



#### Objective

We hypothesize that natural (pre-disturbance) conditions of the Laguna de Santa Rosa (Laguna) watershed have been altered due to land use changes introduced by California settlers of the mid 19th Century. The land use changes were the result of concerns about flooding and its threat to human populations sewage management and the associated risks to human health as the result of sanitation discharges; and the promise of an increased acreage of arable land for agricultural production. The land use changes have created major changes in the stream and wetland features of the Laguna watershed.

The historic accounts of water quality in the Laguna describe it as a productive, low gradient system that included a mosaic of open channels, wetlands, and ake-like features. The historic Laguna was likely a productive warm-water system, supporting wildlife and human use of the Laguna for fishing and recreation. Historical ecological analysis can provide a better understanding of background conditions that can be used to develop scientifically defensible habitat restoration and water quality management goals and objectives. The use of historical ecology does not necessarily result in the identification of management objectives to recreate pre-disturbance conditions. Rather, the analysis provides context for the necessary consideration of what are desirable and feasible future conditions.



Boating on Lake Janine in Sebastopol, Sonoma County, CA, 1900.  
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#### Methods

A similar study was done by Dawson and Michell (2006) in the Sonoma Valley "to detect major changes in the mapped presence or absence of stream channel features" (Pg. 1-1). The scenario of pre-disturbance conditions developed in this current Laguna study should be considered a preliminary one that will be refined through further review and research.

