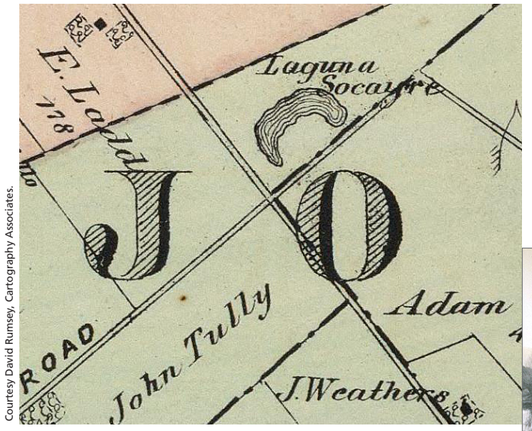
OPPORTUNITIES FOR HABITAT RESTORATION

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.

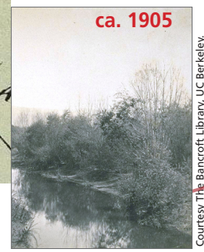
In Coyote Valley, Laguna Seca offers a rare opportunity to restore natural wetland functions and a diverse wetland habitat mosaic. Laguna Seca restoration would link to existing buffers and have regional significance as a large, natural, valley floor wetland. Successful wetland restoration at Laguna 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.

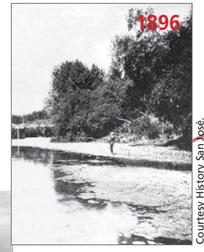


Courtesy David Rumsey, Cartography Associates.

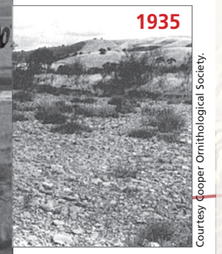
SMALL PERENNIAL POND OF THE LAGUNA SOCAYRE COMPLEX, 1876 (Thompson and West 1876, courtesy David Rumsey, Cartography Associates).



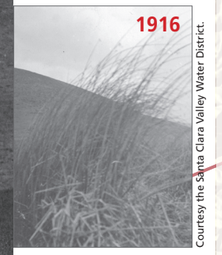
Courtesy The Bancroft Library, UC Berkeley.



Courtesy History San José.



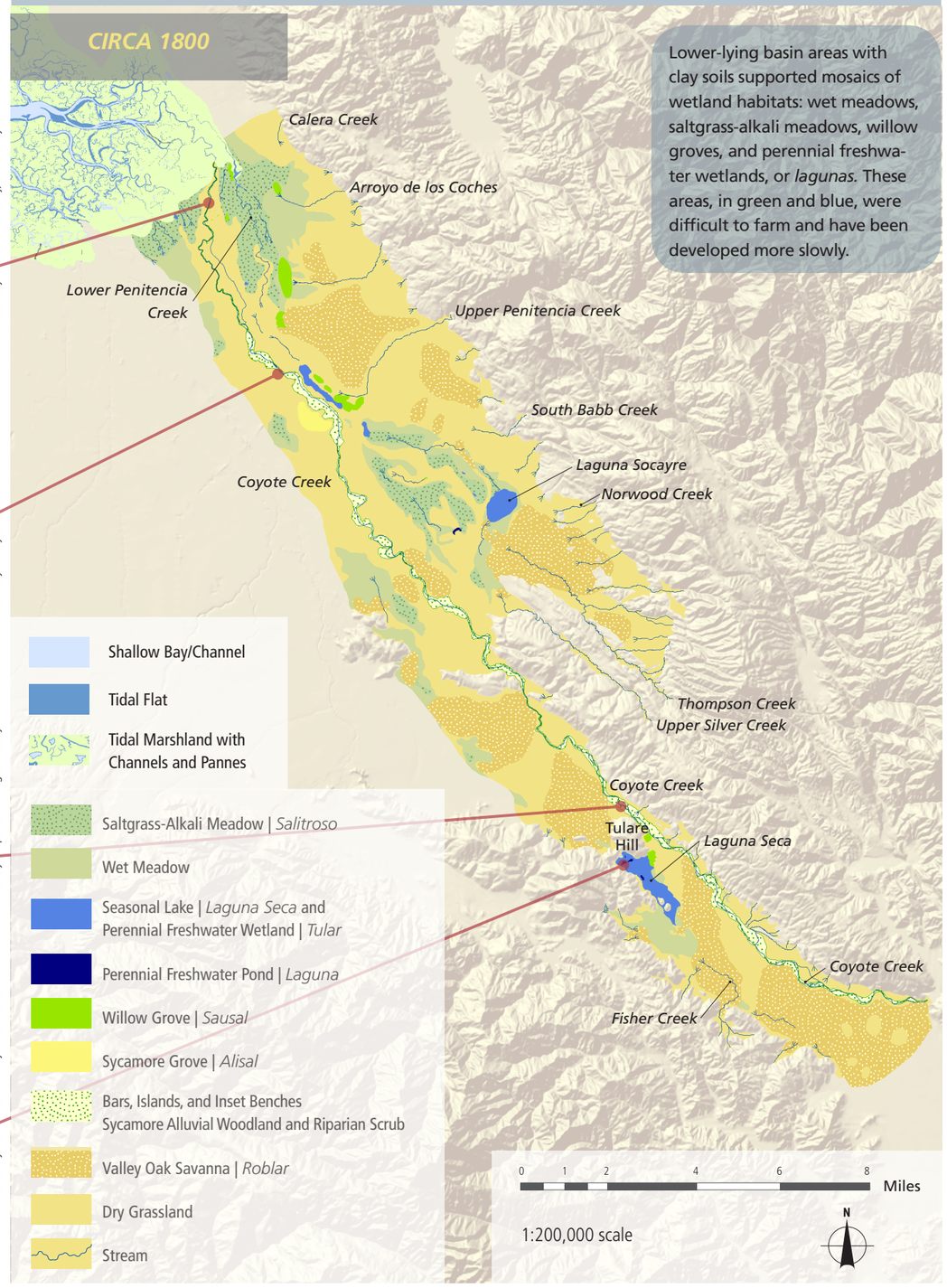
Courtesy Cooper Ornithological Society.



