NPS Form 10-900
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OMB No. 1024-0018

1023

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations of eligibility for individual properties or districts. See instructions in *Guidelines for Completing National Register Forms* (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, styles, materials, and areas of significance, enter only the categories and subcategories listed in the instructions. For additional space use continuation sheets (Form 10-900a). Type all entries.

1. Name of Property

historic name: Childs-Irving Hydroelectric Facilities
other names/site number:

2. Location

street & number: Childs Powerplant — [NA] not for publication
city, town: Camp Verde — [X] vicinity
state: Arizona code: AZ county: Yavapai code: 025 zip code: 86322

3. Classification

Ownership of Property
- [x] private
- [ ] public-local
- [ ] public-State
- [ ] public-Federal

Category of Property
- [ ] building(s)
- [x] district
- [ ] site
- [ ] structure
- [ ] object

Number of Resources within Property

Contributing	Noncontributing	
4	2	buildings
		sites
28	25	structures
		objects
32	27	Total

Name of related multiple property listing: NA

Number of contributing resources previously listed in the National Register: 0

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this [X] nomination [ ] request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property [X] meets [ ] does not meet the National Register criteria. [ ] See continuation sheet.

Shereen Lerner — 6/27/91
Signature of certifying official — Date
State Historic Preservation Officer
State or Federal agency and bureau

In my opinion, the property [ ] meets [ ] does not meet the National Register criteria. [ ] See continuation sheet.

Signature of commenting or other official — Date

State or Federal agency and bureau

5. National Park Service Certification

I, hereby, certify that this property is:
- [X] entered in the National Register. [ ] See continuation sheet.
- [ ] determined eligible for the National Register. [ ] See continuation sheet.
- [ ] determined not eligible for the National Register.
- [ ] removed from the National Register.
- [ ] other, (explain:)

Entered in the National Register

[signature] — 8/9/91

Signature of the Keeper — Date of Action

6. Function or Use

Historic Functions (enter categories from instructions)	Current Functions (enter categories from instructions)
Industry/Processing/Extraction	Industry/Processing/Extraction
Energy Facility	Energy Facility

7. Description

Architectural Classification (enter categories from instructions)	Materials (enter categories from instructions)
	foundation
No style	walls
	roof
	other Concrete, Metal (Steel)

Describe present and historic physical appearance.

Summary

The Childs-Irving Hydroelectric Facilities are located primarily along Fossil Creek in central Arizona and comprise two distinct flume systems and two hydroelectric generating plants with other related components. The facilities were built in two stages: Childs in 1908-1909 and Irving in 1915-1916. These facilities have been recognized for their simple design and efficient means for generating and transmitting power. They are notable for their continuing operation and integrity. Replacement of parts has been, for the most part, consistent in styles with older components, thereby retaining the historical character of the system.

The electricity produced by this system leaves Childs via two routes. One transmission line runs up the steep Verde Escarpment and across very dissected mesa lands to a substation near the Bradshaw Mountains. From there the line is split in two directions, one going to Prescott via the Bradshaw Mountains and the other across the Black Hills to Jerome. This latter route is no longer extant. This line was the first long-distance, steel tower, electrical transmission line in operation in Arizona. Because of problems with downed wires, a second route was constructed to ensure the transmission of power to the mines in Jerome. This transmission line, supported by wooden poles, parallels the Verde River and connects with the other line forming a loop. Electricity generated at Irving was carried by a separate line to Childs and then was routed through the two transmission lines. Later, a portion of the electricity generated from Irving was transmitted to the Payson area via a separate Irving transmission system.

A total of 32 contributing elements have been identified for the Childs-Irving Hydroelectric Facilities. These include elements of the Childs flume, both hydroelectric plants, several peripheral buildings, and portions of a transmission line. In addition, 27 noncontributing elements have been defined. These components have been extensively modified or replaced. Although the system has actively operated for over 80 years, the degree of change to the original system has been relatively minimal. The majority of the alterations occurred because of up-grading, or increasing the voltage of, the transmission lines that distribute power from the two hydroelectric plants. Two other areas of modification worth noting include the modernization of switching and electrical equipment and the rebuilding the employee housing at Childs and Irving.

XX See continuation sheet

Ownership

The Childs-Irving Hydroelectric Facilities are owned and operated by Arizona Public Service Company (APS). The lands on which the facilities sit are managed by either the Coconino, Prescott, or Tonto National Forests. All the flume sections and both the Childs and Irving power plants are located on Coconino National Forest property leased by Arizona Public Service Company. Transmission lines running out of the facilities lie on rights-of-way leased from the three National Forests as well as private landowners, the State of Arizona, and the Bureau of Land Management.

Physical Description

The Childs-Irving Hydroelectric Facilities transfer water out of Fossil Creek through a system of metal and concrete flumes and pipes, and generate electricity in two powerplants, Irving and Childs. The facilities are located within the dissected canyon portion of Fossil Creek and ranges in elevation from 2695 feet to 4268 feet. A wide diversity of plant communities within a relatively small area can be attributed to the permanent water supply and steep canyon slopes. Fossil Creek is a relatively short watercourse and has a small drainage area. However, a steady supply of water is supplied by a series of springs that have a constant flow and temperature. Since the area is so inaccessible, construction for all parts of the system, including the housing, has remained relatively simple. Although much of Irving and Childs has changed because of remodeling and rebuilding, the character of both settlements remains basically unchanged since their inception. The Irving system includes a metal flume, an inverted siphon, and a pressure pipe that conducts water from the capture point down to the powerhouse, approximately four miles from the capture point. A small dam below the springs feeds water into a metal flume. The semicircular galvanized steel flume is supported by wooden trestles. The flume maintains a grade of 1 foot to 1000 feet although it traverses very steep slopes above Fossil Creek. The present flume, which replaced a slightly smaller similar metal flume type in the 1950s, maintains the flavor of the original flume that conducted water to the Irving hydroelectric plant. The pressure pipe for the Irving flume is made from riveted steel and creates a static head of approximately 486 feet. The Irving plant houses a single Allis Chalmers reaction-type Francis turbine. The plant together with housing, storage, and maintenance buildings sit on a broad, flat bench above Fossil Creek. The settlement of Irving, like that at Childs, is characterized by cottage-style houses.

Water is transferred from the Irving plant into a reinforced concrete flume that sits on an artificial bench cut into the steep slopes. Intake usually is from the Irving plant, but water can be taken directly from Fossil Creek as it was originally designed in 1909 when the Childs hydroelectric facility first went into operation. The Childs flume originally consisted of concrete flume, wooden flume, steel pipe, and concrete pipe. All the wooden components have been replaced with steel pipe. There are seven tunnels and a relatively long, inverted siphon along the flume route. Approximately 25% of the original concrete flume has been replaced because of leakage resulting from poor quality concrete construction materials. The flume feeds a reservoir known as Stehr Lake that has a maximum capacity of 287 acre-feet of water. Two earth-filled dams at either end of a dry lake bed were used to create this storage reservoir. The pressure pipe used to conduct the water to Childs in its final descent was obtained from Germany, which was the only source of high pressure steel pipe capable of handling the stress created as water plunged approximately 4700 feet at a grade of 0.0028 feet. The Childs plant is located on the Verde River and houses three Pelton-type, impulse water wheels.

Components of the Irving Flume System

The 1950 blueprint plan drawings of the Irving flume system were used to derive distance measurements for the various components. These drawings are based on earlier 1927 drawings that are also available. However, when discrepancies arose between the two plan drawings of the system, distances from the 1950 were assumed to be the most accurate for purposes of this nomination. There have been no significant changes to the facilities since 1950. Unlike the Childs portion of the flume, no construction reports or correspondence exist for the Irving flume within the APS records. A Forest Service report prepared by Lyle Whitsit is the best source for information regarding the Irving design. This report, dated April 12, 1915, has supplied important information not only about the historic character of the Irving system, but also the need for the second hydroelectric facility on Fossil Creek. Additional descriptive information recorded below comes from discussions with APS personnel at Childs and Irving and from field observations. The Irving flume was replaced during the 1950s with a slightly larger metal flume of similar style leaving the character of this flume system as it was when the system was originally constructed. Below are the specifications of the Irving flume system as of December 1, 1950:

Station to Station	Distance	Type
0+00 to 7+83.1	783.1 feet	Steel flume* on stringers and bents
7+83.1 to 8+98.1	115.0 feet	Gravity tunnel
8+98.1 to 77+15.9	6817.8 feet	Steel flume on stringers and bents
77+15.9 to 81+49.9	434.0 feet	Inverted siphon
81+49.9 to 84+47	297.1 feet	Steel flume on stringers and bents
84+47 to 85+47	100.0 feet	Steel flume on bridge
85+47 to 95+92.5	1045.5 feet	Steel flume on stringers and bents
95+92.5 to 96+96.5	104.0 feet	Steel flume on bridge
96+96.5 to 107+32.7	1032.2 feet	Steel flume on stringers and bents
107+32.7 to 108+66	133.3 feet	Steel flume on bridge
108+66 to 138+74.3	3008.3 feet	Steel flume on trestles and bents

Station to Station	Distance	Type
138+74.3 to 140+20.9	146.6 feet	Steel flume on bridge
140+20.9 to 171+19	3091.0 feet	Steel flume on stringers and bents
171+19 to 171+27	8.0 feet	Surge box (Sand box)
171+27 to 203+28.3	3201.3 feet	Irving penstock pipe
203+28.3 to 203+49.9	21.6 feet	Pipe into plant

*Hess patent steel flume with a 108-inch semicircular circumference. Later replaced with a 120-inch semicircular circumference steel flume.

1 Capture point and diversion dam - Contributing Element of Irving System
The concrete diversion dam is approximately 24 feet thick at the base, which is set on bedrock, 5 feet thick across the top, and approximately 25 feet high. Behind the dam there is a 21.14 acre pond (Springs Pond). The original plans for the capture point and dam illustrate the full extent of this component of the system. This feature remains unchanged and appears to be in good condition.

2 Automatic cleaner - Noncontributing Element
In the late 1960s, an automatic trash rake system with metal grizzlies was built at the beginning of the flume intake. This cleaner and other automatic systems in place negated the need for a gate tender to live at the head of the flume system.

3 Intake System - Contributing Element of Irving System
The intake of water into the Irving flume begins immediately behind the dam. Water is transferred into a concrete flume that then junctures with the steel flume. A 10-foot section of the concrete flume is covered by an arched concrete cover. The purpose of this is unknown and no other section of the flume is similar. A small shed is situated at the junction of the concrete intake flume and the steel flume. This shed covers a system of screens and iron bar grizzlies that were constructed to prevent trash, leaves, and other foreign matter from being diverted into the flume. An automatic cleaner has superseded the screens and grizzlies, but the original system was never removed. The system also includes diversion and cut-off gates, which are still used. This feature remains unchanged except for the interface with the automatic cleaner and is in relatively good condition.

4 Steel flume on trestles - Noncontributing Element
The Irving flume system is primarily composed of a steel flume that is supported by wooden trestles; 81% (16,570 feet) of the system is steel flume that has a hydraulic gradient of 1 foot to 1000 feet. The flume was originally constructed with Hess patent galvanized steel (18 gauge) flume with a 108-inch

semicircular circumference supported by a system of stringers and bents attached to wooden trestles that rested on concrete footings. The concrete footings were later replaced with wood, which proved to be more stable, and the flume was replaced with a 120-inch semicircular circumference flume in the 1950s. The original flume proved to be inadequate since it could only handle normal stream flow and not additional snow melt or rainfall. The new flume was covered with sections of the original flume to inhibit algae growth.

5 Flume tunnel #1 - Contributing Element of Irving System
This is the only tunnel in the Irving system. This tunnel is an unlined, gravity tunnel with a semicircular bottom. It measures 5 feet wide, 8 feet high, and has a total length of 115 feet. This feature remains unchanged and appears to be in good condition.

6 Rock sheds - Noncontributing Elements
The rock shed is a wooden platform that is angled across the flume to divert rock fall over the flume. There are three rock sheds in the Irving system. It is unclear if these sheds were part of the original construction or were added later as need arose.

7 Still wells - Noncontributing Elements
Signals from a still well will cause the gate at the head of the flume to close if water level drops 12 inches from normal stream flow. Such occurrences usually signal a break in the system that needs to be repaired. Three still wells are located along the flume. It is unclear if these devices were part of the original system or when they may have been added.

8 Siphon intake - Noncontributing Element
The intake originally was a concrete box, however, in March 1980 the concrete gave way and a metal box was used to replace it.

