BISHOP CREEK HYDROELECTRIC SYSTEM, PLANT 3, POWERHOUSE NO. 3
Bishop Creek
Bishop vicinity
Inyo County
California

HAER CA-145-3-A
HAER CA-145-Y

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

FIELD RECORDS

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Department of the Interior
1849 C Street NW
Washington, DC 20240-0001

HISTORIC AMERICAN ENGINEERING RECORD

Bishop Creek Hydroelectric System, Plant 3, Powerhouse No. 3
Bishop Creek, Bishop vicinity, Inyo County, California
HAER No. CA-145-3-A

Location: The Bishop Creek Hydroelectric Powerhouse No. 3 (Powerhouse No. 3) is located on the southeast side of California State Route 168 in Inyo County, California. From the intersection of California State Route 168 (West Line Road) and U.S. Route 395 (Three Flags Highway) in the Town of Bishop, California, Powerhouse No. 3 is located approximately 10.92 miles southwest on California State Route 168 and 0.55 miles northeast on West Bishop Creek Road.

The approximate center of Powerhouse No. 3 is located at UTM Zone 11S, easting 364222.54m, northing 4129482.84m. Distances and coordinates were obtained on January 17, 2012, by plotting location using Google Earth. The coordinate datum is World Geodetic System 1984.

Present Owner: Southern California Edison Company
P.O. Box 800
Rosemead, California 91770

Present Use: Powerhouse No. 3 is a hydroelectric power generating facility that uses high-head impulse water wheels to generate electricity for transmission to distant customers, as it was originally designed and constructed to do. Powerhouse No. 3 is one in a chain of five similar power generating facilities located in the Bishop Creek system.

Significance: Powerhouse No. 3, a reinforced concrete industrial building constructed in 1913 by the Southern Sierras Power Company, a subsidiary of the Nevada-California Power Company, is significant because of its association with the construction and design of the historic Bishop Creek Hydroelectric System and because it possesses striking elements of the Mission Revival architectural style.

The Bishop Creek Hydroelectric System Historic District is significant for its position in the expansion of hydroelectric power generation technology, its role in the development of eastern California, and its contribution to the development of long-distance power transmission and distribution. The System is significant under National Register of Historic Places criterion A (broad patterns of history) and C (distinctive characteristics of period and type of engineering and construction). The Period of Significance for the

Bishop Creek Hydroelectric System is identified as 1905-1938.

Historian: Matthew Weintraub, Senior Architectural Historian
Galvin Preservation Associates
231 California Street
El Segundo, CA 90245

Project Information: The Historic American Engineering Record (HAER) is a long-range program that documents and interprets historically significant engineering sites and structures throughout the United States. HAER is part of Heritage Documentation Programs (Richard O'Connor, Manager), a division of the National Park Service (NPS), United States Department of the Interior. The Powerhouse No. 3 recording project was undertaken by Galvin Preservation Associates (GPA) for the Southern California Edison Company (SCE) in cooperation with Justine Christianson, HAER Historian (NPS). SCE initiated the project with the intention of making a donation to NPS. As recommended by Justine Christianson (NPS), the report describes how water flows in and out of the powerhouse to produce electricity, and a vital component of the report documents changes in operating machinery that have occurred over time. Archaeologist Crystal West (SCE) oversaw the project and provided access to the site. Historian Andrea Galvin (GPA) served as project leader. Architectural Historian Matthew Weintraub (GPA) served as the project historian. Jeff McCarthy, Supervisor of Operations (SCE), and Keith Inderbieten, Hydro System Operator (SCE), provided research assistance. Stephen Schafer produced the large format photographs. The field team consisted of Andrea Galvin (GPA), Matthew Weintraub (GPA), Crystal West (SCE), Neil Sliger (SCE), Stephen Schafer (photographer) and David Sanchez (photographer assistant).

Researchers can also be directed to see:
HAER No. CA-145-3, Bishop Creek Hydroelectric System, Plant 3.

PART I. HISTORICAL INFORMATION

A. Physical History of Building:

The physical history of Powerhouse No. 3 was determined by reviewing original construction drawings including architectural elevations,[1] a general foundation plan,[2] and machine foundation plans.[3] Also, drawings for alterations and additions to Powerhouse No. 3 which occurred after its original construction were reviewed.[4] These plans were retained by the power companies that successively owned and operated the plant (currently SCE). In addition, articles describing construction and operation of the powerhouse which originally appeared in the trade journals *Journal of Electricity Power and Gas*[5] and *Electrical World*[6] and reprinted by SCE were reviewed. They included a series of articles written by Charles O. Poole, who served as chief engineer of the Nevada-California Power Company. The building itself provided physical evidence of its history and development via field inspection,[7] as did historical photographs and contemporary drawings in the possession of SCE. Further information was found in previously completed HAER documentation[8] and evaluations of eligibility for listing in the National Register of Historic Places.[9] These sources provided thorough and detailed information regarding the historic design, construction, improvement and operation of the building.

Overview

Powerhouse No. 3 was constructed in 1913 by the Southern Sierras Power Company, a subsidiary of the Nevada-California Power Company. It was one of the last two powerhouses to be constructed in the Bishop Creek system, along with Powerhouse No. 6

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[1] Nevada-California Power Company (NCPC), "Front Elevation of Power House No. 3," August 7, 1912; NCPC, "Power House No. 3 Side Elevation," August 7, 1912.
[2] NCPC, "General Foundation Plan Power Plant No. 3," August 28, 1912.
[3] NCPC, "Machine Foundations Power Plant No. 3," November 4, 1912, revised February 23, 1937; NCPC, "No. 2 Unit Machine Foundations Power Plant No. 3," November 4, 1912, revised February 23, 1937.
[4] California Electric Power Company, "Alterations and Additions to Power Plant No. 3, Bishop Creek Plan Details," October 12, 1954.
[5] Rudolph W. Van Norden, "System of Nevada-California Power Company and the Southern Sierras Power Company. Part 1 – Power Plants," *Properties and Power Developments of the Nevada-California Power Company and the Southern Sierras Power Company*. Reprinted from the *Journal of Electricity Power and Gas*, Volume XXXI, Numbers 1-2, July 5-12, 1913, p. 1-20.
[6] C. O. Poole, "Hydraulic and electric features of stations No. 2 and No. 3 of the Nevada-California Power Company – Tailrace water of former discharges directly into intake of latter," *Power Development and Transmission Systems of The Nevada-California Power Company and the Southern Sierras Power Company*, 1915, p. 19-26. Reprinted from *Electrical World*, New York, 1914.
[7] Field inspections were conducted on October 18 and December 7, 2011.
[8] Thomas T. Taylor, "Bishop Creek Hydroelectric System," HAER No. CA-145, Historic American Engineering Record, National Park Service, U.S. Department of the Interior, 1994, p. 11-12.
[9] Robert Clerico and Ana Beth Koval, "An Architectural and Historical Evaluation of Structures Associated with the Bishop Creek Hydroelectric Power System, Inyo County, California," Southern California Edison Company, December 1986, p. 30-33; Valerie Diamond, Stephan G. Helmich, and Robert A. Hicks, "Evaluation of the Historic Resources of the Bishop Creek Hydroelectric System," Southern California Edison Company, July 1988, p. A-144-151.

which was built at the same time. It is the second highest powerhouse at an elevation of 6,278 feet (lower only than No. 2). The powerhouse is a single-story, reinforced concrete industrial building designed in the Mission Revival architectural style. It contains a large rectangular room that houses three rotating generators driven by impulse water wheels. In 1914, the water wheel-driven generators operated with a combined capacity of 6,750 kilowatts (kw). The power company constructed a shed-roofed addition to the powerhouse in 1945. Currently, Powerhouse No. 3 continues to operate as a hydroelectric powerhouse in the Bishop Creek system. The power plant is situated on the northwest bank of Bishop Creek in the upper reaches of Bishop Creek Canyon. A small battery house (originally a valve house), also built in 1913, is located adjacent to the powerhouse and is complementary in design. The plant originally consisted of the powerhouse (extant), a matching valve house (extant), four residence cottages (not extant), a residential duplex (not extant) and two garages (not extant).

In 1913, the *Journal of Electricity Power and Gas* provided this general description of Powerhouse No. 3, which was completed that year:

> The No. 3 powerhouse is almost a replica of No. 2 [which was constructed in 1908], both in the laying out of the machinery and in the style and type of building. The dimensions of the building inside are 38½ x 82 feet. There are [four] pilasters [per side wall], [not] including the corners on each side and two in each end, and the roof is supported on four Fink trusses and consists of galvanized corrugated iron, with two round ventilators in the ridge. There are three main generating units… They are driven by single overhung runner waterwheels known as the "Henry" type, designed and built by Geo. J. Henry of San Francisco, formerly engineer for the Pelton Water Wheel Company… There are two exciter sets placed in line with the switchboard close to the building wall.[10]

1. **Date of Construction:**
   Construction of Powerhouse No. 3 commenced in 1912, based on construction drawings dated August 1912 and machine foundation plans dated November 1912. Construction was completed and the powerhouse was operational in 1913. An addition (north wing) to the main building was constructed in 1954, as indicated by construction plans for the addition dated November 1954.

