HISTORICAL PERSPECTIVE OF BOLINAS LAGOON WATERSHED
FOR
THE BOLINAS LAGOON ECOSYSTEM RESTORATION FEASIBILITY PROJECT

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1. INTRODUCTION

CHAPTER 1
INTRODUCTION

For more than forty years, Bolinas Lagoon has been the subject of scientific investigations and a number of planning documents, many of which focused on sedimentation of the lagoon from watershed erosion and littoral drift. In 1999 another study, under the authority of the US Army Corps of Engineers, was initiated to identify sources and causes of sedimentation and a feasible restoration project. As part of the effort, Tetra Tech, Inc., of San Francisco, California, was asked to prepare a series of overlay maps at 25-year intervals, beginning with 1900 and ending with 2000, for the purpose of showing historical land use activities that could have contributed and may still be contributing to the sedimentation of the lagoon.

As the research for this project proceeded, it was apparent that some factors did not lend themselves to mapping. While some specific events, such as construction of a road, could be graphically depicted, others, such as earthquakes and storms, could not. Thus, it was decided to prepare a narrative to supplement and expand on the overlay maps. The following report discusses both natural and human factors that the historical research identified.

The human-related factors include a variety of land use activities, some effects of which are exacerbated by natural events. For example, poorly designed and constructed roads and activities on unstable land can result in significant inputs of sediment during storms. Sediment from the ocean is also a factor. Wahrhaftig (1971) estimated that half or more of the sediment in the lagoon comes ultimately from sea cliffs and sea floor eroding on the south and west sides of Bolinas Mesa.

Perhaps equally important in this sedimentation drama is the lagoon's hydrology. The watershed and the ocean contribute the deposits but, as Wetlands Research Associates, et al. (Marin County Open Space District [MCOSD] 1996) point out, "the only agent for removing sediments from a lagoon is the ebb current." When the ability to remove sediment is impaired and the removal rate is less than the deposition rate, the lagoon

fills up. The historical record indicates that changes in the lagoon's hydrology could be a major factor in the accumulation of sediment.

For the purpose of this report, the word "lagoon" will be used to identify Bolinas Lagoon. While the historical records frequently refer to it as a "bay", and there is some support for this term based on the function of the water body, contemporary usage is "lagoon". "Bolinas Lagoon" will be used in order to reduce reader confusion. However, all historical quotations in this report will retain the original usage.

2. METHODS

CHAPTER 2
METHODS

Research for this project was conducted over four months, beginning in February 2000. The researcher made two trips to Bolinas to see the area, take photographs, and visit the Bolinas Museum. One of those trips was over the Fairfax Road, which provided a high elevation view of the lagoon. Five trips were made to the Marin County Library in San Rafael.

Marin County newspapers are stored on microfilm at the Marin County Library, Civic Center, in San Rafael. The *Marin County Journal/Marin Journal* began in April 1861 and continues today as the *Independent Journal*. Every issue from 1861 through 1931 was read for information on Bolinas, Bolinas Lagoon, Stinson Beach and activities that affected those places. In addition, specific issues that reported on important later events were read, so that there is a record that covers in detail the period from 1861 through 1931 and more generally from 1932 to 1999. This effort resulted in 160 pages of newspaper references recorded in most cases as direct quotes and in some instances as notes to identify information of interest.

Also in the Marin County Library is the Anne T. Kent California History Room, which has an extensive archive of Marin County history, including publications and papers on Bolinas and Stinson Beach. This collection includes maps, planning documents, local histories, biographies, and newspaper clippings. Jocelyn Moss is the reference librarian for this collection, as well as the librarian for the Marin County Historical Society.

The Marin County Recorder's Office in the Civic Center has the county's land ownership records and maps and provided copies of survey and subdivision maps related to the project. Greta Brady of Corte Madera supplied a copy of one aerial photograph and the dates of four aerial surveys of Bolinas Lagoon and Stinson Beach. Her late husband, Ed Brady, and his associates, under the name of Aero Photographers, Inc., photographed Marin County from the air, beginning in 1954 (*Independent Journal* [IJ], July 14, 1962).

Residents of the Bolinas-Stinson Beach area, people with expertise in related subjects, and personnel from Golden Gate National Recreation Area, Corps of Engineers, and Marin County were interviewed by phone and in person.

3. FINDINGS

CHAPTER 3
FINDINGS

1. Prehistoric and historic natural events and processes have had and continue to have impacts on Bolinas Lagoon.

2. Human activities have resulted in significant changes in the way the lagoon functions. Historically, watershed disturbances have resulted in both acute and chronic sedimentation to the lagoon. Physical changes in the lagoon have affected its hydrology and the ability of tidal action to remove sediment.

3. Historical research located information on events, activities, processes, and situations that appear to be relevant to past and present conditions in Bolinas Lagoon:

    1. Natural Factors
        a. Earthquakes: In 1868 an earthquake did some damage in the town of Bolinas, however there is no record of any effect on sediment in the lagoon. The 1906 earthquake is reported to have caused bluffs west of the lagoon inlet to collapse and half of the lagoon's floor to drop approximately one foot. The 1989 Loma Prieta earthquake had minimal direct impact on the lagoon.
        b. Fires: Fires have swept through Marin at intervals throughout recorded history, and are understood to have done so long before European settlement. Major fires in the Bolinas watershed are recorded in 1890, 1904, 1923, and 1945, most of which burned through the ranchlands on the northern and eastern sides of the watershed.
        c. Storms: Major storms are reported to have caused extensive erosion and sediment build-up in the lagoon. Major storms that caused flooding and other damage in the watershed were

reported in 1861-62, 1871, 1872, 1874, 1878, 1879, 1894, 1921, 1925, 1955, 1964, 1978, and 1982.

d. Cliff and beach erosion: Historical accounts report erosion of the beach and bluffs west of the lagoon inlet during winter storms. In particular, the 1906 earthquake is reported to have shaken down the bluffs entirely. Since the late 1800s property owners have tried to prevent erosion of the beach and bluffs by building bulkheads and groins. Evidence indicates that at least some of the material eroded from the beach and bluffs is swept into the lagoon on incoming tides.

2. Hydrology
   a. Reclamation: Pine Gulch Creek Delta has built up partly through natural sediment deposition from the creek, and partly from reclamation activities from the 1870s onward. Several trout ponds were constructed in the delta in the early 1870s, and other parcels were reclaimed by diking in subsequent years. The construction of the Seadrift subdivision required filling approximately 56 acres of the lagoon in 1960. These changes have reduced the amount of sediment from Pine Gulch Creek that is carried out of the lagoon.
   b. Seadrift development: Seadrift was constructed in the late 1950s and early 1960s, and currently consists of about 306 homes surrounding an artificial lagoon. Major storms in the 1970s and 1980s have damaged the spit so that Marin County and individual homeowners have installed riprap and bulkheads on both the seaward and inland sides of the spit. Development of the spit has eliminated the potential for the spit to be breached by winter storms, which would “flush” sediments from Bolinas lagoon.
3. Watershed Factors
   a. Roads: Historic road development began in the watershed in the 1830s. By the 1860s a network of roads was in place throughout West Marin, however it was of poor quality. Better roads were laid in subsequent years but were subject to frequent washouts and landslides. In recent years Caltrans has dumped landslide debris along Highway 1 and placed fill adjacent to the lagoon. Logging and ranch roads often become sediment sources during the wet season. Construction and maintenance of trails, roads, and highways in the watershed have resulted in both acute and chronic inputs of sediment to the lagoon.
   b. Grazing, cultivation, and dairying: Mexican ranchers introduced cattle to the watershed, followed by American livestock. By the late 1800s ranching was a primary source of income in West Marin, and the growth of the dairy industry concentrated cattle in gulches along the lagoon. By 1920 ranches throughout the

county were reported to be overstocked and run-down. In the 1970s the development of the national parks resulted in the elimination of most grazing in West Marin. While grazing can result in erosion, especially around streambanks, cattle replicate the function of wildfires in preventing the forests from overgrowing the grasslands. Other forms of agriculture were fairly important in the watershed in the mid-to-late 1800s, with grain and potatoes being major crops, but dairying was the primary activity in the watershed into the first half of the 20th century.

c. Logging: Records of early logging practices do not support the theory that logging initiated the sedimentation of the lagoon; however records do indicate that approximately 15 million board feet were taken out of the watershed during the 1850s. Commercial timber production in the watershed continued into the 1870s and then died out slowly in favor of firewood. Logging for firewood shipped as many as 400 cords of wood per week from the lagoon in the 1870s and 1880s and then died off as well. In the post-war years some logging began again in the Olema area. A logging project on the Righetti parcel along Bolinas Ridge was cut short in 1969 when the county fire department filed suit. Debris flows resulting from the interrupted logging were enough to convince the court to cancel the project altogether. Subsequently the County Board of Supervisors banned all logging in West Marin.

d. Easkoot Creek: Despite anecdotal commentary that Easkoot Creek once drained into the ocean and was redirected, historic maps and oral history indicate that Easkoot Creek and Stinson Beach Creek have always drained, as a single stream, into Bolinas Lagoon.

e. Pine Gulch Creek: Pine Gulch Creek is the source of half the freshwater flowing into Bolinas Lagoon. Forty acres were reclaimed by the Grinter brothers in the delta during the 1870s. The creek has historically been diverted for fish ponds, gardens, reclamation, and residential usage.

f. Eucalyptus trees: Tradition has it that eucalyptus was first planted in the Olema Valley around 1867, and within the succeeding years spread by planting and natural growth to change the appearance of the Bolinas landscape.

g. Mining and oil drilling: Copper mining began in the watershed in the 1860s and lasted until the 1890s, with a brief final spurt in 1917-18. In 1900-1, oil and gas development was pursued on Bolinas Mesa but apparently died out, as no later reports have surfaced.

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4. RESULTS AND DISCUSSION

CHAPTER 4
RESULTS AND DISCUSSION

Bolinas Lagoon came into existence between 5,000 and 7,000 years ago, during the post-glacial sea-level rise (Wahrhaftig 1971). The 1,100-acre lagoon, approximately one mile wide and 3 1/2 miles long, is on the Marin County coast, 12 miles northwest of the Golden Gate. The lagoon has a watershed of 16.7 square miles (10,500 acres), with maximum dimensions of three miles wide by nine miles long (MCOSD 1996). The San Andreas Fault runs southeast to northwest through the Lagoon (Bergquist 1979). Its waters, mudflats, and marshes are biologically rich and diverse, supporting a myriad of invertebrate species, several fish species, including at one time coho salmon and steelhead trout, macroinvertebrates, shorebirds, wading birds and waterfowl (California Department of Fish and Game [CDFG] 1970). The lagoon, sandspit, and ocean beaches are recreational attractions that encouraged the development of tourist accommodations as early as 1870 (*Marin Journal* [MJ] November 12 1870). Over time, watershed activities, development projects, and natural processes and events have caused changes in the lagoon.

> Lagoons are temporary features along a coast. A generalized history of a lagoon may begin with a river mouth drowned by a rising sea level. Littoral drift creates a spit or barrier bar across the mouth so that its access to the ocean is restricted to a narrow inlet. The lagoon begin [sic] to fill with sediment and becomes a tidal flat with channels carrying much of the tidal water. The filling continues until the lagoon becomes a salt marsh as vegetation grows on the rising tidal flats. Eventually, the lagoon becomes a flat plain that may be eroded by waves lapping against its seaward edge. The life of a lagoon depends on the rate at which sediment is entrapped in the lagoon (Ritter 1970).

Bergquist (1978, as cited in MCOSD 1996) determined that prior to the early 1800s, there was a dynamic equilibrium in the lagoon's depth and configuration, with sedimentation, tectonic subsidence, and sea level rise averaging out so that the lagoon's

tidal prism was fairly stable. His results also indicated that the lagoon was never a deepwater embayment and that over the long term it was predominantly intertidal mudflat and shallow subtidal habitat. Historical reports support these findings. The U.S. government's *Pacific Coast Pilot* for 1869 described Bolinas Lagoon as follows: "except for small crooked channels, [the Lagoon] is bare at low tides, and filled with small islets." The entrance to the lagoon at the sandspit was "but 100 yards wide . . . ." Twenty years later, the *Pilot* repeated the description, only to update it with a statement describing "a very contracted channel having only one foot upon its bar at low water" (*Pacific Coast Pilot* 1869, 1889). Both the Sierra Club and the Marin Conservation League used such data in their arguments against dredging and developing the lagoon as a recreational area in 1966.

Using data from various sources, Wetlands Research Associates, et al. (MCOSD 1996) estimated changes in the lagoon's tidal prism. From information in their text and Figure 5, the following changes were roughly calculated:

Year	Tidal Prism (million cubic ft)	Percent Change	Period (years)
1849	200		
1906	86	-57	57
earthquake	169*	+49	n/a
1939	145	-14	33
1968	125	-14	29
1988	97	-22	20
2000	80	-12	12

*The increase was actually greater than 50 million cubic feet due to secondary effects of shifting mudflats and greater wave erosion; Figure 5 indicates maybe 169 million per cubic feet (mcf).

Historical research for this study identified a number of factors, both natural and human-related, that have affected the lagoon over time. Obviously, all there is to know about each factor or even the identification of all possible factors was not possible. The report covers earthquakes, fires, storms, and cliff and beach erosion, reclamation and development that have affected the lagoon's hydrology, and watershed activities and related information.

4.1 Natural Factors

4.1.1 Earthquakes

Earthquakes have been part of the lagoon's history since its formation thousands of years ago. Native Californians recorded major events in oral tradition, and scientists are finding that this tradition is quite accurate. In Humboldt County, oral tradition tells of a tremendous earthquake that hit the region in the distant past and local geologists have substantiated this event with physical evidence (*Humboldt Times* [HT], April 14, 1855; Kroeber, 1976; Deborah Carver, personal communication).

With the San Andreas Fault running through Bolinas Lagoon, seismic activity in the area is not uncommon. Historical accounts of minor events were minimal, generally

limited to passing comments in the newspaper of slight shocks being felt now and then and no damage reported. However, in 1868 an earthquake caused considerable damage in San Francisco, including the loss of several lives. The *Marin County Journal* reported the event in Marin County.

> We have heard of no damage being done in the county except at Bolinas, where it is reported very severe at this point. The ground swayed to and fro like the swell of the sea and persons were obliged to cling to fences for support. Near Crane's Hotel the ground opened in several places and clouds of fine dust were ejected therefrom. The water in the creek was thrown in the air a distance of at least twenty feet. Nearly all the chimneys in the place were either thrown down or shattered. . . . Clocks were stopped, stoves overturned, and furniture thrown around in several houses. From all we can learn, the shock at Bolinas was more violent than at any other point along the coast . . . (MJ, October 24, 1868).

If the 1868 earthquake affected levels of sediment in Bolinas Lagoon, there is no record of it. However the effects of the April 18, 1906 earthquake are recorded both in the newspapers and by scientific investigators. The *Marin Journal* reported that an eye witness at Bolinas spoke of "gaps in the ground at that place which [were] over three feet in width." Another person reported that the steep bluffs at Bolinas existed no more, the quake having shaken them to the ground so that a person could easily walk from the beach to the high land (MJ, May 3, 1906). A "distinct fissure" opened in the ground from Bolinas to Tomales, and fences and trees on the westward side of this fissure were reported to have shifted northerly ten feet or more (MJ, May 3, 1906; May 10, 1906).

Impacts to the town of Bolinas were major. Professor Ebenezer Knowlton walked to the coast to check out the damage and concluded that the quake had its center at this place, noting that the shock itself was more severe in Bolinas than in San Francisco. He reported:

> Along the main street of the [sea]side, ocean shore hamlet of Bolinas, a dozen miles northwest of the Golden Gate, stand most of the houses, not far from half a hundred in number, and all frame. Of these about two-thirds were heaved, slid, tipped and shattered into uninhabitable condition. No fatality occurred . . . .
>
> Along the bay shore were seven buildings. Six of these went over or down. In the Flagstaff Inn the tipping of the house has thrown it so far east into the bay that one may sit along the upper edge of the parlor floor and fish in four feet of water along the opposite edge of the same room . . . .
>
> Back of the Steele place near the north end of the bay, the hillside started eastward toward the bay, bulged upward and cracked

> into several fissures from thirty to a hundred feet along by from five to eighteen inches wide.
>
> From this point nearly northerly extends a sort of windrow of earth fissures and tree breakings for ten miles nearly or quite to Olema. The great ocean bluffs along the south and west of the entrance to Bolinas harbor, some 165 feet high, crumbled and fell, crashing down upon the ocean beach and reducing the slope to half its former angle. Also the two bluffs along the stage road from the head of the bay to the town broke and fell from forty to sixty feet, completely blocking the stage road and driving the stage out along the upper bay beach.
>
> In the bay opposite the hillside on the Steele place, the bottom has risen into a long island, near which the bottom of the bay has sunk so that the water is now ten feet deep where muddy shoals formerly extended.
>
> Along this northerly line of greatest oscillation north of the bay, on the Biesler place, the barn moved fully twelve feet north from the end of a fence which had formerly joined it. On the same place, a slide came down the hillside, opening a spring which fills a four-inch pipe with its flow. . . . (MJ, May 10, 1906).

Geologist F. E. Matthes of the US Geological Survey examined the fault line, following it from a point near Redwood City, San Mateo County, to Mendocino County. He observed it in San Francisco, again at Bolinas, where he determined a "slip of about twelve feet," then northward to Tomales Bay and out into the ocean before striking the land again near Fort Ross (*San Francisco Chronicle* [SFC], May 27, 1906).

G. K. Gilbert photographed the lagoon in September 1906 and again the following spring (Bergquist 1979). The *Marin Journal* reported in May 1907 that Dr. Gilbert of the geological department at Washington, DC, had made several visits to Bolinas in the past year in the interest of the Carnegie Institute. He was preparing an exhaustive report on the 1906 earthquake and from his investigation at Bolinas had determined the "fall of the land on the north side of the rift, the dropping as it were, where it passes through the island in the bay, [to be] twelve and one-half inches . . . . " (MJ, May 2, 1907). Contemporary investigators concluded that Gilbert's twelve and one-half inch subsidence in the lagoon increased the tidal prism by 50,000,000 cubic feet and gave the lagoon a short-term new lease on life, after half a century of activities in the watershed (MCOSD 1996). Gilbert returned in the fall to verify a report that an uplift of about two feet on the ocean side of Bolinas had settled back to its normal condition. On comparing photographs taken after the quake with the current condition, he concluded that the "Clam Patch" had, indeed, subsided (MJ, Oct. 24, 1907).

Using Gilbert's photographs and photographs taken from the same points and under similar tide conditions in 1976 and 1977, Bergquist (1979) determined eight notable

changes in that seventy-year period, concluding that the lagoon's transition from a shallow embayment to a coastal plain was geologically very rapid. Gilbert's historical record has proven valuable in understanding the progression of changes in Bolinas Lagoon.

The Bolinas Lagoon damage report after the Loma Prieta earthquake in the fall of 1989 only told of ghost shrimp being pushed from their holes, as the mud was squished and all the clam and shrimp holes began squirting water (IJ, Oct. 18, 1989). Indirect benefits to the lagoon came later, when Caltrans was required to mitigate the damage it caused in disposing of one million cubic yards of dirt from a quake-caused slide and new roadway on Highway 1 south of Stinson Beach. The disposal covered 2 1/2 acres of ocean floor, and the Coastal Commission required mitigation for the damage. Eventually the commission accepted Caltrans' offer to remove an unused causeway between Highway 1 and the Seadrift subdivision and clean out 16,600 cubic yards of fill in an old garbage dump at the southeast end of the lagoon. According to Caltrans, the work would restore tidal action to 1.8 acres then covered by fill (IJ, Dec. 22, 1991, July 8, 1992).