9 Inverted siphon - Contributing Element of Irving System
The inverted siphon crosses Hot Water (or White) Canyon and is 434 feet in length. The elevation of the siphon intake is 4261.138 feet; water drops down the siphon pipe to a low point of 4154.208 feet, for a drop of 106.93 feet, and is raised back up to 4258.108 feet for a net elevation change of -3.03 feet. The hydraulic grade of the siphon is 0.0069 feet. The siphon is composed of riveted steel pipe of two different diameters; 119.3 feet of the siphon, at either end, are 44-inch diameter pipe while the middle portion (238.5 feet) is made of 40-inch diameter pipe. A steel bridge consisting of a series of seven panels and supported by concrete bases carries the siphon pipe for 69 feet across the canyon at the lowest point in the siphon. The siphon remains unchanged and appears to be in good condition.

10 Flume bridge #1 - Noncontributing Element
This bridge crosses Black Canyon and is 100 feet long. Bridges in the Irving system consist of the steel flume supported by longer wooden trestles. The bridge was replaced in the 1950s when a larger flume was installed.

11 Flume bridge #2 - Noncontributing Element
This bridge crosses Yellow Gulch and is 104 feet long. The bridge #was replaced in the 1950s when a larger flume was installed.

12 Flume bridge #3 - Noncontributing Element
This bridge crosses Spring Canyon and is 133.3 feet long. The flume access road cuts under the flume twice below this bridge. The bridge was replaced in the 1950s when a larger flume was installed.

13 Sandbox and spill gate - Contributing Element of Irving System
The sandbox allows sediments to settle out of the water before it enters the penstock. The spill gate provides a way for emptying the Irving flume before it goes into the penstock. This becomes necessary when the penstock or plant are in need of repair. A set of screens and an iron bar grizzly are associated with the spill gate and sandbox. There also is a gauge to monitor the amount of water flowing into the penstock to permit workers at the power plant to adjust the water flow as needed. This gauge was added after 1930, as was a wooden shed that covers the grizzly and intake for the sandbox. The grizzly and sandbox are original and appear to be in good condition.

14 Penstock pipe - Contributing Element of Irving System
The penstock or pressure pipe is a riveted steel pipe constructed in three different sections. One section is 1143 feet in length and has a 36-inch diameter. This section of pipe is 1/4 inch thick. The second section of pipe is 815 feet in length with a 33-inch diameter and 5/16-inch thickness. The final section of pipe is 1320 feet in length with a 30-inch diameter and 3/8-inch thickness. The average static head created in this pipe was recorded at 486.3 feet in a 1930 Forest Service assessment report on the operations of the Irving facility. This feature remains unchanged and appears to be in good condition.

15 Irving powerhouse - Contributing Element of Irving System
The Irving plant was built in 1915 and consists of a one-room, concrete building with a corrugated iron roof. The plant houses one Allis Chalmers reaction-type Francis turbine (900 revolutions per minute) of 2100 Brake Horsepower capacity (470 foot head) that is direct connected to an alternating current, 3 phase, 60 cycle, 900 revolutions per minute, 1600 kilowatt generator. Except for minor changes to switch panels and some window trim, the powerhouse remains as originally built. The Irving powerhouse went into operation on April 25, 1916.

16 Transformers (Irving substation) - Noncontributing Element
Originally, the transformers were housed in a one-room formed concrete building with a corrugated iron roof. This type of housing for transformers was typical of substations constructed elsewhere along the system then. The transformers altered the electrical current created by the hydroelectric generators prior to transmitting the power to the Childs switchyard. The current substation is a step-up type that has a wooden pole outdoor structure, on which is housed three transformers, with an air break switch.

17A Office and Storage Building - Noncontributing Element
The current office and storage building was constructed in 1936 on the foundation of the oil and ice house. This earlier building was made of corrugated iron on wood frame with two rooms and was built in 1915. The ice house acted as the refrigerator that preserved perishables and furnished ice to employees. The concrete foundation is the only original part of this building today.

17B Storehouse and Cottage - Contributing Elements
There are two buildings within Irving that deserve recognition as the last remaining elements of the early style of architecture present at both Irving and Childs. These include a storehouse that was constructed around 1915 and four room cottage-style house. The storehouse is a wood frame and corrugated steel structure in the central part of Irving. There are seven rooms with wood panel walls. While there have been minor alterations to the interior of the storehouse, it retains the historic characteristics of its original style. The cottage style house is similar to the floor plan for houses constructed at Irving in 1915. It is a wood frame and wood exterior house with a front porch and shingled roof. There are four main rooms and a bath. A back addition and modification to the kitchen area are the only apparent alterations to the original home.

Components of the Childs Flume System
The following information regarding the historic character of the Childs flume system was derived from the monthly construction reports written by R.S. Masson, personal correspondence between various individuals, and plan maps and drawings dating from the inception of the project in 1902 to as late as the reorganization of APS in 1950. Additional information was drawn from the construction specifications distributed to contractors interested in bidding on the project, and various miscellaneous documents uncovered during the research for the National Register nomination of the Fossil Creek Hydroelectric Facilities. The statements regarding the current condition of the facilities are based on assessments provided by Childs personnel and field observations. As is typical of any research project that encompasses such a long period, discrepancies and contradictions were discovered. Original plans were modified both before construction began and while construction was taking place. The original plans and many modifications described in documents or noted on later

plan maps have been identified below. More importantly, there were discrepancies in the measurements of the various components of the Childs flume system, e.g., the length of a tunnel or a section of concrete flume. Again the measurements cited below were derived from the 1950 blueprints of the Childs and Irving system, which were based on a 1927 series of maps.

Specifications of Childs flume system as of December 1, 1950:

Station to Station	Distance	Type
	390.0 feet	Rock cut and sand box
0+00 to 13+52.8	1352.8 feet	Concrete flume on bench
13+52.8 to 25+03.9	1151.1 feet	Wooden flume on trestle
13+52.8 to 14+91.7	138.9 feet	Currently a steel pipe bridge
25+03.9 to 32+81.3	777.4 feet	Gravity tunnel #1
32+81.3 to 47+05	1423.7 feet	Concrete flume on bench
47+05 to 59+05	1200.0 feet	Gravity tunnel #2
59+05 to 89+11.5	3006.5 feet	Concrete flume on bench
89+11.5 to 158+63.8	6952.3 feet	Steel siphon pipe
158+63.8 to 167+29.8	866.0 feet	Steel flume on trestle
167+29.8 to 173+29.8	600.0 feet	Gravity tunnel #3
173+29.8 to 190+87	1757.2 feet	Concrete flume on bench and bridge
190+87 to 198+13	726.0 feet	Gravity tunnel #4
198+13 to 206+58.6	845.6 feet	Concrete flume on bench
206+58.6 to 208+58.6	200.0 feet	Gravity tunnel #5 (under road)
208+58.6 to 228+16.1	1957.5 feet	Concrete flume on bench and bridge
228+16.1 to 233+37.4	521.3 feet	Gravity tunnel #6
233+37.4 to 236+38.8	301.4 feet	Wooden flume
236+38.8 to 254+45.5	1806.7 feet	Stehr Lake
254+45.5 to 303+34	4888.5 feet	Pressure tunnel
303+34 to 317+27.6	1393.6 feet	Concrete intermediate pipe
317+27.6 to 364+72.6	4698.5 feet	Childs penstock pipe

18 Flume intake and Forebay - Contributing Element of Childs System
According to the specifications for the construction of the Childs flume system, a low diverting dam was to be built to turn the stream through a channel cut in the rock. A modification in the plans of taking the water from Fossil Creek farther upstream allowed for the construction of a very small dam instead of the one in the original plans. A sluice gate and sluiceway was cut into the spillway at its lower end and above the screens. At the lower end of the sand box, an iron bar grizzly and a spill gate were built to admit water into the flume.

When the Irving plant was constructed, the flume intake was modified. Water that is discharged from the Irving plant draft tube enters the forebay before it enters the Childs flume. The forebay incorporates the original intake ditch of the Childs flume so that water still can be diverted into the Childs flume directly from Fossil Creek when the Irving flume system is shut down. It normally draws water, however, directly from the Irving powerplant. There are two spill gates associated with the forebay. One spill gate controls the water going into the Childs flume, while the second gate allows for discharge of the water out of the forebay and back into Fossil Creek. This latter gate is used to maintain the water level within the forebay or to divert water from the Childs flume when necessary. The intake and forebay remain unchanged and appear to be in good condition. There has been deterioration of the concrete flume leading out of this element, and a portion of the flume has had to be replaced recently with a metal flume.

19 Concrete flume - Contributing Element of Childs System
The flume for the Childs system was originally planned as a system of wooden flumes and open ditches, however, the difficulty of excavating the ditch through bedrock precluded the use of this format. Instead, the flume was constructed of concrete, reinforced with steel mesh and set on a bench that was excavated into the slopes above Fossil Creek. This system proved to be more durable and had practically no annual depreciation charge. These changes resulted in a cost of approximately $140,000 more than was estimated. But it was felt that this would save at least $5000 in maintenance annually and would increase the earning capacity of the plant by more than $75,000 per year because of the efficient flow in the concrete flume.

The concrete flume measures 6 feet across at the bottom and 3.5 feet high on the exterior, with a 6-inch thick base and walls varying in thickness from 8 inches at bottom to 4 inches at top. Expansion joints were set approximately 100 feet apart. Nearly 8800 feet of concrete flume were constructed with a gradient of 1 foot to 1000 feet. Portions of the concrete flume have been replaced by metal flume. However, at least 75% of the original concrete flume still exists. The condition of the concrete varies from excellent to poor. Portions that were covered by earth are in excellent condition. The metal flume segments are noncontributing elements of the flume system.

20 Rock Shed - Noncontributing Element
The rock shed is a wooden platform that is angled across the flume to divert rock fall over the flume. It is unclear when this shed was constructed.

21 Flume bridge #1 - Noncontributing Element
Bridge #1 was originally a wooden flume supported partially by wooden trestles and partially by a bench excavated into the hillside. The wooden flume bridges of the Childs system were built in sections of redwood and had the same overall dimensions as the concrete flume. The bridges were used to cross deep washes or where it was difficult to excavate into the steep mountainside. This

bridge was built because of the steep slope traversed by the flume at this point along the course. All the wooden bridges have been replaced with steel pipe since 1950. In the original plans this component was not labeled as a bridge.

22 Flume tunnel #1 - Contributing Element of Childs System
The first tunnel in the Childs flume system is a 777 feet long gravity tunnel and has a timbered roof for 100 feet. The tunnel dimensions are 4 by 6 feet. The tunnel remains unchanged and apparently is in good condition.

23 Flume tunnel #2 - Contributing Element of Childs System
This is a gravity tunnel and lacks timbered roofing. The tunnel is 1200 feet long and measures 4.5 by 5.5 feet. There were no adits in this tunnel. The tunnel remains unchanged and apparently is in good condition.

24 Intake for Purple Mountain Siphon - Contributing Element of Childs System
This is the beginning of the Purple Mountain Siphon, which has a concrete box with a sluice gate to divert water from the flume system. An iron bar grizzly is present in front of the box to prevent any large objects from entering the siphon. A corrugated steel shed, housing a telephone and electrical circuits, was built over a portion of the concrete box at some unspecified time. The shed is a noncontributing element. This feature remains unchanged and appears to be in good condition.

25 Purple Mountain Siphon - Contributing Element of Childs System
This inverted siphon is 6952.3 feet in length. The elevation of the siphon intake is 3745.318 feet; water drops down the siphon pipe to a low point of 3409.628 feet, for a drop of 335.69 feet, and is raised back up to 3735.848 feet for a total elevation change of -9.47 feet. The hydraulic grade line for siphon is 0.0028 feet. Four-inch air relief valves are located along the pipe to permit the egress and ingress of the air, which prevents the collapse of the siphon pipe during a sudden removal of water from the system. The pipe is painted with a graphite paint to protect it from corrosion. The route of the siphon was modified at the west end around 1920, due to the unstable conditions of the ground along the original route. This feature remains unchanged except this minor alteration and appears to be in good condition.
Specifications for siphon pipe according to 1950 plans:

Length	Diameter	Thickness
2040.8 feet	48 inches	3/16 inch
1303.7 feet	45 inches	3/16 inch
1110.7 feet	45 inches	1/4 inch
2497.1 feet	42 inches	1/4 inch

Total Length: 6952.3 feet

26 Flume bridge #2 - Contributing Element of Childs System
This steel support bridge for the siphon pipe crosses Boulder Canyon and was originally bridge #1 on the Childs system. The siphon bridges were constructed with a trestle foundation to support the siphon across washes. The feature remains unchanged and appears to be in good condition.

27 Flume bridge #3 - Contributing Element of Childs System
This steel, trestle bridge, which is part of the siphon, crosses Sally May Wash and originally was bridge #2. The feature remains unchanged and appears to be in good condition.

28 Flume bridge #4 - Contributing Element of Childs System
This steel, trestle bridge, which is part of the siphon, crosses a minor wash and originally was bridge #3 in the Childs system. The feature remains unchanged and appears to be in good condition.