2. **Architect/Engineer:**
   The engineer of the construction of Powerhouse No. 3 was apparently R. G. Manifold of Manifold & Poole, Los Angeles, based on the notation "RGM" located in the lower right corner of a general foundation plan dated August 1908. Manifold's business partner, Charles O. Poole served as chief engineer of the Nevada Power, Mining and Milling Company, later the Nevada-California Power

[10] Van Norden, "System of Nevada-California Power Company," p. 8.

Company. In addition, the Sierras Construction Co. was listed in construction plans and may have employed architects. Other architects and/or engineers are not known.

3. **Builder/Contractor/Supplier:**
The builder of Powerhouse No. 3 was the Sierras Construction Co., which is listed on construction drawings, dated 1908. Other builders, contractors and material suppliers are not known.

4. **Original Plans:**
The powerhouse was designed as rectangular in plan with exterior wall-to-wall dimensions of 39’2” x 83’6”. It was constructed of reinforced concrete and finished in stucco on the exterior. The powerhouse was built three bays wide at the end walls (east and west) and five bays long at the longer side walls (north and south) as defined by regularly spaced columns that extended to the interior. At side walls, columns were spaced 14’0” apart at the middle three bays and 14’9” apart at the corners bays. At end walls, two columns were set 12’0” in from the corners, creating a central bay 8’0” wide. Concrete walls between columns were 6” thick. Columns, or “pilasters”, were squared and shouldered at three levels with well-defined drainage slopes. The powerhouse roof was a moderately pitched gable supported by a Fink steel truss system and sheathed in corrugated sheet metal. The building measured 18’6” in height from floor level to the bottom of the trusses, and 9’6” in height from the bottom of the trusses to the ridge, for a total height of 28’0”. End walls terminated in three-level curvilinear stepped parapets with square-profile coping that obscured the gable ends.

In the end walls (east and west), the bays at the south sides contained large service entrances 14’0” in height and filled with corrugated metal doors, which allowed for large machinery to be moved in and out of the building. Also at both ends, the building was accessed by 5-panel wood man-doors in the central bays. The building was fenestrated in a regular pattern with a large rectangular window in each of the side wall bays (five windows total on each side), a window in the north bay of the west end, and a smaller window at the north bay of the east end. The large windows were identical double-hung wood sash, originally designed as 8-light-over-2-light in the upper sash and 4-light in the lower sash, but constructed with a diamond band that replaced the 8-light band. Each gable end contained a large circular window divided into a 9-light grid.

The powerhouse was built with a complex concrete substructure nine feet deep that was designed to house impulse wheel-driven generators. At the interior, the generator room that occupied the structure was open in plan. The generator room housed three water-wheel/generator assemblies situated at the center of the room and related equipment such as valves, pumps, governors, exciters, and switchboard panels. The interior long walls contained recessed bays formed by the post-and-beam construction and filled by curtain-wall panels. The building was open vertically through the trusses. A 20-ton overhead traveling crane furnished by the Cyclops Iron Works of San Francisco spanned the width of the room. The rolling crane ran on rails mounted on concrete beams that formed parallel ledges along the long side walls 14’0” above the floor and 4’6” below the level of the trusses.

Directly to the west of the powerhouse, a separate smaller building, a valve house, was constructed as a functional and architectural complement to the larger building. The reinforced-concrete valve house was a single story with a gabled roof sheathed in corrugated sheet metal. The exterior walls were unfinished and exhibited imprints of formwork boards in concrete. The end walls (north and south) terminated in three-level curvilinear stepped parapets with square-profile coping that were equivalent in design to the powerhouse parapets but dimensionally reduced. The valve house contained two windows: one centrally located in the south end wall; and one at the north corner of the west side wall. The building was accessed on the east side by at least one door. It housed a relief valve that operated in conjunction with the penstock.

5. Alterations and Additions:

A shed-roofed addition was constructed at the east end of the powerhouse in 1954. The rectangular-in-plan addition was built across the lower portions of the central and northern bays on the east wall. Construction of the addition bisected a pilaster and caused the removal of the original walls, man-door, and window in the affected two bays. The addition covered a section of wall 25’4” wide and it projected 11’4” from the east end of the powerhouse. The wing was principally constructed of 8” thick concrete block with large cast-in-place, horizontal, reinforced concrete beams, and roofed with corrugated galvanized iron. It was 10’0” in height (plus roofing) at the north end and 14’8” where it attached to the powerhouse. The east wall was pierced by two small square windows and the south wall contained a metal door.

The addition was built to house an operators room that extended into the main generator room from the central and northern bays of the east end, flush with the north wall, as a rectangular, steel-frame windowed office bay. The internal addition was approximately ten feet in height, 18’6-3/8” in length (east-west), and 6’6” in width (north-south). The long wall of the office bay was heavily glazed with “Fenestra” A35 steel fixed windows, 5’ wide and 7’ tall, with 3-light x 5-light divisions. Steel panels 3’0” high filled the lower section. As designed, the office bay included a “Fenestra” glazed metal door with a solid steel panel in the transom near the north wall. The shorter wall of the office bay was designed similarly with a large fixed divided steel window over a steel panel and a glazed metal door with blind metal transom. During or after construction of the office bay, the office entrance scheme was changed to solid metal doors with glazed transoms. The office bay was capped by a flat roof with 1” metal sheathing over wood frame. At the office interior, the operators desk was positioned at the west side nearer to the generators and the switchboard occupied most of the eastern portion.

Other structural and/or material changes to the powerhouse have occurred. Sometime before approximately 1927, two circular rooftop ventilators were built at the ridgeline and a center-pivot metal cover was installed in the circular window opening at the east gable end (after the window was removed). In approximately 1940s, steel windows replaced original wood sashes in original openings. In 1943, a reversible 55” propeller exhaust fan was installed in the existing circular window opening at the west gable end (after the window was removed), and a rectangular metal frame with a vertical sliding metal panel door was attached to the west end wall over the fan. At an unknown time, a water closet was installed in the northwest corner of the generator room.

Also, substantial changes have occurred to the (former) valve house. Sometime before 1922, the building was divided into two rooms, one continuing to serve as the valve house and the other as a shop room. In 1937, the relief valve was removed from the building and the space was converted to a storeroom. In 1939, the shop room was converted into a battery room and a new floor was laid. Sometime after approximately 1939, the south end window was removed and the opening was blinded except for a small horizontal grill vent. Sometime after 1988, the wood double-hung window at the west side was replaced by a smaller horizontal metal slider and the remaining opening was blinded. In contemporary times, a gabled sheet metal hood with wood knee braces was built above the north door.

B. Historical Context:

The following historical context was included in previously completed documentation which established the eligibility of the Bishop Creek Hydroelectric System for listing in the National Register of Historic Places.[11]

The turn of the twentieth century saw a dramatic change in technological history. The production of cheap, dependable hydroelectric power, and the ability to transport the power over great distances, was perfected at this time. In short order, drainages with sufficient flow for hydroelectric power generation began to be developed. By 1923, the only suitable streams draining the east slope of the Sierra Nevada which were not being used for electricity production were the Carson and Walker river systems. The first hydroelectric power generation along Bishop Creek was a small plant operated by the Bishop Light and Power Company. The facility was reported to be a half mile west of the Standard Flouring Mills (present site of Plant 6) and two and a half miles from the town

[11] Clerico and Koval, “An Architectural and Historical Evaluation,” p. 5-12.

of Bishop. The plant consisted of a Stanley polyphase generator (capable of 150 horsepower) driven by a 48-inch Pelton wheel. The power was generated for local use.

Through the efforts of Loren B. Curtis, an engineer, and Charles M. Hobbs, a banker and financier, the Nevada Power, Mining and Milling Company was incorporated on December 24, 1904. The first facility built by the Nevada Power, Mining and Milling Company was put into operation in September, 1905, supplying hydroelectric power to the mining communities of Tonopah and Goldfield, Nevada. Executives of the power company had purchased controlling interest in the locally operated facilities in Tonopah and Goldfield, so that, when production began, there was a market ready for their product. The original transmission line extended east across Owens valley, the White Mountains, Fishlake Valley, and the Silver Peak Range to the town of Silver Peak in Clayton Valley. Here the line split, diverging northeast to Tonopah and due east to Goldfield. The line distance from Bishop Creek to Goldfield was 95 miles, and that to Tonopah was 118 miles. This was a new record for long distance transmission. On January 5, 1907, the Nevada-California Power Company, successor to the Nevada power, Mining and Milling Company, was incorporated; most of the original corporate officers remained with the new company.

Between 1905 and 1913, four more generating plants were placed on line, in tandem along Bishop Creek, and additional generators were placed in existing plants. As a result of this additional power generation, the “Tower Line” from Bishop to San Bernardino was completed in 1912 and put into operation, again creating a new record for long distance transmission (239 miles). The directors of the Nevada Power, Mining and Milling Company were well aware of the vicissitudes of the boom-bust mining industry and took steps to secure a more constant market for their product. In 1911, the Southern Sierra Power Company was incorporated with the main purpose of creating and servicing the power needs of southeast California. From then until 1918, several smaller power companies were purchased by the new company. The development of southern California's Imperial Valley corresponds directly with Bishop Creek's production of cheap, reliable electricity.

