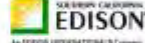


- SCE Big Creek Projects**
- Big Creek Nos. 1 and 2 Project
FERC Project No. 2175
 - Big Creek Nos. 2A, 8 and Eastwood Project
FERC Project No. 67
 - Big Creek No. 3 Project
FERC Project No. 120
 - Big Creek No. 4 Project
FERC Project No. 2017
 - Mammoth Pool Project
FERC Project No. 2085
 - Portal Project
FERC Project No. 2174
 - Vermilion Valley Project
FERC Project No. 2088
- City, Town
 - County Boundary
 - Water Conveyance
 - ▲ Powerhouse
 - Dam
 - Diversion
 - Roads

Note: The Big Creek No. 4 Project received a FERC License on Dec. 4, 2003. The Vermilion Valley Project and Portal Project operate under annual licenses.




EDISON
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With Assistance From


ENTRI

Big Creek Hydroelectric System
Alternative Licensing Process


Figure 1
**Southern California Edison
Hydroelectric System**



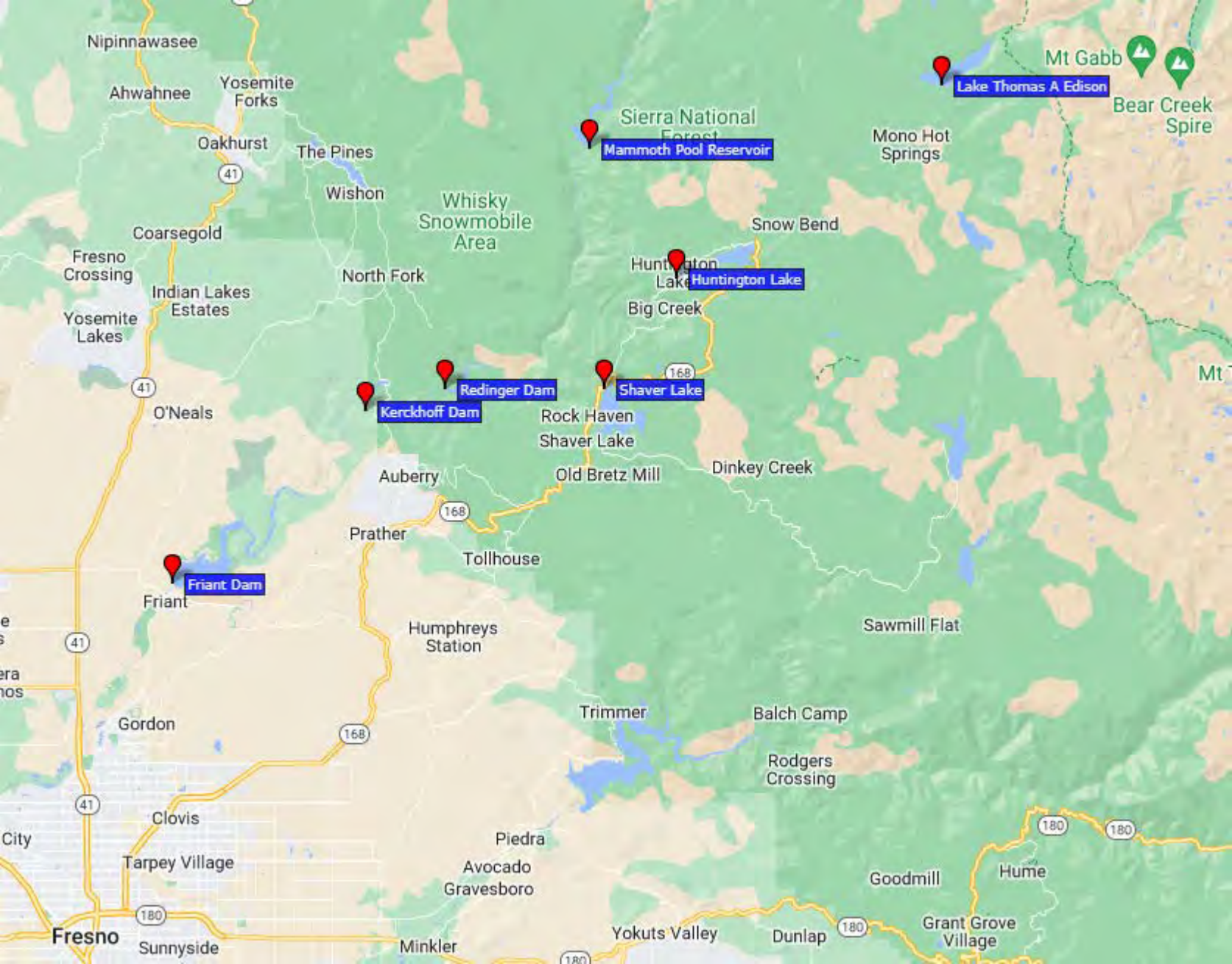
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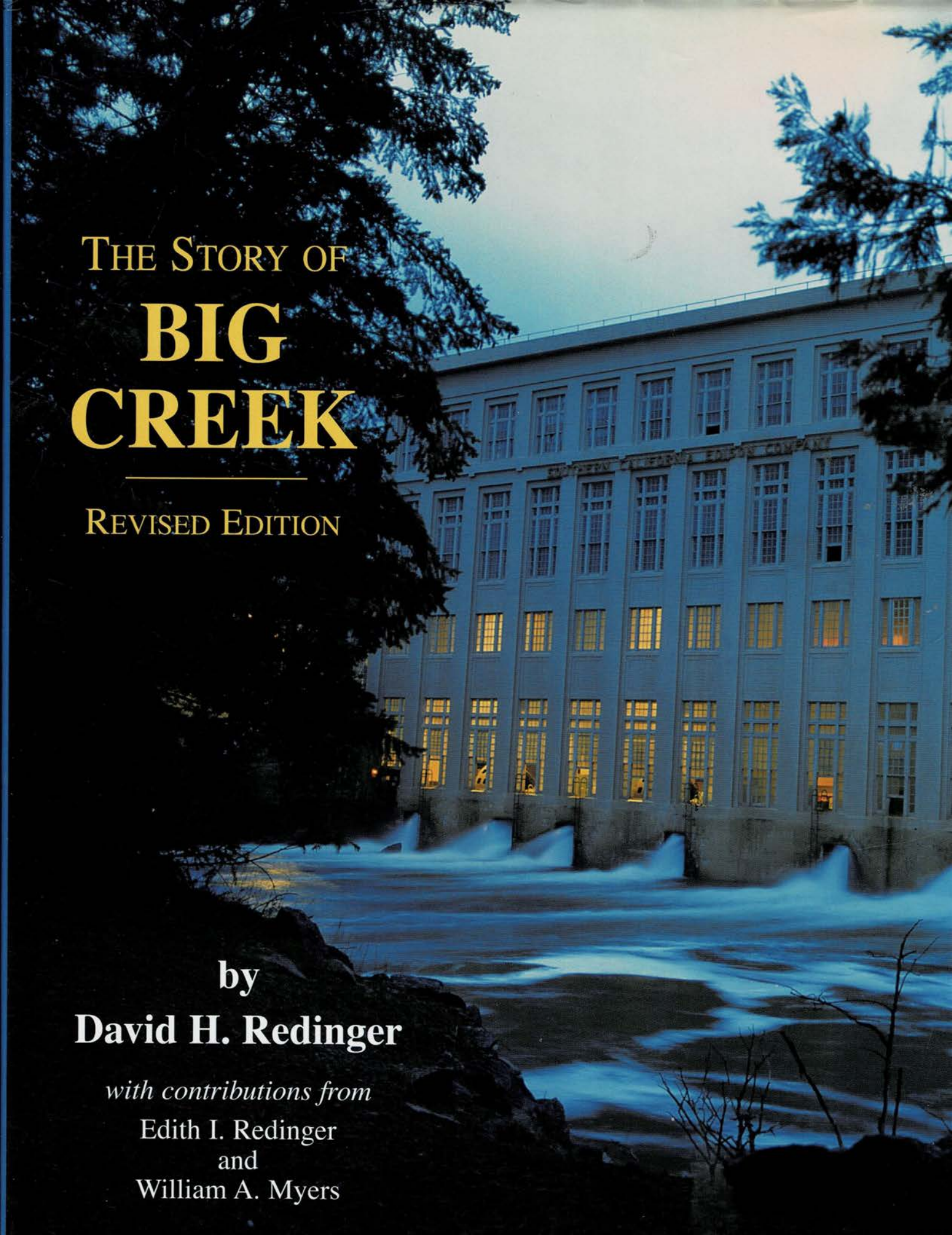