4.1.2 Fires

Fire has been and will continue to be a significant factor on the California landscape. Vegetation patterns, forest stands, species associations, successional stages, stream conditions, and fish and wildlife habitats often are heavily influenced by fire. That influence can result from a major event, frequent localized events, or from the absence of fire. Lightning ignitions played a substantial part in creating the California landscape encountered by the first Euro-Americans, but indigenous burning was also very important in shaping that landscape in specific places. Until Henry Lewis' landmark paper, "Patterns of Indian Burning in California," published in 1973, the use of fire by native Californians often was regarded as accidents or done in ignorance. But as Lewis pointed out, indigenous burning was purposeful and specific (Lewis 1973). In his paper on Karuk tobacco, Harrington (1932) quoted an informant as follows:

> Our kind of people never used the plow, they never used to grub up the ground, they never used to sow anything, except tobacco. All that they used to do was to burn the brush at various places, so that some good things will grow up . . . they do not set fire for nothing, it is for something that they set fire for.

Papers in Blackburn and Anderson (1993) provide extensive evidence of a variety of land management practices employed by native Californians. They used fire to maintain prairies, travel corridors, gathering and sacred sites, resources for materials and food, and places of habitation and to manage for game. In some forested areas in northern California, the prehistoric landscape was generally more open than it is today. Encroachment of Douglas fir onto the prairies in Redwood National Park, for example, has resulted in significant loss of prairies and oak woodlands in the Bald Hills.

Gann's Prairie estimated to be 100 acres in 1890 was reduced to 15 to 20 acres by 1981 (Van Kirk 1997). This invasion is attributed to the cessation of burning by both native people and ranchers and to the removal of native herbivores and livestock, all of which kept the trees at bay.

How Coast Miwok burning affected the Bolinas Lagoon watershed and the lagoon itself and the extent to which those effects may have been evident are simply unknown. The mission system and Spanish and American settlement resulted in devastating impacts to the Coast Miwok, and ethnographers have been able to gather only minimal information about their lifeways before Euro-American contact. But even without information specific to the Coast Miwok, there is every reason to believe that the people of *bauli-n* and *olema-loke* employed fire as a management practice in the Bolinas Lagoon watershed. The contemporary effort to piece together a history of the lagoon should not discount the impact of indigenous burning, natural ignitions, and native herbivores on the precontact landscape, which was probably more open than it is today.

With the arrival of immigrant societies with all the accouterments of late 19th century civilization—livestock, logging, mining, roads—and little regard for the landscape, fires became annual occurrences in Marin County. These were not "controlled" burns ignited with a management objective; they were simply accidents. The editor of the *Marin County Tocsin* [MCT] observed in 1891:

> Fires on Tamalpais are becoming monotonous and it must be evident that there is terrible carelessness somewhere. We lived in this neighborhood twenty years without seeing a fire on the mountain. Then there was a big one and it has been followed by one or more every year thereafter. Precautions never before thought necessary have been taken but the fires recur as regularly as the summer season, so that the only marvel is that anything remains to be burned . . . . (MCT, July 4, 1891).

> Fire has, as usual, paid us its annual visit. Fire on the hills, fire in the valley, fire in our backyard . . . . Millions of cords of fine timber, thousands of acres of grain and grass have gone up in smoke, cattle sheds, barns and houses have been destroyed . . . . (MCT, July 11, 1891).

Four major fires—1890, 1904, 1923, and 1945—were recorded in the newspaper. Each burned areas in the Bolinas Lagoon watershed, with the Wilkins ranch at the head of the lagoon being hard hit by those fires. Popular accounts tend to dramatize fire, so the extent of impacts on vegetation and watershed values cannot be determined from these reports. However, it is noteworthy that substantial parts of the watershed burned on at least four occasions in the past century.

The October 1890 fire started in the chaparral on the ranch of Sam McCurdy. This ranch is on the north boundary of the Wilkins ranch, northeast of Woodville (Dogtown) and drains both into Olema Creek, which flows north to Tomales Bay, and into Pine Gulch, which goes south into Bolinas Lagoon. Spreading southward and eastward, the fire threatened to be "one of the most destructive fires that . . . ever swept over the mountain." The fire crossed the Bolinas and San Rafael Road, destroying eight bridges. All the feed on the Wilkins ranch was "licked up," and smoke was visible in San Rafael, with some reports that the flames could be seen at night. Two hundred men were called to fight the fire (MJ, October 30, 1890). A Bolinas eyewitness reported:

> As we write there is but one subject on the minds of the people of Bolinas. A terrible fire has been raging upon the hills and ranches since last Monday. It first made its appearance on Wilkins' ranch just above the Lewis residence, and it has spread over nine tenths of his ranch, leaving it one black waste. His last gulch south, the one where the patent gate is, is burned down to the bay. Capt. Bourne's gulch, where the old time buildings are, has been burned over to the foot of the hills, and so with his land further south where the trees were standing 'tis now black. The large field where he has year after year raised 50 tons of hay is so far saved from the flames, but all along in the woods a terrible fire is burning and as we write, in the upper part of the gulch above his nice dwelling, a fierce fire is ranging (visible from our window) and we can see no way by which human power can prevent its going to his buildings. Could we only have a good rain, it might be checked (MJ, October 30, 1890).

The Wilkins ranch is at the head of the lagoon and northeast of the Olema-Bolinas Road. The Wilkins Gulch drains directly into the lagoon; Capt. Bourne's Gulch enters the lagoon at the Audubon Canyon Ranch headquarters. The fire continued into late November, burning redwoods on the slopes of Tamalpais and grass ranges on Point Reyes ranches (MCT, November 22, 1890).

The 1904 fire began in September on Bolinas Ridge, rushing westward to again hit the McCurdy and Wilkins ranches. The *Marin Journal* gave this account:

> Flames Sweep Bolinas Ridge—Last Wednesday one of the most disastrous forest fires ever seen in this county commenced on the Bolinas ridge back of the property of Mrs. J. Hasbrouck. A northerly wind was blowing at the time and fanned by this, the flames rushed westward over the ridge to the McCurdy and Wilkins ranches. So rapidly did the flames run that they reached the bay shore twenty-five minutes after crossing the ridge. The great wooded canyons on these two ranches in an instant were transformed into roaring furnaces fed by a supply of giant oaks and redwoods. Swiftly

> running over this, the flames rushed across the pasture lands toward the bay. At the McCurdy ranch they came within forty feet of the barn before they were extinguished. . . . On the Bourne ranch the buildings were in much greater peril, as the heavy woods run down close to the barn, house, and outbuildings. So soon as the danger to the Bourne property was observed at Bolinas, a number of the men sprang into wagons and rushed around the bay. By their efforts alone was the property saved. . . .
>
> Sweeping over the Bourne ranch, the fire rushed across the Weeks, Morse and Stinson places and left not a blade of grass behind it. Pasture on all of the burned ranches has been completely destroyed and for the next two months at least the cattle will have to be fed on hay.
>
> The county road from the summit to Wilkins' gate is a wreck. Burning logs and tons of loose rock obstruct it, every bridge and culvert has been burned out. . . . Sweeping along the top of the ridge, the fire was equally destructive. . . . the fire ravaged wide and well-timbered country. First the wind would drive it towards Camp Taylor, then towards Pine Hill, and then into the Cascade Canyon. . . . It is difficult to estimate the damage done by the fire. Thousands of acres of pasture and timber have been destroyed, besides the buildings . . . . (MJ, September 15, 1904).

This fire burned over the northeastern side of the lagoon, from north of the Wilkins Ranch through the ranches of Bourne, Weeks, and Morse to the Stinson place at the southeastern end of the lagoon and from the lagoon's shores to the ridge. How intense the burn was in the canyons is unknown, but "not a blade of grass" remained on the prairies. Fall rains and new grass were on their way, and the ranchers anticipated feeding their stock for only a couple of months.

The next fire, identified as "Marin's Greatest," swept thousands of acres in the fall of 1923. It smoldered in the vicinity of Novato and Ignacio for a few days before strong north winds drove it south in a "destructive swath miles in width." The fire burned into Lucas Valley, to White's Hill, and up to Woodacre where it "licked through the thick growth of beautiful forest," destroying thirty summer homes there. In the Bolinas section, it reached a quarter of a mile beyond the Summit House to burn through Wilkins Gulch again. Arthur Bourne's house was ignited by flying embers, but the fire was extinguished. Pasture and woods in Lucas Valley and the Alpine Dam section were swept clean in the fire, "the greatest in the history of Marin county . . . . "(MJ, September 20, 1923). Rain relieved the situation before the end of the month, after more than "a hundred miles of territory" was burned, taking fences, pasture lands, and miles of "small timber growth" (MJ, September 27, 1923).

In the fall of 1945, the "worst fire in the history of Marin County," burned 17,000 acres, and 700 to 1,000 men fought to save dwellings and towns from the

conflagration. Although Fairfax and Stinson Beach were threatened, the main damage was suffered by "Marin's magnificent forests of redwoods and green, tree-covered hills." The Marin County Fire Department described the course of the fire as follows:

> . . . . starting at the head of Lagunitas canyon above the mill, it burned southwest to the Bolinas road, down the state highway from Olema to Bolinas, skipped the town of Bolinas, around Stinson Beach; from there to the north of Mt. Tamalpais, north up to and including Lake Alpine to Fairfax, and back to Woodacre and Forest Knolls . . . . (MJ, October 4, 1945).

This short description doesn't give much detail, but it appears that the northeast side of the lagoon was again burned, as the fire moved down the state highway from Olema to Stinson Beach. All four of these fires burned through Wilkins Gulch and, with the possible exception of the 1923 fire, along the southwestern face of Bolinas Ridge above the lagoon.

Accounts of the 1890 fire would have one believe that all the timber on the Wilkins and Bourne ranches was destroyed, but fourteen years later at the time of the 1904 fire, the "great wooded canyons" with "giant oaks and redwoods" and "heavy woods" on these ranches were again on fire. Perhaps these "disastrous fires" were not disasters but just moderate cleansing burns that forests and prairies need now and then. Descriptions indicate that the oaks and redwoods were restricted to the canyons and that open grazing ranges covered the slopes between canyons. The country was obviously more open, as grazing and fire kept the trees in the gulches and maintained the prairies in between. Photographs taken in 2000, when compared to ones taken in 1965 and 1970, clearly show significant encroachment of Douglas fir onto to the prairies, signaling their demise without intervention.

The slopes off Bolinas Ridge are drained by eight gulches that discharge directly into the Bay—Wilkins, Pike County, Thompson, Bourne (Audubon Canyon), Weeks, Morse, McKennon, and Stinson. They are short, steep, and ephemeral. During periods of high water, these gulches would carry fire-related sediments into the lagoon. Removal would depend on adequate tidal circulation and flushing capability.

4.1.3 Storms

Bolinas Lagoon felt the effects of major storms before human-caused disturbances in its watershed, but once those disturbances (for example, roads, development, logging, and agriculture) began, the effects were magnified. Although this report could in no way quantify those impacts, descriptions in the historical record indicate that substantial, probably long-term, impacts have resulted from major storms and to a lesser extent from average rainy seasons.

The Marin newspaper did not record the storm of 1861-1862 but did make reference to it at the time of a December 1871 storm (MJ, December 23, 1871). Northern

California and "throughout" the state were hard hit by a storm that was described as the "most extraordinary flood" ever experienced by white men since settlement (HT, December 21, 1861). On the Trinity River in the Hoopa Valley, Fort Gaston recorded almost 100 inches of rain in a 50-day period between late December 1861 and early February 1862 (HT, February 22, 1862).

A December 1871 storm in Marin County caused damage to roads and bridges estimated at $50,000; the dams on Lagunitas Creek at the paper mill and the powder mill were carried away, and roads, including the one from Sausalito to Bolinas, were described as "horrible" (MJ, December 30, 1871). A January 1872 headline read: "Rain! Rain! Rain! (MJ, January 6, 1872). A "severe storm" in late 1874, described as a freshet, caused Bolinas Creek (Pine Gulch) to overflow its banks, taking out Stephen McGovern's house and destroying his trout ponds (MJ, December 3, 1874). Similar reports of moderate, short-duration storms were regularly recorded in the newspapers, generally in December, January, February, and March. Some of the reports quoted below are not specific to Bolinas but are relevant because they describe slides, streams changes, and erosion in adjacent areas.

> Olema Items— . . . As we write, the rain is pouring down in torrents. Our roads are almost impassable. Being built along steep hillsides, the earth is constantly sliding in and in some instances the roadbed itself is included in the slide. Then the rapidly formed streams, changing their course by being clogged with debris, cut and destroy the heretofore supposed solid road on the land and a literal slough is formed. Heavy caves all along Olema creek have widened the bed fully three times its former width and village lots are going toward the bay, while every day house moving is in order to preserve them from the general destruction (MJ, February 21, 1878).
>
> Damage by Storm—No one remaining in San Rafael can form any just idea of the effect of the rains of this season on the coast line of the county. The amount of rainfall has been by no means unprecedented, but the character of the storms and the ugly and destructive marks they have left, are not only without parallel within the memory of the oldest resident, but they are proven by the face of the country to have been unequaled for a great many years, if ever before. . . .
>
> The hillsides in Nicasio and Tomales are washed so that they resemble gridirons. They will have to be plowed again and reseeded because in their present furrowed and gullied state the reaper could not be worked in them.
>
> But the exceptional and important item of loss is the damage to land. On one dairy ranch of less than 1,000 acres in Tomales, there have been one hundred slides. But the worst feature is the gullies that have been made. Many of these, which a child might

> formerly have stepped over, are now from twenty to fifty feet wide, and of frightful depth. This is irreparable damage. . . . The injury will grow greater with every soaking rain.
>
> Much of this loss was caused by a cloud burst, which occurred on Sunday, two or three weeks ago. The shower lasted less than twenty minutes, yet over three inches of rain fell. On the broad sides of hills, the water was six inches deep, not in places, but everywhere and the ravines, where centered the flood from different directions, were washed out bodily and turned into these yawning and unsightly chasms (MJ, March 7, 1878).
>
> Olema—The storm of last week was by far the heaviest of the season. It rained without a moment's intermission for fully fifty hours. . . . Olema Creek, which in 1865 was a mere rivulet and as late as 1870, a small brook, is now like a river, its banks varying from ten to fifteen feet in height and almost perpendicular, while the bed has more than quadrupled in width. . . . By reason of these washouts along the creek and the upland, the marsh and delta on the Howard ranch are filling in at the rate of one to two feet each year (MJ, March 13, 1879).
>
> The Storm . . . Heavy Landslide at Bolinas. . . . On Monday James Hayes brought information from Bolinas to the effect that a heavy and serious landslide had occurred at that place on Friday morning at 2 o'clock in the vicinity of the point, doing a vast amount of damage. Mr. A'Dean's house was completely wrecked, and also the house of Albert Sayers. . . . Mr. Wheeler's house was carried forty feet by the slide and now stands in the public highway. The barn of Mr. Stump was badly wrecked and Mr. Sheagreen's house badly damaged. The roads between San Rafael and Bolinas being practically impassable, Hayes was obliged to bring the mail on horseback. . . . (MJ, January 25, 1894).

The Christmas storm of 1921 resulted in thousands of dollars in damage. Scores of trees were uprooted, roofs were blown from buildings, poles and wires were torn down, and windows were broken. Flooding caused considerable damage (IJ, December 29, 1921). Photographs of this event, courtesy of the Belvedere Land Company, appeared in the Marin Magazine Section of the *Independent Journal* on Christmas Eve, 1955.

A storm in February 1925, described as the "heaviest wind and rain storm in years," caused damage in Marin County estimated at over $330,000. Heavy rains caused washouts and landslides, delaying for several days Northwestern Pacific Railroad service and causing streams to overflow and drainpipes and sewers to become clogged. The road from Bolinas to Willow Camp (Stinson Beach) was under "water and slush"

(MJ, February 12, 1925). Damage at Bolinas was minimal, although a high tide and four-inch rain flooded the Presbyterian manse (MJ, February 19, 1925).

The 100-year storms, well remembered by all living in northern California at the time, occurred in December 1955 and 1964. Even people who came later have heard the stories and seen the photographs so often that they, too, "recall" the devastation of those storms. In Humboldt County entire communities were washed from the face of the earth, never to reappear. The impacts resulting from intensive post-World War II logging were felt in 1955, which some consider to have actually been a more intense storm than the 1964 one, but another decade of logging caused unparalleled damage from the latter event.

The *Independent Journal* accounts of the 1955 storm were extensive and included photographs. The first report appeared on December 19, with headlines reading: "Worst Storm in 30 Years Hits Here; Rampaging Winds Wreak Havoc; High Water Inundates Many Areas." A ten-inch, weekend rainfall caused Lake Lagunitas and Phoenix Lake to spill over their dams; Marin County took to "rowboats and hip boots"; swollen creeks left their banks; slides stopped traffic; and clogged drains flooded streets (IJ, December 19, 20, 21, and 22, 1955). Before the end of the week, the widespread storm in northern California, western Oregon, and Nevada resulted in twelve deaths, eight flooded towns, thousands homeless, and millions of dollars in damage. Governor Goodwin Knight declared a state of emergency (IJ, December 23, 1955). Rainfall totals for the season were 38.21 inches at Lake Lagunitas, 35.40 at Phoenix Lake, 41.19 at Kent Lake, and 44.14 at Woodacre (IJ, December 27, 1955). For northern California the death toll was reported at 34, and another 35 were reported missing on December 28 (IJ, December 28, 1955).

Damage in the Bolinas area was generally to roads. Ten-year resident Hurford Sharon said the storm was "one of the worst" he had seen at Bolinas (IJ, December 19, 1955).

> A slide closed the road at the end of Bolinas Lagoon. . . . Streets in Bolinas were partly flooded (IJ, December 19, 1955).
>
> The road from Stinson Beach to Bolinas was still closed this noon as state highway road crews worked to clear dirt, rocks, and debris that blocked the highway at several points just north of Stinson Beach. The only way to get from Stinson to Bolinas today was via Olema. The slides started yesterday (IJ, December 21, 1955).
>
> Highway 1 near Stinson Beach was opened to one-way traffic as crews dug out the road from its mud making . . . . [photo] (IJ, December 22, 1955).

This storm caused minor damage at Bolinas, but soils were saturated and when the area was hit with a severe storm in January 1956, major damage resulted. The word

often used to describe this storm and its effects was "mud," and tons of it. A photograph in the January 16 issue of the *Independent Journal* is captioned "Bolinas Home Destroyed" and tells of "slithering mud, a floating garage and its occupant—an automobile" resulting in the destruction of a home on Brighton Avenue. Isolated by "mud slides," Bolinas and Stinson Beach, hardest hit bay area communities, were digging out from an "onslaught of mud" resulting from a weekend storm in mid-January. Damage in Bolinas alone was estimated at $125,000. The streets of Bolinas were described as "rivers of mud." Rescue convoys and airmen from Hamilton Field were dispatched to the scene. Hamilton Air Force Base installation engineer Lt. Col. Edward Fries exclaimed, "Mud poured off the Bolinas hills like rivers of molasses" (IJ, January 16, 1956).

State Highway 1 was closed by slides. In Bolinas four homes were entirely demolished, at least twenty suffered more than major damage, and an untold number had some degree of damage. James Bourne's house was struck by a mud slide, moved off its foundation through the front yard, and ended its 60-foot slide in the middle of Wharf Road. The McComish house was pushed 100 feet and badly smashed as a slope gave way behind it. The hill on which Bolinas is built was described as saturated with water, causing the whole hill to move. The Air Force crew dug trenches around homes in an effort to divert the rivers of mud pouring off the hills and shoveled the "muck" from the streets (IJ, January 16, 1956).