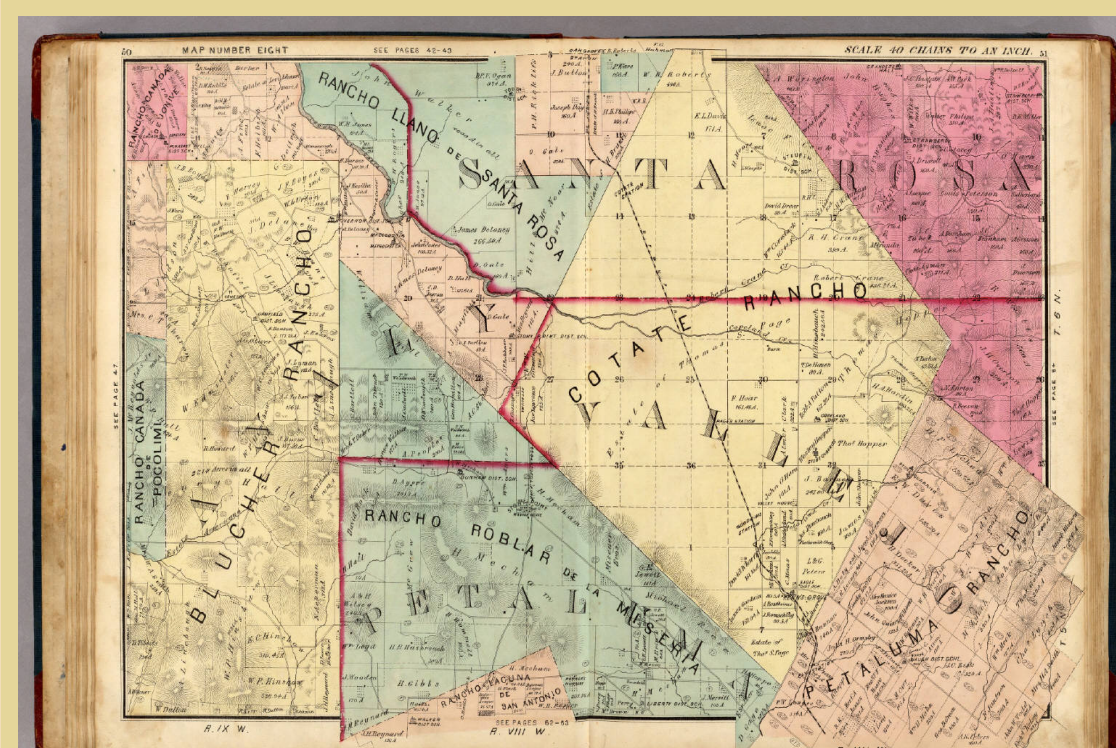
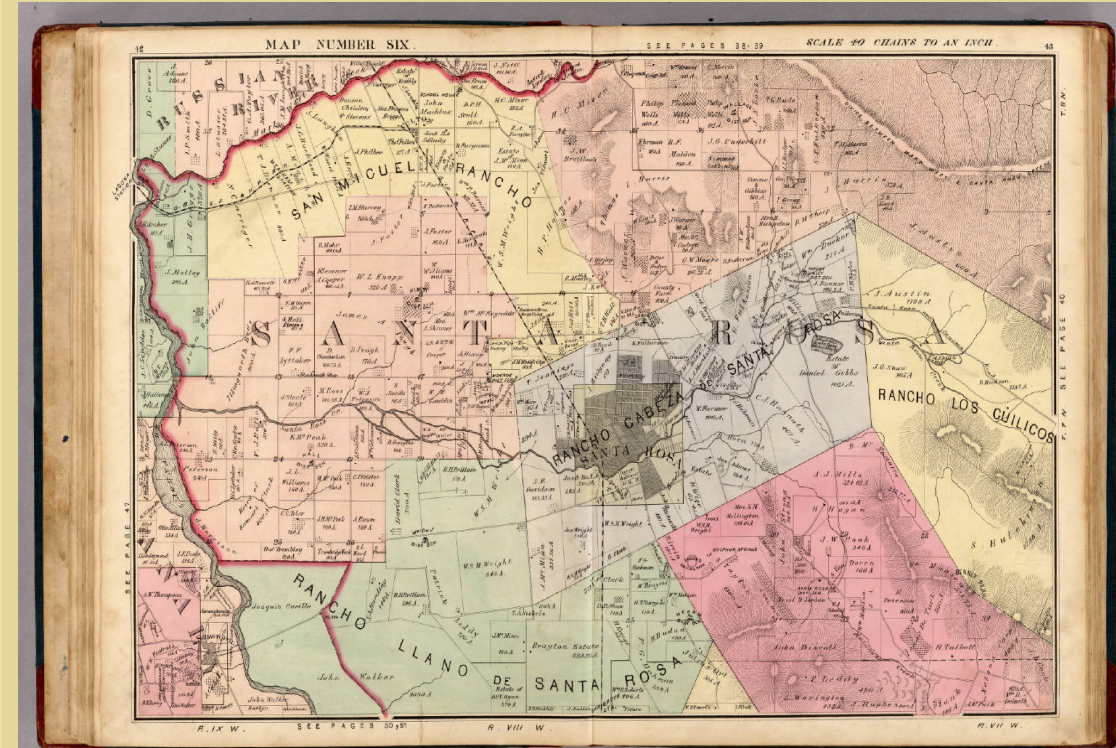
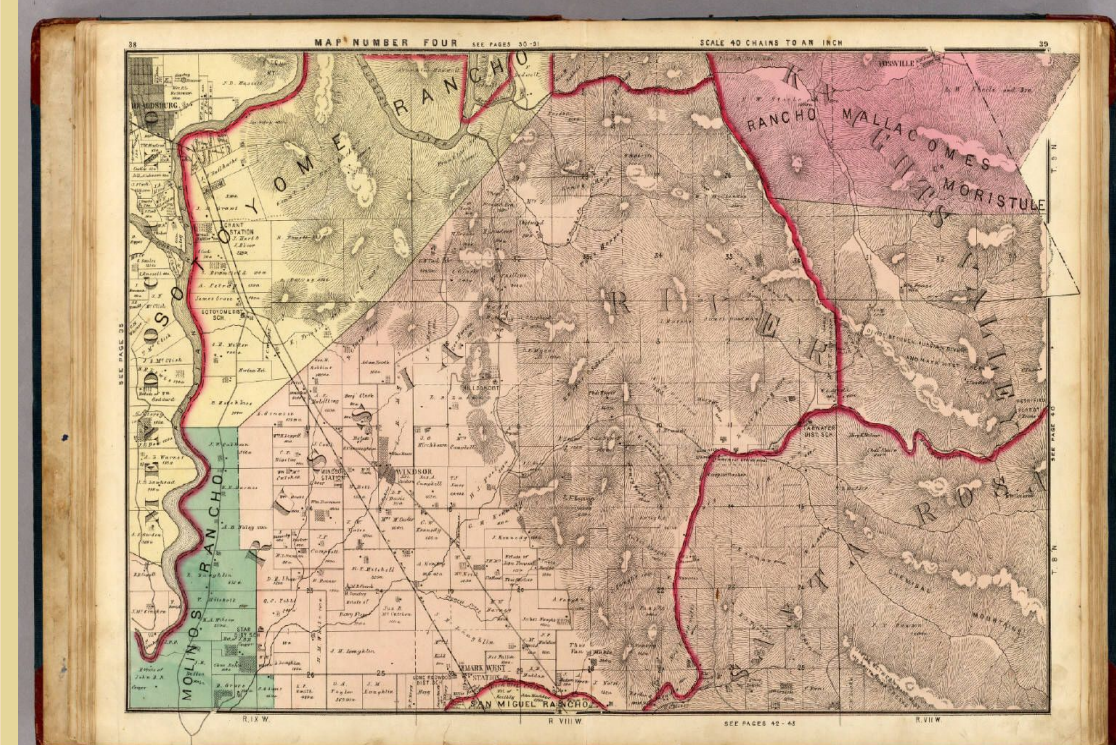
The three maps found in the 1877 Historical Atlas of Sonoma County created by Thomas H. Thompson cover the entire Laguna watershed. Map Number 4 (pg. 38-39) shows the Mendocino, Russian River, Knights Valley and Santa Rosa townships. Map Number 6 (pg. 42-43) shows Santa Rosa in the center of the map. Map Number Eight (pg. 50-51) shows the Anala, Santa Rosa, Vallejo, and Petaluma townships. These maps were obtained from the David Rumsey Map Collection - Cartography Associates website <http://www.davidrumsey.com>. The three maps were downloaded in a MRSID format at a 1:31,680 scale.

