DAM SAFETY PALM SPRINGS
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1883 DISASTER AT ENGLISH DAM – DFIC DECADE DAM FAILURE SERIES

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ABSTRACT

Eureka! The discovery of gold in California in 1848 and the ensuing California Gold Rush instigated an early period of dam building throughout the state. As hydraulic mining methods became more popular, more dams were needed to supply water for those seeking their fortune. English Dam, constructed in the mid-1850's on the Middle Yuba River, was one of those dams. Built between 1856-58 and repaired and raised in the mid-1870's, the dam was composed of three timber crib and rockfill structures. The middle dam, the largest of the three, was over 100-feet-tall and 300-feet-long. On the morning of June 18, 1883, two violent explosions were heard (Dynamite? Sabotage!), and a breach was seen in the upper cribwork of the middle dam. The breach continued to enlarge, and, within an hour, nearly the entire contents of the reservoir were emptied, estimated to be as much as 15,000 acre-feet of water. The resulting flood wave caused a rise of 40-feet at a point 43 miles below the dam, and resulted in at least seven fatalities, in addition to property damage and loss of the dam. The 1883 English Dam failure was followed shortly after by the 1884 Sawyer Decision (*Woodruff v. North Bloomfield Gravel Mining Company*), which brought an end to hydraulic mining in California, and is widely considered to be the state's first environmental law. This case study will (1) highlight information about the history and construction of English Dam, (2) describe the 1883 failure, including downstream consequences, and (3) briefly discuss dam building in California during the Gold Rush era and the fallout of the 1884 Sawyer Decision as it related to dam and levee safety.

I.BACKGROUND

The 1883 failure of the English Dam occurred at a time of great controversy over the practice of hydraulic mining in California. The collapse of the middle dam sent a wall of water downstream, causing at least seven fatalities and additional property damage. In retrospect, the impacts of the disaster and its contribution to the 1884 Sawyer Decision cannot be ignored. The failure of English Dam helped to usher in an end to hydraulic mining, forever changing the landscape of California for generations to come.

A. Site and Location

English Dam was located at the headwaters of the Middle Yuba River, roughly 21 miles northwest of Truckee, California on the historic lands of the Washoe tribe. The dam site (Figure 1) sits just upstream of Jackson Meadows Reservoir, and roughly six miles upstream of Milton Reservoir, both of which are owned and operated by the Nevada Irrigation District (NID). At an elevation of 6,140 feet [12], English Dam was located in the shadow of English Mountain (Elevation 8,373), the tallest peak in NID's watershed.