By the end of 1913, the Bishop Creek system was essentially complete with all five plants operating. In descending order down the drainage, the Bishop Creek facility then consisted of:

> Power Plant 2: Three Westinghouse generators, each capable of 2,000 kw of power (total output of 6,000 kw). Units 1 and 2 were driven by Pelton wheels and unit 3 by a Doble wheel.
>
> Power Plant 3: Three Crocker-Wheeler generators, each capable of 2,250 kw of power (total output of 6,750 kw). All three units were direct connected to Henry impulse wheels.

Power Plant 4: Five generating units consisting of: two National Electric Company, 750 kw, generators connected to Pelton wheels; one Bullock, 1,500 kw, generator driven by a Pelton wheel; one Allis-Chalmers, 1,500 kw, connected to a Pelton wheel; and one Allis-Chalmers, 1,500 kw, machine driven by a Doble wheel (total output of 6,000 kw).

Power Plant 5: Two generating units, one of which was a 1,500 kw, Allis-Chalmers machine driven by a Doble wheel and the other a 1,850 kw unit connected to a Pelton-Francis wheel (total output of 3,350 kw).

Power Plant 6: A single generator capable of 2,250 kw driven by a Pelton-Doble wheel.

It is interesting to note that Power Plant 1 was to have been built at the present site of Intake No. 2, but the plant was never built due to the vulnerability of the site to avalanches. The plant number designators were not adjusted accordingly, so that there is no Power Plant 1, nor has there ever been.

In 1936, the Nevada-California Electric Corporation again was reorganized to become an operating company. The corporation became California Electric Power Co. and continued to operate under this name until 1964, when the company known as Calectric was subsumed by Southern California Edison Company. Since 1964, as a result of acquisition through merger consolidation, Southern California Edison (SCE) has owned and operated the Bishop Creek plants.

PART II: SITE INFORMATION

A. General Description of Building:

The following description of Powerhouse No. 3 incorporates information included in previously completed HAER documentation[12] and evaluations of eligibility for listing in the National Register of Historic Places.[13] This information was verified and new information was gathered via field inspection to inform the building description.[14]

Overview

Powerhouse No. 3 is a one-story, reinforced concrete industrial building resting on a deep concrete foundation and topped by a metal gable roof. It was designed and constructed in the Mission Revival architectural style with stepped parapets at end walls. A small shed-roofed addition was appended to the east end. The main volume houses three hydroelectric power generation units which are mounted in the concrete foundation and driven by impulse water wheels.

Exterior

Powerhouse No. 3 is a one-story, rectangular-in-plan, reinforced concrete building resting on a concrete foundation. A tan, rough-textured stucco covers the exterior. Structural pilasters subdivide the walls into panels. The building is three bays wide and five bays long. The side walls are divided into five roughly equal bays. The end walls have two large, equal-sized panels at the corners and a narrower central bay. The exterior pilasters are shouldered into three tiers with slope-top transitions. The 28-foot-high building is covered by a medium-pitched gabled roof sheathed with corrugated metal panels. The roof is topped by two circular metal ventilators. The transition from the roof to the side walls is accomplished with very simple, square-in-section, concrete cornices. A concrete-block wing with shed roof, exposed metal rafters, and corrugated metal roofing, built in 1954, adjoins the original building on the east end at the central and northern bays.

The end walls, which conceal the gable ends, culminate in symmetrical, three-tiered, curvilinear stepped parapets, finished with square-in-section concrete coping. Symmetrical circular window openings at the gable ends contain a center-pivot metal cover at the east wall and a metal exhaust fan with rectangular metal frame and cover at the west wall. The bays on the long walls each have one large metal framed window, subdivided from top to bottom into: a fixed 3-light window; over a 6-light, top-hinged, outward-swinging; over a 6-light fixed window; over a bottom-hinged, 3-light, inward-swinging window. An identical window is found at the north corner of the west end wall. Windows have stuccoed projecting lugsills. Metal grates secure all operable windows. Entrances to the building include: a five-panel wood door with flat wood surround and security gate at the center of the west end; a metal door in the south wall of the east wing;

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[12] Taylor, "Bishop Creek Hydroelectric System," p. 11-12.

[13] Clerico and Koval, "An Architectural and Historical Evaluation," p. 30-33; Diamond, Helmich, and Hicks, "Evaluation of the Historic Resources," p. A-144-151.

[14] Field inspections were conducted on October 18 and December 7, 2011.

and large contemporary metal roll-up doors behind hinged security grates at the south corners of the end walls.

Interior

The main rectangle of the building is open in plan, except for a rectangular windowed operators office in the northeast corner and a small water closet in the northwest corner. The floor is poured concrete with areas of metal foundation plates bolted into place. Three sets of water-wheel/generator assemblies are mounted in pits at the center of the room, with their axis of spin aligned along the east-west centerline of the building. The generator room also contains water valves and governors on the north side of the building, and other support equipment around the periphery. Concrete walls are painted but otherwise unfinished and exhibit imprints of formwork boards. Walls are subdivided into bays by structural pilasters that extend from the exterior to the interior. All bays along the long side walls contain large rectangular metal-framed windows. An overhead traveling crane is mounted on rails supported by a post-and-beam system that is integrated into the structural system of the long walls. The generator room is open vertically through the Fink steel trusses and the underside of the pressed metal roof sheathing is exposed. The operators office is enclosed with 15-1ight, fixed, steel-framed panels and a similar 10-light panel and it is accessed by two solid metal doors with large glazed transoms. The office contains a desk in the windowed bay and a switchboard at the back of the room, which extends into the addition.

Forming a line along the middle of the generator room are found the three power generation units with original water wheel housings, original generator housings and rotors, and original shaft mountings. The wheel housings are semicircular, made of riveted cast iron, and bolted to the floor over the operating water wheels. Raised lettering at the flared bases reads: HENRY 1912. The generator housings are donut-shaped with open interiors, also made of cast iron, and suspended around the stator cores and rotors. Raised lettering at the sides reads: CROCKER-WHEELER. The generator housings also display stylized circular metal nameplates bolted to the surfaces that read: CROCKER-WHEELER COMPANY, AMPERE, NEW JERSEY; and include original machine specifications and serial numbers.

Battery House

The battery house is a one-story, rectangular-in-plan, reinforced concrete building with a concrete foundation. The tan-painted exterior concrete exhibits imprints of formwork boards and has wood spacer blocks intact. The roof is gabled and sheathed in corrugated metal panels. Concrete cornices provide transition from roof to side walls. The end walls culminate in symmetrical, three-tiered, curvilinear stepped parapets, finished with square-in-section concrete coping, which are identical to the powerhouse but dimensionally reduced. At the north wall, a stacked-rock berm runs into the lower central portion of the wall and indicates the location where the penstock feeder pipeline enters the building. The west wall contains a square metal sliding window within a larger blinded window opening at the north corner. The south wall contains a small square vent within a blinded window opening centrally located. The building is accessed by a pair of five-panel wood doors with flat wood surrounds on the west side. The north door is covered by a sheet metal gabled awning supported by wood knee-braces. The interior is partitioned by a concrete wall into two rooms that are accessed only by the exterior doors. To the south is a battery room. To the north is a room that contains contemporary cooling water filter equipment along the south wall and a large pipeline that enters the room through the north wall. The pipeline is capped and retired from its original use.

1. **Character:**

   In 1913, the *Journal of Electricity Power and Gas* referred to Powerhouse No. 3 as "the most modern plant" in the Bishop Creek system, and compared it to Powerhouse No. 2 (constructed in 1908), which itself was described as "a most ideal example of Western practice of its time."[15] Powerhouse No. 3 remains exemplary of a California hydroelectric powerhouse from the early twentieth century. It retains the significant majority of exterior features that convey its historic architectural character, including (but not limited to) cladding and roofing materials, roof shape, façade details, and pattern of windows and entrances. "The stepped curvilinear parapet of Powerhouse No. 3 is the best example among the five powerhouses of the Mission Revival architectural era."[16] In addition, it retains the significant majority of interior features that convey its original historic character, including (but not limited to) an open linear floor plan, centrally located water wheel/generator assemblies, perimeter walls with recessed bays, natural lighting provided by large windows, and overhead travelling crane. The overall design of the powerhouse is mostly intact. Relatively minor changes that have occurred include window replacement in approximately 1940s, construction of the small east wing in 1954, and service door replacement. The appearance and operation of Powerhouse No. 3 is much the same as it was when its original construction was completed.

   The battery house (former valve house) has diminished in character due to physical and operational changes that have occurred over time. The building no longer serves its original function as a valve house, nor does it contain the machinery that conveys this function. In addition, alterations have modified its appearance, including removal of windows, attachment of an entry hood, and interior renovations. Nonetheless, the signature features of its Mission Revival architectural style are intact, including (but not limited to) its curvilinear parapets (which match the signature parapets of the powerhouse), corrugated iron gable roof, and unfinished concrete walls and cornices. The building retains essential elements that contribute to the character of the power plant.

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[15] Van Norden, "System of Nevada-California Power Company," p. 4, 10.
[16] Diamond, Helmich, and Hicks, "Evaluation of the Historic Resources," p. A-146.