The maps were georectified using the township, range and sections contained in the Public Land Survey System grid for the State of California as a basemap. Townships are roughly six miles square, and are numbered north and south from an established baseline. Either the corners found in the township or in the sections were chosen as reference points. Using the ESRI ArcMap GIS mapping program, these reference points were "tied" from the historic maps to modern coordinates.

#### Data Sources and Description

The hypothesis on the natural conditions for the hydrologic boundaries of the Laguna is based on several historical sources that were consulted, compared, and integrated into lines of evidence:

- 1860 Map of Bodega Rancho. Bowers, A.B. Map in possession of Bob Curtis of Curtis and Associates, Healdsburg, California.
- 1877 Historical Atlas Map of Sonoma County California: Compiled, Drawn, and Published from Personal Examinations and Actual Surveys. Made created by Thomas H. Thompson and Co. Oakland, CA.
- 1888 Illustrated Atlas of Sonoma County California created by Reynolds and Proctor.
- Reports written by John Cummings:
  - o "Crystal Laughing Waters" - Historical Glimpses of the Laguna de Santa Rosa. December 2003.
  - o Laguna de Santa Rosa - Index of the microfilm files of the Sebastopol Times 1895-1965. December 2003.
  - o Draining and Filling the Laguna de Santa Rosa. January 2004.
  - o A Big Puddle - The Early Laguna de Santa Rosa. September 2005.
- Historical Photos:
  - o Narrative descriptions:
    - o Cardwell, G.T. (1958). Geology and Ground Water in the Santa Rosa and Petaluma Valley Areas, Sonoma County, California. USGS Water Supply Paper 1427.



1877 Historical Atlas Map of Sonoma County California: Compiled, Drawn, and Published from Personal Examinations and Actual Surveys. Made created by Thomas H. Thompson and Co. Oakland, CA.

Pre-European

Three tributaries of the Pomo Indians (Koonhomara, Blakomara, and Koonhomara) occupied the Laguna de Santa Rosa watershed. They are believed to have had little impact on the ecology and geomorphology of the basin, with the exception that this basin's conversion released large amounts of sediment from the hillsides into the lower Laguna (PWA, 2004, pg. 6).

PWA. (2004, March). Sediment Sources, Rate & Fate in the Laguna de Santa Rosa, Sonoma County, California.