29 End of Purple Mountain Siphon - Contributing Element
The west end of the siphon has a covered concrete box. The route of siphon was modified around 1920, approximately between engineering stations 153+78.8 and 158+63.8. Originally, the west end of the siphon included a bridge (original #4) across a steep wash; the siphon then traversed a steep slope to hook up with tunnel #3. However, after several cases of undermining of the siphon pipe on this slope, it was decided to reroute the siphon around the slope. The reroute and modification include a steel flume that runs between the end of the siphon and tunnel #3. A corrugated metal, storage shed is located near this component. The siphon remains unchanged, but it is in relatively poor condition in contrast to other elements of the system.

30 Steel flume on trestles - Contributing Element
This is the only section in the Childs system that has a steel flume on steel trestles. It is part of the siphon realignment project completed around 1920. This section runs between the siphon and tunnel #3 and is 866 feet long. It is of the same general construction as the Irving flume, and is built with 120-inch semicircular circumference Hess type steel flume sections. This feature remains unchanged since the 1920s and is in relatively good condition.

31 Flume tunnel #3 - Contributing Element of Childs System
This is a 4 by 6 foot gravity tunnel that is, at least, partially timbered and roofed. The tunnel is 600.0 feet in length. The tunnel remains unchanged and apparently is in good condition.

32 Flume bridge #5 - Contributing Element
This originally was a wooden flume bridge that crossed a steep unnamed wash and connected tunnel #3 with concrete flume. It was replaced by metal pipe around 1920; it remains unchanged and is in relatively good condition.

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33 Flume tunnel #4 - Contributing Element of Childs System
This tunnel is a gravity tunnel that is 726 feet long and measures 4.5 by 5.5 feet. This tunnel remains unchanged and apparently is in good condition.

34 Concrete Trough - Noncontributing Element
A small rectangular, concrete feature is present along the concrete flume section between tunnels #4 and #5; two upright posts are also present. The function of the trough is unknown.

35 Flume tunnel #5 - Contributing Element of Childs System
This tunnel is a gravity tunnel that has concrete slabs placed over sections of concrete flume. The tunnel runs for 200 feet under the Childs road. This tunnel remains unchanged and apparently is in good condition.

36 Flume tunnel #6 - Contributing Element of Childs System
This tunnel is a gravity tunnel that measures 3 feet wide by 8 feet high and runs for 521.3 feet. The tunnel remains unchanged and apparently is in good condition.

37 Flume bridge #6 - Noncontributing Element
This bridge crosses an unnamed, steep wash and empties into Stehr Lake. The bridge was originally made of wood and now consists of a metal pipe with a walkway. The date of the replacement is unknown.

38 Stehr Lake and dams - Contributing Element of Childs System
Stehr Lake was built in an old, dry lake bed and has a maximum capacity of 287 acre-feet with a maximum depth of 13.3 feet. The lake covers 27.5 acres. The presence of this lake bed was one that made the construction of this system possible as it provided an area for a reservoir to run the Childs plant when repairs and maintenance activities shut off the water flow along the flume. The reservoir was created by the construction of two earth-fill dams at either end of the lake bed. The reservoir frequently becomes overgrown with vegetation and has been cleaned several times.

39 Pressure tunnel intake - Contributing Element of Childs System
This intake is located in the southwestern corner of Stehr Lake. Water is drawn from the lake through this intake and into the pressure tunnel. A gate situated at the bottom of intake box allows excess water beyond the plant requirements to reenter the reservoir. This feature remains unchanged and apparently is in good condition.

40 Flume tunnel #7 - Contributing Element of Childs System
This tunnel is the only pressure-type tunnel in the Childs system. It is a concrete lined tunnel that is 3.5 feet wide, 6 feet high, and 4888.5 feet long with a hydraulic grade of 0.001 feet. The tunnel, which cuts through a ridge

known as Ikes Backbone, was excavated in four sections and had three or four adits for access during construction. At the western end of the tunnel there is a release gate through which water can be diverted out of the system. The gate also provides access to the tunnel for cleaning and repairs. This tunnel remains unchanged and apparently is in good condition.

41 Reinforced concrete pipe - Contributing Element of Childs System
This 1393.6 foot long pipe is 48 inches wide and connects the pressure tunnel to the stand pipe. The pipe was laid on a grade of nearly 3 feet in 1000 or a 0.0026 feet hydraulic grade. For the greater part of its length, it is set on a bench or in a trench along the western slope of Ikes Backbone. This feature remains unchanged and appears to be in good condition.

42 Stand pipe (Surge tank) - Contributing Element of Childs System
The stand pipe or surge tank is a reinforced concrete pipe that is 30 feet in diameter and 36 feet high. This component is at the head of the penstock pipe and provides a place for water to back up into when the plant generators are shut off. This feature remains unchanged and appears to be in good condition.

43 Penstock pipe - Contributing Element of Childs System
The penstock pipe, which carries the water on its final descent (0.0028 feet grade) into the power plant, has two types of steel pipe: a riveted pipe and a welded pipe. The riveted pipe was made by the Pelton Water Wheel Company of Harrisburg, Pennsylvania, and was dipped in asphaltum rather than painted. The welded pipe was built in Germany by Krupps Gun Works for the Pelton Company, and was painted with graphite paint. Four-inch air relief valve nipples are present along the penstock to prevent suction and collapse in the pipe when it is being emptied. The pressure pipe is designed for a working stress in the joints of 12,500 lbs, and joint efficiency of 70% for lap riveted pipe. The static head for this system is 1074.86 feet. At the Childs plant, three 18-inch branch lines feed water from the penstock pipe to each of the three units within the plant. This feature remains unchanged and appears to be in good condition.

Specifications for pipe according to 1950 plan map:

Length	Diameter	Thickness	Type
900 feet	48 inches	1/4 inch	Riveted Pipe
300 feet	48 inches	5/16 inch	Riveted Pipe
142 feet	44 inches	5/16 inch	Riveted Pipe
343 feet	44 inches	3/8 inch	Riveted Pipe
175 feet	44 inches	7/16 inch	Riveted Pipe
135 feet	44 inches	1/2 inch	Riveted Pipe
155 feet	44 inches	9/16 inch	Riveted Pipe

Length	Diameter	Thickness	Type
160 feet	40 inches	9/16 inch	Riveted Pipe
343 feet	36 inches	1/2 inch	Welded Pipe
188 feet	36 inches	9/16 inch	Welded Pipe
758 feet	36 inches	5/8 inch	Welded Pipe
585 feet	32 inches	5/8 inch	Welded Pipe
332 feet	32 inches	11/16 inch	Welded Pipe
283 feet	32 inches	3/4 inch	Welded Pipe

44 Childs powerhouse - Contributing Element of Childs System
The powerhouse is built of reinforced concrete, is one-story high, and measures 30.5 by 76 feet. There are three Pelton-type impulse water wheels, each capable of developing 3000 horsepower at 400 revolutions per minute and designed for 1050 foot head. These water wheels were built at the Abner Doble factory in San Francisco. The water wheels are direct connected to 3 phase, 2300 volt, 400 revolutions per minute, 1800 kilowatt alternating current General Electric generators. Delivery of current began on June 26, 1909. The water is discharged through three tailraces directly into the Verde River. Few modifications have taken place at the power plant building, except a porch awning that was added along two sides of the lower portion of the plant, and the windows that have been covered with louvered grills. All the electric switching equipment has been replaced as a result of upgrades.

45 Transformers (Childs substation) - Noncontributing Element
The original transformer house was a one-story, reinforced concrete structure measuring 22.5 feet by 69.5 feet. The roof and parts of the walls have been removed, and exposed transformers were placed inside the remaining walls. The Childs substation presently has three transformers, and the necessary generator switches and transformer switches, all are located in an outdoor metal-clad switchgear.

46 Office - Contributing Element
According to a 1927 plat map, this building was the pump house. It originally was a one-story, reinforced concrete structure measuring 7.5 feet by 9 feet. On the 1939 plat map, it is called an ice house and had been modified to measure 18 feet by 16 feet. By 1960, the function of this concrete building had changed to a storage and office facility. The flat roof of the building is asphalt and slopes toward the rear of the building. There are three wood-frame windows. There appear to have been only minor repairs to the inside of the building, and there is some erosion of the concrete on the outside.

47 Machinist shop - Noncontributing Element
This shop was located on a 1927 plat map as a 1 story, frame structure that measured 28 feet 2 inches by 69 feet 2 inches. It is unclear how the current

machinist shop reflects that 1927 building, save that the dimensions are similar.

Related Transmission Lines and Substations
The importance of the Fossil Springs plants is tied to the generation of electricity that serviced Jerome, Prescott, the Middle Verde Valley, and the surrounding mining districts. Therefore, it is essential to note the related transmission line service points besides the hydroelectric system components. The historic transmission line system can be summarized by the following information (original capacities defined):

Main Prescott and Jerome Lines	45,000 Volt Capacity	180 miles in length
Distribution Lines	17,000 Volt Capacity	27 miles in length
Distribution Lines	11,000 Volt Capacity	34 miles in length
Distribution Lines	2,300 Volt Capacity	20 miles in length
Main Phoenix Line	45,000 Volt Capacity	75 miles in length
Total 3-wire Lines: 336 miles		

Since 1940, the main lines were upgraded to carry 69,000 volts (except for the Phoenix line that was upgraded to 66,000 volts), and many distribution lines no longer exist. In addition, many steel towers and wooden poles along all the lines have been replaced due to instability and deterioration. None of these lines are considered eligible due to lack of integrity.

The following substations and transmission/distribution lines are noteworthy relative to the early development of power from the Childs and Irving power plants.

A. Irving line - Noncontributing Element
This line runs between the Irving substation and the Childs switchyard, a distance of approximately 8 miles. Originally, the line was set up to carry 45,000 volts; it has subsequently been upgraded to a 69,000 volt line.

B. Cedars line - Noncontributing Element
This line runs between Childs and the Sycamore substation for a length of approximately 16 miles. It was part of the original transmission line constructed with steel lattice (windmill) towers. This 45,000 volt line was subsequently upgraded to a 69,000 volt line and wooden poles placed between towers to help support the heavier conductor. The towers and the intermediary wooden pole line have recently been replaced with wood, single poles.

C. Sycamore substation - Noncontributing Element
This substation was built around 1910 as part of the original transmission system distributing power out of the Child plant. There was a dwelling in-

cluded for the substation operator. All the original buildings and equipment have been removed and replaced by an open-air substation.

D. Ash Creek and Jerome lines - Noncontributing Element
The Ash Creek line continued from the Sycamore substation to the Poland Junction substation, and on to the Walker substation before terminating at Prescott. It is approximately 34 miles in length, and again consisted of steel windmill type towers. The line was split at the Poland Junction Substation and a separate line connected the Childs hydroelectric plant with Jerome and the United Verde (UV) Mine. These lines were part of the original transmission system that supplied electricity to the mines and smelters in the Bradshaw Mountains as well as Prescott and Jerome. Both were built with steel lattice towers supporting lines carrying 45,000 volts. When the Ash Creek line was upgraded to carry 69,000 volts, some towers were replaced by wooden poles. Often additional poles had to be placed between towers to help support the heavier load produced by the extra voltage line. The Jerome line, which ran between Poland Junction and Jerome, was removed. Power was rerouted from Prescott over Mingus Mountain to Jerome and Clarkdale in the 1930s. This reroute was subsequently upgraded after 1940.

The Ash Creek line has been extensively modified because of upgrades. However, several small segments, particularly in the Walker area, retain their original visual character and integrity. A portion of the Ash Creek line from the Sycamore substation to a point west of Poland Junction has recently been replaced with wooden poles. As a mitigative measure for the affects of this replacement, the Forest Service and APS have built an interpretive display that includes an original windmill tower from the Cedars-Ash Creek line. This display has been placed near the Dugas Road interchange along Interstate 17.

E. Poland Junction substation - Noncontributing Element
Construction of the transmission lines started at this substation (originally called the Agua Fria substation) on September 10, 1908. The substation was built in 1910 and originally consisted of a concrete building 24 feet square and two stories high. A well, a pumping station with a small gasoline engine, and a house were part of the original substation. All the original structures and equipment have been removed and replaced by an open-air system.

F. Walker substation - Noncontributing Element
This substation, which also included a dwelling for an operator, was part of the distribution system between Poland Junction and Prescott. It supplied power to most mines around Walker, which was a primary mining area in the late 1800s and early 1900s. The substation buildings no longer exist.

G. Prescott substation - Noncontributing Element
This was a major facility that included several buildings. All have been re-

placed as the substation was expanded to meet growing power needs of Prescott.

H. Jerome substation - Noncontributing Element
Located at the UV Mine, this substation was fed by approximately 25 miles of line between Poland Junction and Jerome. This substation was removed when the UV Mine became an open-air pit mine operation around 1930.