2. Condition of Fabric:

Powerhouse No. 3 is in good physical condition. The concrete walls are intact and the exterior stucco facing does not contain noticeable cracks or damage, with few attachments and/or piercings. The corrugated metal roof is intact. Likewise, the interior is in good condition. The concrete perimeter walls and foundation are intact, as is the historic internal addition to the generator room, the office bay. Windows and doors are operable. The only visible damage to the powerhouse consists of deterioration to the wood door surround at the west end. Likewise, the battery house (former valve house) is in good physical condition, with intact concrete walls, metal roofing, and operable doors. The only visible damage to the building is scoring at the exterior surface of the blinded window at the west side, which is primarily cosmetic.

B. Site Layout:

The terrain surrounding Powerhouse No. 3 consists of steep canyon walls covered with natural vegetation. The plant is located on a graded level area on the northwest bank of Bishop Creek. To the northwest, topography rises sharply towards West Bishop Creek Road, California State Route 168, and a distant ridge from which Penstock No. 3 approaches the plant. To the southeast, the terrain slopes down to nearby Intake No. 4 and Bishop Creek, then rises steeply at the opposite valley wall. The powerhouse stands with its long axis running approximately east-west. Directly to the west of the powerhouse, the small battery house (former valve house) is situated with its long axis perpendicular to the larger building. To the east of the powerhouse, an area abutting the east wing contains transformers and a chain-link perimeter fence. A tall stone retaining wall is found directly to the northwest of the powerhouse. Originally, the power plant complex included a powerhouse (extant), a valve house (extant), five residence cottages (not extant), an apartment building (not extant), and two garages (not extant). The residential buildings and garages were removed in 1978 and 1979. Also, the original highway (California State Route 168) followed the northwest bank of Bishop Creek directly past all the powerhouse sites including Plant 3 (apparently along the route of the current West Bishop Creek Road). The new highway, which bypasses the powerhouses, was constructed to the northwest in 1965-1966.

PART III: OPERATIONS AND PROCESS

A. Operation:

This section describes the process that creates hydroelectric power at Powerhouse No. 3, in the context of Power Plant 3 and the chain of power plants that comprise the Bishop Creek Hydroelectric System. This section is divided into two subsections: (1) Basic Components of Hydroelectric Systems, which provides a general background for understanding the operations of hydroelectric plants; and (2) Operation of Plant 3, which describes how water moves through the power plant in order to drive turbines and generate electricity that is transmitted long distances.

Basic Components of Hydroelectric Systems

In a hydroelectric power generating unit, the force of moving water is used to spin a turbine (or "water wheel"). A turbine is connected via a shaft to a rotor, the moving part of an electric generator. The movement of the turbine spins the rotor within the generator and sweeps coils of wire past the generator's stationary coil, or stator, which produces electricity. Once electricity is produced, transformers raise the voltage to allow transmission over long distances through power lines.[17]

The following explanation of hydroelectric systems was included in a previously completed evaluation of eligibility for listing in the National Register of Historic Places.[18]

There are two basic types of hydroelectric systems. The first of these, low-head hydro, uses a large volume or mass of water from relatively low dams in order to turn the angled surfaces of screw-shaped turbines. The other type, high-head hydro, uses streams with relatively low volume flows, where water is diverted away from the natural stream course and elevated by artificially reduced fall far above the natural stream through a man-made canal or pipeline. At some point downstream the water is directed downslope were it achieves a very high pressure. The water at the base of the slope is directed against a bucketed wheel which receives an energy impulse by its impact.

The basic features of a high-head hydro system, of which the Bishop Creek Hydroelectric System is an example, are outlined below.

1. Water from a stream channel is separated from the natural stream using a diversion dam, headgates, screens and a spillway. The headgate regulates the flow of water, while the screens prevent debris from entering the water conduit. The reservoir behind the intake dam acts as the principal regulator of the water flow, allowing excess water to escape into the natural water channel. The dam,

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[17] U.S. Department of the Interior, Bureau of Reclamation Power Resources Office, "Reclamation: Managing Power in the West – Hydroelectric Power," July 2005, unpaginated. Found at http://www.usbr.gov/power/edu/pamphlet.pdf, accessed on January 30, 2012.

[18] Diamond, Helmich, and Hicks, "Evaluation of the Historic Resources," p. 10-11.

headgate, and regulating and cleaning apparatus are all known collectively as the *intake.*

2. Following intake, water is conducted by flumes or canal systems, pipes, tunnels or siphons (pipes in the case of Bishop Creek). The length of the system varies greatly, depending on the area's topography and amount of water-pressure desired. Sluices and sandboxes are usually built into the system to allow sand and gravel, which could clog or damage the downstream equipment, to settle out of the water. *Flowlines* generally incorporate pressure-relief valves, installed at regular intervals along their length. These open and permit outside air to enter the line to prevent the line from collapsing should there be an accidental break in the pipe. A large vacuum would normally be formed by the sudden acceleration of water through a break, which could easily destroy either wood or steel pipe.

3. At the end of the canal system, a pipe is installed as nearly vertical as conditions will allow providing the water pressure needed to operate the water wheel(s). This pressure pipe is known as a *penstock.* At the top of this pipe is a small reservoir, expansion tank or standpipe (standpipe in the case of Bishop Creek) which helps to regulate and smooth the flow of water within the penstock.

4. A *powerhouse* is located at the bottom of the penstock. This consists of a building within which is housed the power generation and distribution equipment. The machinery within the building includes water wheels, generators, batteries and exciters. Exciters provide direct current to energize the electromagnets within the larger alternating current generator(s). The powerhouse also includes the distribution equipment used to initiate transmission of electricity. This equipment consists of switches, circuit breakers and related controls which are connected to a nearby transformer. The transformer increases voltage so that power can be transmitted over long distances. The powerhouse also contains a variety of other apparatus used in the operation of the system. This often includes a small generating unit to operate the powerhouse lights and equipment, as well as telephone links with other system components. Other buildings associated with the operation of the hydro system are usually located in close proximity to the powerhouse(s). These may include such facilities as administrative headquarters, garages, housing for system personnel, equipment storage sheds, pump houses, and machine shops.

5. Where there is more than one power-generating source, it is not uncommon for there to be a *control station* where the transmission of energy may be monitored and regulated. If electrical generating facilities are close by, many functions may be automated or operated from a centralized control point; the control station may serve this additional function.

6. *Transmission lines* carry power to users. Normally a step-down transformer is used near the point-of-use to reduce the voltage to normal house currents.[19]

Operation of Power Plant 3

At Plant 3, the static head of water (or vertical drop in elevation from intake to water wheel) is 809 feet. The water that operates Plant 3 is delivered from distant Intake No. 3, an equalizing pond located to the southwest directly below the tailrace of Plant 2. Water is transferred from the intake over a distance of 13,029 feet by Flowline No. 3, a metal pipeline (originally a redwood stave pipe). The flowline runs along the crest of a moraine located to the northwest of Powerhouse No. 3. The water is conveyed from the flowline to the powerhouse via Penstock No. 3, a metal pipeline that begins at the height of the flowline and descends steeply from the west, thereby using gravity to deliver water at substantial velocity to the plant. The penstock approaches Powerhouse No. 3 below grade, running just north of and parallel to the north side of the powerhouse. Before the penstock reaches the powerhouse, it branches a pipeline to the east that passes beneath the original valve house (currently the battery house). The valve house and its relief valve were installed at a plant site that was historically believed to be susceptible to damage from a serious leak in the high-pressure penstock. However, the valve was removed and the line was capped.

The penstock splits into three separate feeder pipes that enter the powerhouse foundation at an angle to the north wall, with each pipe directed to one of three water wheels located within the powerhouse. The pipes pass through control pits located along the north side of the generator room. These control pits contain the machinery that regulates the flow of water from the penstock feeder pipes to the impulse water wheels, including governors (which can be used to control the positioning of the power needle and/or the stream deflector), gate valves, nozzles and power needles, stream deflectors, and the controlling mechanisms. At Units No. 1 and No. 3 (numbered west to east), the rectangular control pits measure 7’6” x 10’0”. At centrally located Unit No. 2, the larger control pit measures 9’0” x 14’6”. The control pits are 3’8” deep (as measured from the floor line) and each contains five concrete steps at the southeast corner that lead down from the floor level. The control pits are separated by concrete walls 12” thick, and are covered by bolted metal foundation plates that provided flooring.

In the concrete floor of the powerhouse, three power generation units consisting of impulse water wheels and direct-connected generators are shaft-mounted with their common axis of spin aligned horizontally and parallel to the centerline of the building. The impulse wheels are mounted in pits located in front of the control pits, from which extremely high-velocity jets of water are directed at the wheels. Rounded metal casings are bolted to the concrete floor over the water wheels. The wheel pits are 8’0” deep directly beneath the centers of the wheels and the floor openings measure approximately

[19] Diamond, Helmich, and Hicks, “Evaluation of the Historic Resources,” p. 10-11.

4’10” (widening to 5’6” at the bottoms) x 12’8”. The wheel pits slope gradually down to the north and into tailrace channels within the substructure.

