Sonoma Creek *K. Ridolfi*

AN INTRODUCTION TO THE *HISTORICAL ECOLOGY* OF THE SONOMA CREEK WATERSHED

A tool for developing an action plan for the Critical Coastal Areas program

Scattered throughout local and regional archives, *historical information represents a valuable and often untapped resource for watershed management. Can an understanding of the historical landscape help us guide future landscape modifications? Can this understanding help re-establish native habitats and ecosystem function? How did natural and cultural processes create the historic ecosystems that still persists as fragments in the current landscape?*

This publication is intended as an introduction to how historical ecology can help local residents and resource managers understand current conditions and develop strategies for environmental recovery in the Sonoma Creek watershed. The watershed has experienced substantial physical and ecological change due to the history of human activity and development. Understanding this history can help identify opportunities to restore natural watershed function within the contemporary landscape. This document highlights areas of interest for potential restoration including historical freshwater wetlands and stream channels in the watershed. The highlighted opportunity areas will guide the stakeholders of the Sonoma Creek watershed participating in the Critical Coastal Areas (CCA) Program pilot study to identify and prioritize actions that will improve watershed health. The CCA Program seeks to improve water quality along the California coast through the implementation of management measures to reduce the effects of diffuse sources of pollution such as urban and agricultural runoff.

For more information on the CCA program, please visit http://www.coastal.ca.gov/nps/cca-nps.html.

Map courtesy The Bancroft Library, UC Berkeley

www.sfei.org www.sonomaecologycenter.org

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SONOMA CREEK WATERSHED

OPPORTUNITY AREAS

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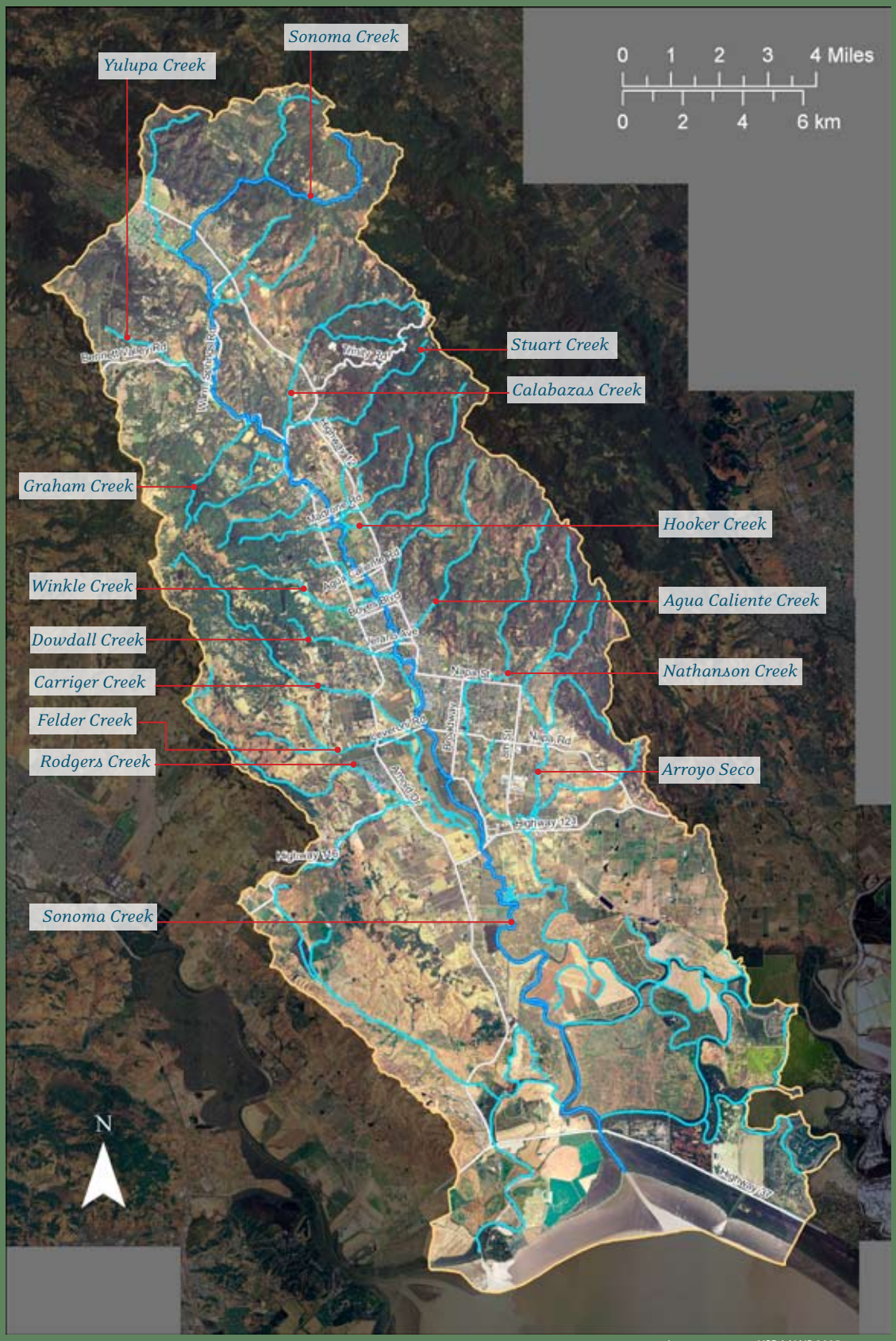