The Division of Highway sent out a timber crew to deal with a huge slide near Bolinas. Fourteen trees came down into the roadway and were found standing in a "mountain of ooze." The timber crew had to cut and haul away the trees before the bulldozer could plow away the mud. One highway crew had to work constantly just north of Bolinas, where a "steady flow of mud" kept the road closed near the Oyster House restaurant [near Bolinas Y]. Oozing mud was blamed for moving a house 40 feet from its foundation into Main street (IJ, January 16, 1956). "Beach Towns Dig Bravely Out" was the headline for the January 17th story. Damage in Bolinas was estimated $135,000 and that in Stinson Beach at $165,000, representing a total that was more than half the estimated damage for all of Marin County from the storms and floods (IJ, January 17, 1956).

The newspaper accounts of the 1964 storm began on December 21 with reports of power failures and minor flooding (IJ, December 21, 1964). However, the following day's account reported heavy rainfall and thousands of people fleeing coastal flooding (IJ, December 22, 1964). Marin entered the fifth day of the storm with 12 inches of rainfall, and mud was beginning to "ooze" off steep hillsides (IJ, December 23, 1964). Things eased up a bit over Christmas, but rain continued to fall and soils became saturated. New Year's Day was the 15th consecutive day of measurable rain in Marin County, bringing December's total to 12.22 inches, the heaviest since 1955, when 22.88 inches fell during that month. Of that 12.22 inches, 11.88 fell during the last fourteen days of the month (IJ, December 31, 1964). The rains returned in early January. The Marin Municipal Water District reported storing two billion gallons of

runoff in five days, and its lakes were flowing over their spillways (IJ, January 5, 1965). Mud slides, downed trees, high tides, and flooding plagued the county. After three weeks of wind and rain, cleanup crews finally were able to get ahead of what some experts called the "thousand-year storm" (IJ, January 8, 1965).

The January and February storms of 1978 resulted in damage in Stinson Beach and Bolinas, not so much from water and mud coming from the hillsides, but from high tides and heavy surfs (IJ, January 11, 1978, February 7, 1978). A January 1982 storm caused several deaths, flooding, and damage estimated at $100 million. Homes were destroyed in the San Rafael area, and West Marin communities, including Bolinas and Stinson Beach, were isolated by mud, high water, rock slides, and washed out roads. Bolinas Lagoon flooded the highway between Stinson Beach and the Bolinas "Y," leaving the pavement covered with debris. Rainfalls were recordbreaking (IJ, January 5, 1982, January 6, 1982).

The storms of December 1955 and January 1956 resulted in significant damage in the Bolinas area, as "rivers of mud" poured "off the hills" onto the Bolinas community and into Bolinas Lagoon. It is interesting that the accounts of the January 1894 and January 1956 storms include similar descriptions of houses being moved off their foundations and into the streets of Bolinas. Land slides, flooding, and mud always were reported whenever Marin County experienced storms, even moderate ones.

4.1.4 Cliff and Beach Erosion

> The sediment is coming in part from erosion of the surrounding watershed. A large part, however, probably half or more, comes ultimately from erosion of seacliffs and sea floor on the south and west sides of Bolinas Mesa. Cliffs on the west side of the mesa are retreating at a maximum rate of three feet per year and those on the south side at between one and two feet per year, measured over nearly a century. This sediment coming from the sea is probably responsible for the Stinson Beach spit that encloses the lagoon and for the large tidal delta built into the lagoon from the head of the inlet (Wahrhaftig 1971).
>
> The tidal inlet to the lagoon is between the western extremity of Seadrift [the sandspit] and a high cliff, which is part of the town of Bolinas. The inlet is bounded by sandy beaches; however, during winter storms the western beach often is entirely eroded away, leaving bedrock abutting the high cliff. During periods of calm the beach is reestablished . . . . (Ritter 1970).

Historical accounts of these processes are limited, but several references were located, some of which go back to the 1870s.

> Bolinas— . . . Approaching this place as we did, via Olema, there are two neat little villages, viz., Woodville and Upper Bolinas, before this old shipping point is reached. Nature was in a kindly mood when she shaped the site for Bolinas. A bluff, nearly two hundred feet high, passes round the site in the form of a crescent, completely sheltering the town. Bolinas is situated on a beautiful bay of the same name. . . . The little settlement is sheltered and hidden by the horn-shaped point from the open sea, so that though you can hear the ceaseless roar of its breakers on the bar you cannot see their white foam nor feel the ocean breeze (MJ, May 1, 1873).

The winter of 1878 was one of intense rainfall and high winds, resulting in a "great deal of damage" in Marin County (MJ, February 21, 1878). Bolinas clam diggers were dismayed when they viewed the "demoralized clam beach," located at the base of the Mesa cliffs, after this intense winter. Residents had thought that the position of the bar had changed somewhat and that the "sand from the beach and [sand] washed up by the sea" was going to prevent the ships from passing out of the lagoon. Happily, there was little trouble, and navigation resumed (MJ, March 28, 1878).

After enjoying refreshment at the Bay View Hotel in Bolinas, the visiting *Marin Journal* editor found the weather nice enough in January to take a look around.

> We took a stroll on the old familiar beach, the same, and yet not the same, for the ocean is ever at work making imperceptible changes; and watched the surf roll in at our feet with the same fascination that it had for us years ago, and we felt that it was good for us to revisit these scenes of our early life. . . . (MJ, January 23, 1879).

As a result of the 1906 earthquake, the newspaper reported that the "steep bluffs at Bolinas are said to exist no more. The earthquake shook them down and one can easily walk from the beach to the high land" (MJ, May 3, 1906). Professor Knowlton substantiated the report.

> The great ocean bluffs along the south and west of the entrance to Bolinas harbor, some 165 feet high, crumbled and fell, crashing down upon the ocean beach and reducing the slope to half its former angle (MJ, May 10, 1906).

The earthquake apparently caused an "up raise" of about two feet on the ocean side at Bolinas, but, when Dr. Gilbert compared photographs taken after the earthquake with ones taken in October 1907, he verified the subsidence of the Clam Patch. The newspaper suggested that both the Bolinas clam diggers and the scientists at Berkeley had "another problem to solve" (MJ, October 24, 1907).

No references were located regarding the construction of bulkheads on the Bolinas beach until 1914. That reference, however, indicated that even prior to that date, residents had built bulkheads to protect their property. But these structures were at the mercy of the very elements they were intended to withstand—storms with heavy surfs and damaging waves and high tides. Bulkheads apparently came and went, as did the beach and cliffs above.

> The people of Bolinas will improve its waterfront and protect its beach by a united action on the part of property owners. During the high tides and at time of storms, much damage has been done to the beach, and the bulkheads built by property owners have been destroyed so that private property has been damaged and the beach made practically worthless. . . .
>
> At medium low tide the sand comes in as of old, but it doesn't stay put. Hence the adoption of the European method of putting in groins or bulkheads running out into the ocean at right angles to the present bulkhead, hoping to hold the sand in position, a common method on the coast of England. . . . (MJ, June 25, 1914).

By October, the system of groins on the beach was proving to be a success. The newspaper reported that the sand had already filled up almost to the top of the bulkheads, and better results were expected with a big storm. Local people footed the bill to the tune of $1,200 (MJ, October 28, 1914).

In "Early Bolinas Memories," Mabel Dodge Bullis said that her father, George Dodge, surveyed and subdivided F. C. Waterhouse's Granda Vista Subdivision. She gave the date as 1889 or 1890, but the map was actually dated August 1882 (Subdivisions Book 1 Page 19). In any event, Dodge "fell in love" with Bolinas and brought Mable and her mother to see the place, the family eventually building a house on Terrace Avenue on the "cliff above the beach." She wrote:

> Then came the year 1943, with a winter of unusually heavy storms and high tides combined, causing great waves to beat mercilessly against the bulkhead on the beach below the house.
>
> Gradually the bulkhead gave way—the cliff washed out ever closer to the foundations, and finally undermined one corner of the building. We decided it could not be saved, and removed as many things as we could from it. . . . The house was eventually sold for one hundred dollars to a man who tore it down for the lumber. And now, even the land has washed away. . . . (Bullis 1974).

A photograph in "Memories" shows the Dodge house and several others sitting above the beach. At the point where the flat sand met the vegetated slope, there was a solid wooden fence of posts and horizontal boards. Perhaps there was rock behind it, but, in any case, this "bulkhead" washed away and, by 1974, even the land was gone.

A storm and high tides in January 1978 caused trouble for one Bolinas property owner at the end of Brighton Road.

> Storm Brings Mixed Blessing; More Rain But Flood Fears Rise—A gale-whipped weekend storm brought mixed blessing to Marin and the Redwood Empire. Water rationing officially ended. . . . Fierce waves and high tides gnawed Sunday toward a waterfront home in Bolinas. . . . Contractors bulldozed and trucks worked late into the night Sunday to repair a washed out bulkhead near the Earl Thompson home at the end of Brighton Road in Bolinas. . . .
>
> Saturday, savage waves propelled by high winds and 6.6 foot tides began tearing loose a 100-foot stretch of old wooden bulkhead near the home and washed away a small geodesic dome. . . . The waves gnawed to within 50 feet of the main house.
>
> Early-risers attending the Bolinas Rod and Boat Club breakfast Sunday watched as the incoming tide carried debris from the seawall past the clubhouse windows.
>
> Throughout Sunday, Ghilotti Brothers trucks carried boulders through Bolinas to dump into the breach created in the seawall and to replace fill that had washed away. A pile of sandbags stands at the end of Brighton Avenue, ready to throw into the breach if needed at the high tide expected this morning. . . .
>
> Bolinas residents reported that Sunday morning's high tide came to within inches of the doorsteps of homes along Wharf Road (IJ, January 9, 1978).

Wave damage to the bulkhead and to the Thompson property was estimated at $110,000. Stinson Beach suffered wave and high-tide damage estimated at $100,000, after 12-foot combers ripped the shoreline (IJ, January 11, 1978). Rain, wind, and heavy surfs pounded Marin's western coast well into March. Three houses perched atop a "crumbling cliff" at Bolinas could not be saved.

> Weakened by heavy rains and pounding surf, whole blocks of the cliff have slumped up to 10 feet in recent weeks, pulling a chimney from a house, buckling a floor, cracking a roof and destroying fences. . . . In the past two months, . . . a huge crack has chewed into the cliff behind 26, 34, and 38 Ocean Ave. and these three homes are starting to tilt into the slumped area which has dropped about 10 feet. . . . Author Earl Thompson . . . borrowed $15,000 to erect his own seawall . . . (IJ, March 15, 1978).

Rain, wind, and high tides in January 1982 prompted formation of the Bolinas Beach and Cliff Association, as local residents attempted to find ways of dealing with cliff and beach erosion:

> Bolinas Beach Fate a Cliffhanger—Breaker by breaker, year by year, the waves of Bolinas are eating away the beach sands and nibbling at the cliffs and local residents are wondering if the cliffs can withstand the onslaught of another winter. . . .
>
> Historically beach sands have had to be courted in Bolinas. . . . Winter storms wash them away and spring and summer tides redeposit them. To help that natural process, people have built rock groins—low walls perpendicular to the shore that extend into the water—to trap sand.
>
> The most important of these groins, the Keystone, was constructed 80 to 100 years ago . . . but began to break up in big storms in the winter of 1977-78. The beach has been eroding steadily since.
>
> With a narrower beach, winter waves beat against the houses lining the shore and against the cliffs. To protect the houses, some of the property owners along the beach both east and west of Brighton Ave. built bulkhead—seawalls of wood or rock. It's only a matter of time, Keller said [chairman of Bolinas Beach and Cliff Association] before the toes of the cliffs are undercut and a house or two falls into the surf.
>
> The Bolinas Beach and Cliff Association was founded in the aftermath of the January 1982 storms and floods to do what it could to protect the shore. A survey showed that 2,200 feet of beach between the mouth of Bolinas Lagoon and an area called the Clam Patch—shallow water below Ocean Avenue—needed protection.
>
> The Association figured that a two-phase project might do the trick: rebuilding the 250-foot Keystone and bringing tons of large boulders that would be placed parallel to the base of the cliff and extend up to 10 feet toward the water. . . . By June it could be finished . . . . (IJ, December 16, 1983).

These accounts indicate that beach and cliff erosion below Bolinas Mesa is an ongoing process with which local residents have always had to contend. The beach comes and goes, and when it goes, the lagoon is a recipient of material. The January 9, 1978, reference is particularly telling. As the bulkhead at the end of Brighton Road was disintegrating, people eating breakfast at the Rod and Boat Club watched the incoming tide carry the debris past the clubhouse windows into the lagoon. And scientific investigations provide the hard data. Preliminary studies conducted by Ritter (1970) included an analysis of parent-material origins of the lagoon's sediments. Thirty-three percent of the sediments contained Monterey Shale fragments, the sources of which are Pine Gulch Creek and the Bolinas Cliffs. Based on data that the cliffs are retreating 2.3 feet per year, Helley (in Ritter 1970) estimated that the 120-foot-high 7,000-foot-long cliffs could have supplied 2,400,000 cubic yards of Monterey Shale to the lagoon during a 100-year period.

> This volume, spread evenly over the 1,100-acre lagoon, would have caused 0.45 yard of vertical aggradation. Since even spreading is unlikely, it is probable that greater amounts of local aggradation have occurred over the last 100 years. The presence in lagoonal sediments of shell fragments of organisms that presently live near the Bolinas Cliffs strengthens the hypothesis that the major source of the Monterey Shale in the lagoon is the rapidly eroding cliffs (Ritter 1970).

4.2 HYDROLOGY

> A coastal lagoon is formed when a river mouth or similar feature is drowned by rising sea level. Littoral drift creates a sandspit or barrier bar across the mouth of the drowned valley such that a narrow inlet is formed. Whereas sediments may enter a lagoon from numerous sources including rivers, creeks, flood currents, wind, and erosion along the shoreline and watershed, <u>the only agent for removing sediments from a lagoon is the ebb current</u>. Hence, in most situations, the rate of overall sediment accumulation depends on the rates at which the sediment is supplied and removed by the ebb current. Once sediment enters a lagoon it is distributed primarily by tidal currents. Tidal current velocity largely controls sediment deposition and erosion. Deposition occurs at zones of low current velocity and wave action (MCOSD 1996). (Emphasis added.)

For the ebbtide to remove sediment, it must have access to the sediment and sufficient velocity to carry it out of the inlet. Good circulation, then, would be an important element in sediment removal. Historical research identified two factors that may be impairing circulation in Bolinas Lagoon— reclamation of lands along the west side of the lagoon at Pine Gulch and the Seadrift development on the sandspit.

4.2.1 Reclamation

Pine Gulch Creek is considered to be a major contributor of sediment to Bolinas Lagoon, and the large delta formed at its mouth affects tidal circulation. It protects areas of mudflats from wave action and it constricts the tidal channel to the west side of Kent Island so that the ebb tide can no longer access the upper end of the lagoon (MCOSD 1996).

Historical research revealed that the delta at Pine Gulch is not only the result of sediment transport and deposition from the watershed but also reclamation activities that began in the 1870s. Once “made land” was purposefully created, it continued to grow both in height and area. And as it grew, it became a stable permanent feature, replete with trees, constantly intercepting more material and preventing tidal circulation.

Associated with the reclamation activity at Pine Gulch was the construction of trout ponds run by Stephen McGovern and brothers John and George Grinter. The first mention of the trout ponds appeared in a "Letter from Nicasio," published in the newspaper on June 19, 1873. The writer recalled an earlier visit in October 1872, remarking that the 2,000 hungry trout had increased tenfold in size during the intervening months. The writer also said that George Grinter intended to devote his attention to fishing, if the business were profitable and that it was "almost impossible to estimate the value of the Grinter property" (MJ, June 15, 1873). It is unclear just what this statement meant, but an article in the April 16, 1874, *Journal* described more fully what the Grinter property was.

> The Grinter Brothers, John and George, of Bolinas, have illustrated what may be done with our tide and overflowed lands by a little experiment at the head of Bolinas Bay. A fresh water creek [Pine Gulch] flows into the bay. The Grinter boys built a dike along the edge of the salt water and flooded the land from the fresh stream. After soaking it well, the water was drained off and the land left to the sun's influences for a time. This simple operation was repeated from time to time until the land was not only reclaimed, but presented a rich and generous soil that is perhaps not surpassed in the county. While creating this new territory, the Messrs. Grinter left a few low places for fish ponds and last spring they introduced some speckled trout which have grown and thriven wonderfully until they are now very abundant. These beauties are all sizes, from 12 inches down, and those that were put in as tiny ones last spring show a growth of six or seven inches within the year.

Thomas Barfield suggested that not only did the Grinter brothers dike the land, they also reclaimed the marshland by "diverting Gregorio's (Pine Gulch or Bolinas) creek" (Gilroy 1970). Making land by moving creeks from place to place behind a dike was apparently common, as ranchers on Humboldt Bay did the same.

Meanwhile, people enjoyed the fishing at the McGovern ponds, including Governor Pacheco, who, in lieu of payment to McGovern, contributed toward a melodeon for the nearby school (MJ, May 28, 1874). Unfortunately, in late November 1874 McGovern's fish ponds, containing 10,000 trout, were destroyed when Pine Gulch Creek swept away ponds, house, and garden (MJ, December 3, 1874). The Grinter brothers fared better. Despite water running from the outside over the banks of one pond and initial fears that the fish had escaped, later investigation found that but few were lost (MJ, December 17, 1874). A note the following spring reported that Mr. McGovern was recuperating and his ponds on higher ground were doing well. The same article revealed the extent of the Grinter reclamation activities.

> The Grinter Brothers have reclaimed about 40 acres of tide land on Bolinas Bay. Their system is very simple. They throw up a

> dike on the bay line of the land to be reclaimed and each winter the fresh water streams bring on a good coating of soil. A good quality of grass is produced on it, which is improved every year as the salt is decreased (MJ, May 6, 1875).
>
> The Grinter Brothers of Bolinas are just completing a large trout pond on the edge of the Bay. It is 100x180 feet and about five feet deep. The bottom is composed of clean gravel, well adapted to the fish. The Grinters are gradually increasing their trout stock to an important interest and their work of reclaiming the marshland bordering on Bolinas Bay goes quietly on meanwhile. Large areas of very productive soil are annually reclaimed from the dominion of the sea (MJ, October 21, 1875).

The county map prepared by Hiram Austin in 1873 does not show the reclaimed land, but George Dodge's 1892 map does, as does the Walkup and Son map of 1911. The Dodge map shows "bunch grass" symbols and George Grinter's name on a piece of land that stretches from just south of the northwest corner of Pepper (Kent) Island to just north of the outlet of Pine Gulch. It is denoted as 39 acres. Adjacent to this property, jutting out into the lagoon, is a 34-acre piece of land belonging to the Strain family. The strip continues from Grinter's land to the head of the lagoon. More symbols appear at the outlet of Wilkins Gulch and at an indentation between Wilkins and Pike County Gulch and at the outlets of Thompson Gulch and Bourne Gulch. The 1911 map shows Grinter's land, Strain's piece, and bunch grass symbols around the head of the lagoon and at the two indentations at the lagoon's northeast shore.

Using Pine Gulch Creek in the 1870s to reclaim tidal land along the western side of Bolinas Lagoon initiated a process that impairs circulation and encourages sediment accumulation. Once established, the reclaimed lands continue to grow by catching material and preventing the flushing action of tides and waves required for removing sediments from the upper end of the lagoon.