Each water wheel drives a rotating generator, which is shaft-mounted in tandem with the turbine. The generators are hung over open rectangular pits located parallel to and centered with the wheel pits. The wheel pits and generator pits are separated by low concrete partitions. The generator pits are 6’0” deep and the floor openings measure 6’5” x 12’0”. Shaft bearings and housings are bolted to the concrete foundation to either side of each generator. The generators rest on additional concrete block supports located beneath the machines at the bottoms of the pits. The centerline of the wheels, generators, and shafts (and of the building itself) is located 19’0” from the north and south walls. Within each unit, the center-to-center distance between wheels and generators is 8’6-¼”.

Currently, Powerhouse No. 3 operates with solid-state exciter units which consist of non-moving electrical machinery housed within metal cabinets. The exciters are used to produce direct current that is used to energize electromagnets within the main power generation units. Originally, the powerhouse contained a pair of water-driven exciters with impulse wheel/generator assemblies similar to those found at the main power generation units but smaller. They were located in front of the second bay of the south wall. Water reached the impulse wheels of the exciters from a dedicated penstock feeder pipe that entered the substructure at the north wall, passed between Units No. 1 and No. 2, and split into a “Y” with branching pipes that terminated at the impulse wheels. The exciter wheel pits drained into tailrace channels to the south.

Within the foundation, three separate tailrace channels run southward from the water wheel pits of the main generating units and exit the south side of the substructure. These tailrace channels are 66” wide and are contained within concrete side walls 12” thick. They exit the powerhouse as separate, open square-bottomed channels that spill into nearby Intake No. 4. A fourth tailrace, also a square-bottomed concrete channel, exits the foundation of the former valve house to the west of the powerhouse. The valve house tailrace was designed to be used in the event that the relief valve was opened, which would have diverted water before it reached the powerhouse. However, the relief valve function has been removed and the tailrace is abandoned.

B. Machines:

This section provides an inventory of extant machinery within Powerhouse No. 3, including descriptions of purposes, manufacturer names and dates of installation (as available), and information regarding changed and removed machinery (as available). This section is divided into several subsections beginning with a general description of the power generation units, followed by detailed descriptions of individual machines and sets of machines. The individual machinery is described in the following order: turbines (water wheels); generators; governors; gate valves; exciters; and additional machinery.

Power Generation Units

The three power generation units at Powerhouse No. 3 are identical in general machinery and operation, with the exception of hydraulic controls. In 1913, the *Journal of Electricity Power and Gas* described the specifications of the power generation units at Powerhouse No. 3:

> There are three main generating units, each having a rating of 2250 k.v.a. The generators are Crocker-Wheeler, two bearing, 3-phase, 2200 volt machines operating at 300 r.p.m. They are driven by single overhung runner waterwheels known as the "Henry" type, designed and built by Geo. J. Henry of San Francisco, formerly engineer for the Pelton Water Wheel Company. Stationary needle nozzles are operated on the two end units with hand control. On the middle unit, the needle is operated by Henry's patented automatic, oil-pressure operated control and in conjunction with this is a similarly operated automatic bypass.[20]

Charles O. Poole, chief engineer of the Nevada Power, Mining and Milling Company, further described the original hydraulic controls of Unit No. 2 for *Electrical World* in 1914:

> Two of the units are provided with hand-regulated needles and governor-operated balanced stream deflectors. The third unit consists of an automatic governor-actuated needle and stream deflector. The relation between the needle and stream deflector is such that water is quickly applied to the wheel by opening the needle and drawing the deflector out of the stream. When less water is required the governor causes a quick movement of the deflector into the stream, the needle slowly closes, and the deflector recedes from the steam proportionally to the closing movement of the needle, thus effecting regulation without serious variation in the water pressure.[21]

It is not known if the current hydraulic controls, which have been modernized, are consistent among the three units.

Turbines (Water Wheels)

The original, identical Henry-manufactured water wheels on all three units were replaced by newer impulse wheels in the mid-twentieth century. The replacement wheels operated at 300 rpm (rotations per minute) consistent with original operating parameters. In 1947 and 1948, Units No. 1 and No. 3 received newer Pelton-manufactured cast iron water wheels that maintained the original number of buckets per wheel (15). In 1959, the water wheel on Unit No. 2 was replaced with a newer Pelton-manufactured cast steel water

[20] Van Norden, "System of Nevada-California Power Company," p. 10.
[21] Poole, "Hydraulic and electric features of stations No. 2 and No. 3," p. 19.

wheel that increased the number of buckets (16).[22] All of the water wheel replacements occurred within the original cast iron machine housings and mountings which are extant.

Generators
Similarly, the original generators furnished by Crocker-Wheeler were upgraded over time. They are revolving field, alternating current generators that operate at 300 rpm (in tandem with direct-connected water wheels). All three generators received maintenance in 1922. Unit No. 1 was serviced again in 1939 and 1985; and in October 1993, a new stator core and rewinding was provided by Westinghouse Electric Corporation and installed by SCE. The generator at Unit No. 2 was redesigned and rebuilt by Westinghouse "in their Los Angeles Repair Shop", probably in 1944; and it was serviced again in 1974-1975. Furthermore, in May 1999, a new stator core and rewinding for Unit No. 2 was furnished by Siemens-Westinghouse (with stator coils manufactured by Hydro Generation Services) and installed in October 1999 by SCE. At Unit No. 3, service was performed in 1945, 1967, and 1986; and in October 1998, a new stator core and rewinding was provided by Westinghouse Electric Corporation and installed in November 1998 by SCE. As originally designed, the generators were rated at 2,250 kw and delivered three-phase current at 2,200 volts. Following redesign, rebuilding, replacement, and rewinding, the generators have an output capacity of 2,750 kw each at 2,400 volts. These rewinds and core replacements occurred around the original rotors which are extant and within the original generator housings which are extant.

Governors
Originally, a Woodward governor operated on Unit No. 2 in conjunction with the automatic nozzle and bypass; and Lombard type M governors were mounted on Units No. 1 and No. 2 and operated balanced deflecting hoods over the nozzle streams. Currently, Woodward governors with distinctive bell-shaped heads and stylized meters, which are known to have been installed at Bishop Creek power plants in the 1930s, are extant on all three units. At Units No. 1 and No. 3, the governors are located adjacent to the wheels; at Unit No. 2, the governor is found to the north near the needle and deflector controls.

Gate Valves
The gate valves are another distinctive feature of the hydraulic system. According to the *Journal of Electricity Power and Gas*:

> On each of the main feed pipes, which enter the building on an angle below the floor level, are 24 in. steel gate valves operated by reversible water motors. These gates were built by the Main Street Iron Works of San Francisco from the designs of Geo. J. Henry Jr.[23]

[22] According to Poole, "Hydraulic and electric features of stations No. 2 and No. 3," p. 26, the original water wheel at Unit No. 2 had 15 buckets. According to a database maintained by SCE, the water wheel at Unit No. 2 that was replaced in 1959 had 16 buckets. This discrepancy should be noted.
[23] Van Norden, "System of Nevada-California Power Company," p. 11.

The gate valves are extant, located in the control pits, with large hand-wheels and small metal nameplates bolted to their surfaces that read: MAIN ST. IRON WORKS, 163-173 MAIN ST., SAN FRANCISCO, CAL.; and GEORGE J. HENRY, HYDRAULIC & MECHANICAL ENGINEER, SAN FRANCISCO.

Exciters

Originally, the powerhouse contained two water-driven exciters that provided the direct current initially needed to energize the electromagnets within the larger generators. The original exciters operated as independent generating units with impulse turbines. The exciters, including impulse water wheels, housings, and generators, were located with their shafts in line along the south wall of the powerhouse in front of the second bay (counting west to east). The original exciter machinery was described in the *Journal of Electricity Power and Gas* in 1913 and *Electrical World* in 1914, with the descriptions differing slightly with regards to voltage and rpm:

> There are two exciter sets placed in line with the switchboard close to the building wall. These have Crocker-Wheeler, 6-pole and interpole, 125 volt d.c. generators operating at 580 r.p.m. and are driven by single runner overhung Henry water wheels equipped with hand regulated needle nozzles. One of the units is quipped with a 150 h.p., 2200 volt, 3-phase, Crocker-Wheeler induction motor between the water wheel and the generator, and connected to the latter through a bolted couping. Both units have two bearings.[24]

> There are also two 100-kw, 120-volt, 600-r.p.m., Crocker-Wheeler exciters, one being driven by an impulse waterwheel, the other driven by a waterwheel and by a 150-hp, 2200-volt, three-phase Crocker-Wheeler induction motor, either unit being ample to supply the excitation for the three generators. The exciters are controlled by a Tirrill regulator.[25]

In 1968, new Allis Chalmers exciters rated at 125 volts, but delivering current at 120 volts, were installed on all three units; and in 1997, new Basler Electric exciters delivering current at 125 volts were installed on all three units. These solid-state exciter units are extant. Directly adjacent to each unit on the west side, an exciter transformer cabinet (presumed Allis Chalmers) is positioned to the north, and a Basler Electric static exciter cabinet is positioned to the south. The two original water-driven exciters were removed from their location along the south wall of the powerhouse, and the pit was filled with concrete to match the floor surface. The area is currently empty.