I. Verde line - Noncontributing Element
This line runs between Childs and the Clarkdale/Jerome area. It was constructed between September 1910 and April 1911, to ensure delivery of power through an alternate connection between Childs and the UV Mine. It was later an important connection between the Childs facility and The Arizona Power Company (TAPCO) steam plant at Clarkdale. This line was approximately 39 miles in length and was constructed using H-pole fixtures with cedar poles and Oregon pine cross-arms. This line has been recently replaced with single wood pole type construction.

J. Copper Canyon substation - Noncontributing Element
This substation along the Verde line was constructed to facilitate delivery of power for pumping water to irrigate farm land. This substation has been replaced.

K. Sycamore Line - Noncontributing Element
This line runs between the Sycamore Substation and Phoenix. This 45,000 volt line was constructed in 1919 to provide power to a growing demand in the Phoenix area. The length of the line is approximately 75 miles. In 1926, it was upgraded to carry 66,000 volts, and since 1940, again upgraded to carry 69,000 volts. Many other modifications, including replacing original poles and equipment, have been undertaken.

Integrity
The major components of the Childs-Irving Hydroelectric Facilities are substantially intact. When components have had to be replaced since 1940, replacement parts have been consistent with the character or function of the facilities. For example, the system still operates as it was intended despite replacement of the Irving flume in-kind and replacement of wooden flume and trestle with steel pipe and trestle. The Irving flume is slightly larger in capacity than the original component but has clearly maintained the historic character of this portion of the system. None of the replacement components detract from the historic character of the facilities. The extensive sections of original components identified as contributing, such as the concrete Childs flume, typify the design, workmanship, and feeling of the system as it was originally constructed. The noncontributing components that represent modifications made to the system since 1930 do not take away from the character that is represented by the original components.

8. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties:

☐ nationally ☒ statewide ☐ locally

Applicable National Register Criteria ☒ A ☐ B ☒ C ☐ D

Criteria Considerations (Exceptions) ☐ A ☐ B ☐ C ☐ D ☐ E ☐ F ☐ G

Areas of Significance (enter categories from instructions)	Period of Significance	Significant Dates
Engineering	1909-1940	
Other: Energy Production and Delivery		1908-1909
		1915-1916

Cultural Affiliation
n/a

Significant Person
n/a

Architect/Builder
n/a

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.

Summary

The Childs-Irving Hydroelectric Facilities were constructed in two phases: (1) 1908-1909 (Childs), and (2) 1915-1916 (Irving). The period of significance, 1909 to 1940, corresponds to a period of expansion of the mining industry in Yavapai County, which dominated the early history of Arizona, and the subsequent growth and dominance of Phoenix and agriculture in Maricopa County. The development of a reliable source of electricity was crucial, not only to the developments in Yavapai County from 1909 to 1920, but also to ensure an adequate supply for the rapid growth in the Phoenix area from 1920 to 1940. The facilities are considered eligible for the National Register under Criterion "A." They were the first reliable electrical service in the area and were essential to the economies of the area. This applies not only to the vitally important mining industry, but also to the growth and development of Prescott and the fertile Verde Valley. The importance of electrical power generation from these facilities simply shifted to Phoenix with changing economic development in the state. It is also considered eligible under Criterion "C" as a uniquely engineered hydroelectric system in terms of construction and operation. It is chiefly the simplistic design and the highly efficient generation and transmission of electric power that makes this system distinctive.

Historic Background

The significance of the Childs-Irving Hydroelectric Facilities is based on its importance to the historic development of Yavapai County following the turn-of-the-century, and later to the expansion of the Phoenix and the Salt River Valley. Development of hydroelectric power using water emanating from Fossil Springs was closely tied to the mining industry of the Black Hills (Jerome) and Bradshaw Mountains from 1909 to 1920. The generation of power along Fossil Creek by The Arizona Power Company (TAPCO) was the only successful hydroelectric venture among at least five projects planned during this time to provide power for the expanding mining operations in Yavapai County. With the transmittal of electricity from Childs, the mining industry obtained a reliable and inexpensive source of power enabling the companies to improve their ore extracting capacities and smelting operations. In addition, electricity

☒ See continuation sheet

was transmitted to Prescott. The facility over the next few years provided the first electrical service to the fertile middle Verde Valley allowing for the development of agriculture. By 1920, the mining industry of Yavapai County was collapsing and the two hydroelectric plants on Fossil Creek began supplying power to a growing Phoenix population. The small power plants were critical to servicing the needs of the Phoenix area, particularly in periods of drought when larger sources of power failed to meet demands.

Engineering Significance

In 1976, the American Society of Mechanical Engineers recognized this historic and engineering significance by selecting it as the eleventh National Historical Mechanical Engineering Landmark. The Childs and Irving facilities represent a uniquely engineered hydroelectric system in terms of construction and operation. The engineering of the system is unique for a couple of reasons. It achieved a high static head pressure, both through the design of the flume and pressure pipe leading to both plants. Also, the system took advantage of the high degree of topographic relief that allows for a drop of 1 foot per 1000 feet over a distance of only 11.26 miles. Fossil Springs produces approximately 20,000 gallons of water per minute. It is conducted to the two plants through a series of flumes, siphons, tunnels, and pressure pipes that generate a static head of over 480 feet at Irving and 1,075 feet at Childs.

The Childs system, in particular, is recognized for its simplicity in design. There are three important aspects of this design that make the engineering noteworthy: the reinforced concrete flume, the reservoir, and the durability of the conduit from the reservoir to the Childs plant. The use of the concrete flume in the Childs system was required because the terrain and ground conditions precluded the construction of a wood and ditch-type flume conduit. When the flume was operational, there was a marked reduction in friction created by using the smoothed concrete. The system was more efficient than the ordinary ditch or wooden flume that was extensively used in the western United States then. The decision to use the concrete was based on issues directed at practicality relating to the terrain of Fossil Creek. There was no knowledge that the system would operate with increased efficiency as a result of the change. A second important feature relating to the simple design of the Childs system is the Stehr Lake reservoir. This reservoir is located five miles from the headworks and covers nearly 28 acres. With an average depth of only 10 feet, this reservoir could store enough water to run the Childs plant for three and one-half days at the average steady flow of the stream. This meant that the flume and other components located above the reservoir could be overhauled or cleaned without interrupting the normal operations of the plant. Finally, the system from Stehr Lake to the headworks is remarkable well protected with a series of tunnels and pipes. For approximately 5,600 feet, the water is conducted through a concrete-lined tunnel and both reinforced concrete and steel pipe. The lower 2,400 feet are welded steel pressure pipe that was imported from Germany, the only source of high-strength steel that could withstand the pressure of the water as it neared the Childs powerhouse at that time.

Finally, the operation of the plant, with its multiple generators, was planned around an innovative concept that minimized interruptions in service. Previously, hydroelectric plants had functioned with a single generator tied to a transmission line. This concept was modified at Childs so that a multiple line system could be operated as though there were two separate and distinct transmission lines doing separate and distinct work. Multiple generators could be tied to this system of transmission. Raymond Masson, the project engineer, devised a plan for the Childs plant that was equivalent to having a backup circuit transmission of power over two lines rather than one. If one circuit was to fail, the load could be diverted to a load tank, a tank filled with brine water, and subsequently, manually rerouted at the master plant to a second transmission line circuit. This avoided the use of automatic switching, which was unreliable, throughout the system. It simply required an operator at Childs to monitor an ammeter that would record any short-circuit problems along either line.

The plan also called for operators to monitor power loads at each substation and in turn switch the load between the lines in sequence. Since the need to switch loads could be monitored on substation equipment, telephone orders between substation operators for subsequent switching procedures along the lines were unnecessary. Masson noted that nearly 85% of the interruptions on electrical systems were caused by problems relating to the use of automatic switches. Therefore, he eliminated the automatic switches.

The innovative transmission system at Childs meant that the service was more reliable than that from other hydroelectric plants in the western United States. The transmission line plan devised for the Childs plant was adopted at other hydroelectric plants in the southern California area in subsequent years. The concrete flume, the reservoir, the transmission line network, and other elements of the Child-Irving Hydroelectric Facilities, make the system not only efficient and reliable but also wonderfully simple in design.

Expanded Historic Context

The Need for Electricity

The following quote from the Prescott Journal Miner (May 1, 1909) places the historical perspective of Fossil Creek within the Verde Valley.

> While the rest of the world is awakening to the necessity of harnessing their rivers and streams for the purpose of furnishing cheap and economical power for their manufacturing, transportation, heat and light, the rivers and streams of Yavapai county, Arizona, are now being

harnessed for the purpose of furnishing cheap electrical power to light and heat the cities and towns, run the machinery of the mines, mills, and smelters in the great mineral belt of the banner mining country of the Territory of Arizona. Because of the fact that the transportation companies have maintained a very high freight rate for hauling coal and oil to the mines, mills and smelters, there is a universal demand throughout Yavapai county for the cheap electrical power to be furnished by the streams within its confines.

The Arizona Power Company is the pioneer in this field. The plant of this company is situated on Fossil Creek, a tributary of the Verde river. In a short time this company will begin to distribute cheap power to some of the mines and mills and smelters. This will mean the beginning of an era of mine development and production of the precious metals that will double and quadruple the annual production of any year in the past....

When one considers the great mining resources that lie back of these water power projects and the scarcity of streams that are available for power purposes, the enormous dividends of our great mines pale into insignificance in comparisons to the dividends that must go on forever from an investment in Yavapai country water power.

The immense mineralized country that lies tributary to those two power projects have no equal in a like area anywhere known on the face of the earth. Many of the ledges and deposits are of low grade and are awaiting the advent of cheap power to turn the precious streams into the channels of commerce.

Another newspaper account (Arizona Journal Miner February 3, 1903) several years earlier stated:

It does not take a sage nor a philosopher to understand the benefits that are bound to accrue to Yavapai County as a result of this enterprise. It is well known that there are scores and scores of good prospects that only need to be developed into mines, many of them with immense loads of low grade ore that would pay to work at the present cost and difficulty of producing power but which can be made to produce millions of dollars by the use of power when it can be furnished at the rate this company proposes to furnish it for - about $100 per horsepower per year.

These quotations illustrate the significance of the early development of hydroelectric power to the Verde Valley and central Arizona. Clearly development of hydroelectric power using water emanating from Fossil Springs was closely tied to the mining industry of Yavapai County in central Arizona dating back to 1900. TAPCO is but one of at least five hydroelectric generating projects that were planned at the turn-of-the-century to provide power for expanding mining operations in the region. These included efforts by the Jerome Power Company, formed in 1900, to develop hydropower on Oak Creek near Page Springs (Jerome Mining News May 14, 1900), and Charles M. Clark, who promoted a power project near Globe (Jerome Mining News September 15, 1904). The potential for development of hydropower on the Colorado River near Peach Springs for bringing electricity overland to the Globe area was actively discussed for over two years by TAPCO. Of these enterprises, it was only the Fossil Creek project that succeeded.

The development of hydroelectric power from Fossil Creek was not the first such project in Arizona. Hydroelectric generation of power in Phoenix began in 1902 with establishment of plants on both the Arizona and Grand Canals. However, the Fossil Creek enterprise was as difficult as any to engineer and construct. The development of this hydroelectric project is one that is in many ways, a microcosm of Arizona's history at the turn-of-the-century. The Fossil Creek project fostered mining in Yavapai County at a time that Arizona mining companies were expanding their ore extracting capacities and smelting operations. In addition, power was transmitted to the growing town of Prescott and later provided the first electrical service to the fertile Verde Valley. By 1920, the two hydroelectric plants on Fossil Creek were supplying power not only to Yavapai County but also to a growing Phoenix Basin population. The importance of the transition of influence from Prescott and Yavapai County to the Phoenix area in Maricopa County is clearly reflected in the history of the Childs and Irving power plants.

From its beginning in the mid-1860s, the mining districts near Prescott and Jerome had problems with their remote location and distance from established transportation networks. The arrival of the railroad in the late 1880s to Prescott and late 1890s to Jerome helped, but installation and operating costs remained high. By 1905, many mines had been abandoned as the quality of the ores had changed and different technology was required as mine shafts became deeper. According to a marketing survey conducted by the developers of the Fossil Creek plants (Electric Operating Construction Co. report, August 1, 1907), the abandonment of many of these mines was because the ores changed with depth from free milling to sulfide ores. Although sulfide ores could be mined by this time due to improved smelting techniques, the excessive costs associated with mining at depths of approximately 1,000 feet and a lack of adequate electricity to mechanize effectively, severely hampered the mines. Generation of power for mines via steam, coal, or diesel oil was not only expensive to develop independently, but also was problematic since costs were high for transporting coal and oil fuels. Another limiting factor was that water for steam boilers was not always readily available in sufficient supplies; sometimes mining companies had to pump the water over long distances or had to purchase water from elsewhere and have it hauled in over roads. The generation of power was not a problem to a large operation such as the United Verde Mine (UV Mine), since the owner, Senator William Clark, had adequate financing and owned coal and fuel companies besides this large copper mining enterprise. However, the UV Mine was to become the largest buyer of hydroelectric power once it was available.