4.2.2 Seadrift Development

According to the Bolinas Lagoon Management Plan Update, prepared by Wetlands Research Associates, et al. (MCOSD 1996), the construction of the Seadrift subdivision on the sandspit and the dredging of the artificial lagoon filled about 56 acres of the lagoon. This filling constricted circulation at the southeastern end of the lagoon, but it had secondary effects, as well. Houses along the sandspit and subsequent construction of protective structures on the ocean side prevent wave overwash and the breaching of the spit. Early accounts, as casual and infrequent as they are, indicate that high tides and heavy surfs were periodic events important to the lagoon's hydrologic function.

High tides periodically washed over the road along the eastern side of the lagoon, interrupting travel and ruining the road surface. Even after steps were taken to move

the road farther inland, it was still subject to "surface washing" (MJ, May 6, 1875, July 1, 1880). In fact, as late as 1915, high tides still meant detours away from the eastside road (MJ, April 22, 1915). The December 1921 storm caused repairs to be made on the bulkhead along the Stinson Beach-Bolinas road after heavy seas wrecked a long section of the seawall (MJ, December 29, 1921).

High tides also inundated the western side of the lagoon. Grinter's fish ponds broke open on more than one occasion by the "force of extraordinary high tides" (MJ, May 4, 1876). A big storm in January 1878 caused the roads on both sides of the lagoon to be washed away, and so high was the wash that Mr. McKennan's garden and yard at the southeastern end of the lagoon received a "stock of drift wood" (MJ, January 24, 1878). The account of this event, which occurred on January 15, 1878, states that fences in front of the McKennan, Bowen [Bourne?], and Weeks houses were destroyed and the yards filled with rock, sand, and timbers. So intense were the waves that the "sand bar known as Easkoot's beach was washed away and the breakers dashed in fury into the door yards" (MJ, January 24, 1878). (Emphasis added.)

Mr. Easkoot's house still stands above the east side of Highway 1 across from Calle Del Pinos and some distance from the ocean. This reference indicates that the sandspit broke open, allowing breakers to dash in fury into the door yards of residences along the northeastern side of the lagoon at least as far north as Weeks Gulch. Not only water, but "rock, sand, and timbers" were deposited in these yards. The water was so high that it was "flowing over and along the roadway" in front of Mr. Ingram's house, located near the head of the lagoon on the western side.

As a result of this event, the shoreline at the southeastern corner of the lagoon was considerably altered.

> Judge Almy tells us that he was astonished at the changes made in Bolinas Bay by the storms and high tides of last winter. The contour of the beach on the east side is so changed that he could only tell where he was by a clump of trees. Twenty-three years ago the Judge built a boat in front of what is now the Stinson ranch and the place remained unchanged up to this winter, but it is now like a strange place (MJ, May 2, 1878).

Thomas Barfield (1984) said that during the very violent winter of 1913, "water went over the sandspit in profusion." The newspaper account of that storm was found in the *Marin Journal*, December 25, 1913.

> Heavy Storm Sweeps Marin County—About four o'clock Sunday morning, the storm-god broke the chains which held him down and raged until the same hour the next morning, sweeping across all of Marin County with downpour of water and great gushes of wind. . . . Out of San Francisco bay, he caused the waves to

> heave, tumble and fall, making the sailor and mariner seek the safety of port. . . .

In his "West County Diary," John Grissim talked about a Stinson Beach of the past, the school, and a day in 1941, when teacher Mildred Sadler called her 13 children to class with a whistle.

> Standing on the school house porch, Mildred could look over the low dunes of what is now Seadrift and see the waves breaking on the beach. She could see the spot in the dunes where during many winters the ocean would cut through the sand and pour into the Bolinas Lagoon, cutting the spit off from the land (Grissim 1988).

G. K. Gilbert's photographs of the lagoon taken after the 1906 earthquake include ones of the sandspit, showing washover fans that were formed by waves overtopping the spit (Bergquist 1979). Because the portion of the spit to the east of the 1906 trace of the San Andreas Fault subsided as much as 60 centimeters, or almost two feet, by Gilbert's calculations, Bergquist concluded that this overtopping became more frequent after the earthquake.

A spring storm in 1905 "played havoc with things" around the Dipsea Hotel. The tide washed all the sand dunes, referred to as "heads," into the lagoon and left the sandspit as "smooth as a barn floor." According to the report, the wind blew at least 75 miles per hour all night, and before morning the "surf had washed all of the heads off, right up to the hotel. . . . " The storm swept all the driftwood off the sandspit and deposited it on the Easkoot heads, where it would dry and be plentiful for the summer camp fires (MJ, March 23, 1905).

In a column entitled, "Marin's Old Days," which appeared weekly in the *Marin Journal* in 1922 and into 1923, Newell Vanderbilt wrote about Marin's history. He was born in Tomales in 1874, his father having settled there in 1857. Newell attended Mt. Tamalpais Academy and was a graduate in chemistry from the University of California. He taught at the academy for many years and was dedicated to Marin County, the academy, horticulture, and history (Biography File, Anne T. Kent California History Room, Civic Center Library). In his column on Bolinas, he wrote:

> Naturally, Bolinas Bay then [at the time of Spanish settlement] had no mud banks or mud bottom because the ocean tides came in over broad areas of clean sand and the land slopes were covered with perhaps centuries of forest carpeting, both of these usual sources of mud deposits being practically natural filtering methods for all waters admitted to the inlet. In every way the contour of Bolinas Bay indicates that at first only the western estero existed

> and the long sandspit was afterward formed, leaving a broad, shallow, still water "pond" at the eastern end . . . . (MJ, January 11, 1923).

The Spanish "estero" refers to estuary or tideland. Estuary is defined as a water passage where the tide meets a river current or an arm of the sea at the lower end of a river. Vanderbilt suggested that before there was a lagoon there was a western channel (a stream coming down to meet the tide). Either subsidence or a rise in sea level or both created conditions for the development of a board, shallow, stillwater "pond" behind an emerging sandspit. If the sandspit is a more recent feature, as he suggests, overwash and breaching would be part of its history.

In due time the William Kent family became the owner of the sandspit. William Kent, Jr. said in an interview that in 1940 or 1945, he offered the whole spit—7,000 feet of beach—to Marin County for $210,000, half of which he was willing to put up. The county turned him down, so he decided that he would have to do something with the land himself. Through the William Kent Estate Co., he subdivided the sandspit, called it Seadrift, and began selling sand dune lots hand over fist (*San Francisco Examiner* Pictorial Living section, c. 1960). Later he developed the Seadrift Lagoon subdivision, which included an artificial lagoon, built by the "good ship Mudhen." The *Examiner* article includes a picture of Kent standing on the spit with the dredger in the background. (This undated article is in the Stinson Beach Box, Anne T. Kent California History Room, Civic Center Library.)

The Seadrift Subdivision #1 Map was recorded at the request of the Marin County Planning Commission on November 10, 1949. Stretching along the spit, it contained 51 lots with Seadrift Road along the north side of the development and the Pacific Ocean on the south (Subdivision Maps 6:92). The Seadrift Subdivision #2 Map was recorded at the request of the Marin County Planning Commission on November 5, 1956. This second subdivision continued development on the spit with lots 51 through 116 (Subdivision Maps 9:62). The third subdivision for Seadrift consisted of lots 125 through 143 and was recorded August 20, 1964. This map was signed by Wm. Kent, III, and Roger Kent after Wm. Kent, Jr.'s death that spring (Subdivision Maps 12:90; SFC, April 2, 1964).

Seadrift Subdivision #1, containing lots 1 through 97, was approved by the Marin County Planning Commission in December 1960 and was recorded January 3, 1961 (Subdivision Maps 10:95). The second subdivision, containing lots 98 through 203, was approved by the Planning Commission on November 19, 1962, and was recorded December 3, 1962 (Subdivision Maps 11:51).

The planning process for the Seadrift Lagoon development received little mention in the newspaper and, surprisingly, nothing to indicate there was any public concern about the dredging and filling of Bolinas Lagoon.

The tentative subdivision for the 83-acre 203-lot subdivision was approved by the Planning Commission in January 1959, with two conditions: a paved, off-street parking area for 50 cars was to be provided at the western end of the subdivision, and the Health Department had to approve the septic system for the subdivision (IJ, January 7, 1959). In May 1960, the Harbor Commissioners deferred action on an application from the William Kent Estate Co. for permission to dredge "a drainage channel on harbor district land." The postponement was to allow completion of engineering and legal requirement studies. According to the newspaper account, the company was proposing the drainage channel to be "navigable for small craft" and to serve as a basin for runoff from the hills (IJ, May 28, 1960). In November a last-minute effort by one Marin County Planning Commissioner to increase the size of the Seadrift Lagoon lots from 6,000 to 7,500 square feet was defeated, the attorney for the William Kent Estate Company saying it would be "hurt" if the change were required. The company was asking for another continuance of the original approval in January 1959 because the lots were being "developed by fill" and apparently the "fill" job was yet to be completed (IJ, November 22, 1960). An aerial photograph by Aero Photographers, taken on December 3, 1960, shows dredging and filling in progress. Classified ads for the Seadrift and Seadrift Lagoon developments appeared in the *Independent Journal*.

> Seadrift and Seadrift Lagoon, on the Pacific Ocean and Bolinas Lagoon, beach houses for sale and for rent. Choice building sites available. James A. Orr, Inc. Seadrift, 868-1613 (IJ, August 4, 1962).

> Stinson Beach, Seadrift, 3 bedrooms, 2 baths, radiant heat, on Seadrift Lagoon, boat and dock included, $55,000. James A. Orr, Inc., Seadrift Office (IJ, June 1, 1963).

By September 1967, 80 homes had been constructed; the following July there were 100 homes at Seadrift (SFC, Sept. 1967; July 17, 1968). By 1986, the mile-long Seadrift development had 229 family homes with yards and trees (*Town and Country*, July 1986, Stinson Beach Box, Anne T. Kent California History Room, Civic Center Library). According to Richard Kamienicki of the Seadrift Association, there are still 40 undeveloped lots (personal communication). If there were, in fact, 346 lots in Seadrift and Seadrift Lagoon, based on the subdivision maps, then about 306 lots have been developed.

Beach houses at Stinson Beach and in the Seadrift development sustained damage as a result of the January 1978 storm. Early in the storm, damage was estimated at $100,000 at Stinson Beach when 12-foot combers ripped the shoreline. Barbara Alban said waves washed out a bulkhead at her house near Calle Del Embarcadero and washed out a portion of the street. At least six homes near the Stinson Beach waterfront were damaged (IJ, January 11, 1978). High tides and strong winds brought

the surf crashing against seawalls and bulkheads built to protect Stinson Beach homes (SFC, January 20, 1978).

In early February, with high winds and lots of rain, Stinson Beach was preparing for the worst. Some homes in Stinson Beach, particularly in the Seadrift subdivision, were flooded by high tides, and the heavy surf had taken over the beach and was crashing against bulkheads. Barbara Alban again reported on the situation, "This is definitely worse than last month." She said white water from the breakers was crashing on what used to be the beach but was now gone, and the water was soaking house roofs. Shoreline Highway was closed for several hours, when Bolinas Lagoon overflowed and spread debris across the road (IJ, February 7, 1978).

A photo caption in the *Independent Journal* read "Waves crash where sand dunes stood at Seadrift beach as residents work to save homes." An attempt was made to install 650 feet of tubing at the base of the dunes to supplement the sandbags in an effort to "slow down the erosion of the beach." One Seadrift resident reported that 93 feet of the dunes in front of her house were gone, leaving seven feet at the most (IJ, February 9, 1978).

High tides, pounding surfs, wind and rain continued to plague the Seadrift development into March. Marin County public works officials joined property owners in the fight to stop the erosion of the beach, after the "sausage" seawall installed in February began to fail. The immediate battle at that time was to save eight homes from waves and high tides (IJ, March 7, 1978). With the county in the picture, the effort took on a new dimension:

> Rocks Used In Fight For Seadrift—Five-ton rocks securing the sand and the absence of strong onshore winds Monday helped residents of Seadrift near Stinson Beach make it through another night without damage to the shorefront homes.
>
> County public works crews were on the scene this morning placing boulders and smaller rocks against the sand dunes to stop the erosion which has washed away more than 90 feet of sand in the past two months.
>
> County officials and homeowners got together Friday night when part of the 650-foot "sausage" seawall installed early last month began to give way before large waves. The fiberglass bag filled with sand was placed in front of nine houses on the beach and broke the impact of the waves until last week when the water got behind the bag and started washing sand over it. Rocks have been placed in front of six homes and crews were working today to shore up the others . . . . (IJ, March 7, 1978).

To save nine Seadrift homes, Marin County taxpayers spent $60,000 to place 2,000 tons of rock riprap along the beachfront that was being torn away by waves and high

tides. Bolinas property owners whose houses were threatened by crumbling cliffs below the Mesa appeared before the Board of Supervisors asking that they be given the same county aid that the Seadrift property owners received (IJ, March 15, 1978; SFC, March 15, 1978).

The Seadrift and Seadrift Lagoon developments have affected the lagoon's hydrology. Houses and trees, dredging and filling, and seawalls and riprap have reduced, and for some processes, stopped ocean functions in the lagoon. Tidal circulation to the southeastern portion of the lagoon was restricted by the dredging and filling of 56 acres that occurred in 1960. Winter storms with record rainfalls, high winds, heavy surfs, and high tides historically resulted in periodic overtopping of the spit, so that "water went over the sandspit in profusion." Breaching of the spit also occurred in front of Capt. Easkoot's house. The 1897 USGS map, surveyed in 1894-1895, shows a very narrow spit where it met the marsh at the captain's place. Breaching at this point was probably not uncommon; in fact, as Mildred Sadler observed, "during many winters the ocean would cut through the sand and pour into the Bolinas lagoon, cutting the spit off from the land." And high tides and heavy surfs flooded the roads on either side of the lagoon and left debris in yards and gardens some distance from the shoreline.

> The [washover] fans were formed by waves overtopping the spit. This overtopping became more frequent after the 1906 earthquake, because the portion of the spit to the east of the 1906 trace of the San Andreas fault subsided as much as 60 cm (Gilbert 1907, as cited in Bergquist 1979). In the early 1960s, most of the washover fans were dredged and the spoils used to build an extension of the spit for the Seadrift residential development (Bergquist 1979).

These stochastic events were part and parcel of the lagoon's hydrologic function. Waves of sufficient velocity and size to overtop and cut through the spit, wash through the lagoon, and send water pouring out of the lagoon onto roads and into yards had the capacity to "flush" sediments from the lagoon when the tide ebbed. Not unlike stream systems that experience inputs of sediment from storms, it also takes "flushing flows" to remove it. So regardless of whether littoral deposits were introduced during these events, the same events were required for their removal and also the removal of watershed deposits. With a gaping hole in the spit—a second exit—the efficiency of removal would be increased as well.

4.3 Watershed Factors

4.3.1 Roads

Native American travel corridors, game and cattle trails, horseback trails, ranch roads, constructed wagon roads, improved roads, motor vehicle routes, and paved highways are part of the Bolinas Lagoon watershed history. As sources of sediment to Bolinas Lagoon, their contributions probably ranged from little or none to major. Historically,

landslides on coastal roads were common, as were washed-out bridges and deep mud. In some cases, construction and maintenance of roads on steep and unstable slopes, along watercourses, and on the lagoon's shores resulted in one-time localized inputs of sediment; in others, they became chronic sources. One chronic source is the Shoreline Highway that has been the subject of construction, reconstruction, and maintenance for more than 130 years.

Travel routes used by Native Americans connected villages, accessed food and material gathering sites, hunting areas, and places of ritual and provided corridors for movement between the coast and the interior. The residents of *bauli-n* had established routes in the watershed that connected them with the folks at *olema-loke* and other villages, both coastal and interior. They had trails to access the lagoon and the ocean and interior prairies and forests. Livingston (1995) suggested that the aboriginal route through the Olema Valley followed the banks of Pine Gulch and Olema creeks. Trails to the lagoon and ocean were a must for these people. Kroeber (1925) noted that living in the open, close to a supply of mussels, clams, fish, and water fowl with occasional visits to the hills to hunt, was the "convenient" life for Coast Miwok. Ridge tops were also important travel corridors for indigenous people.

Horse trail connections between the Garcia Rancho, later Briones Rancho, at Bolinas and the Mission at San Rafael began with Spanish settlement in the mid-1830s. When Maria Briones was married to Francisco Sebrean in 1850, the bridal party rode from Casa Briones on Bolinas Lagoon to San Rafael for the ceremony. They took "the familiar trail, past Casa Garcia and down the Olema Valley . . . , [passing] along the one street that comprised Woodville" (Pepper 1965). In time, this trail became known as the Olema Road, "one of the most important in the county," providing access to San Francisco markets for the products of Point Reyes, Olema, Bolinas, and Nicasio (MJ, February 8, 1862).

The old San Rafael Trail, which Livingston (1995) described as "prehistoric," left the lagoon at Weeks Gulch, went over the ridge to Lagunitas Creek, following the creek some distance before turning east toward what is now Ross. By late 1864, steps were underway to replace the trail and shorten the distance from Bolinas to San Rafael by about three miles. This was considered a much needed improvement because the present "road" was practicable only for horsemen, and teams were obliged to go by way of Olema (MJ, December 24, 1864). But it was another fourteen years before a wagon road was completed.

The rainy season of early 1865 put roads throughout Marin County in a "deplorable" condition. The road from Olema to Bolinas, referred to as the "ill-laid out road," was very bad (MJ, March 4, 1865). Thought to be used more than any other in the county, this road was in the worst condition imaginable (MJ, May 13, 1865). The original Olema-Bolinas Road between Dogtown and the intersection at the Bolinas Cemetery followed the route now known as Horseshoe Hill Road. This was the trail the bridal

party used in 1850, traveling from Upper Bolinas at Casa Briones to Woodville and northward to Olema.

Western Marin residents pushed for road improvement. Following a trip to Bolinas from San Rafael, the editor of the *Marin Journal* remarked in 1866 that he was surprised at the change that one decade had made on this rugged western coast of the county. "In 1854 we threaded our way in bridle paths around these same hills, little supposing that they would so soon, if ever, be made to exhibit the thrift, the rich producing farms and happy homes of a community such as are now permanently settled there" (MJ, June 16, 1866).

The following year, Marin County Surveyor Hiram Austin laid out a new wagon road from the embarcadero at Bolinas to Olema and beyond to the San Geronimo Valley. The road followed much of the older route, one no doubt built in stages by local residents, but bypassed it in a number of locations, including the steep clay hill south of Dogtown and the long hill at Strain's Ranch, now called Thirteen Turns. The new road was apparently built in 1867 or 1868 and, for the most part, is the route currently used as Olema-Bolinas Road, Horseshoe Hill Road and State Highway 1. (Austin Plat 1867)

In 1868, the Saucelito (original spelling) Land & Ferry Co. began making arrangements for the construction of a wagon road from Sausalito to Bolinas, which was to be of "great benefit to the farmers and citizens" of Bolinas Township (MJ, July 4, 1868, September 26, 1868). County Surveyor Alfred Easkoot surveyed a roadway along the lagoon's east shore in 1868 (Easkoot 1868). A petition for this road was presented to the Board of Supervisors in the summer of 1869. As proposed, the road would commence on the County Road at the head of Bolinas Lagoon and terminate at the wharf of "new Saucelito" (MJ, July 17, 1869). Through some technicality of process, action by the Board of Supervisors was delayed until February 1870, when it ordered an examination of the road, which was finally surveyed in mid-May 1870 (MJ, February 12, 1870, April 30, 1870). In late August 1870, the announcement was made that construction was to begin.