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[24] Van Norden, "System of Nevada-California Power Company," p. 10-11.
[25] Poole, "Hydraulic and electric features of stations No. 2 and No. 3," p. 26.

Additional Machinery

Other notable details of operating machinery within the powerhouse include: an oiler located near the middle of the north wall with a small metal nameplate bolted to the surface that reads: ALISS CHALMERS CO., MILWAUKEE, WISCONSIN, U.S.A.; removal of the original Crocker-Wheeler five-panel switchboard equipped with Westinghouse instruments and underground cables from in front of the third (center) bay along the south wall and installation of a new switchboard within the operators office addition that was constructed in 1954; and installation of various electrical conduits, panels, and boxes along perimeter walls and on machinery housings, which support electronic sensors, controls, and automation.

C. Technology:

This section describes the technology of impulse turbines, also known as Pelton wheels, which are used to create hydroelectric power at Powerhouse No. 3.

Impulse Turbines (Pelton Wheels)

The “Pelton” or impulse wheel, the prime converter used for generating electrical energy on the Bishop Creek System, was designed and perfected in northern California during the last quarter of the nineteenth century (1872-1890). The Pelton wheel was named for its inventor Lester Allan Pelton who was based in California. All impulse water wheels are basically variations on the earliest Pelton concept, although impulse water wheels in the Bishop Creek System were also manufactured by the Doble, Henry, and Worthington companies as well as the Pelton company. With the application of a technology which evolved from the water monitor used in hydraulic mining, impulse wheels are driven by extremely high-velocity jets of water playing on buckets at the periphery of a high-strength iron or steel wheel. These wheels depend not on the mass of water falling the distance of the diameter of the wheel but on the velocity of the impacting jet of water. Impulse water wheels are especially well suited to high-head (high-pressure) but relatively low-volume water power resources. These wheels are also adaptable to streams with highly variable flow regimes. Current-day Pelton wheels, which are considered over 80-percent efficient, have bucket shapes which are slightly revised from those used originally on Bishop Creek – an improvement which increases the efficiency of energy transfer by a small percentage.[26]

The operation of an impulse turbine involves precise control over the high-velocity stream of water that strikes the wheel’s buckets. This is accomplished by adjusting the position of a “power needle” that is located at the end of a penstock “nozzle” and that can variously restrict or permit water passage. Water passing through the end nozzle and past the power needle is directed with a “stream deflector” to strike the buckets at the proper angle for the desired rotation. Some impulse wheels are fitted with multiple nozzles and power needles, in which water under high pressure is directed against the wheel at multiple locations at the same time, which provides greater control and efficient use of

[26] Diamond, Helmich, and Hicks, “Evaluation of the Historic Resources,” p. 11-12.

water. After turning with the wheel, the water in the buckets falls to the bottom of the wheel housing and flows out. A typical impulse wheel turns the flow of water approximately 170 degrees from the point it receives the water pulse to the point that it drops the water into the tailrace.[27]

In the Bishop Creek system, which is typified by high-head, low-volume conditions, 12 of the 14 power generation units contained within four of its five powerhouses are driven by impulse turbines. Impulse turbines are installed in the three highest powerhouses at Plants 2, 3, and 4 and in the lowest powerhouse at Plant 6, which utilizes a dual-wheel, four-nozzle configuration with its single power generation unit in order to compensate for the low-head conditions found at the lower reaches of Bishop Creek. Other impulse turbines in the Bishop Creek system are configured with single nozzles, with the exceptions of Unit No. 2 at Plant 2 and Unit No. 5 at Plant 4, which operate with primary and auxiliary nozzles that provide greater control. The only powerhouse in the Bishop Creek system that does not use impulse wheels is located at Plant 5 which contains two units with reaction turbines.

[27] U.S. Department of the Interior, "Reclamation: Managing Power in the West – Hydroelectric Power," unpaginated.

PART IV: SOURCES OF INFORMATION

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__________. "Emergency Lighting Layout for Bishop Creek Plant No. 3." April 5, 1937; first revised December 6, 1938; most recent revision January 17, 1954, SCE Drawing No. 434444-3.

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__________. "No. 2 Unit Machine Foundations Power Plant No. 3." November 4, 1912; revised February 23, 1937, SCE Drawing No. 570896-1.

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C. Likely Sources Not Yet Investigated:

An inquiry was made to The Huntington Library, Arts Collections, and Botanical Gardens (The Huntington) located in San Marino, California, regarding the availability of construction drawings for Bishop Creek plants that may be stored in the Southern California Edison Records, 1848-1989 (SCE Records). According to The Huntington personnel and finding aids, the SCE Records do not contain indexed construction drawings. However, a vast volume of materials is indexed in the SCE Records in a variety of categories that include: Administrative Records; Department/Division Records; Financial Records; Generation, Distribution, and Transmission Records; Project Records; Research Files; Topical Records; and Oversize Materials. These materials could potentially yield additional information related to the historical development of Bishop Creek power plants. This information could be gathered by conducting a thorough review of materials indexed in the SCE Records.

In addition, the Huntington maintains a Digital Library that includes a Southern California Edison Photographs and Negatives Collection (SCE Photograph Collection). This SCE Photograph Collection contains numerous historical photographic images of SCE facilities that could potentially yield additional information related to the historical development of Bishop Creek power plants. This information could be gathered by conducting a thorough review of photographic images indexed in the SCE Photograph Collection.

Other potential sources of information that could be investigated include current and former power company employees, who may have knowledge of the historical development of Bishop Creek power plants which may not be contained in available documents, drawings, or other materials. This information could be gathered by contacting and conducting interviews with individuals who potentially have this knowledge.

Appendix A: Images

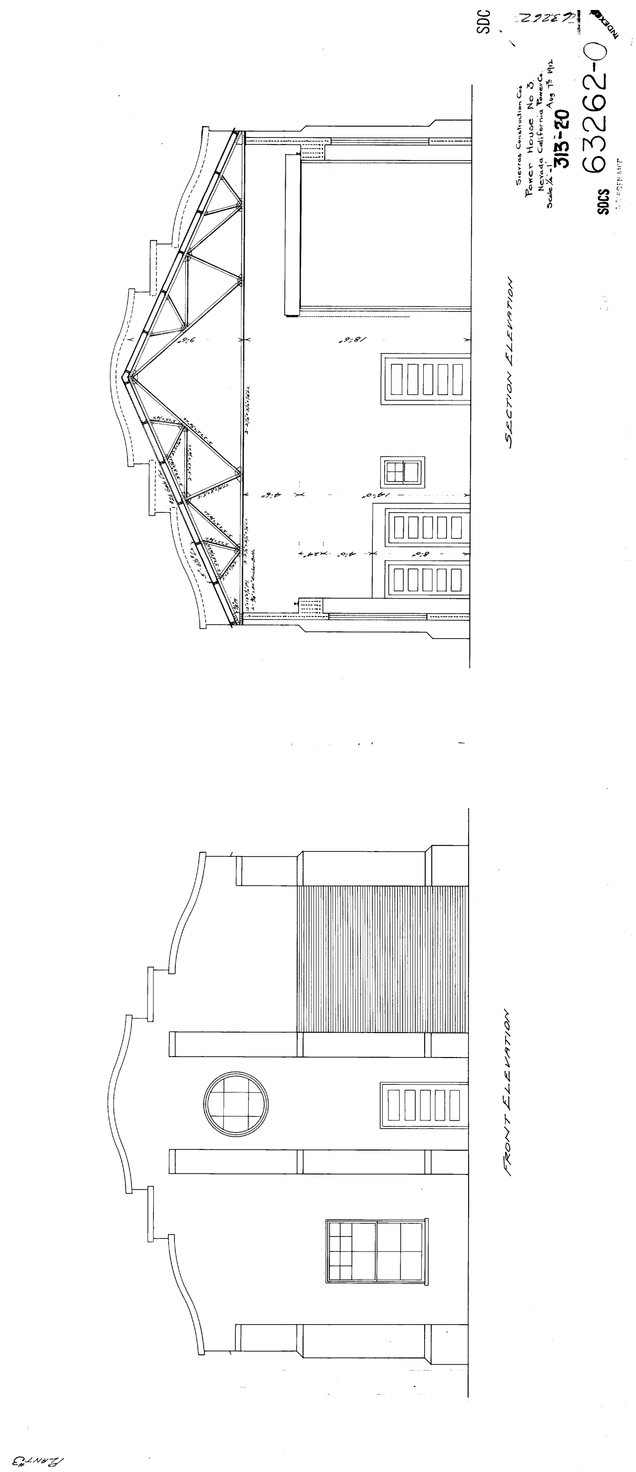

Figure 1: Nevada-California Power Company, “Front Elevation of Power House No. 3,” August 7, 1912. SCE Drawing No. 63262-0.