Imagery courtesy USDA NAIP 2005

Sonoma Creek Watershed: Past and Present

*"**Sonoma is a fountain of fountains,**" wrote Father Jose Altimira in July of 1823, as he explored the North Bay, looking for the best place to build a mission. He found more water in Sonoma Valley than anywhere else, recording in detail the many creeks, ponds, springs, and wetlands that he came across. Even in dry years, the priest's native guides informed him, "the permanent small waters are innumerable." Four years later, and a month further into the dry season, French traveler Auguste Duhaut-Cilly (1827) gave a similar picture, describing Sonoma Valley as "a plain of great extent . . . everywhere watered and crossed by streams of fresh water." Historical maps and aerial photographs confirm these early observations.*

Sonoma es un manantial a manantiales.

- Altimira 1823

Sonoma is a fountain of fountains.

Since 1823, human activity has changed the watershed in many ways. The net effect has been to dramatically increase the speed with which water moves through the watershed, creating a "Freeway to the Bay" for storm runoff. This condition has contributed to major water issues currently facing the Sonoma Valley watershed: channel incision, bed and bank erosion, high sediment load, flooding and associated property damage, groundwater depletion, loss of wetlands, instream habitat, and recreational opportunities.

Shaping the Future: Opportunity Areas

Over the last two centuries, the relationships between the tributaries, wetlands, groundwater, and the main stem of Sonoma Creek have been substantially altered. Historical ecology provides a tool for developing action plans for Critical Coastal Areas. Historical ecology research provides both technical information and an educational perspective that can help us recognize and respond to environmental change. While this preview shows some of the types of analysis that could be useful for the Sonoma Creek Watershed CCA, much more historical information about the local landscape is available and remains to be compiled. For more information about historical ecology methods and resources, please go to www.sfei.org/HEP.

HISTORICAL CONDITIONS

- Abundant water
- Low channel connectivity
- Extensive wetland complexes
- High habitat quality and diversity
- High water quality

MODERN CONDITIONS

- Decreased surface and groundwater
- Increased channel connectivity
- Increased flood risk
- Habitat reduction and fragmentation
- Decreased water quality

Wetland Restoration Opportunity Areas [page 4-5]:

- Protect and restore wetlands within the former Kenwood Marsh area and other areas
- Recreate floodwater retention areas
- Seasonal wetland/Swale protection and restoration at several locations

Stream Channel Restoration Opportunity Areas [page 6-7]:

- Recreate distributary systems and functions
- Restore historical confluence configurations
- Encourage no net runoff from development