> Saucelito and Bolinas Road—Superintendent Austin informs us that on Monday next he will commence operations on the County Road, recently surveyed and approved by the Board of Supervisors between Saucelito and Bolinas. He will begin by clearing the line of road, building culverts, etc. and expects by Monday or Tuesday week to put on a force of one hundred Chinamen. Mr. Austin left for San Francisco yesterday to engage the laborers, purchase lumber, tools, etc., necessary to prosecute the work. He expects to get through the job on or before the first of November next. The length of the road, as per survey, is about ten miles [?]. It will prove of great benefit to the citizens of Bolinas and vicinity, who have long felt the need of a public thoroughfare by which they might have better and more

> expeditious communication with the outside world than at present (MJ, August 20, 1870).

By early September, Austin had 117 men at work and the line was already assuming the proportions of a road (MJ, September 10, 1870). By late October, the road was completed as far as Captain Easkoot's ranch, with fifteen days work remaining (October 22, 1870). The road was soon completed.

> Completed—The Saucelito and Bolinas Road was finished on Saturday last and travel is now being had thereon. Two lines of stages are already established, one running as far as Bolinas and the other through to Olema. The road is pronounced excellent in every respect and reflects credit upon the builder, Mr. Hiram Austin . . . The scenery on the road is described as grandly romantic (MJ, November 5, 1870).

The road opened a whole new world of possibilities for Bolinas and what is now known as the Stinson Beach resort area. The *Alta California* wrote about the "Sportsman's Paradise" to be found at the end of the new road:

> The completion of the new road from Saucelito to Bolinas Bay will give our citizens another desirable place of resort on the seaside. The disciples of Nimrod and Isaak Walton particularly will be convenienced, for on hillsides and lowlands and the waters of Bay and creek, in the immediate vicinity of this highway, game in abundance is to be found. At the settlement of Bolinas, a new hotel will be opened by David L. Woodrom, the present week. Here boats and fishing tackle can be procured by excursionists. The favorite resort for the angler is Duxbury Reef, just off the chalky hills at the entrance of the Bay. Here is where the Italian fishermen haul in their biggest rock cod, perch, and flounders. The quantities of quail killed along the road are enormous at this season, while deer, fat and large, are sent over daily from the ranches to the city. . . .
>
> The scenery all along the road is varied and picturesque to a degree unsurpassed within the limits of California. The traveler reaches the summit by an easy grade over what will be one of the finest roads in the State. From many points can be seen at once the bays of San Pablo, San Francisco, Oakland, Telegraph Hill, Mount Diablo, and towering in the front ground, the black peak of Tamalpais. But for grandeur and sublimity, give us the panorama as viewed from the summit. The Pacific dashes against the rocks far below and from the Cliff House to Bolinas the spectator can trace the outlines of every cove and headland. The Farallones are due west twelve miles and Point Reyes as many to the northwest. Here and there along the shore may be seen snug farmhouses and thrifty

> orchards and gardens yellow with squashes and pumpkins and corn. . . .
>
> For the benefit of the public, we may state that the steamer leaves Meigg's Wharf at 10 a.m. daily, arriving at Saucelito in twenty-five minutes. Here a stage is in readiness to convey passengers direct to the Sea Side House on Bolinas Bay. The distance is 23 miles. . . . The trip can be made in three hours and a half in the stage. On Saturday, a pioneer friend of ours drove his spanking span of bay stallions over the road in less than five hours, notwithstanding he stopped long enough to kill half a dozen quail, visit two or three farm houses, take aboard a load of apples, and rob a corn field of a few choice roasting ears. The rains of the last few days have allayed all dust, and put the road in splendid order (MJ, November 12, 1870).

The December 1871 storm resulted in an estimated $50,000 worth of damage to roads and bridges in Marin County. The road at White's Hill was described as "horrible," while the road from Sausalito to Bolinas was said to be as bad, if not worse (MJ, December 30, 1871). Marin's Shoreline Highway, destined to be Highway 1, may have started out in "splendid order," but flooding and landslides along Bolinas Lagoon have made this stretch a long-time problem.

In 1874, the Board of Supervisors accepted a petition from George Burge and others for a "public highway" at Bolinas (MJ, February 19, 1874). The list of people to receive compensation for "damages" for the new road in Bolinas included land owners along the lagoon's western shore, indicating that this is the present Olema-Bolinas Road, built to bypass the old County Road (Horseshoe Hill Road) through Upper Bolinas (MJ, February 26, 1874). Located on the flat along the lagoon, this road experienced flooding, as did its counterpart on the east side of the lagoon. The January 1878 storm resulted in both roads being "washed away" (MJ, January 24, 1878). Construction, reconstruction, and maintenance after flooding and landslides have made their contribution of material to Bolinas Lagoon.

Hiram Austin's 1870 road on the eastern side of the lagoon was built too close to the lagoon, or perhaps, as the lagoon filled with sediment, it flooded more easily, but high tide always posed a travel problem on the road. Five years after its construction, the road was "thrown back further into the shore line" to escape "all injury" from high tides. Some long stretches were cut through solid rock, involving heavy work (MJ, May 6, 1875).

At a February 1877 meeting of the Board of Supervisors, a petition was filed asking for the construction of a road from near the Fairfax picnic grounds westerly and southwesterly along the San Rafael and Bolinas trail to the top of Bolinas Ridge, thence over the ridge and down to the lagoon near Little Greenwood [Thompson] Gulch (MJ, January 13, 1916). In the spring of 1877, the Board of Supervisors directed Surveyor Austin to conduct a preliminary survey of a mountain carriage road from San Rafael

to Bolinas (MJ, May 3, 1877). He filed his report with the supervisors a month later, estimating that a road over the mountains to Bolinas would cost $4,000 (MJ, June 28, 1877). The board appointed Austin, P. B. Whitney, and Wm. Blodgett as "viewers" for the proposed road, requesting their report at the next board meeting (MJ, August 9, 1877). The newspaper reported in late August that so far as the survey had progressed, the grade would not exceed one foot in fourteen, which was half that of some places on the Sausalito Road (MJ, August 30, 1877).

To pay for purchase of right-of-way and construction of a wagon road between Bolinas Lagoon and the County Road at Fairfax Station, a Bolinas Road Bill was introduced in the Legislature, authorizing the county to collect five cents per $100 of value on taxable property for three fiscal years 1878 to 1881 (MJ, February 14, 1878). The Bolinas Road Bill was signed by the governor in the spring of 1878. It was the wish of the Board of Supervisors to build the road as soon as possible and to expend on it the least possible amount of money (MJ, March 28, 1878). Complications, resurveys in which the route's eastern terminus was changed from Fairfax to San Rafael, and rejected bids kept construction on hold for some months (MJ, May 16, 1878, June 13, 1878, June 27, 1878). On July 1, 1878, a contract was awarded to Jesse Colwell and James H. Wilkins for $8,500 for four of the five sections (MJ, January 13, 1916). By fall, the road was well underway.

> The Bolinas Road—We are informed that the four sections of the Bolinas road now being built by Colwell and Wilkins will be practically finished by November 1st. If so, the new route can be traveled after that time, as the portion on this side of the mountain is already passable. By this route, Bolinas Bay is but sixteen miles away from San Rafael and Burge's Hotel, on Bolinas Point, but eighteen. A gentleman who is very familiar with Tamalpais mountain tells us that many of the finest views he has ever seen from its heights are obtainable from the line of the new road. The drive passes through gulches of almost tropical verdure and presents some of the most magnificent scenery to be found on the coast. The completion of the road will have far more than local interest (MJ, September 26, 1878).

The road—bridges and all—was finished by mid-December. The supervisors drove over the road, accepted the work, paid the bill and discharged contractors Colwell and Wilkins with a final $1,850 (MJ, December 19, 1878; December 26, 1878). The *Journal* reporter took a tour over the new road.

> Over the Hill to Bolinas— . . . I had the good fortune to ride from San Rafael to Bolinas in company with others from the City over the new mountain road. . . . We left San Rafael on a fine morning and made the journey in the space of three hours, without haste, as we were inclined to enjoy the mountain air and scenery, and we amused ourselves by contrasting the easy journey of the present

> time with a pair of fast horses, upon a good road, with the toilsome horseback rides of other days, over the mountain trails. . . .
>
> My mind was enraptured in remembrance of the little mountain streams which dash over the rocks down the ravines, and then pursue their winding course onward with the musical ripple that poets delight to write about, the majestic trees which have stood in lonely grandeur so many years visited only by the solitary traveler or sportsman, the green hillsides with their carpet of moss and ferns and the extended view of land and sea from the summit of the mountain, but they must be seen for an adequate idea of their beauty.
>
> On approaching Bolinas Bay there was much to attract our attention. The comfortable homes dotted here and there along the shore indicate success and comfort that are always pleasing to behold. The village presents changes all for its advantage, showing that it is by no means inert or sleepy. . . . It has always been a source of wonder that more travelers and pleasure seekers have not found their way to that charming little seaside resort, which for its very solitude and quiet would be the more attractive to those who are anxious to escape from the turmoil . . . . (MJ, January 23, 1879).

By summer, H. B. Gibson & Co. was running a stage between San Rafael and Bolinas over the new mountain road three times a week and had plans for making the trip daily (MJ, June 5, 1879). There was some criticism of the route chosen for the road, but the newspaper editor defended the survey, saying it was one of the "best laid out mountain roads" he had seen.

> It is sixteen miles from San Rafael to Bolinas Bay and the rise is 1,400 feet, yet so easy is the grade that a light horse will take two persons in a buggy the 16 miles in three hours and not show fatigue. Coming from Bolinas Bay, you have one long rise of 5 1/2 miles in which you ascend 1,400 feet. The ascent is very gradual and there is not a steep place on the whole road. The scenery along the route is grand and beautiful beyond description . . . . (MJ, July 10, 1879).

Changes in the San Rafael road to Bolinas Lagoon, including new routes and improvements, were made over the course of the years. In the summer of 1884, Hiram Austin began construction of a new Bolinas road via Fairfax on an easier grade. Reducing the distance by more than a mile, the new road had the additional benefit of providing a drive of "great beauty" through the Bon Tempe ranch at Lagunitas (MJ, July 31, 1884). Work began in August and the grading was completed by mid October (MJ, August 21, 1884, October 16, 1884). The 1890 fire crossed this road and destroyed eight bridges, interrupting travel by the mail stage from San Rafael (MJ, October 30, 1890). During the 1904 fire, the road from the summit to the Wilkins gate was "wrecked." Burning logs and tons of loose rock obstructed it, and all the

bridges and culverts were burned out (MJ, September 15, 1904). A 1893 article described the road and the beauty of the landscape.

> Bolinas. A Pleasant Trip to the New Boom Town; Lots Held at High Prices; A Magnificent Drive—Beautiful Scenery—Views from the Beach—Incidents of the Trip—Many of the readers of the *Journal* are familiar with the drive across the "ridge" to Bolinas. To those who are not, a few words concerning a day's drive by the writer to this quiet retreat may not come amiss.
>
> At Fairfax the Bolinas road swings westward off the main thoroughfare, which extends on northerly, and aims for the lowest part of the ridge which rises between us and the coast. Soon the grade commences and the road twists onward and upward on the side of the hill, affording glimpses of little valleys and glades, green with the richest of verdure, with here and there bunches of dairy cattle or horses eagerly cropping the young grass which is now strong enough to afford rich nourishment. Nearly all, if not quite all of the dairymen, have stopped giving any feed to their cows, and the warm days of the last two weeks have brought out the grass rapidly.
>
> Four of five miles of climbing brings us to a high table land, comparatively free from brush, and affording excellent pasture. Here is the well known Liberty ranch, a place noted for the excellence of its table and healthful surrounding. It is near here that the Academy boys from the Mount Tamalpais Military Academy camp for a week or two during the summer, and get their first taste of tent life and sentry duty. Mrs. Liberty is a capital hostess and many persons have made rapid gains in health by a few weeks' stop under her hospitable roof.
>
> Beyond Liberty's camp there comes another climb of four or five miles up the ridge proper. This road was laid out by the gentleman who is now so successfully conducting the Democratic newspaper of this county, but who certainly knows as well how to handle a theodolite [a surveyor's instrument] as to wield a pen. The ridge is very steep, but the grade of the road is comparatively light, and advantage has been taken of every spur and angle. All the way up, the road winds in and out through a forest of redwoods whose shade is most [appreciated] on a hot summer day. Springs are frequent and here and there in a turn of the road are troughs always filled with the clearest and coldest of water, refreshing alike to man and horse. . . .
>
> All the way up the grade, except in a very few cases, the road is hard and smooth, and reflects great credit on the care bestowed upon it by Supervisor Kinsella of this San Rafael district.
>
> At the summit of the ridge, and surrounded by a dense and cool redwood forest, is the Summit House, kept by C.F. Larsen. It is

> a commodious and picturesque structure, and its wide verandahs and neat and attractive appearance indicate that the reputation of this resort for comfort is well provided. Mr. Larsen is a most hospitable host, and his many guests during the summer months all speak highly of his success as a provider for the wants of the inner man.
>
> Just below the summit we get our first glimpse of the sea. The altitude is over 1,000 feet and the descent is so abrupt that the Pacific seems to lie at our very feet. The Farallon Islands, which can be seen on a clear day from the Cliff House near San Francisco, are plainly visible, and to one unaccustomed to distances, seem to be distant not five miles. . . .
>
> For several minutes we stopped, gazing at this enhancing sight. It is, perhaps, as fine a view of the ocean as can be obtained anywhere on the coast. You are up so high, and the sea seems so near.
>
> The grade down is very steep and winding. There are few trees to shade the road, and it is sandy in places. Obviously less care has been bestowed upon this side of the grade than on the San Rafael side. But Supervisor Gardner will soon have this defect remedied as the work of repair now in progress plainly proves.
>
> As we descend the grade, Bolinas bay appears, a little inlet into which the sea rushes at high tide, covering the flats and making an attractive little sheet of water. But when the tide is out, the view is not so entrancing. Along the east side of the bay winds the road which extends on past Willow Camp to Sausalito over the hills . . . . (MJ, March 2, 1893).

Landslides, deep mud, and washed-out bridges were common winter problems on west Marin roads. During the 1878 storm, the road between Olema and Bolinas was "badly washed," and three bridges were carried away (MJ, January 24, 1878). That same storm caused the road between Sausalito and Bolinas to become impassable for wheels because of "extensive slides." And the road around Bolinas Lagoon was gone and "scarce a sign yet is left" (MJ, February 21, 1878). A December report on the condition of one road said that although there were no slides or impediments, the "mud is deep" (MJ, December 18, 1879). The Olema-Bolinas Road suffered a "heavy slide" during a spring storm in 1880 (MJ, April 29, 1880). During a heavy rainfall in late January 1881, stage driver Gibson was unable to make his regular trip over the Bolinas-Fairfax road, and when the road was finally passable, it was by horse not stage (MJ, February 2, 1881). To make way for the stage after a January storm in 1884, driver Cottingham had to use an ax, and there were a few washouts on the road (MJ, January 13, 1884). On the Bolinas road a bridge near the Wilkins spring was carried off during excessive rains in February 1887 (MJ, February 17, 1887). But even summer roads had problems. A newspaper note stated that on the road between Olema and Bolinas there were rocks of "objectionable sizes" strewn along the road in

very convenient places to be struck by every passing vehicle. In a word, the road was a "disgrace" to a civilized people (MJ, August 15, 1889).

In 1903 the people of Bolinas, led by merchant and sawmill owner A. Bonaiti, petitioned the Board of Supervisors for the construction of a road from town to the schooner wharf. The petition noted that because of low water, the schooners could not get up Bolinas Lagoon as far as the town but had to land at a wharf a third of a mile from town. Residents could drive from town to that wharf over the beach at low tide, but at high tide the beach route was not passable. The board agreed and appointed viewers to survey the road (MJ, May 7, 1903). The newspaper noted the importance of the road and urged, "Let nothing be put in its way to hinder or delay" its construction (MJ, July 2, 1903). In July the board adopted a resolution to proceed with construction of the wharf road (MJ, July 23, 1903). John Robson of Bolinas finished grading the new road in early January 1904 (MJ, January 14, 1904).

Bolinas, Willow Camp at Stinson Beach, and Mount Tamalpais became destination points for "pleasure-seekers" early on, but the 1890s brought a new meaning to the word. Resorts and places to "rusticate" were big business ventures throughout the country, and the west Marin coast was no exception. In 1896, the Mill Valley & Mt. Tamalpais Scenic Railway, considered to be one of the "greatest enterprises ever achieved" in Marin County, was completed up the mountain (MJ, August 28, 1896, September 3, 1896). The next step was to extend it from the mountain to Bolinas. Despite rumors and statements of fact that rails to Bolinas were imminent, they never made it. This didn't deter the resort business at Willow Camp and Bolinas; just two things were needed to swell the tourist ranks—better access and a good hotel.

In 1903 S. B. Cushing, manager of the scenic railway and owner of the sandspit, built a "boulevard" to connect Bolinas Lagoon with the scenic railway at West Point.

> The Awakening at Bolinas; Increased Real Estate Values Betoken Boom; Many Improvements in Contemplation, Including a Hotel and Water Supply—Real estate seems to be taking on an increased value at Bolinas when an actual transfer of sand dunes has taken place at over $25 an acre, and more of it bonded for sixty days at double that figure.
>
> All sorts of rumors are in the air, but the only tangible reason for such a rise in values is the work now being done by Mr. S.B. Cushing, the manager of the Scenic Railway, in the construction of a boulevard from West Point, on the Scenic line, to a connection with the Sausalito road where it crosses Steep Ravine; and an additional strip of new road across the marsh to the ocean beach, where it is proposed to erect a hotel.
>
> The boulevard is now nearly completed, and Surveyor Dodge has the plans completed for a short road across the marsh. The line of the new stage line will be from the sharp turn in the

> Scenic road at an elevation of over 1,500 feet, down into the Steep Ravine past the cabin of Welch, the artist, past Willow Camp along the county road to a point near the Stinson ranch buildings, across the marsh to the hotel site. It will be a short and beautiful drive.
>
> Among other improvements in this locality is the development of water in Steep Ravine, to supply the whole territory in the vicinity of Willow Camp with water under pressure, and the establishment of a wharf at the Bay channel, where the visitor can board a launch for Bolinas village, two miles distant . . . . (MJ, February 12, 1903).

By mid-April the road was almost completed, and the hotel, later known as the Dipsea Inn, was soon to be constructed on the sandspit (MJ, April 16, 1903). A new stage line connecting Bolinas with West Point opened for business in May, with County Supervisor Charles Dowd in charge (MJ, 30 April 1903). In 1907, the rumor was circulated that William Kent of Chicago and S. B. Cushing, owners of the Dipsea Hotel and stockholders in the scenic railway, were interested in developing an automobile line between West Point Station and the hotel, making several trips each day (MJ, May 2, 1907). The rumor proved true.

> Bright Future for Bolinas and Willow Camp. . . . The Kent, Cushing, and Stinson interests are working together in the construction of a road of which one end will be at the Dipsea Hotel and the other at a junction with the road coming down from West Point. When completed there will be direct communication between West Point on the Scenic Railway and Willow Camp and Dipsea on which it is proposed to put automobiles for this season's service. . . . (MJ, March 12, 1908).

Marin County boosters were responsible for the construction of Ridgecrest Boulevard on Bolinas Ridge and up to Mount Tamalpais in 1924-25. Operated originally as a toll road, the road is now managed as part of Mt. Tamalpais State Park (Dewey Livingston, personal communication; SFC, September 13, 1925).

By 1911, a 25-passenger auto stage was making daily, round-trips between Sausalito and Willow Camp to "carry passengers to that popular resort" (MJ, July 27, 1911). Not only were people taking the auto stage, they were making trips in their private automobiles, one such trip being reported in the *San Francisco Call*.