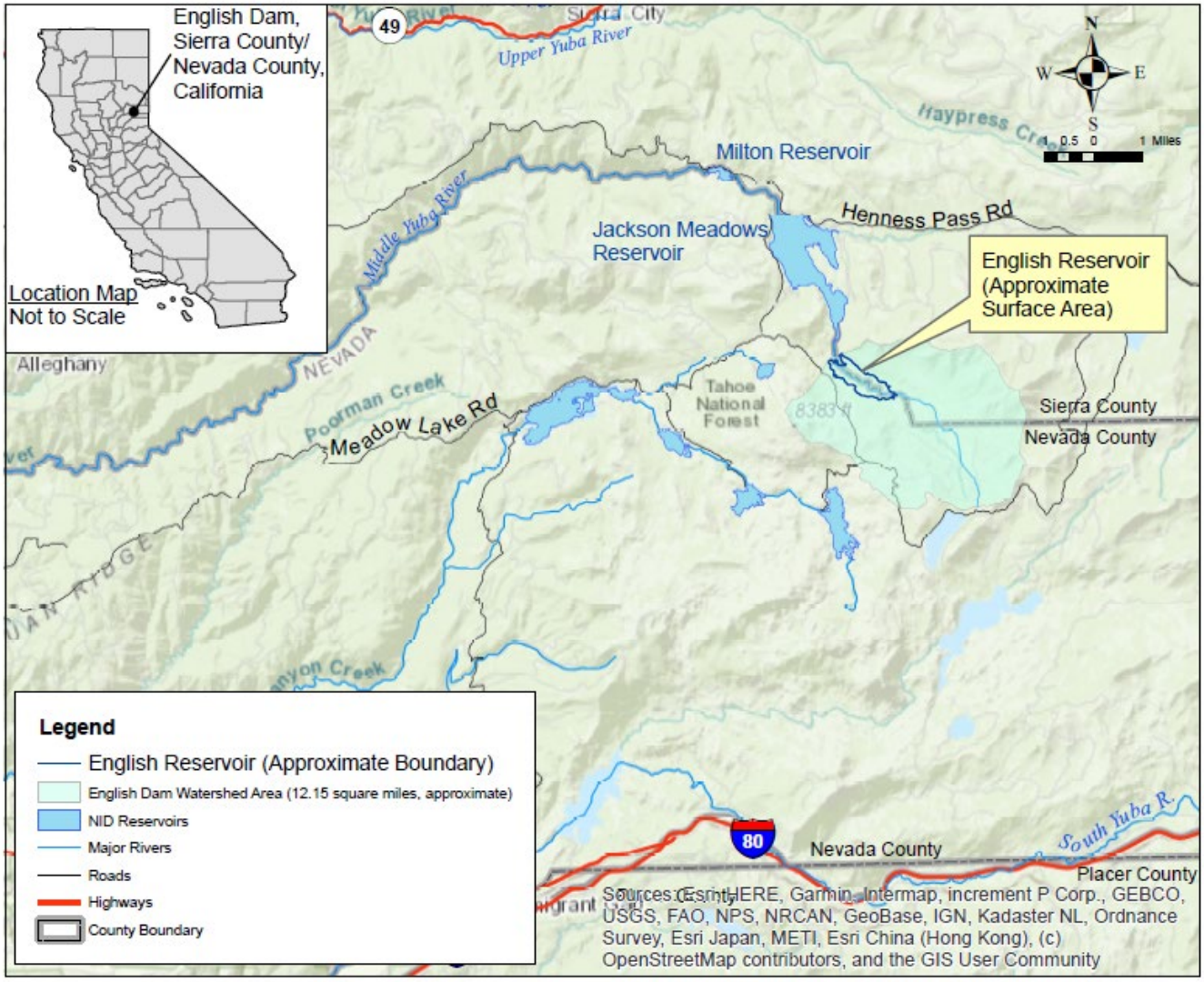


Figure 1. Site location map.

Also referred to as Rudyard Dam, the structure was built in approximately 1856-58 by the Sierra Nevada Water and Mining Company. As a large portion of the capital in this company was in English hands [15], it was often referred to as “the English Company”, and thus the dam came to be known colloquially as “English Dam”. The dam had a surface area of 395 acres, measured roughly two and a half miles long by one-half mile wide, and impounded approximately 15,000 acre-feet of water (Figures 2 and 3). The reservoir was supplied by snowmelt and runoff from a 12.1-square-mile drainage area [12].

English Dam was acquired in approximately 1868 by the North Bloomfield Gravel Mining Company, owners of the famous Malakoff Diggins claims. The reservoir was sold to the Milton Mining and Water Company (Milton Company) around 1872 or 1874 [1; 15].

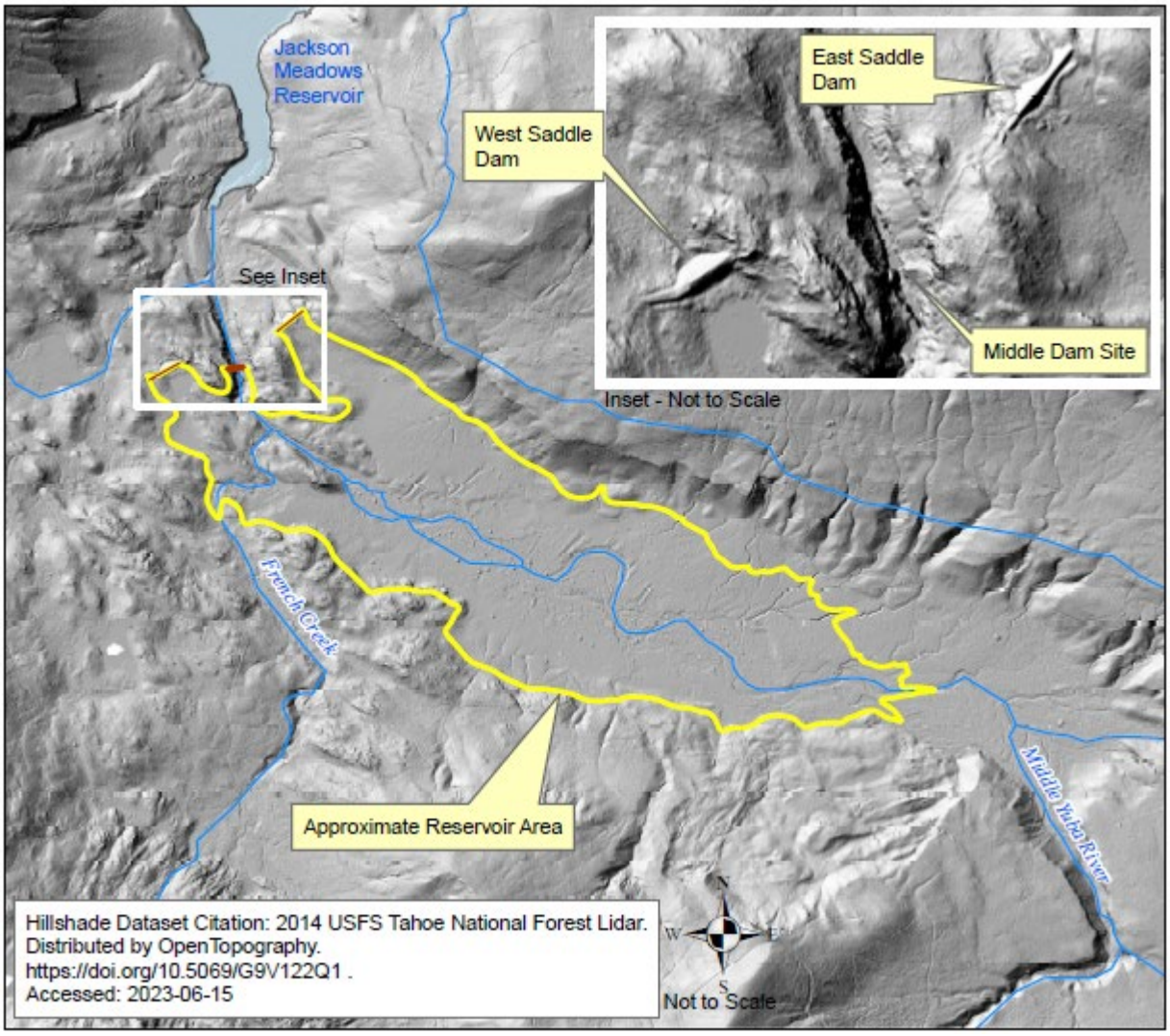


Figure 2. English Dam Site Vicinity Map.