Projection: UTM Zone 11
Datum: NAD 83



Big Creek Hydroelectric Project





THE STORY OF
**BIG
CREEK**

REVISED EDITION

by
David H. Redinger

with contributions from

Edith I. Redinger
and
William A. Myers

References

[John Samuel Eastwood](#)

[INITIAL INFORMATION PACKAGE](#)
for the BIG CREEK HYDROELECTRIC SYSTEM
ALTERNATIVE LICENSING PROCESS

[Big Creek Hydroelectric System Produces 'Hardest Working Water in the World'](#)

[Big Creek Hydroelectric System Historic District](#)
National Register of Historic places

INITIAL INFORMATION PACKAGE
for the
BIG CREEK HYDROELECTRIC SYSTEM
ALTERNATIVE LICENSING PROCESS

May 2000

Prepared By



With Assistance From

E N T R I X

3.1 PROJECT HISTORY

3.1.1 GENERAL OVERVIEW

Construction of the Big Creek System was begun by Pacific Light and Power Company in 1911 and carried forward by its successor, Pacific Light and Power Corporation. In 1917, the latter corporation conveyed all rights and properties to Southern California Edison Company, who completed construction and continues to operate the project.

Construction of the Big Creek System occurred over four distinct construction phases. During the initial phase, from 1911 to 1914, Powerhouse Nos. 1 & 2 were built with two generating units each, and Huntington Lake was built with half the current capacity. The second construction phase occurred from 1917 to 1929. During this phase, Huntington Lake's storage was increased, and additional generating units were added to Powerhouse Nos. 1 & 2. Additionally, Florence Lake, Shaver Lake, Mono-Bear Diversions and Siphon, various back country diversions, Powerhouse No. 2A, Powerhouse No. 8, and Powerhouse No. 3 were built. The third construction phase occurred from 1948 to 1960. During this period, Redinger Lake, Lake Thomas A. Edison, Mammoth Pool Reservoir, Powerhouse No. 4, Mammoth Pool Powerhouse, Portal Powerhouse, and several small diversions were built. The last construction phase occurred from 1984 to 1987. At this time, Balsam Meadows Forebay and Eastwood Power Station were built.

The history of the development of the Big Creek System is summarized in further detail below.

3.1.2 INITIAL DEVELOPMENT

1911

- The Pacific Light & Power Corporation, almost entirely owned by Henry Huntington, purchased from the San Joaquin Light & Power Corporation all rights necessary to proceed with the development of the Big Creek System.

1912

- Construction began with the Stone and Webster Engineering Corporation as the primary contractor.
- February-July: The 56-mile San Joaquin and Eastern (SJ&E) railroad from El Prado (near present-day Friant) to Big Creek was built. This railroad was

used to transport construction material, equipment, and people to the construction site.

- Summer: Work was started on three dams in the Basin that, when completed, created Huntington Lake.

1913

- Spring: The concrete foundations for Powerhouse No. 1 and Powerhouse No. 2 were poured.
- October 14: Powerhouse No. 1 began generating electricity. By the end of the year, Powerhouse No. 1 contained two generating units with a combined capacity of 20,800 kW.
- Fall: Dams 1, 2 and 3 forming Huntington Lake were completed, however they were not yet at their present height.
- December 18: Powerhouse No. 2 began generating electricity. By the end of the year, Powerhouse No. 2 contained one generating unit with a capacity of 14,000 kW.
- Dam 4, at the tailrace of Powerhouse No. 1 was completed forming the Forebay for Powerhouse No. 2.

1914

- The second operating unit at Powerhouse No. 2, Unit 4 with a capacity of 14,000 kW was installed.
- July: Tunnel work began on a tunnel from Powerhouse No. 2 to the future site of Powerhouse No. 3.