> Auto Trip in Scenic Marin— . . . One of the most infrequent trips that is made is the journey from Sausalito to Tocaloma, thence over the hill to Olema and down the coast by way of Bolinas Bay back to Sausalito by way of Manzanita. . . . Swinging the car to the left at [Olema] the start is made for Bolinas Bay, the beginning of the most interesting part of the whole journey. For more

> than four miles, the *Call's* pathfinder rolled along the shore of Bolinas. And speedy rolling it was for the members of the party had forgotten to consult the tide tables. Most of the time the wheels on the right hand side of the car were in the water and the dash through this little stretch was quite exciting for the tide was coming in rapidly. Had the party arrived at Bolinas an hour later, the pathfinding trip would have been rudely interrupted (MJ, August 24, 1911).

In 1915, while considering other road contracts, the board decided to just put the road in traveling condition, except during high tide, with a view to building a good and permanent road at a later date. The supervisors wanted to build a road back on the hillside but found it would be very expensive, and in order to get around the gulches, it would lengthen the distance. The county's engineer suggested building a road along the beach but raising it a few feet above high tide and constructing a "suitable bulkhead" (MJ, April 8, 1915). Until that time, most traffic traveled the beach anyway as very little suitable road existed.

In February 1916, County Surveyor Richardson submitted plans for rebuilding the Willow Camp road from that place to the intersection of the San Rafael-Bolinas Road, a distance of 4.6 miles. The bids were too high, so the board eliminated three sections of the road and awarded the $13,000 contract to Peterson & Greer for work on a three and a half mile stretch. The new road was to be raised to a height of nine feet above the tide so that it could be traveled at any time (MJ, February 10, 1916, March 9, 1916). After viewing the construction in the summer, the board decided to have some "wooden bulkheads" put in (MJ, July 6, 1916). The completion of the work of raising the road above high tide suggested the "propriety" of sending the mail via Willow Camp direct to Sausalito, instead of to San Rafael (MJ, September 21, 1916). Unfortunately, the board was not happy with the work performed by the contractors, finding that the "major portion of the road . . . was considerably lower in the center than the grade specified in the contract . . . . " (MJ, February 8, 1917).

The December 1921 storm wrecked a long section of the seawall along the Stinson Beach to Bolinas Road, and county road crews were ordered to make the repairs (MJ, December 19, 1921). In the spring of 1922, the board advertised for bids for road work on the Olema-Bolinas Road and between Stinson Beach and Bolinas, but all bids were rejected on two occasions (MJ, May 4, 1922, May 25, 1922, June 8, 1922, June 29, 1922). Finally in July, S. P. Brownlee was the successful bidder for two contracts, the Stinson Beach-Bolinas Road and a portion of the Olema-Bolinas Road from Randall Ranch over the Strain Hill. He had 90 days to complete the $28,000 contract (MJ, July 20, 1922). At one point, a cost estimate for building a road across Bolinas Lagoon, a distance of 4,900 feet, was provided the Board of Supervisors. Despite 57 signatures on the petition, the county rejected the project, saying $142,302.75 was too much to spend (MJ, November 8, 1923).

During a storm in February 1925, roads in the area suffered from washouts and mud. The road to Stinson Beach from Bolinas was "under water and slush for some distance." The new stretch of road from Stinson Beach to Manzanita (near Sausalito) suffered from cutbanks sliding onto the road and portions of the roadbed washing into the canyon below (MJ, February 12, 1925). The instability of coastal lands was evident. Board Chairman Gordan stated that the most serious slides he had ever seen were on the highway above Big Lagoon, and to fill the "caverns" and make the highway safe for automobiles was a "tremendous task" (MJ, February 26, 1925).

In October 1925, a bond election for $1,250,000 included $77,000 for improvements to the Mill Valley-Stinson Beach road of seven miles, $12,000 for two and a half miles of the Bolinas Lagoon road beginning at its junction with the San Rafael Road, and $5,500 for the Bolinas Road to Dogtown (MJ, June 18, 1925, October 1, 1925). The priority was the Mill Valley to Stinson Beach road, but action on this work was delayed by the Tamalpais Park Conservation Club until January 1928. James Currie got the contract, as well as the contract for grading and graveling five miles of the Olema-Bolinas Road (MJ, January 19, 1928). During Currie's work on the Mill Valley-Stinson Beach Road, the State Parks Commission asked for a restraining order to compel him to stop allowing "boulders, trees, dirt and other debris" from rolling into Steep Ravine. The judge modified the order to include only "boulders" (MJ, September 6, 1928). This road became known as Panoramic Highway.

In 1928, preliminary steps were taken to form a joint intercounty highway district to complete construction of the coast route known as the "Shoreline Highway." The move was sponsored by the Redwood Empire Association to facilitate the movement of commercial, agricultural, and tourist traffic in the coast areas of Del Norte, Humboldt, Mendocino, Sonoma, and Marin counties and the city and county of San Francisco (MJ, March 15, 1928). Two years later, the directors of the Shoreline Inter-County Road District, officials of the Highway Commission and the US Bureau of Public Roads, Redwood Empire Association representatives, county supervisors, and the press toured the route of the proposed highway, with a view of bringing about action toward immediate improvement of the route (MJ, August 7, 1930). Another year passed before a Shoreline Highway folder was issued, depicting tourist and vacation attractions and industrial features. A centerfold map of the highway included the Bolinas Lagoon Road, today's State Highway 1 (MJ, July 16, 1931). The widening of this road to a full, paved two-lane highway, occurred around that time.

The storm of 1955 damaged roads throughout Marin County. The Bolinas Lagoon road was closed by "dirt, rocks, and debris" that blocked the highway at several points just north of Stinson Beach and had to be "dug out . . . from its mud making" (IJ, December 21, 1955, December 22, 1955). During the January 1956 storm, slides closed State Highway 1.

Road Closed; Steep Banks Collapse on Highway 1—
Highway 1 from Tamalpais Valley to north of Stinson Beach took a

> pounding from the storm over the weekend as wet roadside banks flowed into the road in dozens of places.
>
> Highway crews with bulldozers and graders battled the flowing mud all during the weekend in attempts to open sections of the road. However, by noon today, the road remained closed, isolating Stinson Beach and Bolinas at times . . . . (IJ, January 16, 1956).

The 1960s brought new proposals for the Bolinas Lagoon road, including rerouting and conversion to a four-lane freeway (IJ, August 1, 1960, August 5, 1960). The Bolinas-Stinson Beach Plan called for a "scenic, high-speed road," with limited access to Bolinas and Stinson Beach, but public sentiment resulted in a change of wording from "high-speed" to "adequate capacity" (IJ, June 1, 1961; June 5, 1961). An August 1962 hearing on the Caltrans proposal for a four-lane freeway from Mill Valley to a point south of Olema, which residents said would "scar the cliffs along the ocean and require huge earth causeways over coastal gulches," was indefinitely postponed by the State Highway Commission, pending completion of the West Marin Master Plan (IJ, June 4, 1962, June 26, 1962). Today the Bolinas Lagoon road, a.k.a. Shoreline Highway, a.k.a. State Highway 1, remains a two-lane road with turnouts.

A number of improvement projects affected Shoreline Highway along the lagoon in the 1960s and 1970s. In one area, between Pike County and Thompson Gulches, an extremely sharp curve was eliminated by cutting back a prominent point of land that had jutted into the lagoon. The massive excavation created a wide pullout of several acres and left the old pavement intact. This area later became a dumping ground for landslide debris maintained by Caltrans and earned the moniker "Winnebago Point" for its use by campers. Other sections along the lagoon also saw large cuts and fills to decrease the radius of curves on the road. For instance, the oft-flooded road crossing Weeks Gulch was replaced by a new roadway closer to the lagoon on new fill (Livingston 2001).

Ranch roads throughout the watershed and haul routes and skidroads used in past logging operations are not easily documented. But these roads were generally not built to standard. Without maintenance, culvert blowouts and fill failures can and do happen during storms or even during normal rainy winters. These roads often become chronic sources of sediment. In some areas of northern California, logging roads are considered to be the most important single source of sediment and the cause of significant water quality degradation and loss of aquatic habitat. Numerous ranch roads, most created or improved by bulldozers and graders, traverse the ridges leading to the top of Bolinas Ridge. For instance, the McCurdy, Wilkins and Bourne Ranches had at least five roads to the ridge between them, most of which were steep and prone to erosion. A dirt ranch road leading up Pine Gulch Creek between the Strain/Teixeira and Hagmaier Ranches has been rerouted at least once in areas subject to landslides. (Livingston 2001).

Grading for other purposes likely added to sedimentation events. According to Dr. L. Martin Griffin, in 1961 the owner of the former Bourne Ranch sold "thousands" of cubic yards of topsoil from the alluvial flats of Thompson Gulch which was transported to a site near Bolinas School for use as fill. Griffin wrote that the bulldozing "turned the stream bed into a barren gully and caused floods for the next *twenty years* (Griffin 1998).

Over the years, construction, reconstruction, and maintenance of trails, roads, ranch roads, and paved highways in the watershed have resulted in both acute and chronic inputs of sediment to the lagoon. Built on an unstable coastal landscape, these routes are subject to storm events, fires, high tides, and earthquakes, which historically have resulted in slides, washed-out bridges, failed culverts, and mud. It all moves downslope, either through time on its own or more rapidly with the help of highway crews and bulldozers.

4.3.2 Grazing, Cultivation, and Dairying

Thirty years ago, the Bolinas Lagoon watershed of approximately 10,500 acres consisted of 30 percent coniferous forest (second-growth redwood and Douglas fir), 25 percent mixed evergreen forest (madrone, oaks, California laurel), 25 percent grasslands, and 20 percent divided equally between chaparral and coastal shrub (Conservation Foundation 1971, CDFG 1970). Photos taken in 2000, when compared with ones taken in 1965 and 1970, show that the prairies are diminishing in size as the Douglas fir advance onto the grasslands. With no way to document the extent of indigenous burning, natural wildfires, or native herbivory, it is only speculation, but grasslands probably accounted for significantly more than 25 percent of the watershed prior to Spanish settlement and certainly more after grazing by Spanish-owned livestock.

Mexico's introduction of livestock in the 1830s replaced, in some respects, the control that fire and native herbivores had over forest encroachment. Documentation is again poor regarding both numbers and possible impacts from Mexican-era domestic grazing. Munro-Fraser (1880) said Gregorio Briones, whose 9,000-acre Rancho Las Baulines covered a major portion of the watershed, owned stock that "multiplied very fast and in a few years, he numbered his cattle by the thousands and his other stock by the hundreds." On Rafael Garcia's rancho in the Olema Valley, 3,000 head of cattle roamed freely over the hills and valleys, along with 400 horses and extensive flocks of sheep and herds of swine (Livingston 1993). The cattle business was the backbone of the Spanish subsistence and cash economies—meat for local consumption, hides and tallow for the export trade. Livestock numbers were a measure of worth, and the prairies above Bolinas Lagoon and at Point Reyes provided the forage to sustain that wealth.

American settlement of Marin County began in the late 1840s, and for decades livestock numbers far exceeded the human population. The US Census in 1850 counted only 188 people in the county, but agricultural statistics in 1856 included

12,667 head of stock cattle, along with 4,443 cow and calves, 2,060 horses, and 3,925 sheep (State of California 1857). A detailed government map shows a number of small farms on the east shore of Bolinas Lagoon as early as 1854 (USCS 1854). Statistics for 1867 show a significant change in the types of livestock being grazed on the Marin landscape. Stock cattle numbers dropped to less than 3,000, but dairy cows and calves numbered almost 17,000 (State of California 1870). By 1883, the total number of milch cows in the county was nearly 25,000, topping all other counties in the state, including neighboring Sonoma with 20,000 (State of California 1885). And the US Census found just over 13,000 residents in the county in 1890 (MCT, July 19, 1890).

The transition from range cattle to dairy cows affected the landscape and use of pasture land. Fencing was practically unheard of previous to the mid-1850s, as cattle wandered freely over the large ranchos of Briones and Garcia. As ranches were divided and operated as dairies in the late 1850s and 1860s, fencing contained the herds to specific pastures. Dairy cows crowded the areas where milking and feeding occurred, creating bare ground, mud and concentrated amounts of manure. Virtually every gulch on Bolinas Lagoon had a small dairy operating by 1870, and at least four larger dairies occupied the Pine Gulch Creek region.

One early reference to grazing appeared in the *Marin County Journal* in 1863.

> Stockmen are complaining of short pasturage on and about the hills in this vicinity and are apprehensive that the coming winter will be a hard time for cattle. The fact is the ranches have been over-stocked for many years—the grass not being permitted to seed is giving place to weeds and will soon disappear unless some change or system be adopted . . . . (MJ, May 30, 1863).

This reference is interesting, although it may have referred to the drier ranges of eastern Marin County. The Bolinas Lagoon watershed saw non-Mexican livestock grazing beginning around 1850 as Briones' leases for timber cutting included grazing rights for cattle and horses (Livingston 1995). Livestock included oxen, which were used for hauling logs and lumber in the area. Agricultural census records of 1870 indicate low numbers for livestock on the Wilkins and McCurdy ranches. That year McCurdy and his partner McMullin owned only 16 milk cows and 24 oxen; Wilkins owned 150 head of cattle and eight horses and colts. As rangeland acreage was limited on the lagoon ranches, it is not likely that they supported very large herds. While the herd count is not indicated, the State Dairy Bureau in 1896 listed the Morse dairy on Bolinas Lagoon as a Jersey herd with a creamery and/or cheese factory (State Dairy Bureau 1896).

The dairy industry in Marin County boomed between the 1860s and 1890s, with this small but richly pastured county leading all others in California in dairy production. This resulted in virtually every acre of grazeable land put into use and the seeking of profits by many dairymen. When M. B. Bossevain of the U. C. Berkeley Agricultural

Extension Office became the first county Farm Advisor in 1920 he found overstocking throughout the ranches in the county, resulting in pastures exhibiting "a greatly run down condition." He introduced range management programs to local ranchers, including Wilkins and others around Bolinas Lagoon. Boissevain promoted deferred grazing and establishment of new feed crops, including a number of experiments with the exotic Harding grass. A deferred grazing program in a former oat field on the Wilkins ranch produced fine results in 1925. Dairymen A. V. Silva and O. W. Hall of Bolinas both were very pleased with Harding grass as pasture feed (United States Department of Agriculture [USDA] et al 1920, 1923-25).

In 1970, about 350 dairy cows and 100 beef cattle were reported on Bolinas Lagoon, mostly in the northwest portion and along the western slopes of Bolinas Ridge (CDFG 1970). By 1975 most grazing activities and all dairying in the Bolinas Lagoon watershed had ceased. The creation of Golden Gate National Recreation Area in 1972 resulted in the purchase of the White Gate, Stinson, Morse, Wilkins and McCurdy Ranches, while the Point Reyes National Seashore's purchase of the Teixeira Ranch near Woodville ended dairying and grazing there. Audubon Canyon Ranch had already eliminated grazing at the former Bourne and Weeks ranches in the early 1960s. As of March 2001, only a handful of cattle and horses graze on the Wilkins Ranch, while some privately-owned ranches in the Paradise Valley/Horseshoe Hill area continue minor ranching activities.

The extent of cultivation on Marin's coastal prairies is difficult to determine. Agricultural statistics for the entire county for 1856 indicated that about 3,000 acres, or less than one percent of the county, was cultivated for grains and potatoes (State of California 1857). The agricultural schedule of the 1860 US Census recorded that Henry Strain, north of Dogtown on Pine Gulch Creek, had harvested 600 bushels of Irish potatoes the previous year. Strain owned only 26 head of livestock and appeared to be devoted mainly to farming at that point (1860 Census). By 1867, 33,257 acres were in cultivation throughout the county, and more than half those acres were in wheat, barley, or oats, with oats accounting for 12,500 acres (State of California 1870). By 1870 Strain was producing 1,000 bushels of potatoes, while his neighbors McCurdy and McMullin produced 400 bushels. Closer to the lagoon, Stephen McGovern produced 50 bushels of winter wheat, 200 of oats, 300 of barley and 700 of potatoes (1870 census). In 1880 McMullin reported 18 acres of tilled land, Strain 25, McCurdy ten acres (1880 census). The 1883 statistics indicate a significant drop in cultivated grains as dairying took the agricultural lead in Marin (State of California 1885). Few newspaper references regarding cultivation were located.

> In traveling from Olema to Bolinas, one would forget that the country is afflicted with drouth and prospect of a famine. Streams of pure water rippling in every valley among the hills, herds of dairy cows and other stock rolling fat, green grass covering every valley and hilltop, fields of as luxuriant grain as ever grew in the most favored seasons to be seen in whatever direction the eye may turn,

> demonstrate the great truth of the laws of Nature, that thrift and plenty follow industry and economy, as surely as want and beggary are the attendants upon idleness and improvidence. It is surprising to see to what good account those worthless chaparral hills, as they were supposed to be some ten years ago by many of the first California settlers, can be turned to. No extraordinary amount of labor has already converted them into rich, productive farms and homesteads, soon to rival the old New England homes, from whence swarm the surplus population to these Pacific shores to create new homes and a new civilization . . . . (MJ, June 18, 1864).

And the area was growing. In an 1864 election, 115 votes were cast in the Bolinas Township and the following year, 131 people voted (MJ, September 16, 1865). Because these numbers exclude women, children, and others deemed ineligible to vote, the township's population could have been three times that number, or about 400. By 1870 the township had 500 inhabitants, most of whom were engaged in the dairy business or in cutting wood and shipping it to market (MJ, November 12, 1870). The 1890 US Census showed 900 residents in Bolinas and Nicasio townships (MCT, July 5, 1890).

Olema was described as being the center of a rich farming country, with Upper Bolinas at Gregorio Briones' ranch identified as being in the very "midst of a rich agricultural country, thickly populated" (MJ, May 6, 1865). Great quantities of grains were shipped, along with wood and dairy products from the port of Bolinas to San Francisco in the late 1860s (MJ, September 26, 1868). Samuel McCurdy called himself a farmer in the 1870 census: he grew hay on his ranch that year but no crops, and had an orchard producing apples, cherries and pears in 1900. Occasional reports were made about crops doing well, good weather, and happy dairymen (MJ, May 1, 1873; June 19, 1873). A few references were found regarding potato planting and harvesting, and two references reported on the cultivation of barley in Pine Gulch and at Willow Camp (MJ, June 3, 1875, May 4, 1876, June 10, 1880). Marin County's History devoted only a couple of paragraphs to agriculture.

> The soil of this township is generally very rich and fertile . . . The soil of the valleys is well adapted for the purposes of growing grass, grain, vegetables, and fruits . . . . Some years ago quite large quantities of oats were raised about Olema for the city market, and oats and barley are still grown very extensively for hay. They are sown together. . . . Fine potatoes are also grown in this section, but as it is found to be more profitable to use the land for dairying purposes, the growing of all these grains and vegetables is mostly abandoned. . . .
>
> Products—The fertility of the soil of this township would admit of a versatility of products, but here, as elsewhere in Marin county, the chief industry is dairying. . . . The products of this

> township at the present time chiefly consist of butter and cordwood . . . . (Munro-Fraser 1880).

Grains and potatoes were the primary crops cultivated in the Bolinas Lagoon watershed, but this cultivation may have been limited in both time and space and was replaced by dairy operations early on. By the 1880s the once-thriving potato industry which had largely occupied Bolinas Mesa had ceased (PRP, December 1, 1888). According to Livingston (1993), a regionally significant dairy industry began developing by 1857, and over the next several decades, Swiss and Portuguese dairymen settled on Marin County ranches. Where extensive herds of half-wild Spanish cattle once roamed, placid milk cows soon took their place. Not many references to Bolinas Lagoon dairy operations were located. Another industry at Bolinas Lagoon and the Stinson Beach area, underway by 1870, was the resort business, and reports on recreation far exceeded reports on cows.