1837

Start of intensive ranching. The Santa Rosa Valley plain was converted to cattle grazing. The PWA study anticipates that this led to changes in vegetation from perennial bunch grasses and annual forbs to Mediterranean grasses, with soil compaction and increased runoff and erosion, and the clearance of some woodlands (PWA, 2004, pg. 6).

PWA. (2004, March). Sediment Sources, Rate & Fate in the Laguna de Santa Rosa, Sonoma County, California.

William J. Hart  
Student Intern - TMDL Unit  
North Coast Regional Water Quality Control Board  
[whart@waterboards.ca.gov](mailto:whart@waterboards.ca.gov)  
707.570.3766

1853

Conversion of some grazing to wheat farms. This land use change led to the start of large-scale land drainage to convert wetland areas to productive farmland. In addition the first large-scale oak wood clearance began around this time. It has been suggested that this land use conversion released large amounts of sediment from the hillsides into the lower Laguna (PWA, 2004, pg. 5).

PWA. (2004, March). Sediment Sources, Rate & Fate in the Laguna de Santa Rosa, Sonoma County, California.

Spring 1885

Grey's Lake was a Laguna lake which once existed between what is now Greenville and River roads, but was filled in beginning in the early 1920s. The Grey's Lake section of the Laguna was also known at the time as the Green Valley Lake. The Santa Rosa Lake and by the turn of the century, the lake became locally known as Bellert Lake.

J. Cummings. (2006, October). Fish & Pisciculture in 19th Century Sonoma County.

December, 1877

Parties interested in devising ways and means to drain the Laguna met in Bodega Hall in Santa Rosa. Participants at the meeting determined to form a company, the Laguna de Santa Rosa Reclamation Company, and to acquire the rights to the bottom lands by draining the Laguna four miles above the railroad bridge and discharging the surplus water into Lake Selma. (That is, draining the Laguna between what is now River Road south to about Sebastopol).

J. Cummings. (2004, January). Draining & Filling the Laguna de Santa Rosa.

August, 1879

Another meeting of residents near the Laguna was called to take steps toward having an outlet for the surplus water from the obstructions were added to be increasing each season. Press Davis was reported a month later to have surveyed the ground and pronounced feasible the plan to reclaim 600 acres of rich bottom land by draining the Laguna four miles above the railroad bridge and discharging the surplus water into Lake Selma. (That is, draining the Laguna between what is now River Road south to about Sebastopol).

J. Cummings. (2004, January). Draining & Filling the Laguna de Santa Rosa.

Late 1906

Sebastopol Times began to build the upper end of its nearby industrial lake. Lake Janine, by adding water round discharges of untreated sewage tank effluent to its industrial discharges.

J. Cummings. (2003, March). The Awful Offal of Sebastopol.

Early 1924

Petaluma Daily Courier newspaper headline reads, "Reclamation of Laguna Swamp a Plethora". Professor W. W. West, UC Berkeley Extension service, plans to survey the Laguna to determine the feasibility and estimated cost to drain the Laguna. A new 352-acre law made forming a drainage district and reclamation company in California. The next step was to define the boundaries of the proposed district and to gain local support for the project. The Sebastopol Chamber of Commerce held a meeting to discuss the proposed project, which now included forming an artificial recreational lake in the Laguna to replace a former lake within two miles of Sebastopol.

J. Cummings. (2004, January). Draining & Filling the Laguna de Santa Rosa.

November, 1929

Sebastopol Times reported on the success of a private drainage project in the Laguna - an example of what a complete drainage system could mean to ranches along the Laguna. L. C. Cropland of Sebastopol and L. J. Fines of Santa Rosa had bladed a one-half mile ditch between their properties, lowered Lake Janine 18 inches, and had made available for agriculture a number of acres of valuable land.

J. Cummings. (2004, January). Draining & Filling the Laguna de Santa Rosa.

July, 1943

A polio epidemic broke out in California in the summer. The incidence in the county, centered around the Laguna, was the highest to have been cleared by farmers along the Laguna north of Sebastopol in the following year. A sanitary survey of the county was completed early in the following year.