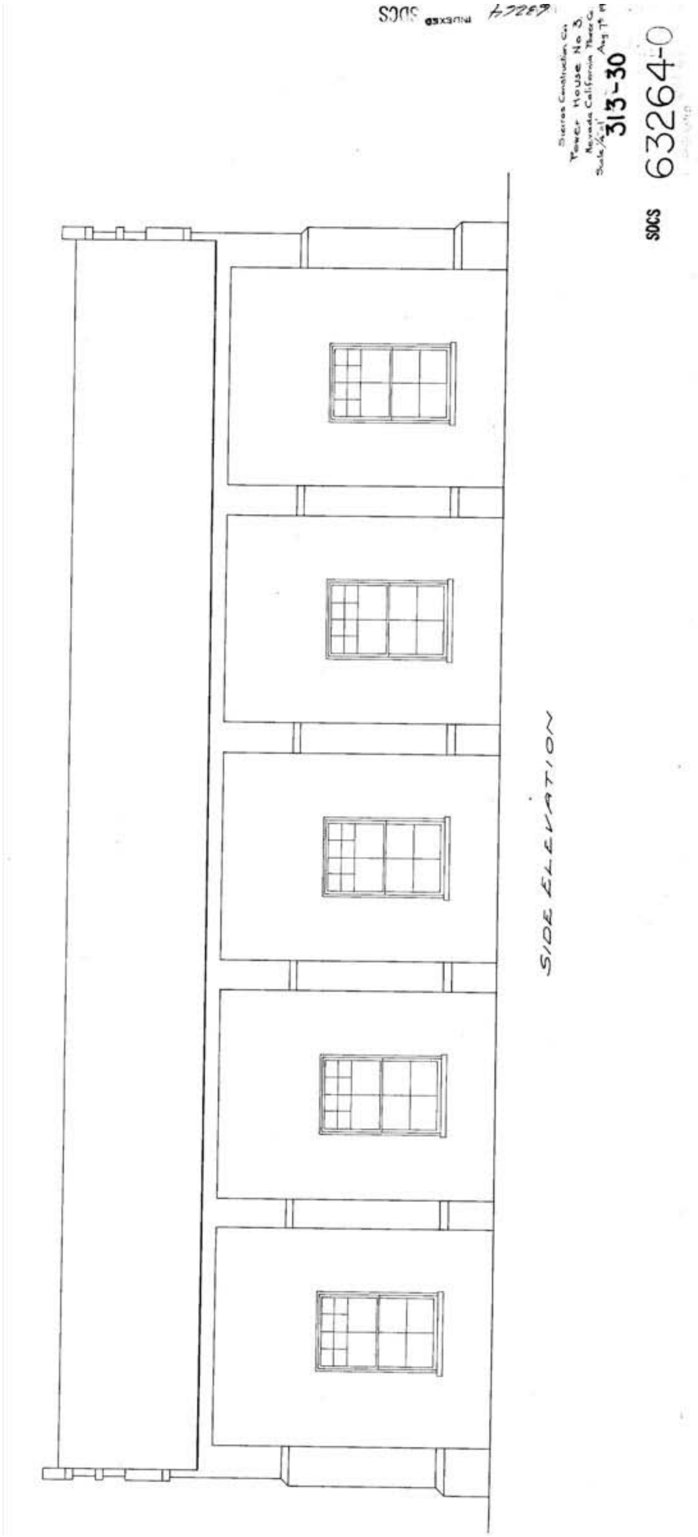

Figure 2: Nevada-California Power Company, "Power House No. 3 Side Elevation," August 7, 1912. SCE Drawing No. 63264-0.

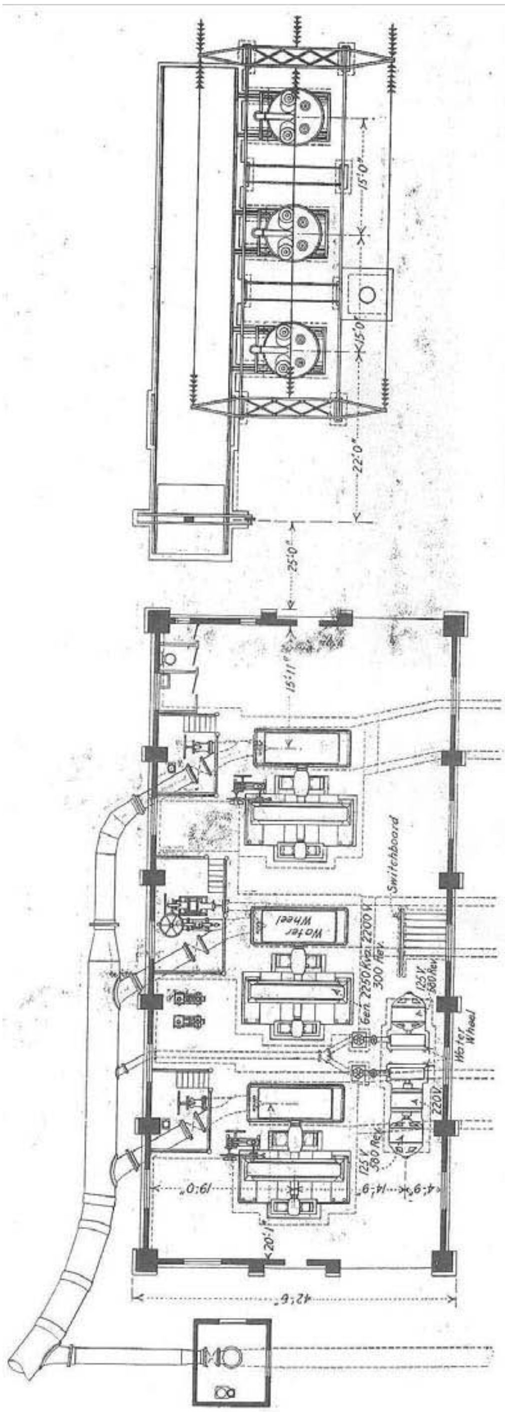

Figure 3: General plan of Plant 3. Poole, C. O., "Hydraulic and electric features of stations No. 2 and No. 3 of the Nevada-California Power Company – Tailrace water of former discharges directly into intake of latter," *Power Development and Transmission Systems of The Nevada-California Power Company and the Southern Sierras Power* Company, 1915, Figure 33, p. 23; reprinted from *Electrical World*, New York, 1914.

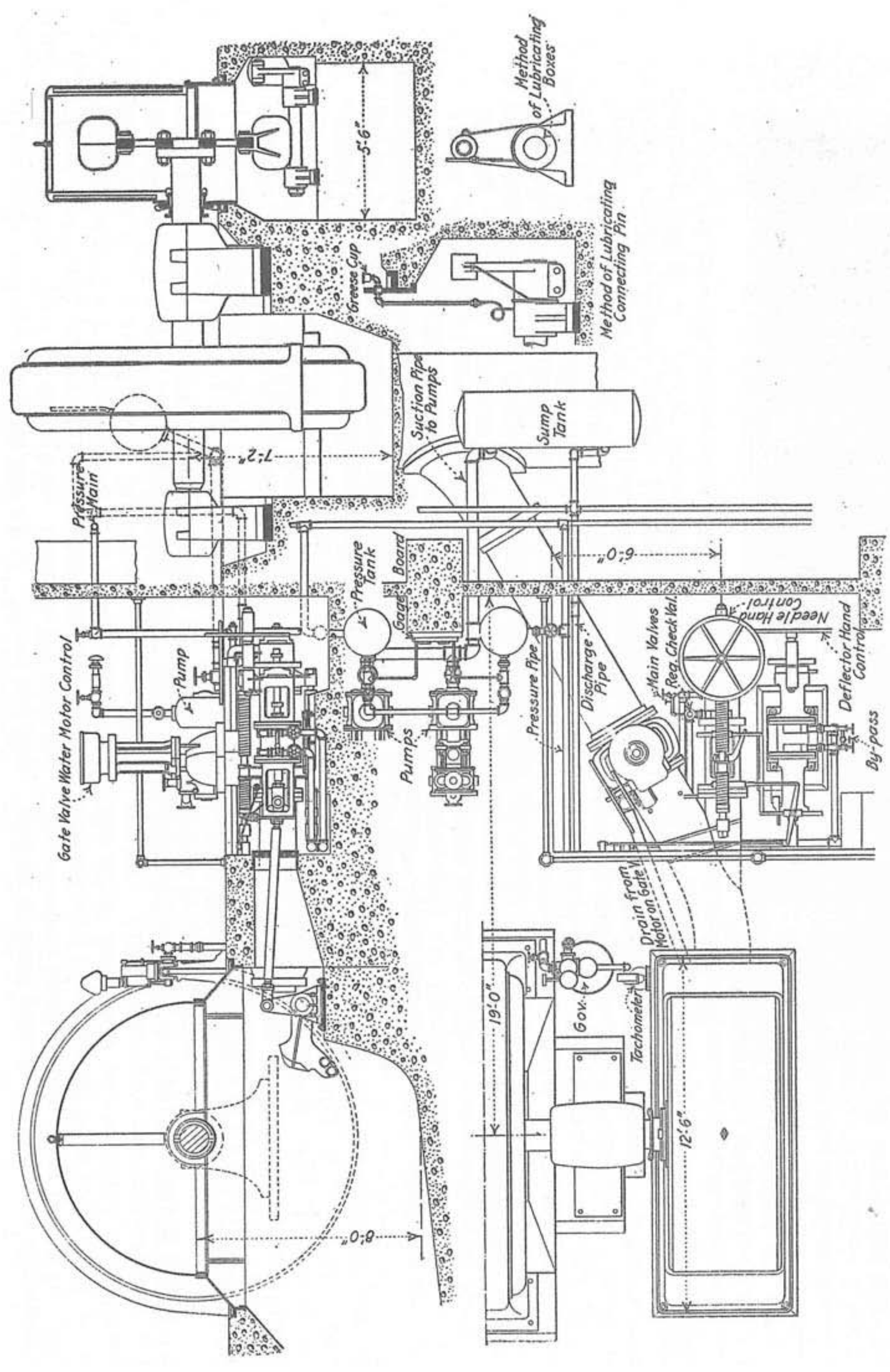

Figure 4: Section elevation and plan view of a power generation unit. Poole, C. O., "Hydraulic and electric features of stations No. 2 and No. 3 of the Nevada-California Power Company – Tailrace water of former discharges directly into intake of latter," *Power Development and Transmission Systems of The Nevada-California Power Company and the Southern Sierras Power Company*, Figure 36, p. 25; reprinted from *Electrical World*, New York, 1914.