There were several solutions to these problems that were considered. The Tiger Mine in the Crown King District, for example, considered the installation of a 1,000 horsepower diesel engine plant from which they would transmit one-half the power to their operation, and sell the other half to neighboring mines. The Colonel Mine near Jerome considered a similar plan as did the Little Jessie Mine. In each case, these electric generating plants would be placed near a railroad line to insure minimal costs of transportation of fuels. Power would then have to be transmitted to service points. To share power as envisioned by the Tiger and Colonel, plans would have required construction of high tension transmission lines as well as low tension distribution lines. However, the issue of whom was to bear this cost remained unresolved. According to an undated report of TAPCO, Arizona Smelting Company proposed to generate about 1,000 horsepower from the waste heat of smelting furnaces. Excess power could be sold at an annual rate of about $90.00, but customers would have been required to pay for transmission lines and step-down transformers. The cost of the line, though, would be refunded gradually. This meant a large cost up-front, however, that was prohibitive for all but the larger mines who could produce their own power anyway. These types of solutions were difficult to finance. Most mines used less than 75 horsepower, and return on investment for power generation at this scale was totally impractical.

The actual cost of power appears to have varied from $120.00 to over $200.00 per horsepower per year. The Tiger Mine manager indicated that to run an oil power generator cost about $120.00 per horsepower, and fuel accounted for three-quarters of this cost. However, it is important to note that this plant was situated only three miles from a railroad line that minimized the costs for transportation. The Tiger Mine costs were the lowest noted for the region. Most annual costs exceeded $200.00 per horsepower. The price of crude oil was about $1.50 to $2.00 per barrel, and the price of coal varied from $4.25 to $5.50 per ton at the different railroad points. The cost of fuel at the mines could have increased from 25% to 100% depending on the length and character of a haul. The actual rail freight cost was about $6.00 to $8.00 per ton for coal or oil. To haul fuel from the railroad to mines could increase substantially with a $0.50 per ton per mile charge for a four-horse team and wagon. Market estimates point out that fuel had to be brought from sea level to elevations over 5,000 feet with grade in excess of 3%. This meant that premium rate charges for delivery would be assessed.

Costs for operating other sources of power, such as a Compound Condensing Corliss Engine, a slide valve engine, or a diesel engine, varied according to situation. Mines requiring from 100 to 200 horsepower for operation generally were using these types of engines to drive their stamp mills or air compressors and hoists. Because these engines were inefficient only raised the cost of power production still further. The most important point was that it was likely for a small mine using one of these engines to have average costs for power of over $250 per year on a 24-hour production basis.

One means of lowering costs would have been to rely on wood as a fuel supply. But only a few mines could rely on a sufficient wood supply to operate their plants. While this would have lowered costs, wood could not be viewed as a long-term reliable source of fuel because of supply problems. A few mines in the remoter areas ran engines off gasoline and their fuel cost alone were nearly $200.00 per horsepower per year. In addition, the reliability of the fuel supply was highly variable. It was not unusual for mine managers to hold men at half pay or full pay for several days while they waited for fuel to be delivered.

Only the highly productive, well-financed mining operations, such as the UV Mine, could remain in business under these circumstances. Therefore, the smaller mines looked favorably on hydroelectric power as a means to survive. A development such as that envisioned for Fossil Creek in 1907 could sell power on a meter basis at $0.02 per kilowatt hour and cost a small mine approximately $130.00 per horsepower per year. This would mean a dramatic savings to each mine. This contrast between the excessive cost of steam power throughout the region owing to heavy transportation charges for fuel. The more reliable and lower cost of water generated power were primary reasons that excited people about hydroelectric power at the turn-of-the-century. In addition, this power could be distributed throughout the region by a company aimed at that goal. Whoever could generate and guarantee delivery of hydroelectric power would be relatively free from competition and would have a ready market.

The Development of Hydroelectric Power

The abundant water emanating from springs in Fossil Creek was rediscovered around 1900. Ranchers in the region probably knew of this water source nearly thirty years before it was developed for electrical power generation. The Apache and Yavapai as well as prehistoric peoples had previously depended upon the springs to supply water for their horticultural fields along Fossil Creek. The flow of water from the springs is highly consistent and is equivalent to approximately 20,000 gallons per minute or 43 second-feet of water.

Lew Turner, a local rancher, filed the first claim to the water rights of Fossil Springs. Within a year, Turner formed a partnership with F.E. Jordan, Edwin Meek, and Mrs. Iva Tutt to develop this water into electricity. Jordan was a local rancher. Meek was a local developer whose interest in generation of hydropower was not limited to the Fossil Creek project, but also extended to the proposed Jerome Power Company development of Oak Creek and later to the planned development of a project on the Verde River. Mrs. Tutt, an electrical engineer from Long Beach California, provided the engineering expertise.

Mrs. Tutt and a group of investors formed the Arizona Power Company (APCO) in 1902, and planning for two power plants began later that year. Mrs. Tutt formed the Arizona Power Construction Company (APCC) that was obliged to actually build the facilities. Surveys for a road into Fossil Creek, the transmission lines, and the flume were carried out through 1903 under the direction of Mrs. Tutt. At the same time, she was instrumental in persuading the territorial legislature to exempt the proposed utility from taxes for ten years. Mrs. Tutt later was able to have the state legislature enact the same provisions. Meanwhile, the Board of Supervisors for Yavapai County agreed to permit APCO to place poles and wires along public roadways.

Attempts to finance the project from 1904 to 1907 were unproductive. Initial financing was sought with the aid of a Tutt associate, William G. Kerckhoff. A total of $550,000 was allocated for construction of the first plant on Fossil Creek with Kerckhoff agreeing to purchase the balance of a $1,000,000 bond issue ($450,000) at a price of 90% of par whenever the company decided to construct the second plant. Kerckhoff also agreed to assume Mrs. Tutt's contract in return for stocks in APCO. These contractual arrangements eventually placed Kerckhoff in a difficult position. He had been given the task of securing rights-of-way from the federal government as well as finding additional investors. Had evidence of the proper securing of these rights been turned over to APCC, Kerckhoff would have been obliged to proceed with his contract, supply the money, and build the second plant. In return he would have received one-half the construction profits and approximately 35% of the shares in APCO. Because of his relatively small holding in the company, Kerckhoff was unsuccessful in obtaining moneys from eastern investors. He consequently never submitted evidence of the proper legal securing of titles, rights-of-way, etc., and a final contract between all the parties was never signed. This matter was at a dead-lock for many months, and prospects for realization of the project were low. By late October of 1906, Mrs. Tutt was notified that her services as general manager of APCC were no longer required.

Early in 1907, plans to reorganize APCO began with the assistance of the Electric Operating Construction Company (EOC). This plan called for $1,500,000 funding through the sale of bonds by January 1, 1908. Raymond S. Masson, who had been a shareholder in APCO since its founding, was to serve as an arbitrator. Masson was also involved with the EOC, headed by Francis Viele, from that company's inception on November 18, 1906. On January 28, 1907, Masson became an equal partner in EOC with Viele, and in February of the same year, both men began to arrange contracts with all parties involved in the Fossil Creek project.

Viele's interest in managing a project such as this can be traced back at least ten years prior to 1907. While at General Electric, Viele made many attempts to purchase or stimulate power projects. It was Viele and Masson as a team who ultimately directed the course of the Fossil Creek project to its completion.

With new direction for the Fossil Creek project, a contract was completed with the UV Mine on March 19, 1907, and an earlier contract between the Jerome Power Company and UV Mine was voided. The UV Mine agreed to purchase a minimum of 1000 horsepower, but ensured itself delivery of 1500 horsepower from the new Fossil Creek plant.

By April of 1907, all the necessary contracts had been signed and a contract was drawn between APCO and APCC that permitted EOC to attempt to raise $1,500,000 financing by January 1, 1908. EOC began arranging the sale of the bonds through William P. Bonbright and Co. and issued a prospectus on August 1, 1907. One of the company's chief allies during this time was Mr. W.A. Coffin, President of General Electric. It is known that Mr. Coffin wrote to prospective investors with solid recommendations favoring the Viele and Masson enterprise in Arizona. With the influence of the Bonbright company in places like New York, Boston, and London and allies such as Coffin, EOC had little trouble in raising the necessary funding. In a letter dated December 30, 1907, EOC informed APCC that the bond underwriting had been completed, but asked for an extension until July 1, 1908, to complete final financial arrangements.

During the early part of 1908, more contracts were drawn between the participating individuals and companies, and changes in APCO Articles of Incorporation were enacted. On March 28, 1908, TAPCO was incorporated under the laws of the State of Maine. On April 1, 1908, another company was formed for the express purpose of receiving assigned rights from APCO to TAPCO. This company, the Arizona Securities Company, served to help the transfer of assets between the old and new companies and ceased doing business in 1914.

In April of 1908, the reorganized company began construction of the first plant. By May of that year, there were 250 men working on building a 40-mile road from Blue Bell Siding near Mayer, the location of the nearest railroad, to Fossil Springs. The round trip to Childs would take from five to six days by horse or mule train once the road was built. A main warehouse was constructed at Blue Bell Siding, and several boarding houses were established along the road at places such as Dugas Ranch. The establishment of telephone service to this remote area was also a priority.

The original plans of APCO had called for two plants, an upper and a lower plant, with the upper plant to be constructed first. The EOC revised this plan in August of 1907 intending to construct the lower plant first. Another change from the earlier plans was in the route of the flume system. APCO plans prepared by 1905, showed a ditch-flume-pipe-tunnel configuration that would have started at the springs and run on the left side of Fossil Creek to the upper plant. From there it would cross and head toward a yet to be positioned lower plant on the Verde River. EOC began new surveys for a revised plan that positioned the conduit system only on the right side of Fossil Creek. A system of open ditches, wooden flumes, pipes, and tunnels was conceived, yet many details remained to be worked out. It is clear from the correspondence and sequential maps and diagrams that the configuration of the system continued to evolve as construction proceeded.

By late April of 1908, there were still clauses in the UV Mine contract that needed to be discussed. Since the total amount of the contract had the potential to reach $200,000, this contract remained extremely important to TAPCO. Other contracts, however, were not sought at that time. TAPCO believed that contracts with other mines would be signed easily once the delivery date for power was closer. Throughout the remainder of 1908, the correspondence indicates that attention focused on construction details.

By June of 1908, a number of construction contracts had been signed. These contracts included provisions to provide 450 mules to transport materials from Blue Bell Siding to Fossil Creek, supplies and operation of commissaries at Childs and several other of the field camps, a doctor for a field hospital, and a crew to excavate tunnels.

Use of steel lattice towers, which could be transported in pieces by burros and erected in-place, were selected over traditional wooden poles due to difficulties in travel across the rugged terrain between Childs and the mining areas of Prescott and Jerome. No steel towers for transmission lines had been developed at that early date so a windmill tower was adapted for this purpose. These were to be the first such towers put into use in Arizona, although similar towers were being constructed in conjunction with Roosevelt Dam power transmission at the same time. The towers were purchased from the U.S. Wind Engine and Pump Company of Batavia, Illinois. A contract was completed with the company on June 17, 1908, for 700 steel towers, each weighing approximately 1240 pounds. Two steel towers were shipped as samples for testing; these were erected in Prescott. Use of the towers proved problematic, and steps had to be taken to strengthen all the towers with additional support braces within the first year of operation. Snow, wind, and lightning took their toll on the line and maintenance continued to be a major undertaking. The labor force was around 450 men by July, and five work camps (West Portal, Stehr, Purple Mountain, Sally May, and Hynes) were established along the flume route. It is difficult to find a period when more men were working on this project, but it appears that from 300 to 450 men continued to work for the better part of a year. It is interesting that Masson refers to the fact that there were nearly 400 men working on the flume and one could hardly find them since they were scattered over such a vast area. The workers included both Mexicans and Indians, but records do not show the relative proportions of each.

Regular communications were maintained between Prescott, the location of the TAPCO business office, and New York, the location of the EOC office, throughout the period of construction. Monthly progress reports chart the incredible amount of work that was accomplished in such a short time. By August 1, a road was completed to the intake point along Fossil Creek and bridges had been constructed across the Verde River and Sally May Wash. A telephone line was almost to the intake. Warehouses at Blue Bell Siding, Stehr, and Purple Mountain camps were either in place or nearly completed. By the end of September, several smaller tunnels were completed. A total of 250 steel towers had arrived and about eight towers a day were being erected. Siphon pipe and pressure pipe had begun to arrive at the staging area of Blue Bell Siding. In September alone, a total of 1,483,500 pounds of food, equipment, and supplies had been hauled from Blue Bell Siding to Fossil Creek. By October, a temporary 75-watt generator was built in the middle of the flume system near Sally May Canyon to provide electricity for the construction project.