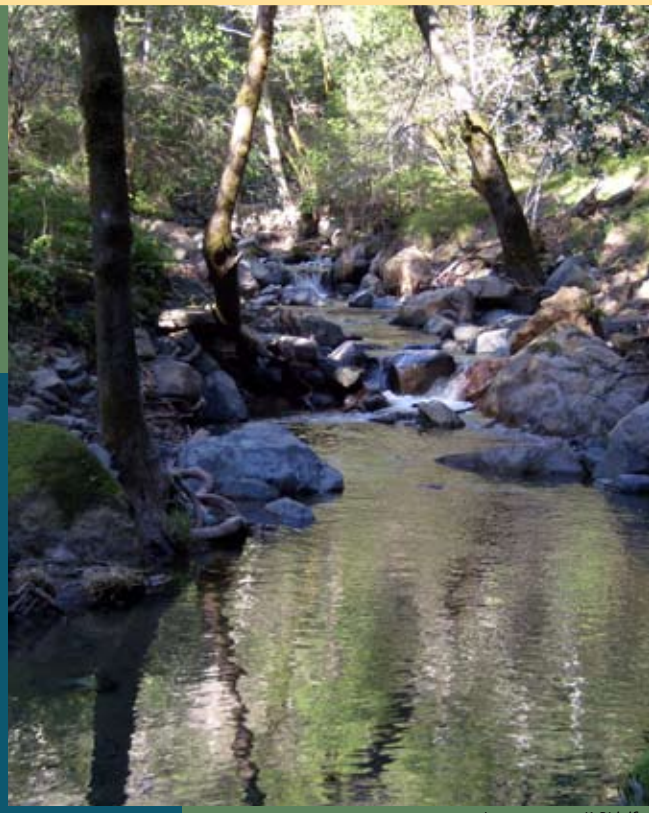


Image courtesy K. Ridolfi

1 SONOMA CREEK WATERSHED
Freshwater Wetlands

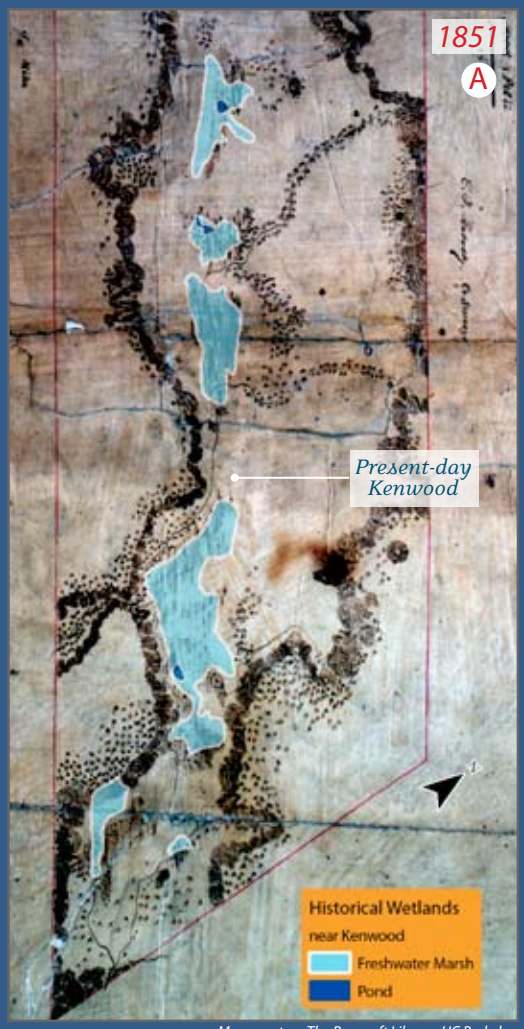
***Historically, Sonoma Valley's abundant wetlands** ranged from seasonal swales and vernal pools to perennial features such as willow thickets, tule stands, and open water. Many of these wetlands were watered directly by tributaries flowing out of the hills and onto the valley floor. These pages discuss perennial wetlands (below) and seasonal wetlands (right).*