J. Cummings. (2004, January). Draining & Filling the Laguna de Santa Rosa.

1960s

Completion of 1960 aerial photographs with the old 1942 aerial photos showed that the Laguna had been cleared by farmers along the Laguna north of Sebastopol in the following year. A sanitary survey of the county was completed early in the following year.

J. Cummings. (2004, January). Draining & Filling the Laguna de Santa Rosa.

# Historic Changes to the Laguna de Santa Rosa



#### Results and Discussion

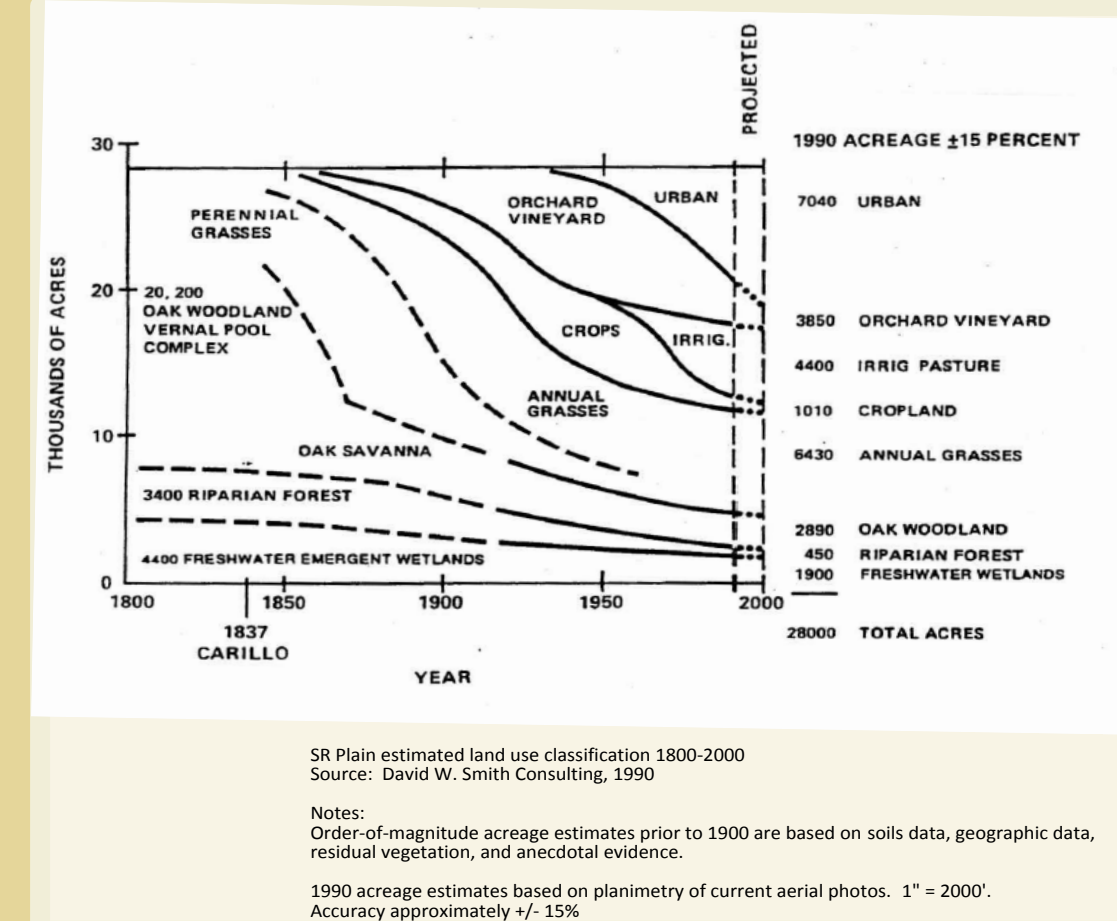
Land use change and the creation of drainage and flood channels, while making the Santa Rosa plain more habitable and productive, has generated more sediment and shifted the focus of deposition to the lower tributaries and the Laguna itself (PWA, 2003 revised 2004). It is estimated that, in the early 1800's, the 28,000 acres of the Santa Rosa plain consisted of approximately 20,200 acres (72%) of oak woodland/vernal pool complex (dominated by Valley Oaks), 3,400 acres (12%) riparian forest and 4,400 acres (16%) emergent freshwater wetlands (PWA, 2003 revised 2004). Some natural attenuation processes in the Laguna may include nutrient removal by riparian vegetation and wetlands before reaching the streams. Riparian vegetation and wetlands can remove nutrients through uptake and denitrification processes which convert nitrate into gases. However, riparian vegetation and wetlands have decreased (PWA, 2003 revised 2004).