Figure 3. Overview of English Dam, c. 1871 (Source: California State University, Chico, Meriam Library Special Collections).

The dam served as water supply for the Milton Company's hydraulic mining operations located on the San Juan Ridge, and provided flows to roughly 80 miles of ditches with a carrying capacity of 2,800 miner's inches, or about 70 cubic feet per second (cfs). Claims operated by the Milton Company included workings at Badger Hill, Manzanita Hill, Birchville, and French Corral. Together, the Manzanita and French Corral claims grossed roughly $620,000 in 1878, providing a profit of $360,000 after expenses (nearly $11M in 2023) [15].

B. Dam Description

English Dam was composed of three timber crib and rockfill structures, including a main dam and two saddle dams (east and west). Historic photographs of the three structures are provided for reference in Figures 4-6. The Main Dam had an interior height of 100-feet, and exterior height of 131-feet. The base width was approximately 185-feet. The total length along the dam crest was estimated to be 331-feet, with a minimum bottom length of about 50-feet [1]. The original dam consisted of a rock-filled timber crib constructed of tamarack logs, 79-feet-high, 100-foot-thick at its base, and with an inner slope of 60-degrees [12]. The entire structure was faced with wooden planking.

In 1876-77, the structure was substantially repaired. Decayed portions of the timber crib were replaced with new timbers. At the same time, the dam was raised and thickened by building up a stone facing on the outside, laid up as a dry rubble wall at a slope of 44-degrees [12]. The total raise was approximately 14-feet above the original dam crest, with the upper 7-feet formed by a substantial timber crib work.

The East and West Saddle Dams (also referred to as the north and south dams [15]) were reportedly 50-feet and 60-feet high and 150-feet and 200-feet long, respectively. Both dams were approximately 40-feet wide at their base. A spillway was provided with spill crest 14-inches below the top of the upper cribwork. Observation of the remaining dam structure as it exists today (2023) as well as review of historic photographs (Figure 3) appear to indicate that the spillway was located at the East Saddle Dam.

Figure 4. Overview of east saddle dam, c. 1871 (Source: California State University, Chico, Meriam Library Special Collections).

Figure 5. Overview of west saddle dam, c. 1871 (Source: California State University, Chico, Meriam Library Special Collections).

Figure 6. Overview of main dam, c. 1871 (Source: California State University, Chico, Meriam Library Special Collections).

C. Conditions at Failure

On June 17, 1883, the day before the failure, the reservoir level was reportedly 2.5-inches below the spillway crest (16.5-inches below the top of the upper cribwork) [12]. The dam had been inspected three days prior to the failure and had been found to be in satisfactory condition according to Milton Company Superintendent H.C. Perkins. There had been no signs of weakness or leakage in the structures following the raise and repair work completed in 1876-77. The water was raised annually to the spillway crest.

II.FAILURE AND CONSEQUENCES

A. Dam Failure

English Dam failed on June 18, 1883, at roughly 5 or 5:30 am. On that morning, Watchman George Davis, a Milton Company employee, heard two violent explosions. Upon reaching a point from which he could view the dam, he observed water pouring through a wide breach in the upper cribwork of the middle dam. As described by Davis in the *Nevada City Daily Transcript* two days after the failure, “It started by carrying off the upper wooden portion…It gradually crumbled the rest, stones and all, until nothing was left but the site. The water was an hour and a half running out” [10]. It was inferred that the dam breach had been caused by dynamite [12], though this claim was never proven. The resulting dam failure sent nearly 15,000 acre-feet of “water and debris crashing down the entire canyon of the Middle Yuba River, from the mountains all the way to Marysville and beyond” [10]. The initial breach produced an estimated discharge of over 166,000 cfs [1], and the resulting flood wave caused a rise of 40 feet at a point 43 miles below the dam [12].

B. Downstream Flood Wave

On the morning of the failure, a warning message flashed along the stations of the Ridge Telephone Line:

"The English dam broke this morning at 5 o'clock. Warn everyone along the Middle Yuba River!" [9]

N.C. Miller, ditch superintendent, had received word from George Davis about the dam failure and rushed to warn those downstream. Miller dispatched the message and gave approximate time of arrival of the "hundred-foot wall of water" [6]. Reported to be the oldest long-distance line in the country [5; 18], the Ridge Telephone Line had been built in the late 1870's to help manage the long series of ditches and conveyances supplied by English Dam [15]. The line provided communication between the Milton Company's headquarters at French Corral up to Milton, just below English Dam (Figure 5).