Interesting Fact (1914):

At the completion of the Initial Development phase, Big Creek Powerhouse No. 1 had the highest head (vertical distance between the top of the penstock and power turbine) of any hydroelectric generator in the country. The penstock serving Big Creek No. 1 was the longest and steepest penstock in the world. The water wheels and generators were also the largest of their type at the time.

3.1.3 SECOND PHASE

1917

- A consolidation occurred between the Pacific Light & Power Corporation, Mt. Whitney Power & Electric Company (Kaweah 1-3, and Tule), and the Southern California Edison Corporation with the consolidated company retaining the Southern California Edison name.

- Dams 1, 2, and 3 at Huntington Lake were extended by 35-feet in height and Dam 3A was added, doubling the storage capacity of the Lake.

1919

- Southern California Edison acquired the Shaver Lake lands and water rights from the Fresno Flume and Lumber Company.
- Design work began for the Huntington-Pitman-Shaver Conduit, Shaver Lake Dam, Powerhouse No. 2A, and Tunnel No. 5 (Shaver Lake to Powerhouse No. 2A).

1920

- February: Only 2,050 feet of the approximately 6 mile long tunnel between Powerhouse No. 2 and the future site of Powerhouse No. 3 had been completed.
- June: Due to the pressing demand for power and improvements in reaction-turbine type water wheels (which could produce efficient power at lower head pressure) the decision was made to build Powerhouse No. 8 at the confluence of Big Creek with the San Joaquin River. The length of the tunnel being constructed was reduced from 6 miles to 5,933 feet.
- To provide additional waterpower for the Big Creek System, SCE decided to utilize the water resources of the South Fork San Joaquin River, at the time called the “East Side Development”.
- Camp 61 was established near the present site of Portal Forebay and Camp 62 was established near the present fork in the road for Florence Lake and Lake Thomas A. Edison to accommodate construction workers.
- November: Construction of the 13.5 mile long Ward Tunnel from Florence Lake to Huntington Lake began.

Interesting Fact (1920):

The rapid increase in population and industry in Southern California Edison's service territory after the end of World War I made swift additional development of the Company's power resources necessary. Over 2,000 workers were employed during this period of construction. The work camps were isolated from the outside world most of the winter months except for radio communications and a dog sled, which carried the first class mail.

1921

- January 8: Excavation for Powerhouse No. 8 was started.

- May 6: Years prior to the completion of the Shaver Lake Dam and 7 years prior to the completion of Powerhouse No. 2A, the power capacity of the Big Creek System was increased by 17,500 kW when water from Stevenson Creek was diverted through the newly constructed Tunnel No. 5 to Powerhouse No. 2.
- August 15: Southern California Edison filed an application for license of the Big Creek No. 3 Hydro Project with the Federal Energy Commission.
- August 16: Unit No. 1 at Powerhouse No. 8 was placed in service with a rating of 22,500 kW.
- Early Fall: Construction of Tunnel No. 3, between Dam 6 and Powerhouse No. 3, began.

1922

- June 5: Excavation for Powerhouse No. 3 began.
- Early Fall: Excavation for the footings of Dam 6 began.
- November 20: Placing of concrete for Dam 6 began. The flume discussed in the interesting fact below was abandoned on December 6 with the water flowing through the sluice gates that had been poured.

Interesting Fact (1922):

According to David Redinger, construction of Dam 6 was about the most difficult job encountered in the development of the entire Big Creek Project. While the footings for the dam were being excavated, the flow of the river had to be carried around the site through a flume hanging on the slick canyon side.

1923

- March 18: Dam 6 was completed just a few days before the first spring flood came down the river.
- In May, the Big Creek System voltage was increased from 150 kV to 220 kV. This was the highest voltage transmission system in the world at the time.
- August: The last section of Tunnel No. 3 (Powerhouse No. 3 Water Conveyance System) was “holed through” on August 1 and the tunnel was officially completed on August 26.
- September 30: The first generating unit of Powerhouse No. 3 began generating power.

Interesting Fact (1923):

After completion in 1923, the trade press hailed Powerhouse No. 3 as “the Electrical Giant of the West,” for its then 99,000 kW of rated capacity made it the largest hydroelectric plant in the West.