Rain was the only problem that slowed progress. Clearly transporting the vast amount of pipe, cement, and other materials into Fossil Creek was difficult, but muddy roads made it nearly impossible. In December 1908, a 48-hour rain followed by 8 hours of snow resulted in an 18-foot rise in the Verde River. Simultaneously, Viele tried unsuccessfully to supervise the transport of the first generator to the site.

The Use and Consequences of Hydroelectric Power

The first generator was placed in operation on June 18, 1909, two and one-half months later than the projected April 1 deadline. The steel lattice towers were used to deliver power to Jerome in what was the first transmission of power across long distances in Arizona. By the end of the year, the Childs Generating Station was fully operational with three generators and nearly 2700 horsepower generated and delivered. The vast majority of this power, 1600 horsepower, was delivered to the UV Mine in Jerome while the rest was split between many smaller mines.

The power immediately injected new life into the mining development of the copper-rich Jerome area. The availability of dependable and cheaper power sources enabled the mining industry to expand in several directions:

(1) larger, up-to-date smelters and stamp mills were built that could process larger amounts of ore more efficiently, (2) many mining companies could focus on the upgrading of their machinery, and (3) miners could develop deeper portions of their mines.

The Arizona Smelting Company of Humboldt, which contracted for 200 horsepower while the construction of the Childs plant was under way, purchased thousands of dollars worth of equipment in 1909 after being connected to the power service; "the force at the smelter is said to be growing larger each day. Over 60 men are now employed...." (Jerome Miner News June 29, 1909). By the end of 1912, the smelting company added "one of the biggest concentrating mills in the state of a capacity that insures any tonnage to be readily and economically handled" (Prescott Journal Miner December 6, 1912).

The impact at the UV Mine was equally dramatic. Expensive electrical machinery was purchased in anticipation of the hydroelectric power. In late 1910, a gigantic air compressor, "the largest electrically driven appliance of its kind in the southwest" (Prescott Journal Miner November 28, 1910), was hooked up to provide air for the deeper tunnels of the mine. The UV company gradually changed all its mechanical components from steam power to hydroelectric power and eventually petitioned for additional horsepower.

Other mining companies, which had been closed, or at which the work had been slowed because of the difficulties and costs of extracting more ore, were not left out of the picture. The companies that benefited the most from the new hydroelectric power were the smaller mines that had been unable to produce economically enough power to exploit their finds. This benefit was recognized by TAPCO. In an operating report for February 1910, the general manager of the Childs facility discussed the fact that TAPCO had very few large customers, and that with enough of the "innumerable small customers" who desperately needed to receive power, TAPCO would receive a higher rate per kilowatt hour.

Agreements with TAPCO precipitated purchases of new and more modern equipment. Mines such as the Shylock and Cleopatra near Jerome purchased new equipment as lines were extended into their areas. The Arkansas and Arizona Mining Company purchased approximately $7,000 worth of electrical equipment after signing a contract with TAPCO for the provision of only 150 horsepower. The Copper Queen Gold Mining Company purchased a large line of "modern" equipment and, thereby, became "better equipped...to go ahead on an exploitation basis than any other mine" in the area (Prescott Journal Miner September 17, 1912). The Mount Elliott Mine in the Chaparral District had the first electrically equipped mine and mill. After two months of operation, the secretary of the company reported that the project was proving to be economical for both above and below ground work. However, four months later the Mount Elliott Mine was closed.

Electricity was not the answer to all the problems confronted by the mining industry, particularly the small mines.

The new source of electricity was also to prove a benefit to the Verde Valley and other areas in Yavapai County. New customers were found outside the mining industry. Within the first few years of operation seven large irrigation companies and over 50 individual farm owners in the Verde Valley contracted for the electricity to run pumps for watering thousands of acres of land. Besides the opening up of new land for cultivation, this new source of pumped water would mean that the use of canals with the associated costly maintenance and the loss of large volumes of water when ditches overflowed could be curtailed. This ability to pump water also provided security to ranchers using artesian wells since "even if the water fail[ed] to come to the surface in some of the wells it [was] certain water [would] be encountered in all at a depth shallow enough to justify pumping. This [was] made feasible since power lines from the Fossil Creek generators traverse[d] the entire length of the valley" (Yavapai Magazine 2(1):10).

Clearly, service to Prescott was an equally important facet. From street lights to home appliances and home heating, the benefits of having relatively inexpensive hydroelectric power were felt within the "boom saloon town turned residential," as Raymond Masson noted in TAPCO correspondence.

Planning for the second or upper plant (Irving) began almost immediately, but construction did not begin until May 1915. Many factors appear to have led to this delay: (1) a minor recession in mining, (2) abnormally wet weather that led to problems in the mines, (3) questions about the marketing of power to the large number of unstable small mines, (4) interest in other ventures including development of a hydroelectric power plant near the Grand Canyon, (5) plans for a competing hydroelectric facility on the Verde River just below Fossil Creek, and (6) difficulties with additional funding.

By 1914, nearly all the TAPCO customers had increased their use of electricity and new customers continued to be added. This precipitated the development of the second plant on Fossil Creek. Forest Service inspections of the Childs plant operation indicate that power demand dramatically increased by the end of 1914 because of World War I. In an article about the health of the mining industry, the Yavapai County Chamber of Commerce boasted that the industry was expanding because of the availability of the "numerous railroads, good highways leading through the state in every direction, ample food supplies close at hand through the opening up of thousands of acres for farming, cheap hydroelectric power, and new methods for the reduction of complicated ores that...permit[ted] the mining at a profit of hundreds of properties that ha[d] lain idle for years since their discovery" (Yavapai Magazine 1(1):12). The increased demand for power, which was especially noticeable in the Verde District due to the high price of copper and the revival of the mining industry, encouraged TAPCO to go forward in 1915 with their plans to construct a second hydroelectric plant on Fossil Creek. With the completion of this plant at Irving in 1916, TAPCO announced the need for a third plant almost immediately as they had requests for more power than they could produce. An article in the February 1917 issue of Yavapai Magazine described the situation as follows:

> It is hard to realize the full importance of "electric juice" in the developing of Yavapai county's mines. The price charged has resulted in a saving of 30 to 50 per cent to consumers as compared with other means of power generation. In many cases it has supplied power easily, where the condition of the roads and the country would practically prohibit the transportation of fuel (Yavapai Magazine 5(2):4).

An alternate source of power generation was constructed. Continued need for delivery of power to the mining industry, and particularly the new UV Clarkdale smelter, led to the construction of the TAPCO Steam Generating facility in Clarkdale. On September 1, 1917, the steam plant in Clarkdale was put into service by TAPCO, thereby doubling the amount of electricity available.

The connections between TAPCO and the power interests in Phoenix began in 1912 with the death of Arthur Ballard. Ballard had been the long-time President and Chairman of the Board of Pacific Gas and Electric (PGE), then an important source of electricity for Phoenix. The involvement between the two companies continued from 1912 to 1920; the directors and officers of each company often were the same people. By the Spring of 1919, PGE power use equaled the amount of power that could be purchased from the Bureau of Reclamation, which controlled the electricity generated at Roosevelt Dam. With excess power available due to a decline in the mining industry, sale of electricity to Phoenix became practical for TAPCO. A contract was signed in 1919 in which PGE agreed to purchase 2,000 kilowatts from TAPCO, most of which was to be the more expensive electricity generated from the TAPCO steam plant in Clarkdale. A transmission line was constructed between Fossil Creek and Phoenix, a distance of 72 miles, at the expense of PGE. This contract was highly favorable to TAPCO since it sold excess steam-generated electricity at a premium price while reserving hydroelectricity for future TAPCO customers in Yavapai County. As much as 70% of the power needs of Phoenix, which had a population of 44,000 in 1920, were met by generation of power from the Fossil Creek Hydroelectric Facilities. Within a year of the initial transmission of power to Phoenix, the circumstances surrounding power use in the State of Arizona had changed dramatically. Power demand declined sharply in Yavapai County with a recession in the mining industry, while the need for more electricity continued to grow in the Phoenix area. TAPCO and PGE renegotiated their contract to supply additional electricity and guarantee PGE priority for power generated by the Fossil Creek plants.

The construction of the 72-mile long 40,000 volt transmission line between a point on the TAPCO distribution system (the Sycamore Substation near Dugas) and Phoenix was seen as an economical way to provide the additional electricity. A total of 2000 kilowatts of power was transmitted over the line, which was known as the Sycamore line, to Phoenix. This line was upgraded in 1926 to transmit 66,000 volts, and large, new transformers of 10,000 kilowatt capacity were installed at the Childs hydroelectric plant. Simultaneously, TAPCO was looking for additional markets for the surplus electricity. In 1927, a 44,000 volt transmission line was constructed between Prescott and Constellation to provide electricity to the mines in the Wickenburg area. Additional power was routed to Prescott for local use via a new line from Mingus Mountain through Lonesome Valley. TAPCO purchased the Ash Fork and Seligman electric systems in 1929-1930 and built new transmission lines from Prescott to Ash Fork (44,000 volt) to Seligman (11,000 volt). By 1932, electricity was also being sold to the Town of Wickenburg and to the Flagstaff Electric Light Company.

By 1929, all possible power that could be provided by TAPCO and purchased through interconnections with United Verde Copper Company and United Verde Extension Mining Company, was being directed to Phoenix. A prolonged drought in central Arizona had lowered the water in the reservoirs on the Salt River and the Salt River Valley Water User's Association (SRVWUA) hydroelectric plants, from which Central Arizona Light and Power Company (CALAPCO, formerly PGE) obtained the bulk of their power, could not generate enough electricity. The contract between TAPCO and CALAPCO was canceled in 1933. However, the Sycamore line continued to transmit critical electricity to the Phoenix area during periods when reoccurring drought conditions resulted in power and water shortages in the SRVWUA system. Finally in 1949, CALAPCO purchased TAPCO and operated the company as a wholly owned subsidiary until 1952, when a merger between CALAPCO and the Arizona Edison Company resulted in the creation of the Arizona Public Service Company (APS), who currently owns the facilities on Fossil Creek. The two plants continue to supply power efficiently into the central Arizona electrical grid, and should continue doing so into the future.

The hydroelectric power from Fossil Creek was created for the mines of Yavapai County. However, the power also served to expand the potentials of the region. While the benefits of having hydroelectric power enabled growth and development within central Arizona and the mining industry, it was not the answer to many problems related to mining, nor did it allow the area to reach its full projected potential. According to observations by people at the time, the Verde Valley was seen as a rich place that had more potential for growth than the hotter areas of the state, such as Phoenix and the Salt River Valley. They further observed that the mining industry had an infinite future. The Arizona Power Company was a fundamental contributor to that growth. Clearly it had a profound impact on the development of Jerome, Prescott, Mayer, and other central Arizona communities. First developed for the mining industry, the power eventually was redirected to an emerging focal point of Arizona's population in Phoenix. So as with the history of Arizona, the history of Fossil Creek power development and usage ran a parallel course.

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[X] See continuation sheet

Previous documentation on file (NPS):
- [ ] preliminary determination of individual listing (36 CFR 67) has been requested
- [ ] previously listed in the National Register
- [ ] previously determined eligible by the National Register
- [ ] designated a National Historic Landmark
- [ ] recorded by Historic American Buildings Survey # ______
- [ ] recorded by Historic American Engineering Record # ______

Primary location of additional data:
- [ ] State historic preservation office
- [ ] Other State agency
- [ ] Federal agency
- [ ] Local government
- [ ] University
- [x] Other

Specify repository: Arizona Public Service Company Archives

10. Geographical Data

Acreage of property 342.7

UTM References

	Zone	Easting	Northing
A	1 2	4 4 7 3 6 0	3 8 0 9 1 2 0
B	1 2	4 4 7 5 2 0	3 8 0 9 1 0 0
C	1 2	4 4 7 1 3 0	3 8 0 8 7 9 0
D	1 2	4 4 7 2 0 0	3 8 0 9 0 6 0

[X] See continuation sheet

Verbal Boundary Description

The boundary of the property is delineated by a combination of polygon and linear references. The initial point of reference begins at the northern edge of the Fossil Springs area marked by the following UTM reference points: A-D. The Irving flume is marked by several points along the linear path of the

[X] See continuation sheet

Boundary Justification

The boundaries for the Childs-Irving Hydroelectric Facilities begin with the Fossil Springs and the capture point for the Irving flume at the north. A polygon area is established to surround the area where water is captured from Fossil Creek in the Irving flume. Linear references are used to project the

[X] See continuation sheet

11. Form Prepared By

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United States Department of the Interior
National Park Service

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1913 Annual Stockholders Report. On file, Archives, Arizona Public Service Company, Phoenix.

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NOTE: Copies of all articles and correspondence cited in Section 8 are on file at Arizona Public Service Archives and the Sharlot Hall Museum in Prescott.