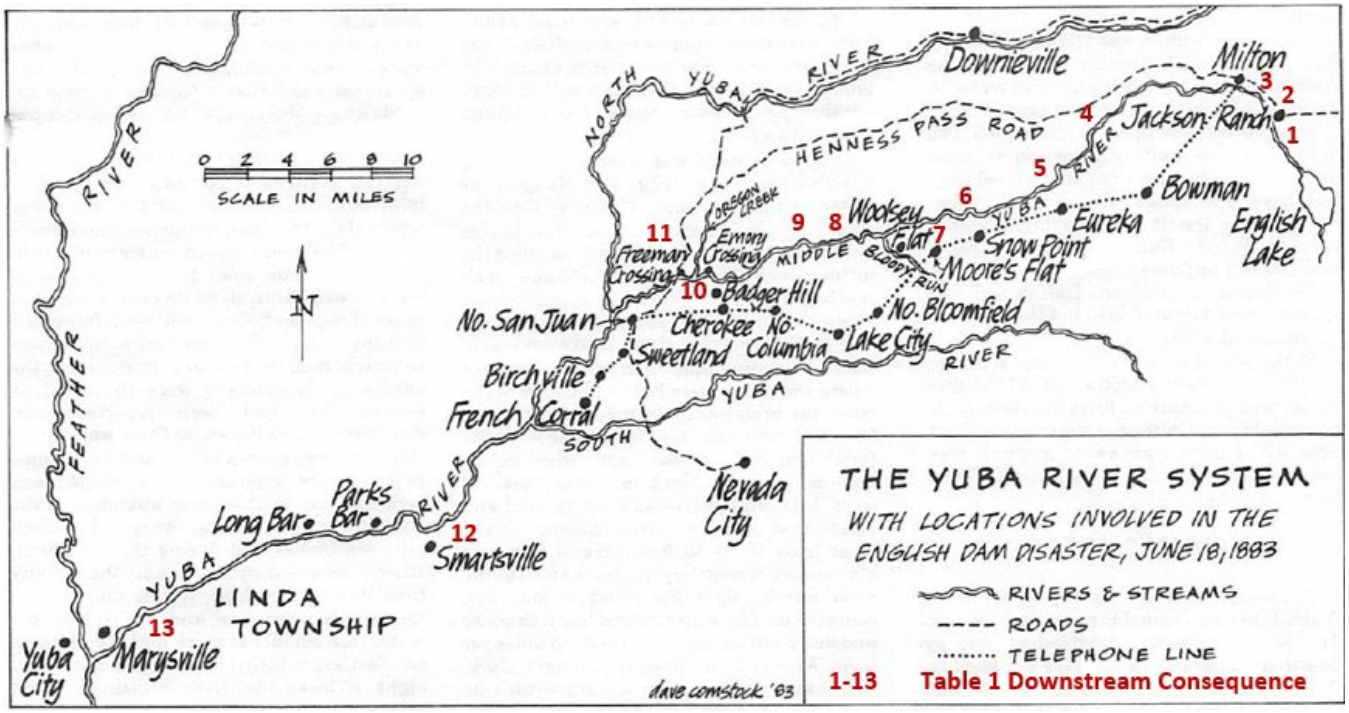


Figure 7. Yuba River and Ridge Telephone Line Stations (annotations added by authors) [15].

A thorough account of the ensuing flood wave and resulting damage is provided in a 1949 article that appeared in the *California Historical Society Quarterly* titled "The 1883 Flood on the Middle Yuba River," by Doris Foley and S. Griswold Morley [5]. Further details can be found in publications by the Nevada County Historical Society (NCHS) [9, 15], NID [10], and Bowie [1]. The timeline in Table 1 below has been summarized from these references to illustrate the timing and level of destruction wrought by the failure of the English Dam:

Table I - Flood Wave from English Dam Failure – Downstream Consequences

Location Reference	Time or Mile	Description
1	Unknown	Sheep herders tending to a flock belonging to W.P. Lipp of Wheatland, California were the first to experience the flood wave. While most of the sheep were driven clear of the raging waters, some were lost, together with a gun and some utensils.
2	3 miles downstream at Jackson Ranch	Operated by the Black brothers. Both managed to crawl out of bed just in time to escape. As reported in the Grass Valley Union after the disaster: *"The bottom land is strewn with trees and parts of trees smashed in all kinds of shapes. In many places, pieces of the*