1925

- April: The Ward Tunnel (from Florence Lake to Huntington Lake) was completed. Water first flowed from Jackass Meadows (Florence Lake area) through Ward Tunnel to Huntington Lake on April 13.
- Spring: Construction of the Florence Lake Dam was started.
- November: Construction of the Huntington-Pitman-Shaver Conduit was started.

Interesting Fact (1925):

The 13.5-mile long Ward Tunnel through the massive Kaiser Mountain was at the time the longest water tunnel in the world. George C. Ward was vice president of engineering and construction during the busiest phase of the Big Creek Project construction.

1926

- Spring: Excavation work for the Shaver Lake Dam began.
- July: Work was started on Mono Diversion, Bear Diversion, and the Mono-Bear Siphon, which would augment water into the Ward Tunnel with water from the Mono Creek drainage and the Bear Creek drainage.
- August 15: Florence Lake Dam was completed. The previous year, water had been stored in the lake at half capacity while work continued on the dam.
- Fall: Construction of Powerhouse No. 2A began.

1927

- October 23: Shaver Lake Dam was completed.
- November 15: The Mono and Bear diversions and siphon were completed.

1928

- April 21: The Huntington-Pitman-Shaver Conduit was completed allowing water to be diverted into Shaver Lake.

- August 6: The first generating unit of Powerhouse No. 2A was placed in service.
- Diversion of water from Tunnel No. 5 to Tunnel No. 2 was discontinued after Powerhouse No. 2A went into service, as it was more efficient to run the water directly into the Powerhouse No. 2A penstocks and waterwheels.
- Upon completion, Powerhouse No. 2A consisted of two units rated at 40,500 kW each.
- Due to construction winding down as the various projects were completed, most of the construction camps were dismantled by the end of this year.

1929

- Unit 2 of Powerhouse No. 8 was installed with an initial rating of 31,500 kW.
- June: The second construction phase of the project was complete.

Interesting Fact (1929):

Increases in water supply, made available from the South Fork San Joaquin River watershed by construction of the Florence Lake Reservoir, Mono Creek Diversion, and Bear Creek Diversion, and from the Pitman Creek and Stevenson Creek watersheds by construction of the Shaver Lake Reservoir and their respective water conduits, increased the generating capacity of the Big Creek System from the original 70,000 kw to a total of 424,500 kw. The Big Creek System consisted of 533,000 Hp capacity of operating turbines, 398,000 kW of generation capacity, and 36 miles of tunnels. At the time this was the largest hydroelectric project in the world, providing 90% of the electric power needs of SCE into the 1940's. The construction of the project was at the time considered to be an engineering and construction challenge of the same magnitude as the Panama Canal.

3.1.4 DEPRESSION/WAR YEARS

1929 TO 1945

There was no construction activity on the Big Creek project during this period due to the Great Depression and World War II. SCE satisfied its needs for increased generation during this period by investing in the large public works project known today as the Hoover Dam.

3.1.5 THIRD PHASE

1948

- The fourth generating unit was added to Powerhouse No. 3. Space had been provided in the original design of the powerhouse.
- April 28: Powerhouse No. 3, Unit 4 began commercial operation.

1949

- June 29: Approval was granted for SCE licenses and permits to construct the Big Creek 4 project.
- July: Construction began on Redinger Lake Dam and on the Powerhouse No. 4 Water Conveyance System consisting of two tunnels and associated penstocks.

1951

- Dam 7 and Redinger Lake were completed.
- June 12: The first generating unit of Powerhouse No. 4 began commercial operation.
- July 2: The second generating unit of Powerhouse No. 4 began commercial operation.
- SCE filed applications for licenses and permits to construct the Mammoth Pool Project and Vermilion Valley Dam.

1953

- The approval to construct the Vermilion Valley Dam was received.
- April 18: Construction of the Dam began. Forty percent of the earthfill material for the dam was placed during this first construction season.

1954

- October: Vermilion Valley Dam was completed.
- SCE filed with the Federal Power Commission for the necessary licenses and permits to build the Portal project, a power turbine/generator to the outlet of the Ward Tunnel. The development of efficient Francis-type reaction turbines operating at low head meant that a small power plant at this location was now feasible.