An 1873 reference mentioned the Weeks ranch on the eastern side of the lagoon, where he had a "fine dairy, his cattle grazing on the rich hills that rise abruptly back of his garden home." To the north was the Bourne ranch, where year after year 50 tons of hay were raised (MJ, October 30, 1890). By the turn of the century, eggs and butter by the ton left Bolinas every week bound for San Francisco (MJ, May 18, 1899). A 1900 "Bolinas and Olema" note reported that several dairymen, including W. W. Wilkins, Beasley Bros., and G. W. Longley, were putting in cream separators. Longley was milking 100 cows and making one pound of butter to a cow (MJ, February 22, 1900). Eastside rancher Peter Bourne was milking forty cows in 1901 (MJ, March 21, 1901). A 1903 "Notes from Bolinas" stated that Bolinas was the town for butter and eggs, with the schooner making two trips a week to the city with her decks loaded each time (MJ, April 16, 1903). Not all this production came from Bolinas. Ranchers from the Olema Valley and outlying areas also brought their products to Pt. Reyes for shipment, but by 1919, the Pt. Reyes creamery was sending down a truck several times a week to collect cream cans at Bolinas (MJ, December 18, 1919).

A list of Marin County dairies and their butter production appeared in the *Journal* of June 20, 1901. It accounted for 9,000 cows in the county, but the newspaper said this was estimated to be only a third of the actual number. For Bolinas, sixteen dairies were listed, ranging in size from fewer than 20 cows to 75, totaling about 760 cows. W. W. Wilkins at the head of the lagoon had 64 cows; Peter Bourne at the site of the present Audubon Canyon Ranch was milking 60 cows, Sam McCurdy just north of Wilkins had 60 cows, Garzoli on the Mesa was running 55 head, and S. P. Weeks had fewer than 20 cows. These numbers are small compared to the typical 150-300 cow dairies operating on the Point Reyes Peninsula and elsewhere in Marin County. The small acreage of the lagoon-side dairy ranches limited the number of cows and so set the standard for minor dairy operations.

The late Jose Silva, former fire chief of Bolinas, recalled in 1976 that his family's 3,200-acre White Gate Ranch on Panoramic Highway, in an area which drains largely

into the lower part of Bolinas Lagoon, supported 300 head of cattle, 150 dairy cows and about 200 pigs. Silva, whose memories would refer to the 1920s through 1941, also told of the family growing about 200 tons of hay on a field at the southern part of the lagoon watershed, plowing, planting and harrowing the land in the fall using horse-drawn teams. The Silvas began to import hay in the early 1930s and let the large hayfield go to pasture. The ranch operated under different owners from 1941 until the early 1970s (Silva 1984).

A sixty-cow dairy was a substantial operation in 1900, requiring maybe up to ten acres per cow and two or three men to do the milking (USDA et al 1923). A moderate climate and wet winters maintained grass into early summer, but during the dry months in late summer and fall, the dairymen would have supplemented the pasture with hay (Isaac Moxon, personal communication

If, in fact, Mexican livestock grazing was as heavy and extensive as indicated by early accounts, it would have resulted in significant watershed degradation. But there was probably little overgrazing by the dairy herds that came later, although impacts around the dairy barn were more extensive. On the other hand, cattle access to riparian areas and creek banks, and the location of ranch roads in the gulches and on the slopes would result in the introduction of sediment to the water courses. Grazing impacts to Bolinas Lagoon diminished as cattle disappeared from the landscape, but unmaintained former ranch roads may continue to be sources of sediment.

4.3.3 Logging

Research papers, planning documents, and historical articles concerned with Bolinas Lagoon usually begin with an account of early logging and place primary blame on this activity for initiating the sedimentation of the lagoon. The primitive nature of that first logging and the relatively small amount of timber removed do not support that conclusion. On the contrary, the historical record identified a number of different factors involved in the sedimentation of the lagoon.

Munro-Fraser (1880) is generally cited for the information on early logging and its impacts to the lagoon. The many historical articles written over the years about Spanish settlement, the selling of timber by Rafael Garcia and Gregorio Briones for the construction of San Francisco, and the filling of the lagoon indicate this source. Publication of county histories was common in California before the turn of the 20th century. Humboldt County's history was published in 1882 by W. W. Elliott, and that of Marin County in 1880 by Alley, Bowen & Co. They were written by employees of the publishing companies, not by local residents.

> The History of Marin County—We are happy to announce that the history of our county under the able hands of representatives of Messrs. Alley, Bowen & Co. is fast getting into shape. Mr. Fraser, their historian, has been engaged since his arrival in hunting up the old records . . . . (MJ, February 12, 1880).

Munro-Fraser's history is not the eyewitness account of a local resident. It was written by an outsider who hunted up the old records and probably talked to local people. What he wrote is extremely valuable, but he had his own perception of what he saw. The following is taken from the "History of Marin County."

> Bolinas— . . . Its only harbor is the bay of the same name situated at the southeasterly corner of the township. In days gone by this, doubtless, afforded a very ample anchorage, but the soil from the hillsides on the one hand and the sands of the sea on the other, have conspired to fill the entire bay, almost. The entrance to it is now nearly closed by an extensive sand-beach, there being only a narrow channel open through it. The greater portion of the bay is a great sandbed which is bare at every low tide, and which affords a breeding ground for countless gigantic clams. It has, of course, required ages to effect these changes, for the attrition of the soil and the accretion of the sand, must necessarily have been very slow. When the country began to settle up, this filling in of the harbor progressed much faster; for the soil, being loosened by the plowshares, was the more easily washed into the bay by the Winter rains. When vessels first began to sail into the port, a schooner drawing ten feet of water could pass over the bar with ease at any stage of the tide, while now, the same draught of vessel can barely pass at the highest stage; and where those large vessels formerly lay at the wharf, the depth of water will not admit of more than a fishing smack [a small sloop or cutter]. Old sailors are free to assert that the day is not far distant, at the present rate of filling in, when the entrance of the bay will be entirely closed, and the body of it will be mere tide and overflowed land open to reclamation and cultivation. . . . It does not seem practicable nor probable that any efforts will ever be made to reopen the channel or to care for it in its present condition. . . .
>
> Timber—There was a time when the timber of this township was bountiful, and its forests grand and extensive. It was from Bolinas that the greater portion of the early lumber supply for San Francisco came. It is estimated that about fifteen million feet of lumber was cut in the immediate vicinity of Bolinas, and judging from the stumps which still remain, the redwoods of this grand old forest primeval must have been the peers of any of their congeners in the State, always excepting of course the "Big Trees of Calaveras." This forest extended from about midway of the bay on the eastern side northward to the summit between Bolinas and Olema. They grew much larger in the gulches where they were in a measure sheltered from the fierce winds of the ocean and also where the fog was the densest. On the ridges they grew very sparsely. . . .
>
> Early Settlement— . . . In 1849, quite late in the season, a party composed of the following named persons came to Bolinas Bay

for the purpose of getting out wharf timbers: Joseph Almy, Charles Lauff, Henderson, B. F. Winslow, James Cummings, James Hough, Fred Sampson, Dr. Grattan, Hiram Nott, William F. Chappell and a few others whose names have been forgotten. James Hough had the contract for getting out the timbers and employed the other men, and received two dollars per running foot for the timbers delivered at San Francisco. The timber was rafted down the bay and over the bar where a vessel was anchored ready to receive it. It was used in the construction of wharves and warehouses in San Francisco. . . . The company had quite a large building located about one hundred yards north of the present residence of W. W. Wilkins.

Saw-Mills—In 1851 Captain Hammond built the first sawmill in this section, which was located on the present site of Woodville. It was a circular, and had a capacity of eight thousand feet daily and was run by steam. In 1852 this mill was reconstructed . . . and a circular saw put in, giving it a capacity of twenty thousand feet. This mill was run at times for about six years. . . . It is estimated that all told the mill cut six million feet of lumber. The second mill was built by an association known as the Bolinas Saw Mill Company, who had also come into possession of the first mill. It was put in operation soon after the first one and was located in a gulch very near the former. It was a steam, circular saw, and had a capacity of about eight thousand feet daily. It was afterwards sold to George R. Morris, who moved it down to what is now known as Pike County Gulch, near the head of the bay, and run there for some time. It is estimated that this mill cut three million feet. The next mill was built in December 1853 by J. L. Moulthrop, and was located on what is known as Peck's ridge. It was a steam, circular saw, and could cut twelve thousand feet daily. It was afterwards . . . moved farther up the ridge and was thereafter known as the Peck Mill. It is estimated that this mill cut three million feet of lumber. The last one built in that section was put in operation by D. B. L. Ross and John Rutherford in 1858 and was located on the road leading from Bolinas to Olema, just south of Wm. Randall's place. This mill did not run but a short time and it is estimated that it cut one million feet. This would make a total yield of thirteen million feet of lumber from that belt of redwood. When the mills were first put in operation it was estimated that there were fifty million feet in those forests, but they did not approximate the estimation. The logs were drawn to the mills with heavy ox teams on carts, the wheels of which were made from sections sawed off from a log. The lumber was drawn to the head of the bay, and thence lightered out over the bar where it was loaded on vessels for San Francisco. The transportation of this lumber required from six to eight vessels ranging in carrying capacity from eight thousand to one hundred and twenty thousand feet each.

> The remnants of the old lighter wharves are all that is now left to mark the site of these busy operations, and where once there existed an industry which gave employment to hundreds of men, and yielded a handsome income not even the stroke of an ax is heard. All is gone, and naught of it will ever return. In the days of pristine glory of this forest primeval it was no uncommon thing to find trees fifty feet in circumference, and the lumber was all first-class . . . . (Munro-Fraser 1880).

Munro-Fraser saw Bolinas Lagoon as already filled up. To him, the "great sandbed" at low tide and an entrance "nearly closed" by an "extensive sand-beach" indicated that the lagoon was "almost" filled up. He attributed the filling of the lagoon to natural processes prior to settlement. After settlement, he said the lagoon filled more rapidly because winter rains washed the soil, loosened by "plowshares," into the lagoon. He discussed timber in some detail, but did not suggest that it caused the sediment problem. He did say that when the lagoon was first used as a port, a schooner drawing ten feet of water could pass over the bar at any stage of the tide, but by 1880 it could barely pass at the highest tide and that the wharf channel could no longer accommodate those large vessels. In 1854 the depth of water over the bar was surveyed at one foot at low water, limiting the draft of vessels using the lagoon to a maximum of seven feet (MCOSD 1996). These data appear to be at odds, and information on ships adds to the confusion.

Between 1854 and 1870, ten schooners were built on Bolinas Lagoon, ranging in size from 28 to 80 tons: two 80-ton ships, one 65-ton, five of between 40 and 50 tons, one 35-ton, and one 28-ton. The 1854 ship was 50 tons and the 1870 ship was 45 tons (Munro-Fraser 1880). In 1874, a group of Bolinas men contracted for the construction of a 77-foot steamer for the Bolinas trade. (MJ, April 23, 1874, May 28, 1874). Unfortunately, the *Continental* was plagued with broken propellers on her runs to Bolinas, and the owners had her lengthened 35 feet to a capacity of 200 tons (MJ, January 7, 1875, January 28, 1875, July 22, 1875). She apparently made only one run to Bolinas Lagoon after being refitted, carrying away 80 cords of wood. The newspaper noted that since she had been lengthened, she did not, when loaded, draw so much water as formerly and could "sail out of Bolinas with one hundred cords at an average high tide" (MJ, December 23, 1875). But she was not "adapted" to the Bolinas line because she drew too much water, and the Bolinas stockholders sold her to San Francisco men in 1876 (MJ, March 2, 1876). Barfield (1984) said that the *Owl*, built in 1911 for Bolinas Lagoon, was 66 feet long and 47 tons, drawing 6.5 feet of water. Would the draft requirements for the 50-, 65-, and 80-ton schooners, built on Bolinas Lagoon before 1870, have been greater than the seven feet that could be accommodated by the bar depth measured in the 1854 survey?

According to Munro-Fraser, 15 million board feet (MMBF) was cut in the immediate vicinity of Bolinas. The first two million feet was not milled but was rafted down the lagoon and over the bar to a waiting vessel for transport to San Francisco, where it

was used in the construction of wharves and warehouses. The building for this operation was 100 yards north of the Wilkins residence. The 13 MMBF was milled by four mills between 1851 and about 1859 from that "belt of redwood." These mills were at Woodville, in a nearby gulch, and at Pike County Gulch and Peck's Ridge, and along the Olema to Bolinas Road south of the Randall place. With the exception of the Pike County Gulch location, all of these mills were northwest of the lagoon; Pike County Gulch drains into the lagoon from the northeastern side near the head of the lagoon.

From this description is appears that the logging was generally concentrated in the Pine Gulch drainage, but certainly timber also was cut in the Olema Creek watershed, which drains to Tomales Bay. What portion is anybody's guess at this point, but obviously over a ten-year period, something less than 15 MMBF was cut from the Bolinas Lagoon watershed. Land transportation of logs and lumber was with oxen, but without constructed roads that involved culverts and fills, the primary cause of watercourse sedimentation was from modern logging operations. And 15 MMBF is not a significant volume. Modern THPs produce one MMBF from less than a hundred acres of selectively logged second- and third-growth redwood, which average 18 to 24 inches in diameter. And foresters consider this a "light" cut. Munro-Fraser's report was for old-growth redwoods, which measured up to fifty feet in circumference, or roughly 16 feet in diameter. It required far fewer trees to make a million feet in the 1850s than it does today on lands that have been cut two and three times. In addition, a cordwood industry thrived in the Bolinas Lagoon watershed and all over Marin County, as "wood choppers" cut oak, bay, fir, redwood, and tanoak to feed the fires of San Francisco homes, Bay Area industries and railroads. For instance, W. W. Wilkins listed his business in the 1860 census as "Lumber" and employed three men cutting 500 cords of wood (1860 Census).

The first rights to timber in the Bolinas Lagoon watershed were transferred from Wm. Blazsdell to James Hough and P. G. Hatch in September 1849. Hough and Hatch were given the exclusive right and privilege of cutting timber on Blazsdell's farm, which was between Gregorio Briones and the "High Mountain" toward San Francisco (Deeds A:282). In October Wm. Smith granted Hough and Hatch timber rights on his farm on the seacoast, two leagues from the house of Gregorio Briones and to the north and westward (Deeds A:284). Briones and his brother-in-law Rafael Garcia granted Hough timber rights on the Rancho Baulines in October 1849 (Deeds A:279). In March 1852, Briones issued a lease to George R. Morris for "all the Red-woods and timber lands on the ridges and in the gulches running in either direction which are on the [Briones] Rancho . . . . " (Deeds A:216). Morris, in turn, granted the lease to John Hammond and J. E. De La Montague five months later (Deeds A:220). De La Montague advertised in the San Francisco paper for "eastern lumbermen" accustomed to circular sawmills, saying that he could provide steady employment for eight to ten such men (*Alta California*, July 2, 1853).

The 1850 US Census for Marin County listed 22 people with occupations in the "lumber business," and there were 115 farmers. Agricultural statistics for Marin County in 1856 listed three steam-powered sawmills, compared to nine in Humboldt County (State of California 1857). The 1860 US Census for the Bolinas Township, Olema Post Office, included 20 men who listed their occupation as "wood chopper." The 1870 Bolinas Township, Olema Post Office, listed 13 wood choppers and one logger. For the same census, the Bolinas Post Office district listed eight wood choppers. The 1880 census was too illegible to read, and there is no 1890 census. For the Bolinas Township in 1900, no person listed his occupation as lumber or logging related.

There are no contemporaneous references to this early logging because the Marin County newspaper did not begin publication until 1861. In 1849, however, San Francisco's *Alta California* (AC) began publishing the destination of the timbers and lumber produced in Marin County. Although there were advertisements for lumber, including redwood, and proposals for wharf construction, no references were located that specifically mentioned Bolinas Lagoon logging, mills, or shipping during the early 1850s. Logging or timber-related references in the Marin newspaper were not extensive but do provide some information about the forests and some impacts from later logging.

In other parts of Marin, logging was being pursued throughout the 1860s. A new sawmill was built at Nicasio to cut 14,000 feet a day in 1863 (MJ, May 16, 1863). A year later Shafter & Co. moved an existing mill a short distance downstream from its former site on Lagunitas Creek (MJ, August 27, 1864). The valley was "heavily covered with redwood," and the Shafter and Mitchner partnership had the mill about ready to operate in the spring of 1865. Along with the mill, they build a good road to Ross Landing, where they shipped the lumber to San Francisco (MJ, April 15, 1865). In 1868, the Shafters sold the railroad $10,000 worth of wood from the Lagunitas vicinity (MJ, May 16, 1868). Two sawmills in San Rafael were each cutting 10,000 feet a day in 1866 (MJ, May 26, 1866).

Over fifteen years, Bolinas Point provided active employment to ten or fifteen small vessels for transporting wood and lumber from Bolinas Lagoon (MJ, June 16, 1866). But the big timber and milled lumber business of that early period "died out," and was replaced after that time with an active firewood business (MJ, May 1, 1873). In 1870, Robert Ingram, who lived near the head of the lagoon on the western channel, constructed a wood wharf to accommodate small lighters. At that time, about 50,000 cords of wood were shipped annually from Bolinas. Conveyed by lighters to the landing near the point, the wood sold for $3.50 to $6.00 a cord (MJ, August 6, 1870). In the spring of 1873, wood was selling at Bolinas at $11 a cord, and the demand exceeded the supply (MJ, May 1, 1873). A note in January 1874 stated that Bolinas cut about 67,000 cords of wood a year, consisting of oak and redwood. The best quality mountain oak sold at the head of the lagoon for $7.00 a cord, live oak sold for $6, and redwood sold for $4. Choppers worked by the cord, commanding $1.50 to $2.50 a

cord (MJ, January 29, 1874). In 1873-1874, the steam scow *Col. Baker* was taking ninety cords of wood each week to San Francisco (MJ, January 29, 1874).

By 1875, in the Lagunitas district, Howard, Shafter, and Richmond employed about 75 choppers and cut 200 cords a week with a ready market for 10,000 cords. The newspaper reporter remarked that the "hills about Olema are being rapidly denuded of timber" (MJ, June 17, 1875). A few months later the paper reported that a "large force of ruthless woodschoppers are soon to commence denuding the western slopes of the Lagunitas ranch of their splendid body of timber" (MJ, October 7, 1875). Meanwhile, the steamer *Continental*, reassigned to the Half Moon Bay trade, was needed at Bolinas because 4,000 cords of wood were waiting at the landings and McMullin and McCurdy had another 1,800 cords on hand. Sale of that wood would circulate about $20,000 in the community (MJ, October 7, 1875). Little wood was chopped during the winter of 1877 because there was no market for it in San Francisco (MJ, January 11, 1877). The following summer considerable wood was being shipped but at a very unprofitable figure, yet it was giving work to people and caused the circulation of a small amount of money (MJ, July 11, 1878). At one time, as much as 400 cords of wood per week were shipped from the lagoon, and it was estimated that 500,000 cords were exported from Bolinas, requiring during the busy season ten schooners, each making two trips a week (Munro-Fraser 1880). After about a decade of being a "staple interest of Bolinas," the cordwood business slipped from the scene.

Sometime about 1902, the only sawmill in Marin County started operations in the McCurdy gulch north of the lagoon.