Location Reference	Time or Mile	Description
		trunks of trees, two or three feet through and eight to twelve feet long were peeled of all their bark as clean as could be done with an ax, and some trees 100 feet long are uprooted and peeled of all their bark and limbs…"
3	Between Milton and Jackson	Two bridges were destroyed along the Henness Pass Road
4	About six miles downstream	Ditch tender Tom Fairweather managed to escape with his new bridge thanks to the warning from N.C. Miller.
5	Roughly 12 miles downstream, north of Eureka and opposite Graniteville	Miners escaped by climbing the north bank of the river. One of two Reese brothers drowned despite efforts to save him.
6	Opposite Snow Point, about 16 miles downstream	A new tunnel was being driven for McKillon's (or McKillicum's, or McKillicon's) mine. The flood wave rapidly filled the tunnel, nearly trapping the miners inside. The men would likely have drowned had a new airshaft not just been completed, allowing them to escape.
7	Near Moore's Flat	The flood wave was reportedly as high as 60-feet.
8	About one mile above Foote's Crossing bridge	The flood wave destroyed a dam owned by the Eureka Lake Company. Between 24- to 30-feet high, the dam raised water into the San Juan Ditch that supplied the American mine at Sweetland. Two flumes were also destroyed.
9	At Horseshoe Bend	Five miners drowned.
10	At Emory's Crossing, three miles above Freeman's Crossing	12 cabins were carried away.
11	By 9 am, the flood wave had reached Freeman's Crossing, near Oregon Creek and the (present) California Highway 49 crossing of the Middle Fork Yuba River	Built in 1871, a four-span covered bridge existed at this location, measuring 240-feet-long, and resting on piers 15- to 18-feet above the water. • Upon receiving N.C. Miller's warning, Thomas Freeman guided his blind wife to higher ground. • Flood waters backed up into Oregon Creek, engulfing the covered bridge, lifting it from its foundation and carrying it 150-feet downstream. The Downieville Stage to Nevada City had crossed the bridge just moments before and was only 100-yards beyond the crossing when it was swept away. A month after the disaster, teams of oxen were used to drag and roll the bridge on planks and logs back to its original location.
12	Around 11 am, the flood wave reached Smartsville	A $5,000 stash of gold amalgam was washed away at the American Mine, along with 40 head of cattle.
13	By roughly 3 pm, the flooding reached Marysville, roughly 85 miles below the dam	The floodwaters carried a mass of mining debris, brush, trees, logs, and other debris. To the dismay of the locals, the observed rise at this point was estimated to be only 2-feet, 8-inches. Bets had been placed on how high the flood waters would rise. It was later revealed that a levee break near Linda, seven miles upstream, had flooded the Beeney ranch and largely spared Marysville from major damage.

Location Reference	Time or Mile	Description
Not shown	Sacramento	The reported river rise was only 8-inches. The flood wave reached the State capitol in roughly 24 hours, with a total time in passing that point of 26 hours.

C. Fatalities and Property Damage

In total, at least seven fatalities were attributed to the dam failure and resulting flood wave [18]. Resulting property damage was estimated to be $40,000 to $50,000 ($1.2-1.5M in 2023), including a loss of $4,000 (2023 - $120k) for flooded wheat fields, at least 40 head of cattle and an undetermined number of sheep that were caught in the flood wave, along with approximately $5,000 (2023 - $151k) in gold amalgam that was swept away. The Milton Company suffered an estimated loss of $150,000 for the value of the dam (2023 - $4.5M), in addition to $75,000 in lost water revenue (2023 - $2.3M). The company reportedly paid all damage claims.

D. Whodunnit?

The 1883 failure of the English Dam occurred at a time of great controversy over the practice of hydraulic mining in California. Three other Sierra dams had already been attacked, reportedly by interests who objected to hydraulic mining activities. This included Brush Dam on the Yuba River, which had been burned, as well as the Birdsall Dam on the Bear River and the Alta Dam on Cedar Creek, both of which had been destroyed by dynamite [18].

In the days following event, Milton Company Superintendent H.C. Perkins publicly charged “The break was not accidental…the dam was blown up by powder” [18]. Suspecting sabotage, the Milton Company and Superintendent Perkins offered a $5,000 reward for information leading to the arrest of the responsible parties; no one was ever brought to trial. Soon after the failure, Watchman George Davis fell to death from a flume; foul play was again suspected but never proven.

Although mining officials feared more acts of sabotage would follow, the failure of English Dam was the last as the 1884 Sawyer Decision brought an end to hydraulic mining, thus stemming the controversy between mining and farming interests.

E*. English Dam Today*

English Dam was never rebuilt. A portion of the main dam and most of the two saddle dams still exist today (Figures 8 -10). Water rights to the Middle Yuba River, including the dam site, were acquired by NID in the 1920’s. The original dam site was considered again in the 1960’s during planning for NID’s Yuba-Bear Hydroelectric Power Project; however, construction of a new dam at the site was considered too costly. Furthermore, flows would be more effectively captured at the new (1965) Jackson Meadows Reservoir, just downstream [10]. NID continues habitat and hydrological restoration work at English Meadows (formerly inundated behind English Dam) to restore connectivity between the heavily incised Middle Yuba River and the floodplain. It is assumed that this disconnect is a result of the rapid draining of water following the dam’s failure.

Figure 8. Remails of Middle English Dam looking southwest at the Middle Yuba River Canyon (Source: Nevada Irrigation District, Cameron Townsend).