Interesting Fact (1954):

On the 75th anniversary of the invention of the electric light bulb, October 19th, the Vermilion Valley Dam was dedicated and the lake was named Lake Thomas A. Edison in honor of the great inventor's contribution to the electric power industry.

1955

- Construction of the Portal Powerhouse and Portal Forebay began.

1956

- December: Portal Powerhouse was completed.

Interesting Fact (1954):

Portal Powerhouse, a small 10,000 kW facility, was different from any built previously at Big Creek, in that it was an outdoor design, built open to the weather. The plant was entirely automatic in operation, at the time controlled by Powerhouse No. 1. Portal Powerhouse was later upgraded to the current installed capacity of 10,800 kW.

1957

- December 30: After many delays, the approval to build the Mammoth Pool project was given.

1958

- Spring: Work on the Mammoth Pool Dam site, Water Conveyance System, and Powerhouse began.

1959

- October 17: Mammoth Pool Dam was completed.

1960

- March 28: Mammoth Pool Powerhouse became operational Fourth Phase

1983

- November 1983: Construction of the Balsam Meadows Project began.

1987

- December 1: Balsam Meadows Project was complete.

3.2 DESCRIPTION OF SCE HYDROELECTRIC PROJECTS IN THE BASIN

3.2.1 GENERAL OVERVIEW

The Big Creek System includes seven hydroelectric projects licensed under separate FERC licenses (Figure 3.2-1). The Big Creek hydroelectric projects within the Basin range in elevation from approximately 1,000 feet msl to about 9,000 feet msl and include: Big Creek Nos. 1 & 2 (FERC No. 2175), Big Creek Nos. 2A, 8, & Eastwood (FERC No. 67), Big Creek No. 3 (FERC No. 120), Big Creek No. 4 (FERC No. 2017), Vermilion Valley (FERC No. 2086), Portal Powerhouse (FERC No. 2174), and Mammoth Pool (FERC No. 2085).

Major components of the hydroelectric project infrastructure are the dams and diversions, reservoirs and forebays, water conveyance systems, and

powerhouses. These components for the seven individual projects are summarized in Table 3.2-1. Detailed descriptions of the project facilities/components are provided in Appendix C.

Table 3.2-1 Summary of Big Creek System Components by License

BIG CREEK NOS. 1&2		FERC No. 2175	
License Issue Date:	1959	Dependable Operation Capacity (MW):	150.00
License Expiration Date:	02/28/2009	Exhibit M Generator Capacity (MW):	154.85
<u>Huntington Lake</u>			
<ul style="list-style-type: none"> • Dams 1, 2, 3, and 3A 			
<u>Powerhouse No. 1</u>			
<ul style="list-style-type: none"> • Tunnel No. 1 and penstocks (from Huntington Lake) 			
<u>Powerhouse No. 2 Forebay</u>			
<ul style="list-style-type: none"> • Dam 4 			
<u>Powerhouse No. 2</u>			
<ul style="list-style-type: none"> • Tunnel No. 2 and penstocks (from Dam 4) • Diversion dam and conduit on Balsam Creek to Tunnel 2 • Diversion dam and conduit on Ely Creek to Tunnel 2 • Diversion dam and conduit on Adit 8 Creek to Tunnel 2 			

BIG CREEK 2A, 8 AND EASTWOOD		FERC NO. 67	
License Issue Date:	1977	Dependable Operation Capacity (MW):	370.00
License Expiration Date:	2/28/2009*	Exhibit M Generator Capacity (MW):	384.80
<u>Florence Lake</u>			
<ul style="list-style-type: none"> • Florence Lake Dam 			
<u>Diversion to Florence Lake</u>			
<ul style="list-style-type: none"> • Tombstone Creek Diversion Dam and Conduit (steel pipe natural channel) • Crater Creek Diversion Dam and Conduit (ditch and natural channel) • Hooper Creek Diversion Dam and Conduit • North Slide Creek and South Slide Creek Diversion Dams and Conduits (steel pipe) 			

Table 3.2-1 Summary of Big Creek System Components by License (continued)