Photo by the Sonoma Ecology Center

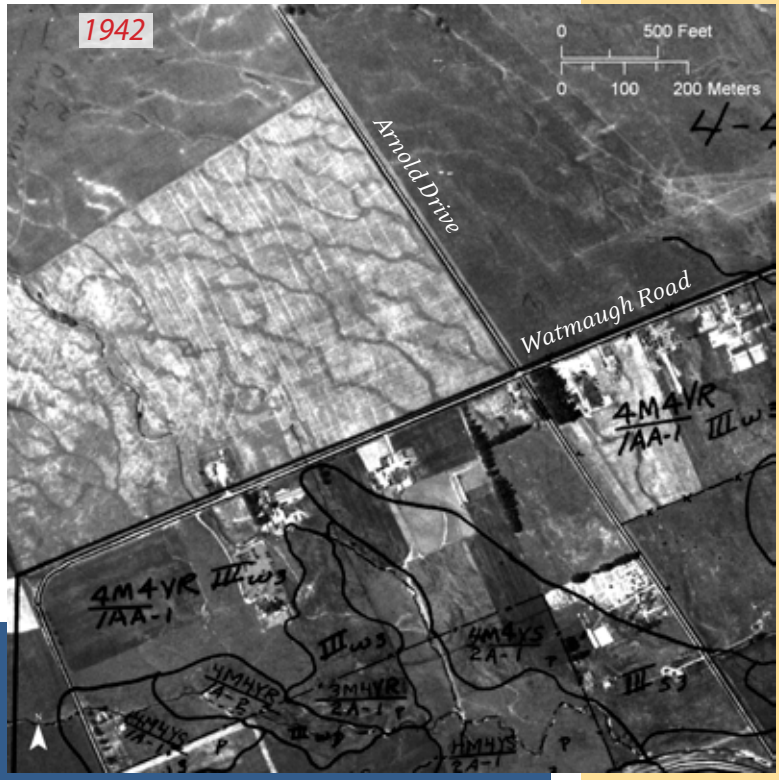
Perennial Wetlands

Early maps and accounts (Anonymous 1837; Peabody 1851, Boggs 1861) describe a large marsh complex near the upper end of the watershed covering about 400 acres. Known as the Kenwood Marsh (right A: 1851, B: 1942 , C: 2005), these wetlands stretched five miles from the watershed boundary (Pythian Road), through present-day Kenwood, to near Dunbar School in Glen Ellen. In fact, this marsh was part of a larger wetland complex extending to present-day Santa Rosa. This suggests that a subsurface connection existed, and may still exist, between the Sonoma Creek and Santa Rosa Creek watersheds. Groundwater was exceptionally high throughout this part of Sonoma Valley. Parts of the Kenwood Marsh probably held surface water throughout the year. By catching runoff from winter storms and releasing it over many months, the Kenwood Marsh acted as a sponge, reducing downstream flooding and increasing the flow of Sonoma Creek during the summer dry season.

Smaller wetlands existed in many other parts of the watershed. On the eastern side of what is now the city of Sonoma, Altimira described six or seven small ponds, "some between willows and others amidst tules." An elder remembered "vernal pools all over the place" in this especially wet area, which extended several miles from the base of the hills near Lachryma Montis (Vallejo's home) southeast all the way to tidewater at Sonoma Slough. Another elder recalled two artesian ponds on property his family has owned since 1860, that could be drained for irrigation and would refill overnight. Altimira also described ponds in the southwestern part of the valley at a former village site his native informant called *pulpula*. This Coast Miwok word has been translated as "ponds."



