

CASE STUDY REPORT #8
ANTELOPE VALLEY DAM
INDIAN CREEK

I. Project Description

Antelope Valley Dam was constructed on Indian Creek by the State of California Department of Water Resources. The project is located in northeastern California near Susanville (see Figure 1). It was operational in 1964 with a storage capacity of 21,600 acre-feet and a surface area of 890 acres. Figure 2 illustrates the relationship of Antelope Valley Dam to the North Fork Feather River basin. The project was designed to include recreation and fisheries development as project purposes.

II. Pre-Project Condition

Historical stream flows in Indian Creek at Antelope Valley Dam reflected annual precipitation. The mean discharge pattern shown in Figure 3 illustrates a response to early winter rainfall and snowmelt, freezing conditions between January and March and peak snowmelt runoff from April to June. Summer and early autumn stream flow result mainly from subsurface accretions to stream flows. Great monthly variations occurred depending upon the water year, the rapidity of snowmelt and intensity of rainfall (see Figure 3).

Indian Creek drains approximately 746 square miles of watershed, heading in and around Antelope Valley. It had a mean monthly flow of 238 cfs in June and 3 cfs in September.

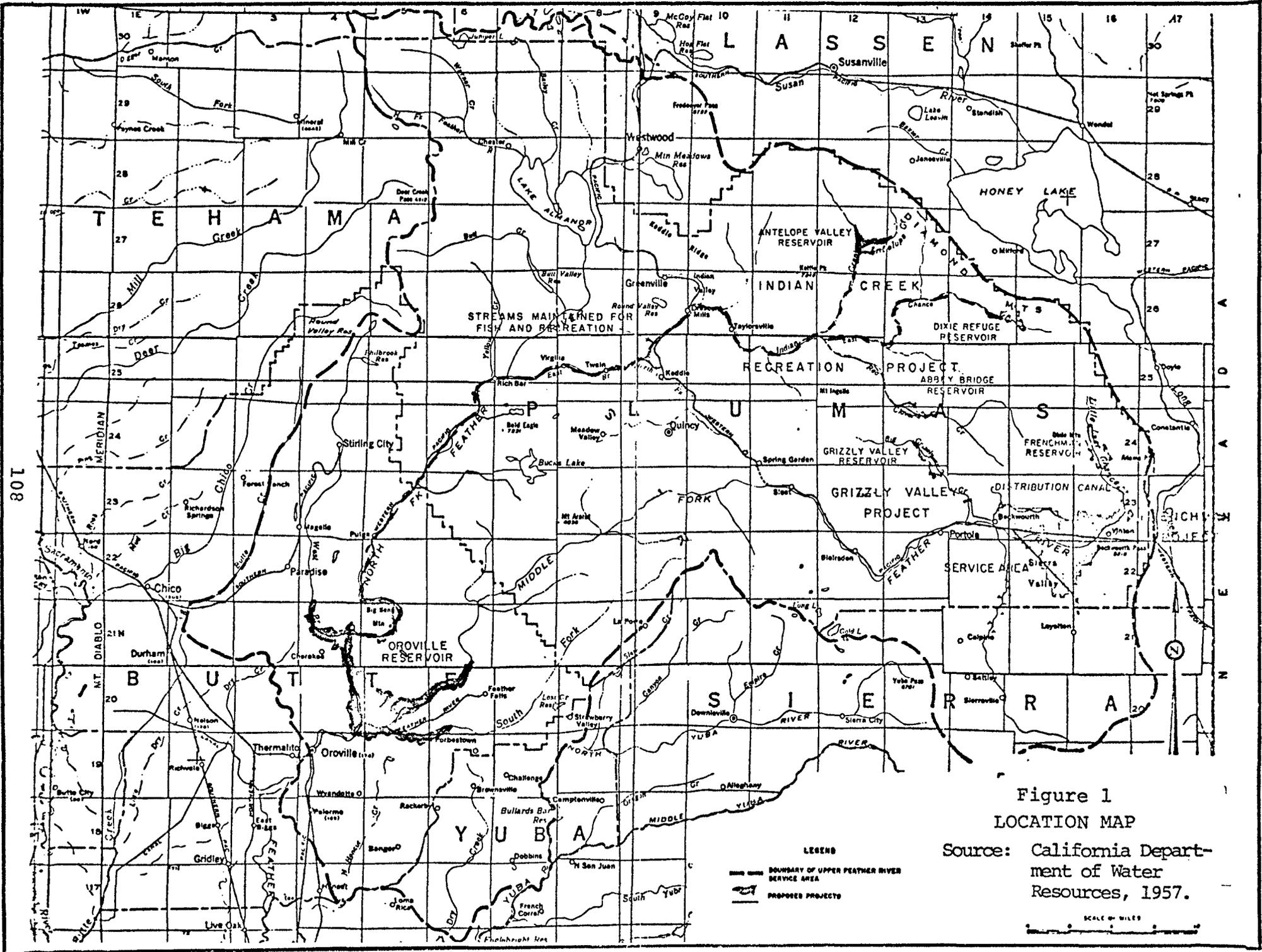


Figure 1
LOCATION MAP

Source: California Department of Water Resources, 1957.

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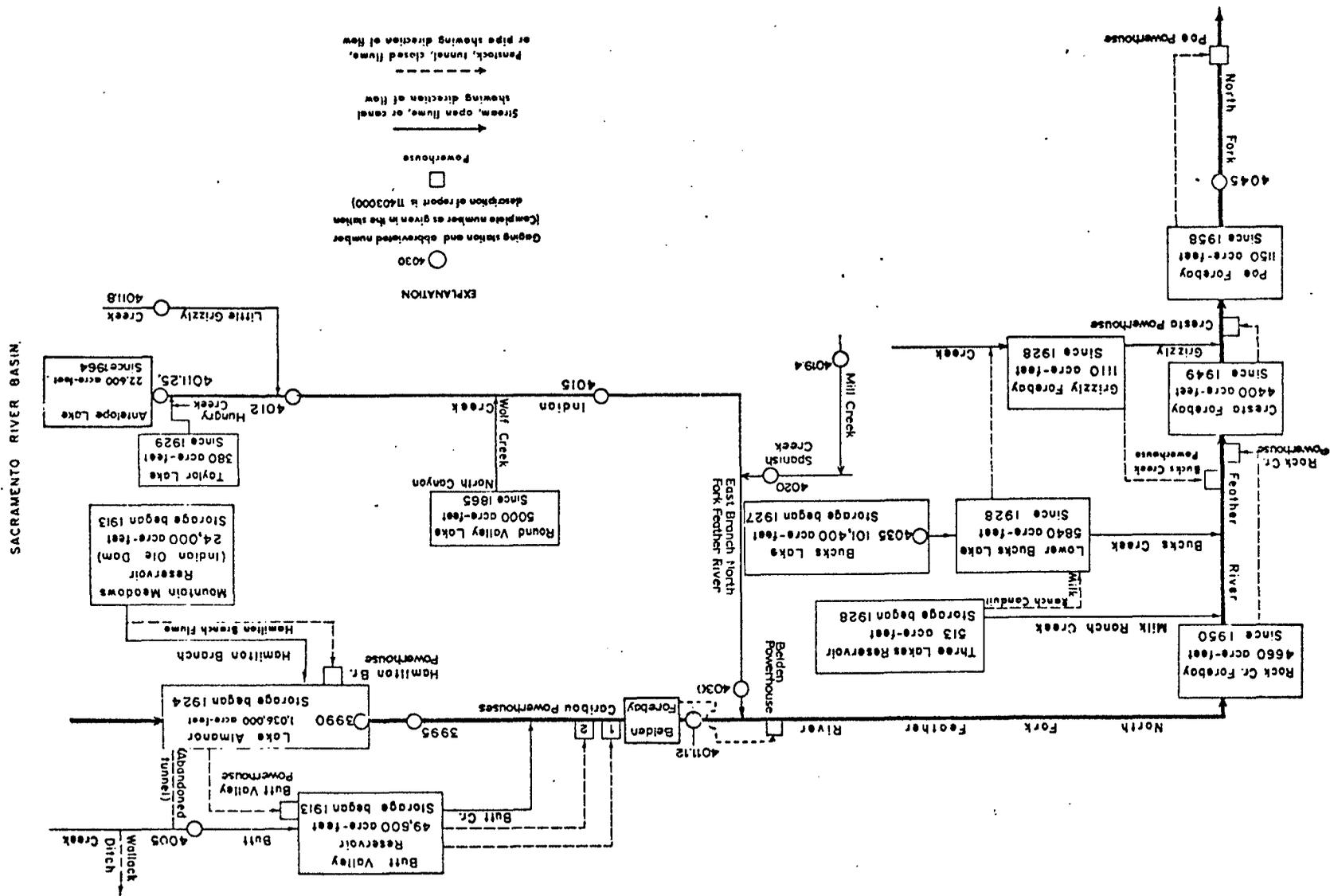
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Source: U. S. Geological Survey, 1973 - water resources data for California.