National Register of Historic Places Continuation Sheet

UTM Coordinates for the Childs-Irving Hydroelectric National Register Property

Point	Zone	Easting	Northing	Description
A	12	447360	3809120	Point on polygon delineating area of Fossil Springs and the Springs Pond
B	12	447520	3809100	Point on polygon delineating area of Fossil Springs and the Springs Pond
C	12	447130	3808790	Diversion Dam and Point on polygon delineating area of Fossil Springs and the Springs Pond
D	12	447200	3809060	Point on polygon delineating area of Fossil Springs and the Springs Pond
E	12	445690	3809040	Point along Irving flume system
F	12	444230	3808070	Point along Irving flume system
G	12	443400	3807240	Point along Irving flume system
H	12	443370	3807090	Point on polygon delineating area of Irving
I	12	443200	3806980	Point on polygon delineating area of Irving
J	12	443245	3806790	Irving powerplant and point on polygon delineating area of Irving
K	12	443300	3806850	Point on polygon delineating area of Irving
L	12	443420	3807040	Point on polygon delineating area of Irving
M	12	442600	3806540	Point on Childs flume system
N	12	442510	3806400	Point on Childs flume system
O	12	442050	3806380	Point on Childs flume system
P	12	440840	3806060	Point on Childs flume system
Q	12	439060	3805050	Point on Childs flume system
R	12	438860	3804640	Point on Childs flume system
S	12	438830	3802940	Point on polygon delineating Stehr Lake
T	12	438940	3802770	Point on polygon delineating Stehr Lake
U	12	438570	3802400	Point on polygon delineating Stehr Lake
V	12	438460	3802540	Point on polygon delineating Stehr Lake
W	12	438600	3802840	Point on polygon delineating Stehr Lake
X	12	437220	3801140	Point on Childs flume system
Y	12	435900	3800760	Point on polygon delineating area of Childs
Z	12	435530	3801110	Point on polygon delineating area of Childs
AA	12	435660	3801200	Point on polygon delineating area of Childs
BB	12	435970	3800880	Point on polygon delineating area of Childs

Verbal Boundary Description (continued)

flume from points E through J. UTM reference points H through L delineate a polygon area surrounding Irving. The Childs flume is marked by several reference points along the linear path of this flume from Irving to Stehr Lake (UTM reference points K - S). The Stehr Lake area is referenced within a polygon area noted by UTM reference points S through W. The rest of the Childs flume is delineated with reference to points V and X through Y. The Childs area is referenced within a polygon configuration defined by point Y through BB.

Contributing elements have been given individual UTM reference points on a separate sheet that has been attached.

Boundary Justification (continued)

general course of the Irving flume from this capture point to the Irving powerhouse. The area of Irving inclusive of the powerhouse and associated buildings are outlined in a polygon. The general course of the Childs flume to a point where this enters the Stehr Lake reservoir is then plotted. A polygon surrounds the Stehr Lake area before the course of the Childs flume is again established by a few reference points. Finally, the area encompassed by the Childs complex of buildings, including the powerhouse, is marked by another polygon. This fully takes in all contributing components of the Childs-Irving Hydroelectric Facilities as nominated.

UTM Coordinates for Contributing Components of the Childs-Irving System

Irving System

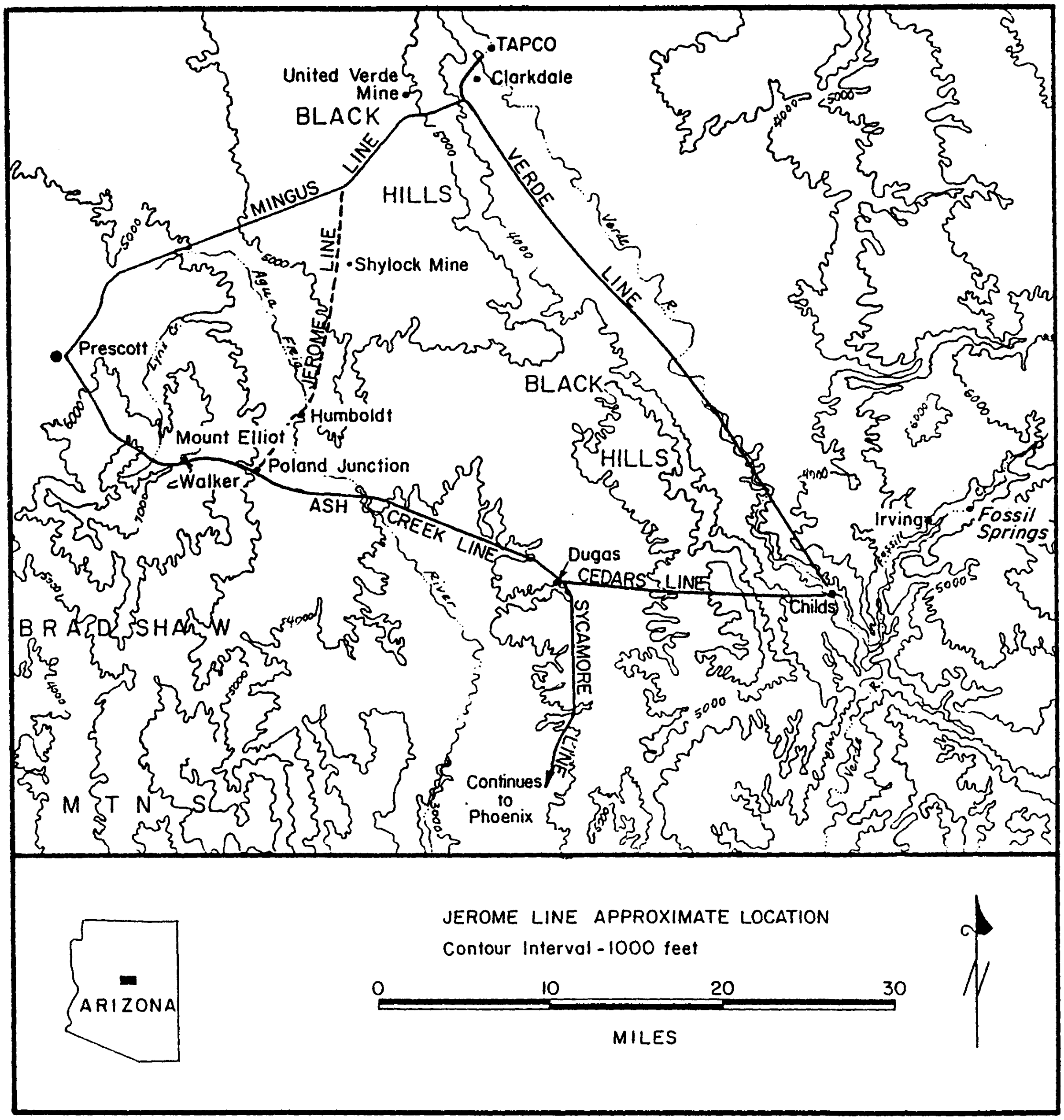
Component	Zone	Easting	Northing	Component Name
1	12	447130	3808790	Diversion dam
3	12	447120	3808790	Intake system
5	12	446835	3808735	Flume tunnel #1 (central point)
9A	12	445135	3808880	Inverted siphon (beginning)
9B	12	444995	3808880	Inverted siphon (end)
13	12	443760	3807530	Sandbox
14A	12	443760	3807530	Penstock (beginning)
14B	12	443280	3806850	Penstock (end)
15	12	443245	3806790	Irving powerhouse
17B	12	443290	3806945	Storehouse and cottage

Childs System

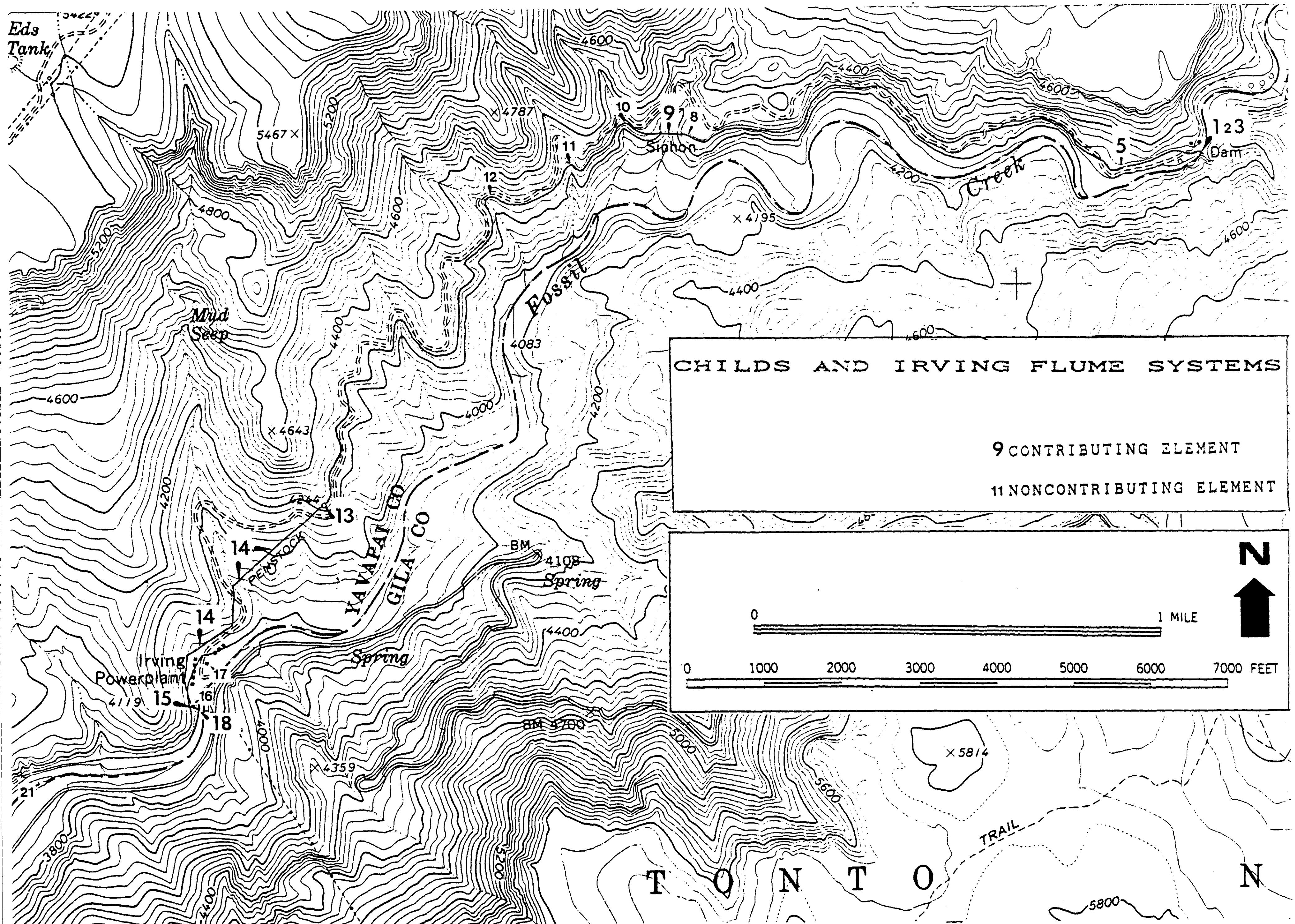
Component	Zone	Easting	Northing	Component Name
18	12	443280	3706850	Flume intake and forebay
19A	12	443250	3806780	Concrete flume
19B	12	442600	3806540	Concrete flume
22	12	442455	3806400	Flume tunnel #1 (central point)
23A	12	442040	3806390	Flume tunnel #2 (beginning)
23B	12	441640	3806180	Flume tunnel #2 (end)
24	12	440825	3806060	Intake for Purple Mountain Siphon
25A	12	440825	3806060	Purple Mountain Siphon (beginning)
25B	12	439050	3805070	Purple Mountain Siphon (end)
26	12	440360	3805680	Flume bridge #2 (central point)
27	12	439720	3805205	Flume bridge #3 (central point)
28	12	439445	3805100	Flume bridge #4 (central point)
29	12	439050	3805070	Purple Mountain Siphon End
30	12	439000	3804940	Steel Flume Trestles (central point)
31A	12	438970	3804860	Flume tunnel #3 (beginning)
31B	12	438890	3804710	Flume tunnel #3 (end)
32	12	438960	3804680	Flume bridge #5 (central point)
33A	12	439040	3804220	Flume tunnel #4 (beginning)
33B	12	438950	3803920	Flume tunnel #4 (end)
35	12	438980	3803790	Flume tunnel #5 (central point)
36A	12	438999	3803220	Flume tunnel #6 (beginning)
36B	12	438870	3803100	Flume tunnel #6 (end)
38	12	438200	3802800	Stehr Lake (central point)
39	12	438520	3802560	Pressure tunnel intake