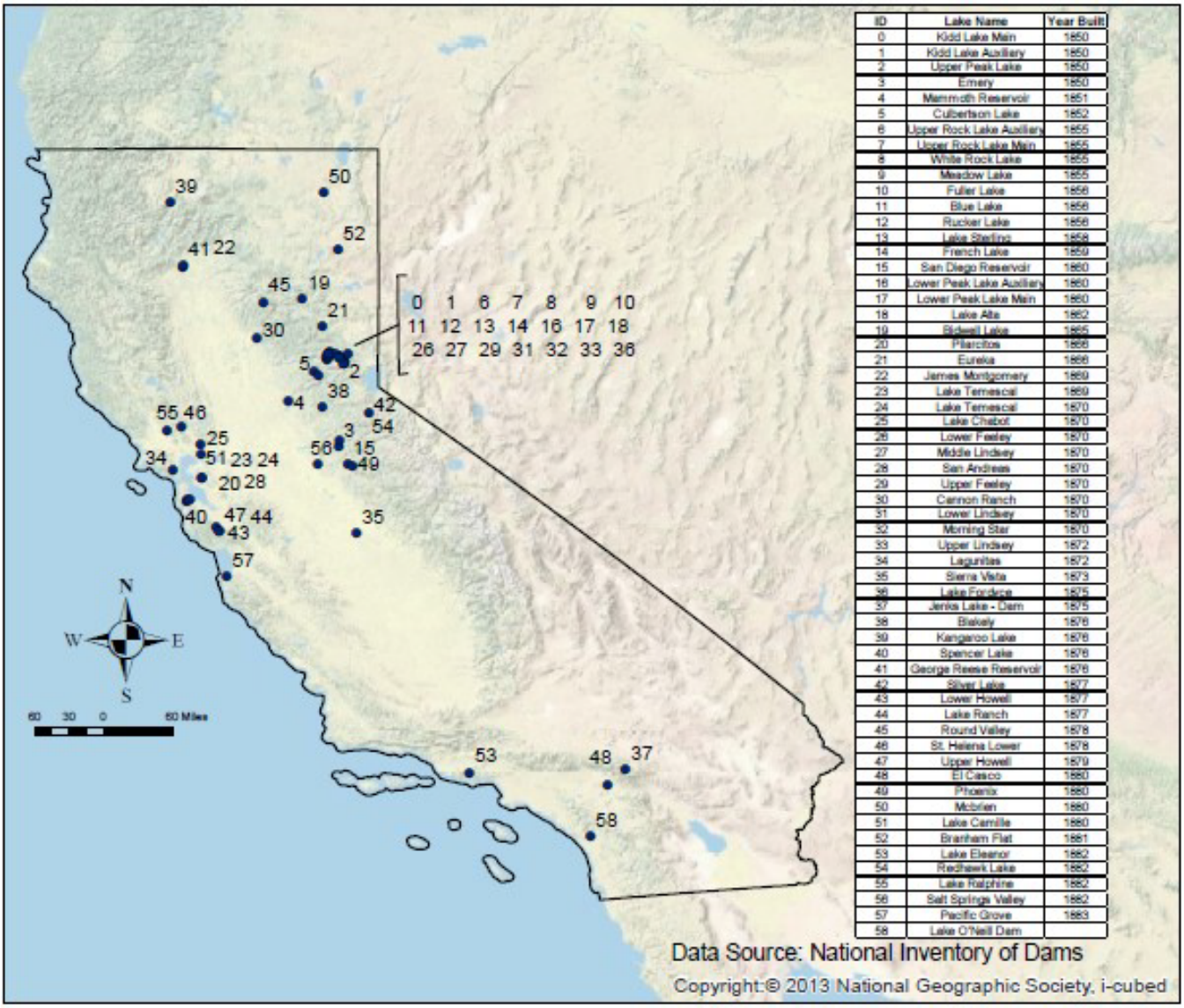
Figure 9. Remains of East Dam looking southwest (Source: Nevada Irrigation District, Cameron Townsend).

Figure 10. Remains of the East Dam looking upstream (Source: Nevada Irrigation District, Cameron Townsend).

III.FALLOUT

A. Early Dam Building in California

To consider the 1883 English Dam failure in better context, it is necessary to consider the momentous events that set its construction into motion. The 1848 discovery of gold by James Marshall at Sutter's Mill in Coloma on the South Fork of the American River forever changed the framework for constructing dams in California. Following Marshall's discovery and a second major gold strike in the Auburn Ravine five months later, thousands of people flocked to the region in hopes of striking it rich. The easy pickings were quickly diminished, and ambitious miners were compelled to design and construct more elaborate systems to separate the gold from the sand and gravel deposits. Prior to 1850, there were no engineered water systems in the foothills of California's Sierra Nevada mountains [11]. By 1884, over 58 dams had been built in California as catalogued in the National Inventory of Dams (Figure 11).