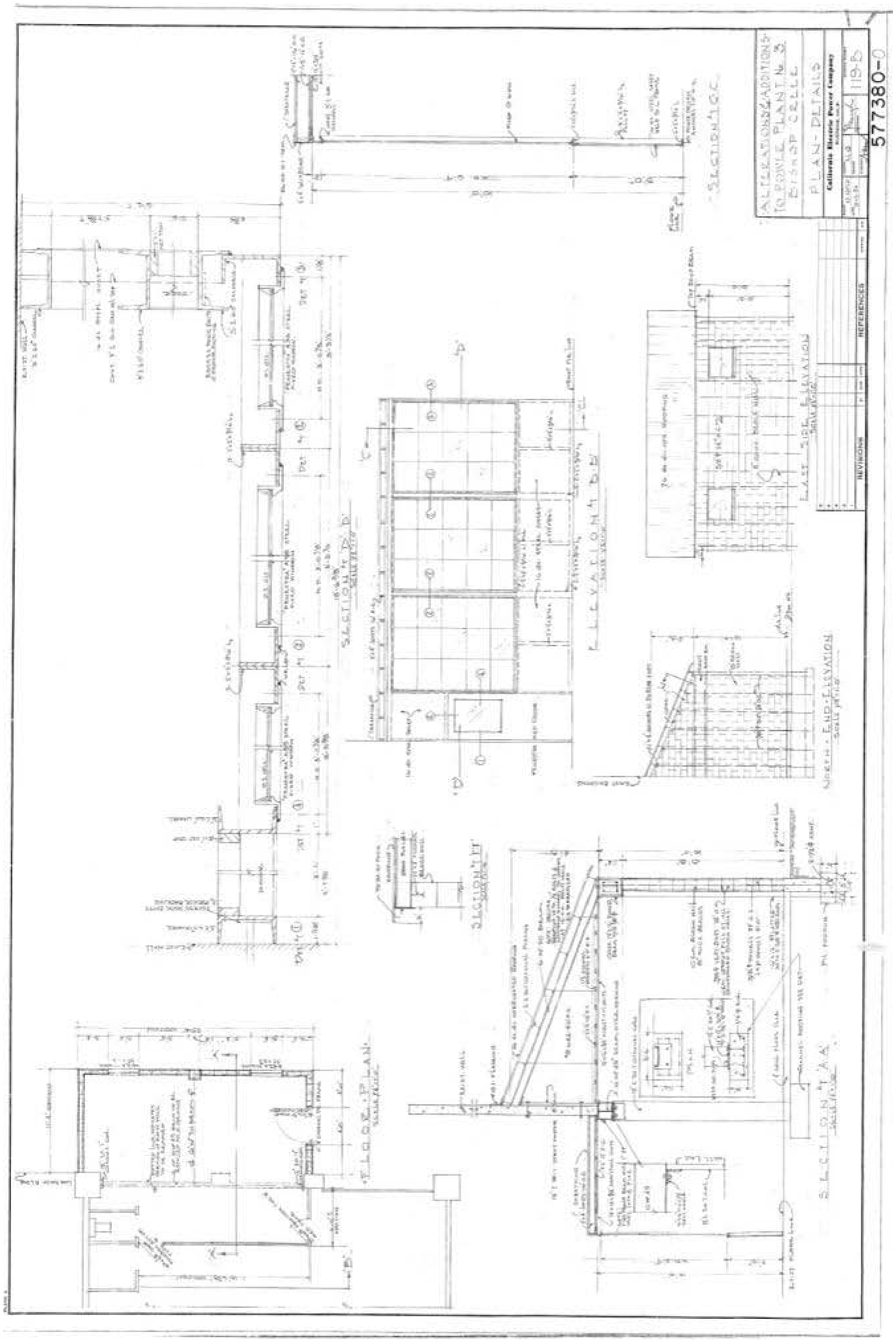

Figure 5: California Electric Power Company, "Alterations and Additions to Power Plant No. 3. Bishop Creek Plan Details," October 12, 1954. SCE Drawing No. 577380-0.

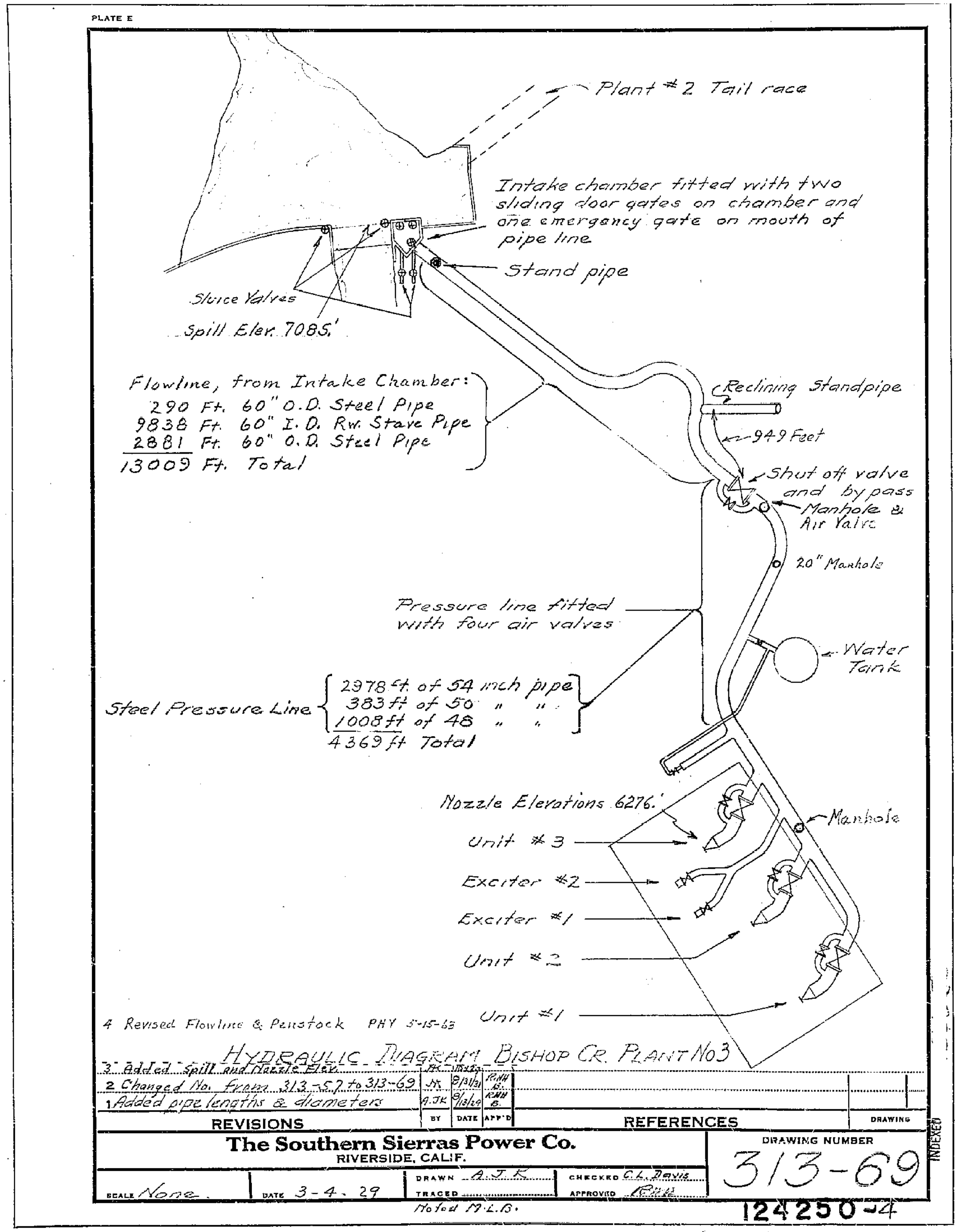

Figure 6: The Southern Sierras Power Company, “Hydraulic Diagram Bishop Creek Plant No. 3,” March 4, 1929; first revised August 13, 1929; most recent revision October 4, 1931. SCE Drawing No. 124250-4.