The 1877 map of the area shows Santa Rosa Creek possessing a series of channels between Santa Rosa and the downstream wetland area; it is supposed that these channels are distributary channels formed in the originally forested area as bedload carried from the headwaters was deposited on reaching the lower gradients of the Santa Rosa plain (PWA, 2003 revised 2004). By 1877 the mouth of Mark West Creek appears to have been diverted 915m (3000 ft) south (upstream) of its original confluence close to the point that a new bridge for the San Francisco and Northwest Pacific Railroad crossed the Laguna (PWA, 2003 revised 2004). It is assumed that this action was taken to avoid annual flooding of the low-lying railroad when the annual formation of a sediment dam at the confluence of Laguna and Mark West Creek caused water to pond upstream. By the time of the 1915 soil survey, Mark West Creek is shown to have a new confluence further upstream still into the Woolley Creek channel (now over a mile south of its 1867 confluence position) as local farmers attempted to fill wetlands and to harvest in silt-rich lands further north (PWA, 2003 revised 2004).

Over time, the Laguna has been straightened and channelized in places, increasing its transport capacity locally. However, the fundamental control on the Laguna is the area approximately 1,500 feet north of the Trenton Road crossing - at Richurst Knob - where the channel is constrained by a bedrock outcrop and forced to take a circuitous route to its confluence with the Russian River (Pg. 13). The current state of the Laguna de Santa Rosa is a result of extensive hydromodification and other cultural activities within the watershed that have occurred in the past or are now occurring.

#### Bibliography

- Cardwell, G.T. (1958). Geology and Ground Water in the Santa Rosa and Petaluma Valley Areas, Sonoma County, California. USGS Water Supply Paper 1427.
- Dawson, A. and Michell, E. (2006). Historic Changes to Wetlands and the Stream Channel Network. Appendix 1 to Limiting Factors Analysis. Sonoma Ecology Center, Sonoma, CA. Retrieved on August 25, 2009 from <http://knowledge.sonomacreek.net/node/10>
- Philip Williams and Associates, Ltd. (PWA). (October 2001, revised March 2004). Laguna de Santa Rosa feasibility study: year geomorphic investigation. Volume I PWA Project Number 1411-08.
- Philip Williams and Associates, Ltd. (PWA). (2004). Sediment sources, rate and fate in the Laguna de Santa Rosa, Volume II. PWA Project Number 1411-08.
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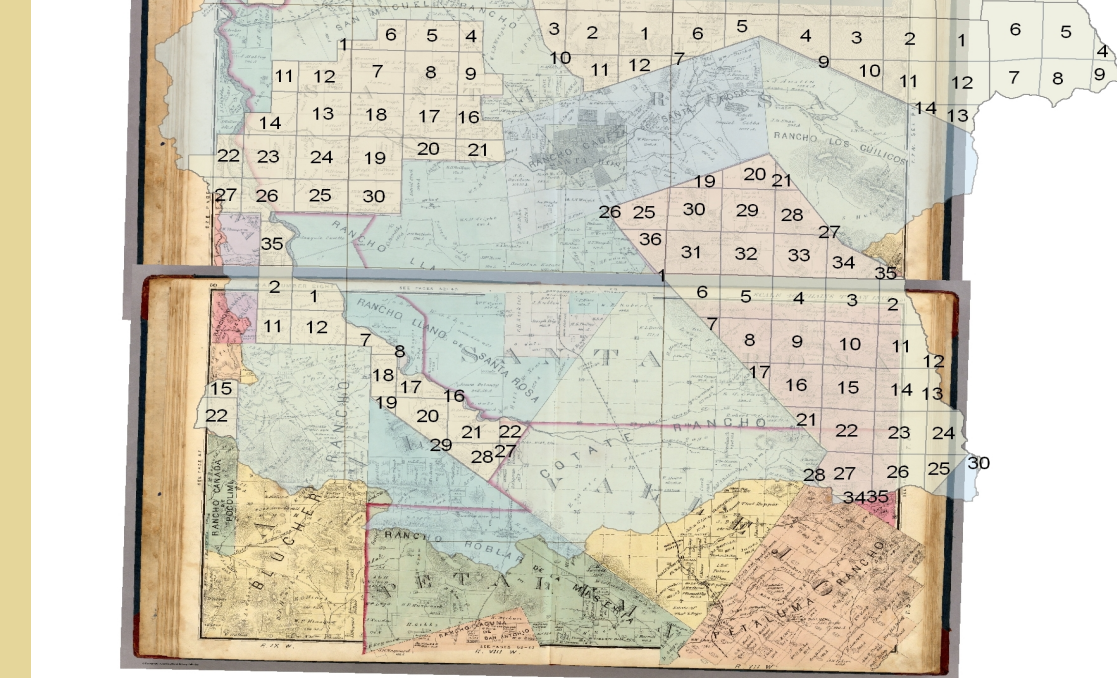