ID	Lake Name	Year Built
0	Kidd Lake Main	1850
1	Kidd Lake Auxiliary	1850
2	Upper Peak Lake	1850
3	Emery	1850
4	Mammoth Reservoir	1851
5	Culbertson Lake	1852
6	Upper Rock Lake Auxiliary	1855
7	Upper Rock Lake Main	1855
8	White Rock Lake	1855
9	Meadow Lake	1855
10	Fuller Lake	1856
11	Blue Lake	1856
12	Rucker Lake	1856
13	Lake Sterling	1858
14	French Lake	1859
15	San Diego Reservoir	1860
16	Lower Peak Lake Auxiliary	1860
17	Lower Peak Lake Main	1860
18	Lake Alta	1862
19	Bidwell Lake	1865
20	Pilarcitos	1866
21	Eureka	1866
22	James Montgomery	1869
23	Lake Temescal	1869
24	Lake Temescal	1870
25	Lake Chabot	1870
26	Lower Feeley	1870
27	Middle Lindsey	1870
28	San Andreas	1870
29	Upper Feeley	1870
30	Cannon Ranch	1870
31	Lower Lindsey	1870
32	Morning Star	1870
33	Upper Lindsey	1872
34	Lagunitas	1872
35	Sierra Vista	1873
36	Lake Frodeca	1875
37	Jenks Lake - Dam	1875
38	Blakely	1876
39	Kangaroo Lake	1876
40	Spencer Lake	1876
41	George Reese Reservoir	1876
42	Silver Lake	1877
43	Lower Howell	1877
44	Lake Ranch	1877
45	Round Valley	1878
46	St. Helena Lower	1878
47	Upper Howell	1879
48	El Casco	1880
49	Phoenix	1880
50	Mcbrien	1880
51	Lake Camille	1880
52	Branham Flat	1881
53	Lake Eleanor	1882
54	Redhawk Lake	1882
55	Lake Ralphine	1882
56	Salt Springs Valley	1882
57	Pacific Grove	1883
58	Lake O'Neill Dam	

Figure 11. Locations of dams built in California prior to 1884.

Beginning in the early 1850's, the mountain watersheds in the area near English Dam were bustling with activity as miners and speculators were attempting to claim and develop the waters associated with them. Initially, pans and rockers were used to collect and extract the pay dirt from the ancient riverbeds, but competition was fierce, and construction was frantic. The need to process more material at a faster rate led to the construction of water conveyance features and the invention of the water cannon, leading to the birth of hydraulic mining. The first noteworthy attempt to convey water in an artificial channel was made at Coyote Hill in Nevada County in March of 1850 [10].

"Modern" hydraulic mining was first used in 1853 outside of Nevada City, California. The process used large canvas hoses to redirect water and dislodge gravel from large hillsides. [13] The resulting slurry was run through a sluice to extract the gold. Water delivered to a mining site would be shot though a nozzle onto the face of a cliff washing away tons of boulders, gravel, and dirt. The water cannons, or monitors, could "throw" 185,000 cubic feet of water in an hour with a velocity of 150 feet per second [14].

By 1869, there were 5,328 miles of artificial water courses for mining purposes in California. By the late 1860's, most of California's placer gold (gold eroded from a vein and located in a secondary deposit) was obtained by hydraulic mining and the most profitable mines, as a class, were those worked by the hydraulic process [3].

B. Woodruff v. North Bloomfield Gravel Mining Co. and the Sawyer Decision

Concerns began regarding the tailings resulting from hydraulic mining soon after its inception. Land near downstream rivers was flooded and farms were destroyed. In the years leading up to the Sawyer Decision, it is estimated that the San Francisco Bay was filling with silt and debris at a rate of one foot per year as a result of hydraulic mining. Downstream rivers including the Feather, Yuba, and Sacramento had to be closed to riverboat traffic as a result of the increase in debris. In response to the fear of a rise in water levels, downstream residents built higher levees [4].

In 1882, Marysville resident Edward Woodruff filed suit against the North Bloomfield Gravel Mining Company due to the damages caused by hydraulic mining. In 1884, following the failure of English Dam in June 1883, Ninth Circuit Judge Lorenzo Sawyer issued what has become known as the Sawyer Decision [17]. The decision describes the damage caused by hydraulic mining and permanently enjoined the mining company against dumping any material into watercourses. Sawyer is often credited for handing down the first environmental decision from a judge in the history of the United States of America.

In the decision, Sawyer refers to the impact on levees resulting from the mining debris as well as the English Dam failure and the resulting flood as reasons for the need to outlaw the practice.

> *There could have been acquired no prescriptive right to extend the injury to other lands by continuing to send down other refuse matter from the mines, and raising the level of the bed of the river, by deposits of debris between the levees, higher and higher from year to year, thereby constantly and surely increasing the danger of breaking the levees, and discharging their augmented contents upon the surrounding country not yet destroyed. That an increase of these deposits, already elevated several feet above the level of the country outside the levees, must greatly enhance the danger, and in an increasing ratio, cannot fail to be obvious to the most superficial and least-informed observer. These barriers, upon which the present and future safety of Marysville and the adjacent country depends, are even now, with the present level of the debris confined within the levees, frail indeed, when compared with the forces of nature; liable at any time during our rainy season to be turned against them by any accidental obstruction to the currents of the flood. The temerity of those who trust their lives and fortunes to the protection afforded by these relatively feeble barriers during a flood is well calculated to excite wonder.*
>
> *The brief flood occasioned by the breaking of the English dam, in June last, afforded a striking illustration of what is liable hereafter to occur. This enormous deposit of debris in the Yuba, at and near Marysville, and in the streams in the mountains above, is a continuing, ever-present, and, so long as hydraulic mining is carried on as now pursued it will ever continue to be, an alarming and ever-growing menace, a constantly augmenting nuisance, threatening further injuries to the property of complainant, as well as the lives and property of numerous other citizens similarly situated. Against the continuous and further augmentation of this nuisance the complainant must certainly be entitled to legal protection. [17]*

The ruling effectively ended the practice of hydraulic mining in California. Although subsequent legislation has replaced the Sawyer Decision, the principles of the decision and impact it had can be seen in current legislation. The 1893 Caminetti Act modified the decision somewhat by allowing hydraulic mining in areas where a debris-retaining dam could be built to keep material from entering Sierra streams. The Rivers and Harbors Act of 1899 (33 U.S.C. Sec. 401 et seq.) provides the initial authority of the U.S. Army Corps of Engineers, and can be tied directly to the 1884 Sawyer Decision as it similarly makes it illegal to excavate or fill, or in any manner to alter or modify any navigable water of the United States without proper approval.