> . . . . Merchant Bonaiti of Bolinas has given us a plant that is good for twenty-five thousand feet of lumber a day. Many who have lived a life time in Marin County are not aware that we have more than a million feet of lumber in its primitive state, standing right in the county. They have been using horses at the mill for hauling. . . . The coming year will find them using ox teams which will make a good demand for dairy bulls when done on the dairy. A dozen choppers are making ready for a busy season as soon as the rains cease and most of the lumber to be used in building the new Bolinas hotel will be obtained right here . . . (MJ, March 12, 1903).

It is unclear how long this mill operated but after the earthquake, the newspaper announced that a "new sawmill" would start up on the McCurdy ranch at Bolinas. It was estimated that the entire output would find a ready market in that section because so many houses were injured and so many were being built that the operation of the sawmill would "solve a difficult problem" for many people (MJ, June 28, 1906).

For the next half century, Bolinas concentrated on its seasonal tourist business and year-round dairying. But the post-war logging boom experienced in southern Oregon and northern California made a brief appearance in Marin County. In 1957, the Sweet

Timber Company of Oregon bought timber rights to 8,000 acres on the Tevis, Stewart, and Golden Rule Church Association ranches in the hills surrounding the Olema Valley. The Sweet mill at Olema took six months to build at a cost of $700,000, and more than two million dollars were invested in the entire operation. Omer Wisby, who started out as a faller in northern California in the 1930s and later was a "cat" operator, laid out nine miles of roads in the Olema ridges with no "formal training in surveying." Redwood from the San Geronimo Valley and Douglas fir from the area between Olema and Bolinas were processed at the Sweet mill, which employed 45 men in the mill and seven in the woods (IJ, August 6, 1960). During the campaign for Pt. Reyes National Seashore, Sweet agreed to refrain from logging an area proposed for inclusion in the park. The company also agreed to "correct practices at variance with State requirements" (IJ, April 13, 1960). Sweet's operations included areas in both the Olema and Pine Gulch drainages. Substandard and poorly maintained roads associated with the operation would have contributed sediment to these streams.

"Logging Returns to West Marin" was the headline to a story in 1969 about an operation on the Righetti property, the former McCurdy Ranch. Matthews, Humbert and Walker Timber Co., another Oregon firm, proposed to cut all the marketable trees, about 80 percent, on the 400 acres of timber on the ridge property. The logging on Bolinas Ridge was expected to yield 12 million board feet, worth an estimated $1.5 million. The redwood and Douglas fir were said to be 60 to 70 years old. (IJ, April 7, 1969). Both Marin County officials and conservationists were alarmed.

Logging started on the property notwithstanding local opposition, but the Marin County fire department filed suit, requesting an injunction against the logging, claiming it would constitute a fire danger. The court imposed a temporary restraining order against any further logging, pending the results of monitoring to evaluate the results of the logging. Within three months of the imposition of the order, a major storm came through the Bay Area. Debris flows roared down from the Righetti property and blocked Highway 1 for weeks. The court made the injunction permanent, and no further logging took place on the parcel (Kojan 2001). The Board of Supervisors passed an emergency 90-day interim ordinance banning all logging in western Marin County, pending the adoption of a natural resources ordinance, which ultimately prohibited logging (SFC, April 16, 1969).

At an old settlers gathering in 1911, a paper, written by pioneer lumberman Charles Barney, was read by his son.

> Those of us who love to extol the natural beauties of Marin County today can scarcely appreciate its old time beauty of the fifties, when almost every [canyon] leading down from old Tamalpais, the mountain that we never forget, was filled with a dense growth of redwood. Not the merely graceful and pungent smelling second growth of today, some twelve to twenty-four inches in diameter, which cluster about old and blackened stumps, but the majestic, awe

> inspiring parent trees, some of them over two hundred feet in height and fifteen feet or more in diameter, rising often one hundred feet from the ground to the first branch. Trees that were well-grown trees at the time of the birth of Christ. Trees such as we may still have the privilege of seeing in the protected groves of the Big Basin, Bohemian and Armstrong Groves and in Muir Woods and for whose preservation we and succeeding generations cannot be too thankful for. Rank on rank they descended from the mountain spurs and covered the flats almost to the water's edge. To the lumberman these trees meant 35 to 40 thousand feet to the tree, sometimes half a million feet to the acre (MJ, October 26, 1911).

In his series entitled, "Marin's Old Days," Newell Vanderbilt wrote in 1922 about lumbering in Marin.

> What a wonderful heritage we would now have in Marin County if some of the mammoth old redwoods of pioneer days still grew in our midst! Our railway travelers can note what first appear to be groups of these redwood trees from Kentfield to Corte Madera and one often hears a stranger ask why they were so planted. Yet closer examination would show that they are but sprouts of the original tree which stood there towering up into the sky and with a base of from twenty-five to fifty feet in circumference. It is still living in that its shoots appear as the present day growth, but wholly robbed of the dignity and beauty of the single giant of the old days. Down in the Muir Woods we have some of the original trees of Marin county, yet none are in any way as large as those which stood in the Mill, Ross, Nicasio, Bolinas, Liberty and Lagunitas valleys of the county. One [tree] used to stand near the old Liberty Ranch and is now probably gone before the Alpine Dam assault. Another old timer stood out Camp Taylor Way. But both of these were either too much branched for timber or had been topped by storms some centuries ago, [and seemed] to be but mourners of a lost race . . . . (MJ, July 6, 1922).

4.3.4 Easkoot Creek

The location or relocation of Easkoot Creek is sometimes mentioned in articles about Bolinas Lagoon. The general opinion is that it historically emptied into the ocean but was relocated to flow into the south end of the lagoon (MCOSD 1996), although the earliest detailed map dating from 1854 shows otherwise (USCS 1854). According to 76-year-old Hal Airey, born and raised in Stinson Beach, Easkoot Creek is in the gulch that comes directly down the slope alongside the Easkoot house (Interview with Airey by Darren Fong, GGNRA, April 12, 2000). The Easkoot house is on the east side of Highway 1 at Calle Del Piños. The creek referred to as Easkoot Creek by the Park Service is what was always called Stinson Beach Creek.

The 1854 U.S. Coast Survey and 1897 USGS maps shows eastern gulches emptying into the lagoon, and the drainages that would be Stinson Beach Creek and Easkoot Gulch emptying into a marsh area at the extreme southern end of the lagoon. On the 1897 map, the Easkoot house sits on a slope above the marsh at about its midpoint. The subdivision map for Stinson's first development in 1906 shows quite clearly the creek in Easkoot Gulch coming right down alongside the house and the Stinson Beach Creek of at least two forks, coming off the slope between Belvedere Avenue and Willow Street, passing under the highway, and then in two channels turning northwest to meet up with the water coming down Easkoot Gulch. The map for Stinson's Subdivision 3 in 1915 shows the Stinson Beach Creek passing under Arenal Avenue and skirting the Willow Camp Tent City before passing under Calle Del Piños (as it does today) on its way into Bolinas Lagoon.

The 1925, revised 1931, map, published by the Northwestern Pacific Railroad Company, shows Easkoot Gulch meeting Stinson Beach Creek just before the amalgamated stream drains into the most southeastern point of Bolinas Lagoon. Mr. Airey recalled only one occasion about 65 years ago when the Stinson Beach Creek left its channel and emptied into the ocean. His memory of the creek is that it generally flowed in a defined channel in its existing location through the Calles.

The maps and Mr. Airey's personal experience support the conclusion that neither Easkoot Gulch nor Stinson Beach Creek emptied directly into the ocean, but drained, as a single stream, into the most southeastern point of Bolinas Lagoon.

4.3.5 Pine Gulch Creek

Pine Gulch contributes half of the freshwater input to Bolinas Lagoon (CDFG 1970). According to Wetlands Research Associates, et al. (MCOSD 1996), during the last half of the 19th century and the period of most rapid sedimentation, Pine Gulch carried large quantities of sediment, extending its delta out into the lagoon.

When the Nicasio correspondent for the Marin Journal visited Pine Gulch at Bolinas in October 1872, he found that Mr. McGovern was using water from the creek for his trout pond, as was Mr. G. Grinter (MJ, June 19, 1873). The following spring the newspaper reported on the Grinter brothers and their "little experiment at the head of Bolinas Bay," where they were using Pine Gulch Creek to flood land behind a dike and by repeating the process from time to time, the land was not only "reclaimed" but was left with a deposit of "rich and generous" soil that was perhaps unsurpassed in the county. And while they were at it, they left a few low places for fish ponds (MJ, April 16, 1874). High water in late 1874 caused Pine Gulch Creek to sweep away Mr. McGovern's residence and destroy his fish ponds (MJ, December 3, 1874). The Grinter brothers' experiment resulted in the reclamation of 40 acres at the mouth of Pine Gulch in 1875, and the work continued (MJ, May 6, 1875, October 21, 1875).

Little information was located regarding the native fisheries in Pine Gulch Creek. One reference speculated about the fish in Grinter's pond.

> Grinter's fish ponds broke again last winter, this time by the force of extraordinary high tides. They were flooded with salt water, but the fish were not killed. This proves that they can live in salt water. What then are they, salmon or brook trout? Many anglers from the city think they are the regular speckled trout. Mr. Grinter thinks all trout go into salt water, if they have the opportunity (MJ, May 4, 1876).

An article in 1877 spoke about the first run of salmon at the mouths of the numerous rivers and creeks that flow into the Pacific from the coast range of mountains from Carmel north to Oregon.

> . . . . The grilse [young salmon] make their appearance about the middle of October, followed in November by the adult fish. These remain at tide water, waiting for the rise caused by the winter rains. With these fish comes a large species of trout, known here as the salmon trout, which have similar habits, and return to the sea about the same time. Now these latter fish, when enabled to do so by the rise of water, enter Pine Gulch creek and follow its course towards its head. They are frequently taken from the stream, however, by the youth of the village and others, and in the very unsportsmanlike manner of "hooking" with a large hook fastened to the end of a stick . . . . (MJ, December 6, 1877).

In 1873 fishing regulations were instituted on Bolinas Lagoon. Use of weirs, dams, nets, or seines of any description were prohibited inside the Bolinas Bar (MJ, December 18, 1873). Complaints about seines on Paper Mill Creek preventing salmon trout from ascending the stream to spawn, prompted the Olema correspondent to say that the same custom prevailed at Bolinas. However, after a law was passed entirely prohibiting fishing with seines in Bolinas Lagoon, "there are plenty of salmon trout, both there and far up in the stream emptying into the bay" (MJ, January 10, 1878).

Pine Gulch Creek, also known as Gregorio's or Bolinas Creek, was diverted for fish ponds, gardens, and reclamation and no doubt provided domestic water for the earliest settlers along its course. Eventually it was piped to town.

> . . . . People have depended for years on one well and a good supply of water from Bolinas Creek [Pine Gulch], but the drought and the fact that farmers along the creek are using the creek for irrigation purposes has compelled the citizens to reach out for other sources of supply. . . . The present shortage of water is caused primarily by an Italian Company which has leased over 40 acres of land along Bolinas Creek and is diverting water by use of dams, to irrigate and prepare the ground for planting artichokes for the San Francisco market (MJ, July 17, 1924).

That fall ninety residence and property owners in Bolinas, representing 3,000 acres, and the town of Bolinas, filed a petition with the Board of Supervisors asking that an irrigation district be formed for the purpose of supplying water for irrigation and domestic purposes, using water from Arroyo Honda Creek (MJ, November 6, 1924). The Bolinas Water District was approved by the Division of Water Rights in Sacramento in 1926 for 650,000 gallons of water daily from Arroyo Honda, and pipes were laid that fall (MJ, June 24, 1926, November 25, 1926).

In 1927 the California Fish and Game Commission planted 89 cans of trout fry in Marin County streams. Bolinas Creek received 10 cans of fry, above and below the road (*San Rafael Independent*, July 1, 1927). In 1929, Marin County received 150,000 steelhead and 12,000 German brown trout from the Cold Creek Hatchery at Ukiah. The steelhead were planted in Marin County Water District lakes and local streams, including Bolinas Creek (MJ, November 7, 1929).

> Politics Could Leave Bolinas Waterless This Summer. . . . For about five years, a major part of Bolinas' summer water supply has come from Pine Gulch Creek. The Bolinas Community Public Utility District . . . hasn't had any legal right to the water. But creekside property owners have been understanding and have permitted the summertime pumping. This year . . . the farmers who live on the creek put their collective feet down and told the BeePUD, No More. Last year [the district] built a small 20-acre-foot holding pond in a dry canyon near Arroyo Honda. . . . The Arroyo yields enough water for the town during high flow winter months but not enough in the summer.
>
> The pond was filled with Arroyo Honda's winter time surplus, but it still didn't furnish enough water for the town last summer. It still had to pump 20 acre feet (about 6.5 million gallons) from Pine Gulch (IJ, March 20, 1978).

Pine Gulch Creek provided water for trout ponds, was used to reclaim land at its mouth, provided habitat for steelhead, got its share of planted trout fry, watered family gardens and commercial crops, and was a municipal water supply.

4.3.6 Eucalyptus Trees

The eucalyptus trees on Bolinas Lagoon are notable exotics, but little information was located regarding their introduction. An article in the *Marin Journal* in 1873 told of experiments being conducted in San Mateo County regarding the suitability of eucalyptus for timber (MJ, June 5, 1873), but oral tradition places eucalyptus planting in the Olema Valley area as early as 1864. Henry Strain reportedly planted the long rows of eucalyptus trees bordering Highway 1 north of Woodville around 1867 after the new road had been built (Livingston 1995). Mr. Sam Clark, who lived next to the Bay School at Bolinas, was improving his farm by planting a large number of trees along the road in front of his house in the spring of 1873. The Nicasio correspondent,

who was visiting Bolinas, noted that the eucalyptus that Clark had planted in the fall of 1872 had already grown "sufficient to change the appearance of the roadside" (MJ, June 19, 1873). As a result of the January 1878 storm, the "gum trees and other shade trees were roughly used, many of them being broken down" on the Olema-Bolinas road and at Woodville (MJ, January 24, 1878).

A 1908 article by a Tomales Bay resident advocated planting Australian blue gum trees, noting that the gums he planted in 1875 were quite large, one 13 1/2 feet in circumference and another 12 feet 3 inches (MJ, January 30, 1908). In 1896, J. A. McNear of Pt. Reyes set out 20,000 young eucalyptus trees, purchased from W. A. T. Stratton, the nurseryman at Pt. Reyes. McNear had heard from a landowner at Stony Point that he was cutting wood at a rate of $600 per acre from eucalyptus groves planted in 1882 and was hopeful to reap the same reward for his effort at Point Reyes (MJ, December 17, 1896).

These few references indicate that at least by the fall of 1872, eucalyptus was planted along the road into Bolinas and has since then grown to "change the appearance of the roadside" and, in fact, the Bolinas landscape.

4.3.7 Mining and Oil

Prospecting for copper on Bolinas Lagoon began in 1863 and was periodically pursued to sometime in the 1890s.

> The copper mines at Bolinas, in this county, are still being worked and the fact that they will prove valuable is beyond question. . . .
>
> The first lead located and opened was the "Pioneer," and is owned by Messrs. Ewing, Cluver and Pablo Briones. . . . The "Union" tunnel is being worked so as to strike the "Pioneer" at a distance of 600 feet back into the mountain from the shaft of the latter named company, about one half of which distance has already been made. The "Pike County" is located 1 1/2 miles from the "Union" on a parallel lead lying eastwardly from said claim. After doing considerable work on their claim, the company moved about one-half mile below and commenced a tunnel to cut across to the lead very low under ground. . . . The "Weeks" mine at this time, the owners being largely interested in the "Pike," are awaiting developments in this mine . . . . (MJ, December 17, 1864).

The Pioneer and Union mines were located on the Wilkins Ranch, about a mile east of Dogtown, the Pike County on the Bourne Ranch on the upper lagoon. The Weeks mine was probably located on the Weeks Ranch just south of Bourne's.

> While at this place [Dogtown], accompanied by Mr. Ewing, we visited the Union Copper mine situated on Union Gulch, also the

> "Pioneer," just above the "Union," which is owned by Mr. Ewing and others. The work on the "Union" has progressed to some extent—a tunnel having been run into the mountain about four hundred feet. We were informed that at six hundred feet the company expects to strike the ledge. From frequent assays made, there can be no doubt as to the richness of the mine. The tunnel is timbered to prevent caving, and a railway penetrates the bowels of the hill by which means the earth is conveyed to the outside. The stock of this company is owned by the people residing at Bolinas, and we learn that the holders do not care about selling, as they are confident that when the ledge is reached they will have a good thing. The work on the "Pioneer" has not progressed to any great extent. A shaft has been sunk from which ore has been taken and sold to the Antioch Smelting Company at $27 per ton. There can be no doubt but that when these mines are fully developed, and the mountains are made to unbosom their riches, that Bolinas will present a very lively appearance (MJ, May 6, 1865).

Reports of extended tunnels and rich assays continued to come in until 1868, when the newspaper noted that the Bolinas copper mine was at a "standstill" (MJ, April 4, 1868). Nothing much happened until 1875 when a Mr. Mann began prospecting at the "Union" again (MJ, April 8, 1875). But apparently nothing came of this effort, and another five years passed before the Union was again being prospected (MJ, May 27, 1880). No further word until an 1895 reference that the copper mines on the Wilkins Ranch were being actively worked, with 40 to 50 tons ready for shipment to the smelter in San Francisco. Each ton was worth $45 and with only three miles to the landing at Bolinas Lagoon, "prospects" were very "encouraging" (MJ, December 5, 1895) Bolinas also had oil excitement. In 1865 a Mr. Daly had reached a depth of 68 feet after three weeks of work and assured the newspaper reporter that "indications were better than any he had seen in the famous oil regions of Pennsylvania" (MJ, May 6, 1865). Work was suspended in January 1866. In 1900, headlines read: "Bolinas Oil Lands to be Developed; Leases Executed; Company Incorporated for Boring Oil; a Dozen Ranchers Make Contracts for Developing their Property; Work to Commence Soon." The leases were on the Mesa and included two different developers, the Bolinas Bay Oil Company and S. Sherman (MJ, November 22, 1900). Machinery for boring arrived in December, and by late January Sherman had a hole thirty feet deep on the Howard Ranch, and Mr. Harvey of the Bolinas Bay Oil Company was nearing the 200 mark (MJ, December 20, 1900, January 24, 1901). Harvey continued drilling, and in February 1901 the well was 700 feet deep where gas was discovered (MJ, February 28, 1901). Oil prospects sparked a scramble for mineral rights on Bolinas Lagoon tide and overflow lands (MJ, March 14, 1901). The announcement of an oil strike came in June 1901.

> During the past week, good news has been coming from Bolinas. The oil well on the Garzoli Ranch reached a depth of 1,350

> feet and a good supply of oil is being pumped out. . . . We understand about 800 gallons of oil has been pumped from the well . . . . (MJ, June 6, 1901).

Nothing more has been reported about oil in the watershed. But copper was again in the news in 1904, when W. W. Wilkins took legal action to eject miners from his ranch. The article in the *Marin Journal* gave quite a story about the "wildcat mining venture" of 1895. The reporter concluded that "Bolinas and Wilkins are tired of the mine. They want no more of it and the court has been appealed to rid the community of what at one time was supposed to have been a veritable El Dorado" (MJ, May 26, 1904). In 1917 and 1918 the Chetco Mining Company worked the Wilkins Ranch mines for the last time, removing 22,500 pounds of copper ore. Chetco employed 25 men and developed the mine to its greatest extent; ruins of these and earlier operations remain in what today is called Copper Mine Gulch (Livingston 1995). Evidence of tailings piles also remain; the amount of erosion of the mine tailings has not been calculated, but must have been significant considering the level of activities there over a span of 55 years.

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CHAPTER 5
REFERENCES

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