BIG CREEK 2A, 8 AND EASTWOOD (continued)	
---	--

Diversion to the Ward Tunnel

- Florence Lake
- The Mono-Bear Conduit (steel pipe)
- Bear Creek Diversion Dam
- Mono Creek Diversion Dam
- Chinquapin Creek Diversion Dam
- Camp 62 Creek Diversion Dam
- Bolsillo Creek Diversion Dam

Shaver Lake

- Shaver Lake Dam
- Huntington-Pitman-Shaver Conduit /Tunnel No. 7
- Pitman Creek Diversion Dam and Conduit

Big Creek 2A Powerhouse

- Tunnel No. 5 (from Shaver Lake)

Powerhouse No. 8 Forebay

- Dam 5

Big Creek 8 Powerhouse

- Tunnel No. 8 (from Dam 5)

Eastwood Development

- Balsam Meadow Forebay /Diversion structure/Tunnels
- Eastwood Power Station

Transmission Line

Big Creek 1 – Eastwood Power Station Transmission Line

BIG CREEK NO. 3

FERC No. 120

License Issue Date:	1977	Dependable Operation Capacity (MW):	181.90
License Expiration Date:	02/28/2009	Exhibit M Generator Capacity (MW):	174.45

Powerhouse No. 3 Forebay

- Dam 6

Powerhouse No. 3

Tunnel No. 3 and penstocks (from Dam 6)

BIG CREEK NO. 4

FERC No. 2017

License Issue Date:	1949	Dependable Operation Capacity (MW):	100.20
License Expiration Date:	02/28/1999**	Exhibit M Generator Capacity (MW):	100.00

Redinger Lake

- Dam 7

Powerhouse No. 4

- Tunnel / pipe and penstock (from Dam 7)

Table 3.2-1 Summary of Big Creek System Components by License (continued)

PORTAL

FERC No. 2174

License Issue Date:	1955	Dependable Operation Capacity (MW):	10.50
License Expiration Date:	03/31/2005	Exhibit M Generator Capacity (MW):	10.80

Portal Forebay (Camp 61 Creek Forebay)

- Diversion dam
- Adit 2 Conduit and surge chamber (to the Ward Tunnel)

Portal Powerhouse

- Steel pipe (from Ward tunnel)
- Powerhouse bypass to Rancheria Creek

MAMMOTH POOL

FERC No. 2085

License Issue Date:	1957	Dependable Operation Capacity (MW):	187.00
License Expiration Date:	11/30/2007	Exhibit M Generator Capacity (MW):	190.00

Mammoth Reservoir

- Mammoth Pool Dam
- Fishwater Generator

Mammoth Pool Powerhouse

- Mammoth Pool tunnel and penstock (from Mammoth Pool Reservoir)
- Ross Creek diversion and conduit
- Rock Creek diversion and conduit

Transmission Lines

- Big Creek 3 – Mammoth Pool Powerhouse Transmission Line

VERMILION VALLEY

FERC No. 2086

License Issue Date:	1953	Dependable Operation Capacity (MW):	0.00***
License Expiration Date:	08/31/2003	Exhibit M Generator Capacity (MW):	0.00***