Courtesy the Santa Clara Valley Water District.

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).

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.



UNDERSTANDING LANDSCAPE CHANGE

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

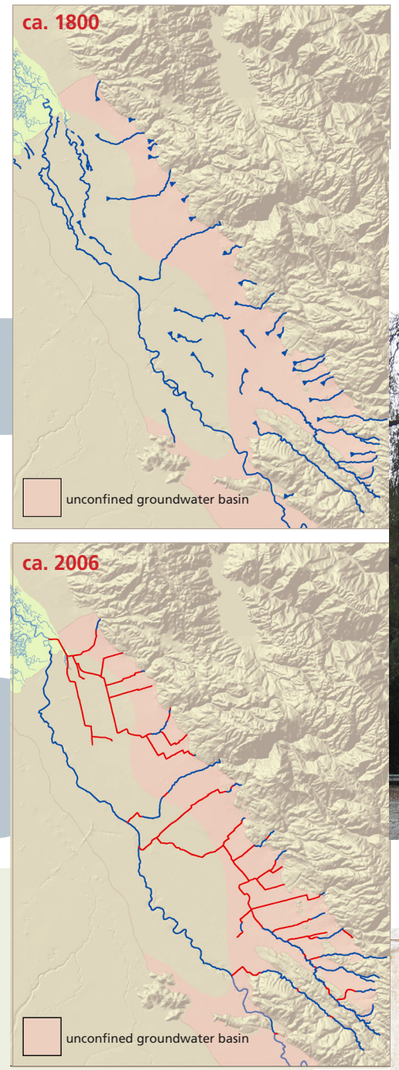
DRAINAGE INTENSIFICATION

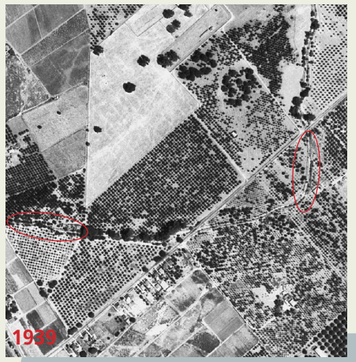
Today nearly 50% of the valley floor water courses draining into Coyote Creek are constructed channels. These channels convey runoff across areas that previously had no surface drainage. The natural drainage network was highly discontinuous, supporting groundwater recharge on the coarse alluvial fans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

OPPORTUNITIES FOR HABITAT RESTORATION

CAN VALLEY OAKS PERSIST WITHIN THE URBAN FRAMEWORK?

VALLEY OAK ALONG COYOTE ROAD.

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.

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

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).

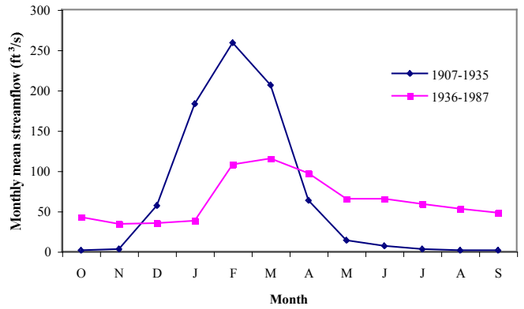
Courtesy History San José.