C. Lasting Environmental Impacts

The English Dam disaster and its contribution to the 1884 Sawyer Decision and subsequent environmental law in general cannot be ignored. The Sawyer Decision affirmed the courts' role in disputes between industry and private property owners, and balanced economic growth with benefit that industry brings to an area [16]. The impact of the decision can be seen today as the NID, the current owner and operator of several dams and reservoirs previously used to store water for hydraulic mining, works with Federal, State, and Local partners to restore the meadow that was inundated by the English Dam.

NID is in the process of implementing a meadow restoration project that includes constructing a series of native woody debris structures in the Middle Yuba River channel; raising the river channel and subsequently the water table to re-activate the meadow floodplain and improve hydrology. NID plans to treat and fill dewatering channels and headcutting tributaries to promote infiltration and absorption of surface flow, and reduce sediment transport. In addition, the project will thin 180 acres of dense understory forest vegetation on the slopes surrounding the meadow

to improve forest health and decrease the risk of extreme wildfire. This project has included coordination with State and Federal regulatory agencies and locally affiliated Tribes, including the Washoe who have aboriginal rights to this area, in the planning and upcoming implementation stages of the restoration project. The Wildlife Conservation Board and the Sierra Nevada Conservancy are active partners working with NID to provide grant funding to realize the English Meadow Restoration Project. The agencies have provided over $2M collectively to support the expansion of forest management practices to create healthier and more resilient ecosystems in the Yuba River watershed.

Montane meadow environments are critical features throughout the high elevation of the Sierra Nevada region, providing refuge habitats for terrestrial and aquatic communities. Today we realize that these meadows are valuable and justify public investment to restore, monitor and manage them as parts of functional headwaters watersheds.

IV.CLOSING

The English Dam disaster serves as a unique case study in dam safety and environmental law. Although the cause of the failure will likely never be known, the impact of the resulting destruction is long lasting. The potential sabotage associated with the failure speaks to the need to provide adequate security to remote dam sites. Communication via telephone about the flood wave undoubtedly saved lives and highlights the need to have adequate emergency detection and response plans. The Sawyer Decision and subsequent Rivers and Harbors Act are two of the oldest state and federal environmental laws and trace their roots to the failure on June 18, 1883. As the NID and its partners in the watershed work to repair the meadow inundated by the dam and subsequently damaged by the failure, consideration must be given to the long lasting social and environmental impacts of the English Dam disaster.

V.ACKNOWLEDGMENTS

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Cory Miyamoto is a Senior Engineer with the California Division of Safety of Dams (DSOD) in Sacramento, California. He currently serves as an Area Engineer in DSOD’s Field Engineering Branch with oversight of 140 jurisdictional dams in northern California. Mr. Miyamoto is a registered civil engineer with over 12 years of experience in dam safety and water resources engineering. He earned his B.S. and M.S. in civil engineering from the University of California, Berkeley (Go Bears!). Mr. Miyamoto is active involved in ASDSO, including serving as Co-Chair of the Committee on Career Development and Student Outreach (CCDSO), Chair of the Young Professionals Interest Group (YPIG), and Subcommittee Chair of the Decade Dam Failure Series with the Dam Failures and Incidents Committee (DFIC). He is also a contributor to ASDSO’s DamFailures.org website.

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Keane Sommers is a Civil Engineer with 20 years of experience in the fields of dam safety, water resources planning, hydraulics, and hydropower. His experience includes project/construction management, design and evaluation of numerous hydropower related structures, hydraulic model development, watershed level evaluation of potential drinking water contaminant sources, and a variety of water resources related tasks. Mr. Sommers has

participated in and managed projects involving various scientific and engineering disciplines, including civil engineering design, hydrology, hydraulics, surveying and mapping, and geomorphology. He also has extensive training in emergency management and response.

He currently serves as Nevada Irrigation District's (NID) Director of Power Systems where he provides leadership, vision, and direction to the 34 staff members in NID's Hydroelectric Department. The Department is responsible for the operations, maintenance, regulatory compliance, and improvement of seven NID powerhouses, fifteen jurisdictional dams, over sixteen miles of water conveyance, nine miles of 60 kV transmission line and eight on-stream diversions.

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Lacy Cannon joined Nevada Irrigation District's Hydroelectric Department in 2019 and has spent the past 4 years working in dam safety. The District's Dam Safety Program applies to 15 jurisdictional dams, 9 diversion dams, and associated appurtenant structures and waterways. She has over 15 years of professional experience and has worked for several private consulting firms gaining experience in geotechnical and water resources engineering prior to joining NID. Lacy is a registered Professional Engineer in the State of California and has a Bachelor of Science in Civil Engineering from California State University, Sacramento.