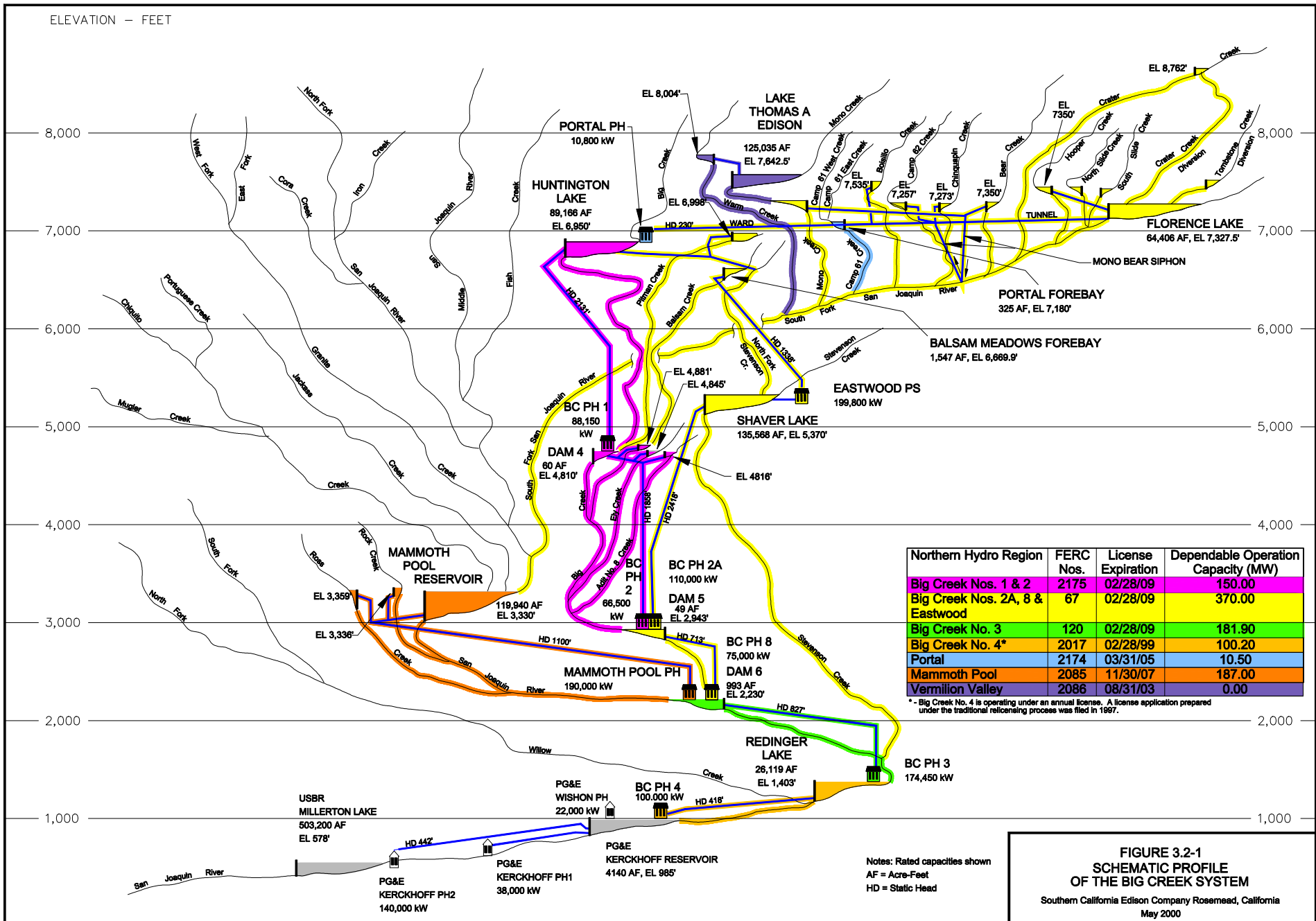
Lake Thomas A. Edison (Storage only)

- Vermilion Valley Dam across upper Mono Creek
- Warm Creek diversion and canal

Footnotes

- * Amended in 1983 to include Balsam Meadow Development.
 - ** Application for new license filed with FERC for Big Creek No. 4 in 1997.
 - *** Project does not include generating facilities.
-

ELEVATION - FEET



Northern Hydro Region	FERC Nos.	License Expiration	Dependable Operation Capacity (MW)
Big Creek Nos. 1 & 2	2175	02/28/09	150.00
Big Creek Nos. 2A, 8 & Eastwood	67	02/28/09	370.00
Big Creek No. 3	120	02/28/09	181.90
Big Creek No. 4*	2017	02/28/99	100.20
Portal	2174	03/31/05	10.50
Mammoth Pool	2085	11/30/07	187.00
Vermilion Valley	2086	08/31/03	0.00

* - Big Creek No. 4 is operating under an annual license. A license application prepared under the traditional relicensing process was filed in 1997.

Notes: Rated capacities shown
AF = Acre-Feet
HD = Static Head

**FIGURE 3.2-1
SCHEMATIC PROFILE
OF THE BIG CREEK SYSTEM**
Southern California Edison Company Rosemead, California
May 2000