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

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.

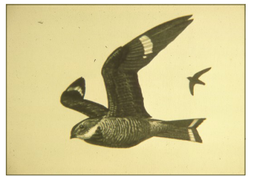
MANAGING WATERSHED FUNCTIONS AND PROCESSES

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.

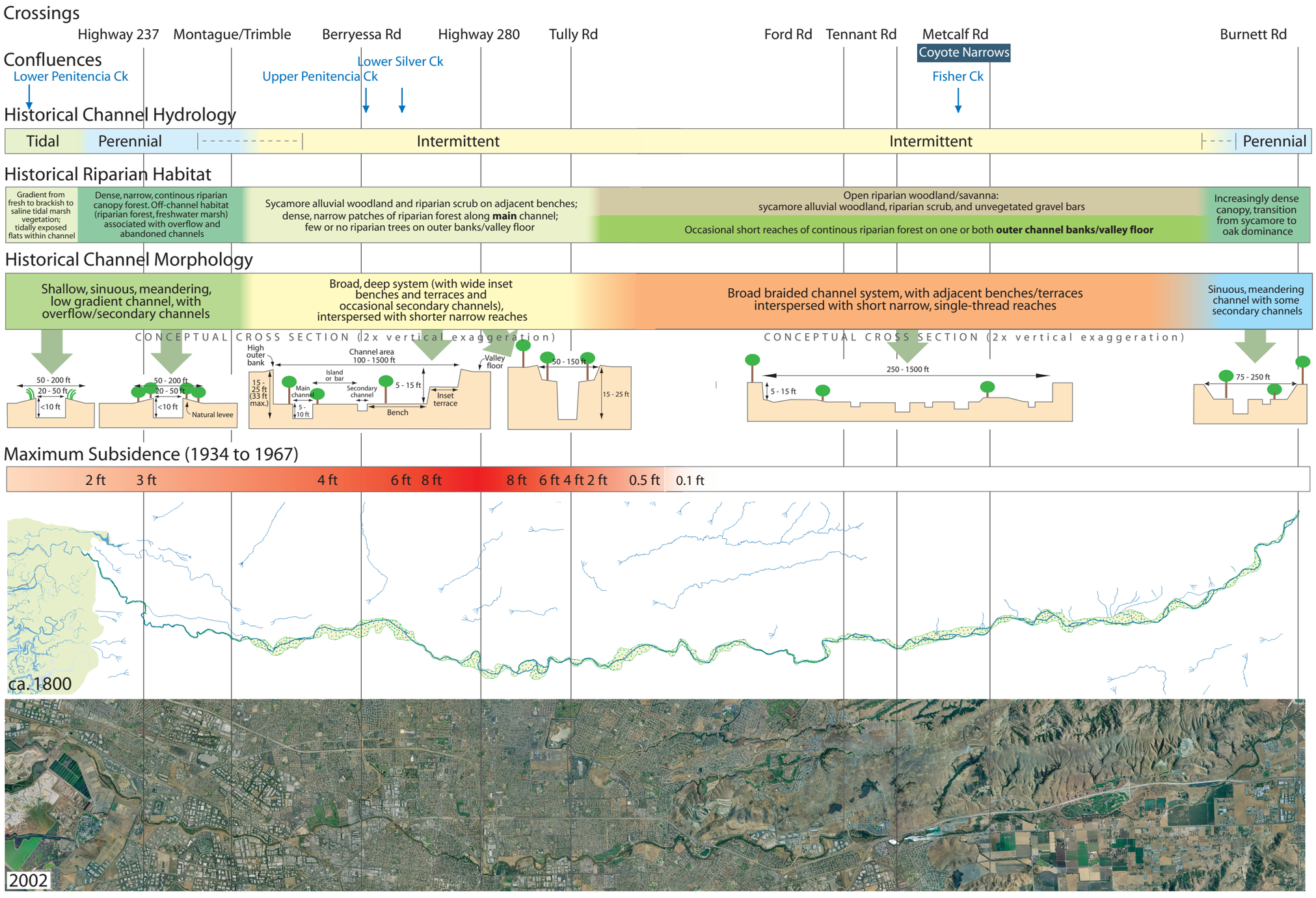
"…whose course is marked with groups of giant sycamores, their trunks gleaming like silver through masses of glossy foliage…"

- 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).