#### Lines of Evidence

- 1) The Sonoma Democrat of Santa Rosa - January 12, 1878  
DRAINING THE LAGUNA  
"Several thousand acres of the richest land in the county will be rendered arable."  
2) Reynolds and Proctor - 1898  
San Francisco and North Pacific Railway:  
The Picturesque Route of California Traverses the Most Favored Area of the Pacific Coast for Climate, Health, Pleasure and Recreation. It's Rich and Fertile Soils requires no irrigation, and is especially attractive to the Home Seeker.  
Published by Reynolds and Proctor, Santa Rosa, CA. 1898.
- 3) The Sebastopol Times - January 2, 1903  
THE BEST PART OF THE COUNTY  
"A beautiful body of water a mile long, 150 feet wide, and from 20 to 30 feet deep, bordered with oaks, willows, etc., is situated a mile of town and is a favorite place for bathing, boating, and fishing."  
4) The Sebastopol Times - January 2, 1903  
METROPOLIS OF THE THRIFTY GOLD RIDGE - SEBASTOPOL MAKING A VIGOROUS GROWTH  
The article repeats the previous articles descriptions of Lake Janine, but adds:  
"That vast hop fields extended along both sides of the lake."  
"From the clear waters of this body have been caught salmon-trout that filled the sportsman's heart with joy."  
That the lake shore could be a lovely spot for a hotel
- 5) Cardwell, G.T. (1958).

GEOLOGY AND GROUND WATER IN THE SANTA ROSA AND PETALUMA AREAS, SONOMA COUNTY, CALIFORNIA. USGS Water Supply Paper 1427.

"The Laguna de Santa Rosa, or the Laguna, as it is known locally, is a swampy, intermittent drainage course at the western edge of the floor of Santa Rosa Valley that extends from about 4 miles southeast of Sebastopol (in 6/8-17) to about half a mile east of Trenton (in 7/9-31). Along the Laguna are several permanent lakes or "lagons"; the largest of which are in 7/9-10 and in 7/9-26 and 7/9-35 (pl. 1). However, the extent of the lakes ranges considerably, particularly during winter and spring when the water surface of the Laguna generally expands owing to storm runoff. The lake level in 7/9-14 commonly rises 8-12 feet above the dry-season level, and, at times, the Laguna area is one continuous body of water as much as 10 miles in length and ranging in width from a few hundred feet to as much as 1.5 miles locally (pg. 10)."



"Evapotranspiration occurs on a large scale along the Laguna de Santa Rosa at the western side of Santa Rosa Valley in a swampy area that varies in size with seasonal rainfall conditions but averages about 1,000 acres during the summer (McDermide, 1945). This area is subject to natural losses by evaporation from the water surface and by transpiration from reeds, tules, willows, and other water-loving plants which flourish around the margins of the Laguna. Most of the evapotranspiration is believed to be supplied by ground-water inflow (pg. 85)."