Map courtesy The Bancroft Library, UC Berkeley



Imagery courtesy USDA NAIP 2005

Imagery courtesy USDA NAIP 2005

Seasonal Wetlands

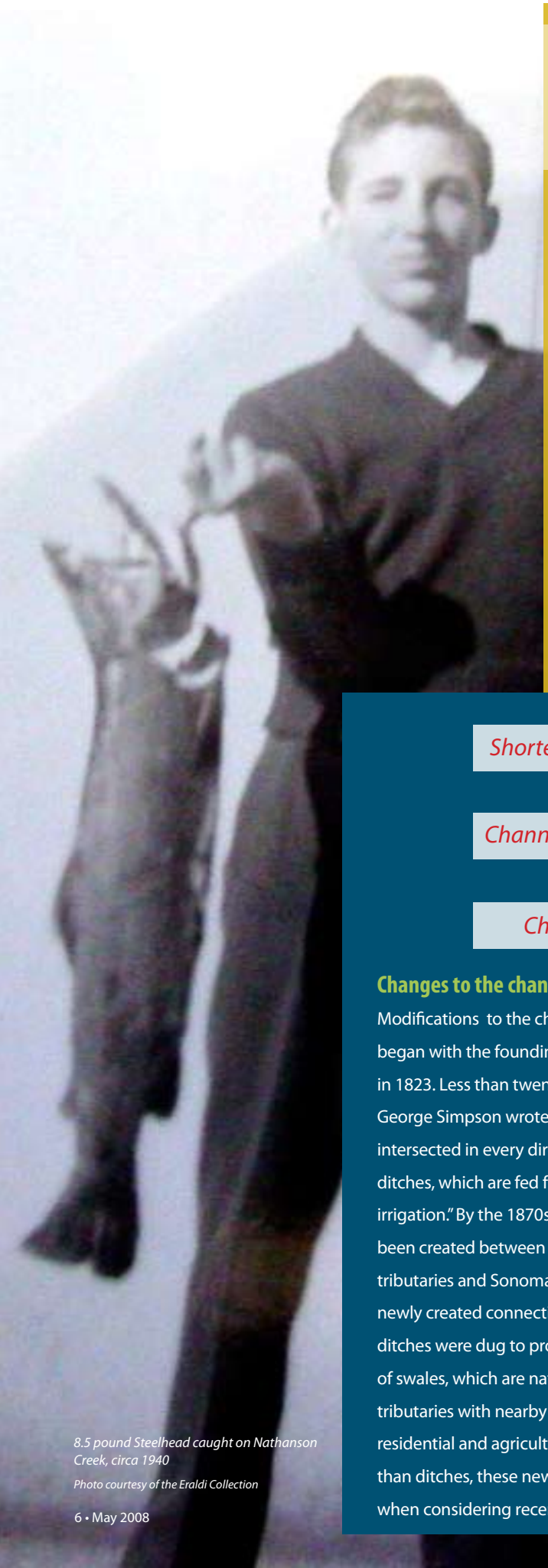
Seasonal wetlands such as swales and vernal pools dotted the valley floor. Altimira's description of "innumerable small waters" may refer to these features, which apparently still held surface water during his visit in the dry season. On aerial photographs from 1942, swales show up as network of linear dark patches [above left]. These probable seasonal wetlands were especially common on the western side of the valley from Boyes Blvd. south to Watmaugh Road. Complex networks of these features show up on the alluvial fans of Rodgers and Carriger Creeks.

A 1967 soil survey (Miller) describes the Huichica loams, common in Sonoma Valley as having "a hummocky, or 'hog wallow' micro relief", a description consistent with vernal pool habitats. A number of seasonal wetlands still exist in Sonoma Valley today.

WETLAND RESTORATION

Freshwater wetland loss is estimated to be greater than 95% in the watershed. Benefits of restoration include: flood reduction, water quality improvement, habitat restoration, groundwater recharge, recreation, and aesthetic value.

Photo by the Sonoma Ecology Center



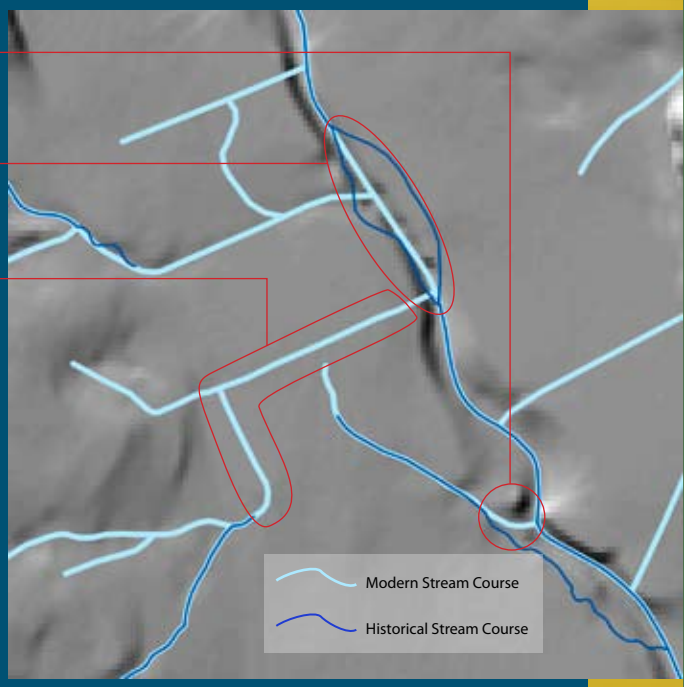
8.5 pound Steelhead caught on Nathanson Creek, circa 1940

Photo courtesy of the Eraldi Collection

2 SONOMA CREEK WATERSHED
Stream Channels

The tributaries of Sonoma Creek represent the most complex and dynamic part of the pre-settlement water picture. The historical record is difficult to interpret, but strongly points to the conclusion that many tributaries lacked direct channel connections to Sonoma Creek; and that some channels shifted over time across their alluvial fans. Summer dry conditions were probably not uncommon on many lower reaches.