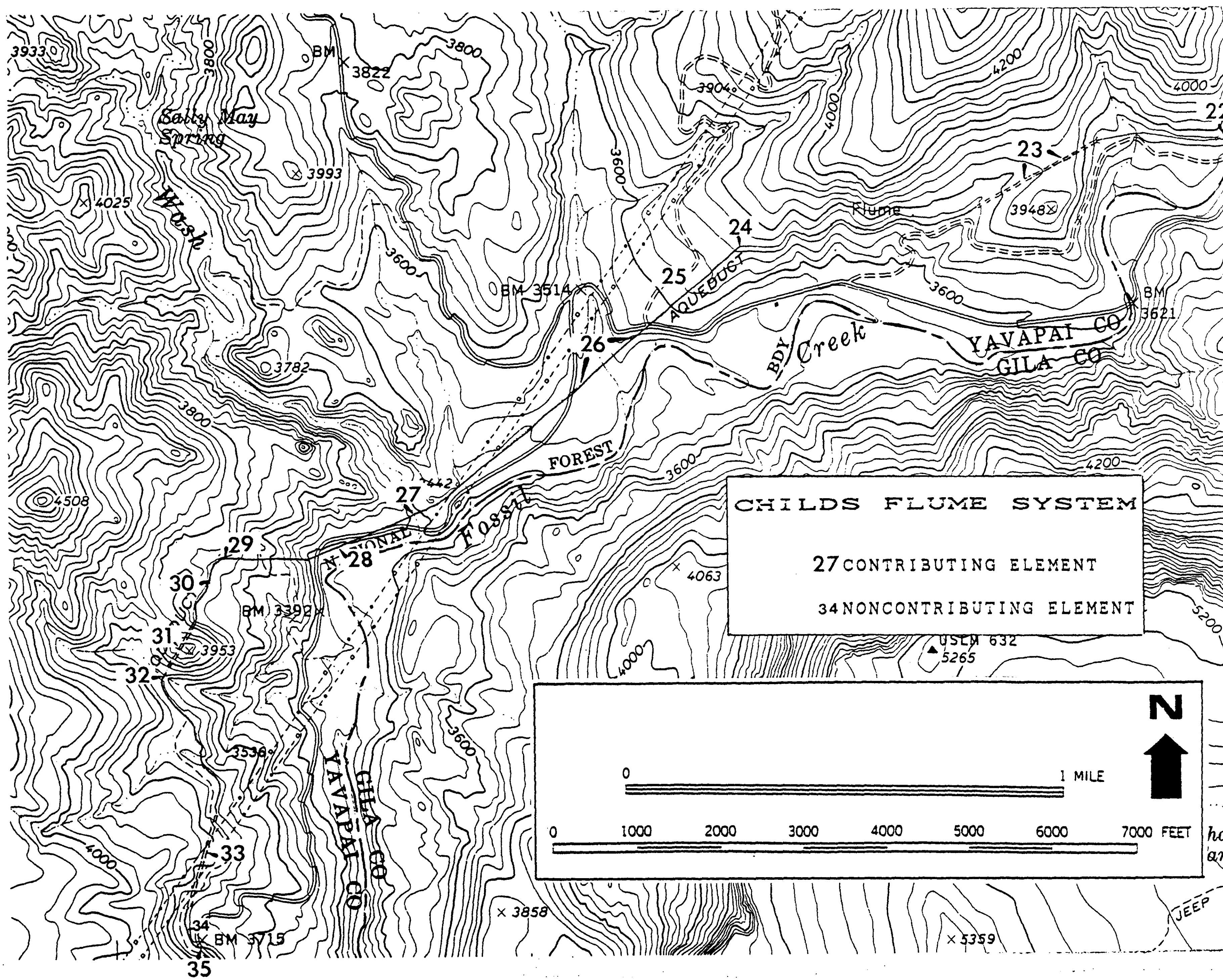
Childs System (continued)

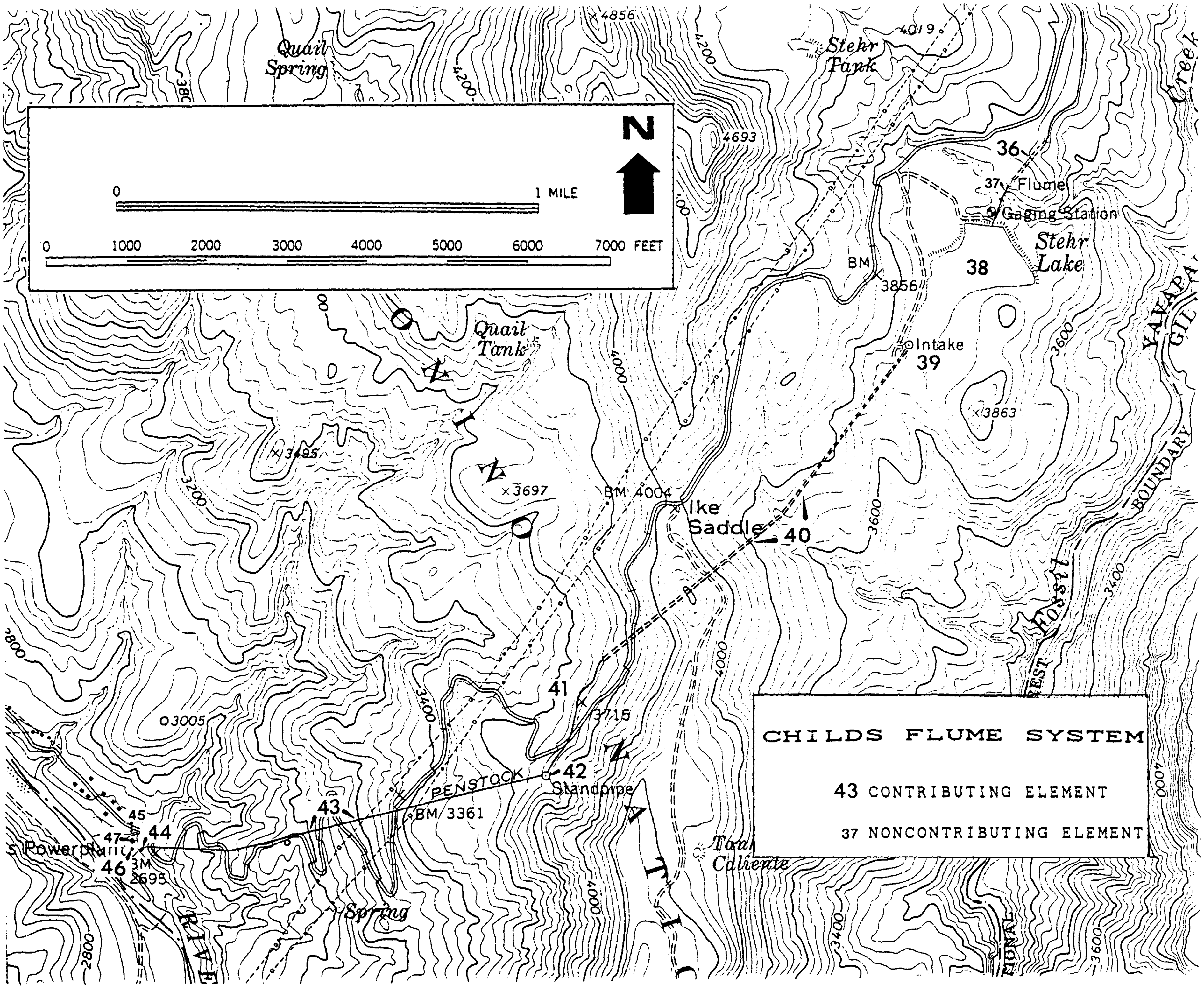
Component	Zone	Easting	Northing	Component Name
40A	12	438520	3802560	Flume tunnel #7 (beginning)
40B	12	437440	3801540	Flume tunnel #7 (end)
41A	12	437440	3801540	Reinforced concrete pipe (beginning)
41B	12	437250	3801140	Reinforced concrete pipe (end)
42	12	437250	3801140	Stand pipe
43A	12	437250	3801140	Penstock pipe (beginning)
43B	12	435835	3800920	Penstock pipe (end)
44(46)	12	435835	3800920	Childs powerhouse (and office)



Area map showing the location of Childs and Irving powerplants, the transmission lines, and geographic references used in the National Register of Historic Places nomination.


CHILDS AND IRVING FLUME SYSTEMS
9 CONTRIBUTING ELEMENT
11 NONCONTRIBUTING ELEMENT
0
1 MILE
0
1000
2000
3000
4000
5000
6000
7000 FEET
N
Eds Tank
Mud Seep
Siphon
Dam
Fossil
Creek
YAVAPAI CO
GILA CO
PENSTOCK
Irving Powerplant
Spring
Spring
BM 4108
BM 4700
TRAIL
T O N T O N
1 2 3
5
8
9
10
11
12
13
14
14
15
16
17
18
21
5467
4787
4643
4195
4083
4359
5814
4119
4244


CHILDS FLUME SYSTEM
27 CONTRIBUTING ELEMENT
34 NONCONTRIBUTING ELEMENT
0
1 MILE
0
1000
2000
3000
4000
5000
6000
7000 FEET
N
Sally May Spring
Wash
Fossil
Creek
FOREST
AQUEDUCT
Flume
BDY
YAVAPAI CO
GILA CO
BM 3822
BM 3514
BM 3621
BM 3392
BM 3715
USLM 632
5265
22
23
24
25
26
27
28
29
30
31
32
33
34
35


CHILDS FLUME SYSTEM
43 CONTRIBUTING ELEMENT
37 NONCONTRIBUTING ELEMENT
N
0
1 MILE
0
1000
2000
3000
4000
5000
6000
7000 FEET
Quail Spring
Quail Tank
Stehr Tank
Stehr Lake
Flume
Gaging Station
Intake
Ike Saddle
PENSTOCK
Standpipe
Powerplant
BM 4004
BM 3856
BM 3361
BM 2695
3697
3495
3863
3715
3005
4856
4693
4019
36
37
38
39
40
41
42
43
44
45
46
47
Spring
Fossil
Creek
BOUNDARY
YAVAPAI
Caliente

Photographs

Photograph #1
Childs-Irving Hydroelectric Facilities
Camp Verde, Yavapai County, Arizona
Mark Hackbarth
July 1987
APS Archives
North facing view of dam and capture point
Contributing elements #1 and #3
Map Point C on topographic maps

Photograph #2
Childs-Irving Hydroelectric Facilities
Camp Verde, Yavapai County, Arizona
Barbara Macnider
October 1987
APS Archives
West facing view of the steel flume on trestles in the Irving System
Noncontributing element #4

Photograph #3
Childs-Irving Hydroelectric Facilities
Camp Verde, Yavapai County, Arizona
Mark Hackbarth
July 1987
APS Archives
West facing view of flume tunnel #1 in the Irving System
Contributing element #5

Photograph #4
Childs-Irving Hydroelectric Facilities
Camp Verde, Yavapai County, Arizona
Richard Effland Jr.
May 1987
APS Archives
West facing view of the inverted siphon in the Irving System
Contributing element #9

Photograph #5
Childs-Irving Hydroelectric Facilities
Camp Verde, Yavapai County, Arizona
Barbara Macnider
July 1987
APS Archives
Northeast facing view of steel flume on trestles in the Irving System
Noncontributing element #4

Photograph #6
Childs-Irving Hydroelectric Facilities
Camp Verde, Yavapai County, Arizona
Richard Effland Jr.
May 1987
APS Archives
Southwest facing view of the Irving Powerhouse
Contributing element #15

Photograph #7
Childs-Irving Hydroelectric Facilities
Camp Verde, Yavapai County, Arizona
Unknown APS photographer
After 1980 and before 1987
APS Archives
South facing view of interior of Irving Powerhouse
Contributing element #15

Photograph #8
Childs-Irving Hydroelectric Facilities
Camp Verde, Yavapai County, Arizona
Barbara Macnider
October 1987
APS Archives
East facing view of Irving; work area, cottages, and powerhouse
Contributing elements #15 and #17B

National Register of Historic Places Continuation Sheet

Photograph #9
Childs-Irving Hydroelectric Facilities
Camp Verde, Yavapai County, Arizona
Richard Effland Jr.
May 1987
APS Archives
North facing view of concrete flume on prepared bench in Childs System
Contributing element #19

Photograph #10
Childs-Irving Hydroelectric Facilities
Camp Verde, Yavapai County, Arizona
Barbara Macnider
July 1987
APS Archives
South facing view of the stand pipe in the Childs System
Contributing element #42

Photograph #11
Childs-Irving Hydroelectric Facilities
Camp Verde, Yavapai County, Arizona
Unknown APS photographer
After 1980 and before 1987
APS Archives
Southeast facing view of interior of Childs Powerhouse
Contributing element #44