Where tributaries did join directly with larger streams, they tended to flow closely parallel before joining the mainstem. In some cases, tributaries ran parallel to to Sonoma Creek's mainstem for hundreds of meters before joining it. Such "leisurely" confluences likely created large areas of slow moving water that made good habitat for salmonids and other fish.



Changes to the channel network

Modifications to the channel network began with the founding of the mission in 1823. Less than twenty years later, George Simpson wrote that "The valley is intersected in every direction by artificial ditches, which are fed from the creek for… irrigation." By the 1870s, connections had been created between all the major isolated tributaries and Sonoma Creek. Ditch-digging undoubtedly played a role. However, the fact that these newly created connections often follow sinuous paths, implies natural forces were also at work. Perhaps ditches were dug to property lines and then the water itself cut a fresh channel from there. The abundance of swales, which are naturally sinuous, suggests the possibility that some ditches connected isolated tributaries with nearby swales. Efforts to increase connectivity continue to this day. On newly developed residential and agricultural lands, underground drains are installed as a matter of course. Much less visible than ditches, these newer underground channels are easily overlooked, yet are likely a significant factor when considering recent hydrological change.

Map courtesy The Bancroft Library, UC Berkeley

Map courtesy The Bancroft Library, UC Berkeley

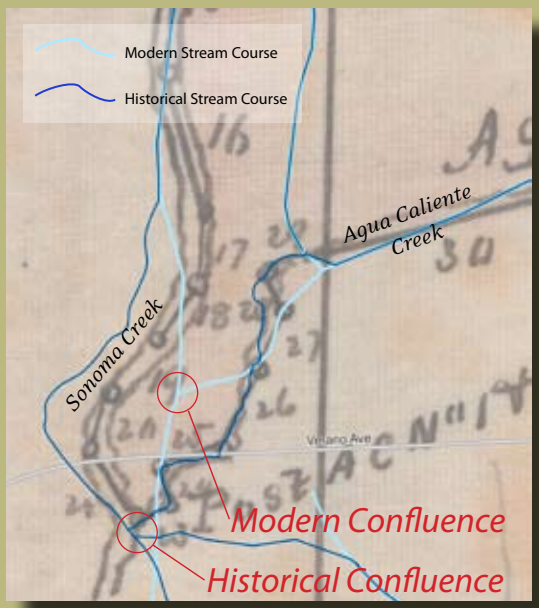
Discontinuous tributaries

Maps of Sonoma Valley made before 1875 consistently show tributary channels which seem to end on the valley floor (left) before reaching the mainstem of Sonoma Creek, especially in the El Verano area and above the Kenwood Marsh (O'Farrell 1848; Peabody 1851; Bowers 1867). Altimira describes a creek, which did "not flow beyond the base of the hills, but instead [ended] on the plain." He compares it to a nearby creek which "runs until it joins the Arroyo Sonoma." Similarly discontinuous tributaries may have included Rodgers, Carriger, Hanna, Winkle, Fisher, Champlin, Stuart, Nathanson, and Kunde creeks as well as numerous smaller ones. In the Kenwood area, Sonoma Creek itself was described as 'spreading out and losing itself in the valley,' "forming a kind of willow thicket and marsh or lagoon." (Boggs 1861). This evidence suggests that the mainstem Sonoma Creek may have lacked a direct channel between the outlet of the Kenwood Marsh complex and Adobe Canyon. One interpretation of this phenomenon is that these creeks descended from the hills and spread out into a system of distributaries, sinking under the surface as they crossed their alluvial fans. This historical pattern of isolated tributaries with channels ending on alluvial fans has been documented for other Bay Area watersheds including Napa River and Coyote Creek (Grossinger et al. 2006, 2007). Under winter conditions on saturated soils, sheet flows from these creeks probably spread out over much of the valley floor. Water from winter storms was slowly shunted down the valley, raising water levels of wetlands and lakes and replenishing groundwater as it moved toward the bay (Micheli 2003).

Shortened confluences

A more subtle modification has been the shortening of confluence channels. Historical confluences typically made sharply acute angles, the two streams flowing almost side by side for some distance before they came together. Today, most confluences are close to perpendicular. In this case, channel length has been decreased to promote faster drainage.

In some cases it appears this was done to increase the usable land on a piece of property. The confluence of Agua Caliente and Sonoma Creeks appears to have been intentionally moved upstream to eliminate the need for a culvert on Verano Avenue.



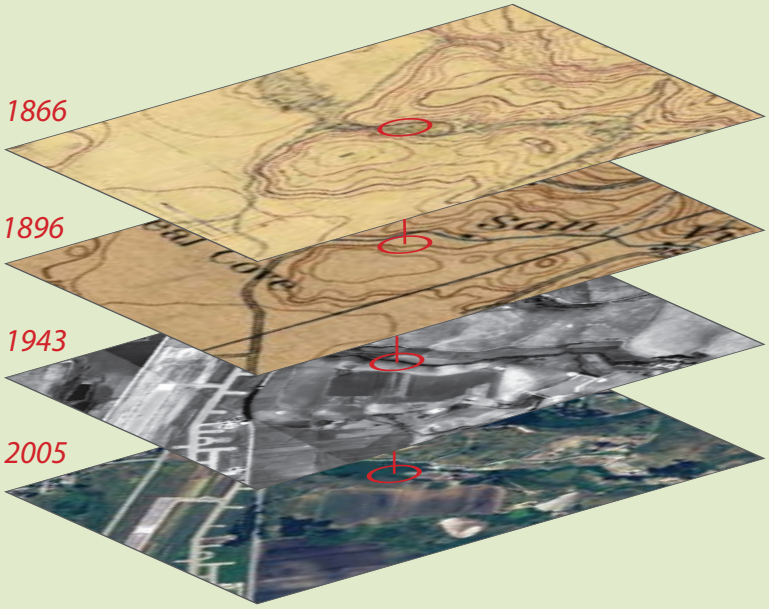
Map courtesy The Bancroft Library, UC Berkeley

Sonoma Creek near El Verano. Watkins 1887.

Image courtesy The Bancroft Library, UC Berkeley

Building a **HISTORICAL ECOLOGY** Project

DATA COLLECTION • Research begins with the acquisition of historical materials from a broad range of institutions, including local museums and historical societies, city and county archives, and regional libraries. Journals, diaries, oral histories, interviews and newspaper articles about the landscape and notable environmental features document historical conditions. Early maps, surveys, and aerial photography provide the locations of historical features, such as streams, wetlands, and plant communities, as well as remaining property boundaries and roads that are valuable links to the contemporary landscape. Other important sources include landscape photography, sketches, and paintings.



DATA COMPILATION • Sources are drawn together for synthesis and analysis along the themes of historical vegetation types, channel geometry, seasonality, and land use. We georeference early maps and aerial photography in a geographic information system (GIS), which allows historical evidence to be compared to modern conditions. We also extract and organize pertinent quotes from early land surveys and narrative sources and, where possible, place them on maps of the past and present. This process of comparing multiple, independent sources of historical and modern information facilitates a detailed and accurate depiction of environmental change.

SYNTHESIS AND ANALYSIS • We rely heavily on GIS to synthesize the data into layers that represent historical landscape characteristics. Mapped features may include channels, perennial and seasonal wetlands, coastal features, woodlands and savanna, and other habitats — each coded independently with their supporting sources and relative certainty level. A variety of methods are used to compare past and present landscapes, describing changes in habitat form and distribution. These depictions of habitat change are used by ecologists and other environmental scientists to describe changes in ecological functions, such as wildlife support. As a reliable map of the pre-modification landscape is developed, it begins to reveal the relationships between native habitats and physical gradients such as topography, salinity, and hydrology, providing a basis for identifying adaptive restoration and management strategies for the contemporary landscape.

REPORTS, GRAPHICS, AND PRESENTATIONS • The analysis is brought together into broadly accessible tools, including illustrated reports, websites (such as wetlandtracker.org), and maps. These present trends in habitat types and extent, discuss conceptual models and areas of interest for future environmental improvements, and provide direct access to many of the most significant historical data sources.

APPLICATIONS • Understanding the historical landscape and how it has changed over time can help address many of the challenges associated with managing and planning for the future of local watersheds. Historical ecology can help set priorities for restoring natural functions to local creeks, identify natural ways to reduce flood hazards, and reveal previously unrecognized conservation opportunities. The historical analysis often reveals ways to restore native habitats within our developed landscape for recreational benefits as well as wildlife conservation. Historical ecology can also reveal management constraints resulting from historical landscape changes, providing a more realistic basis for planning the future.