Figure 2

--Schematic diagram showing diversions and storage in North Fork Feather River basin.

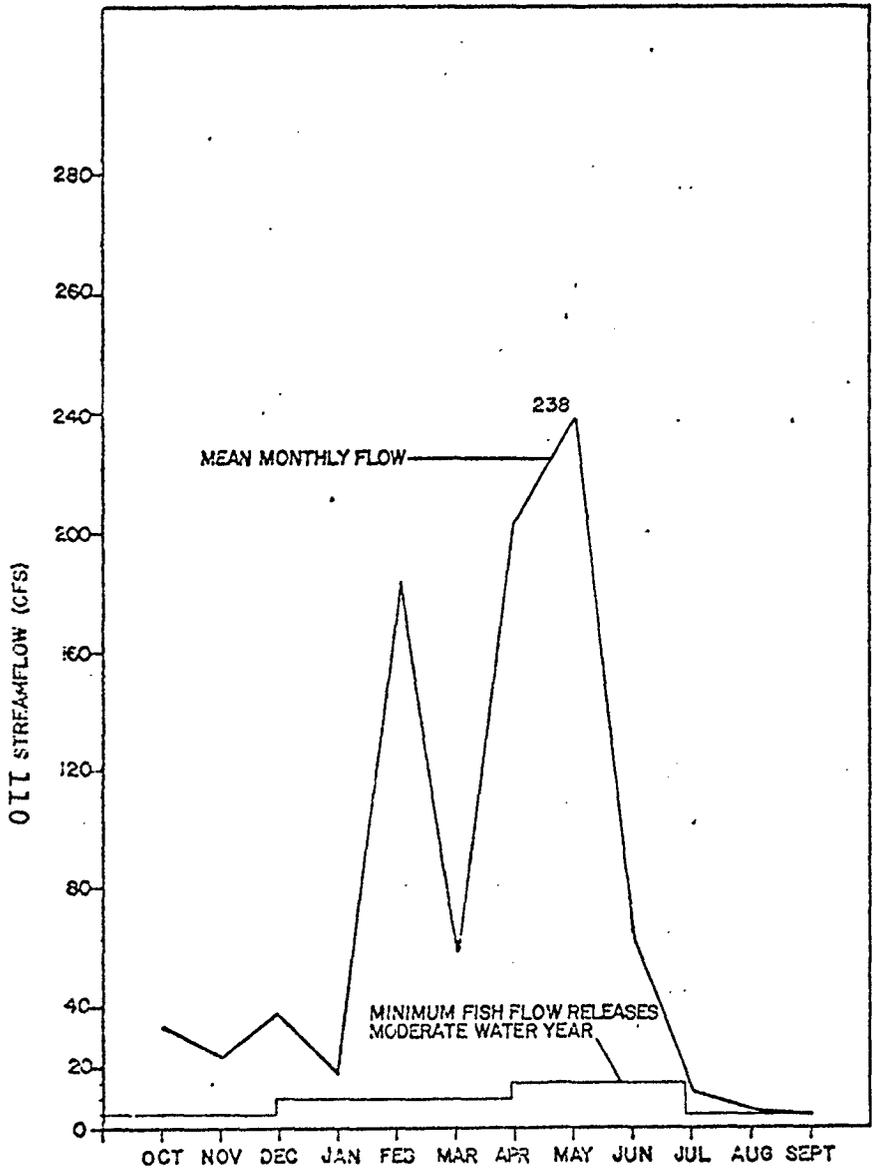


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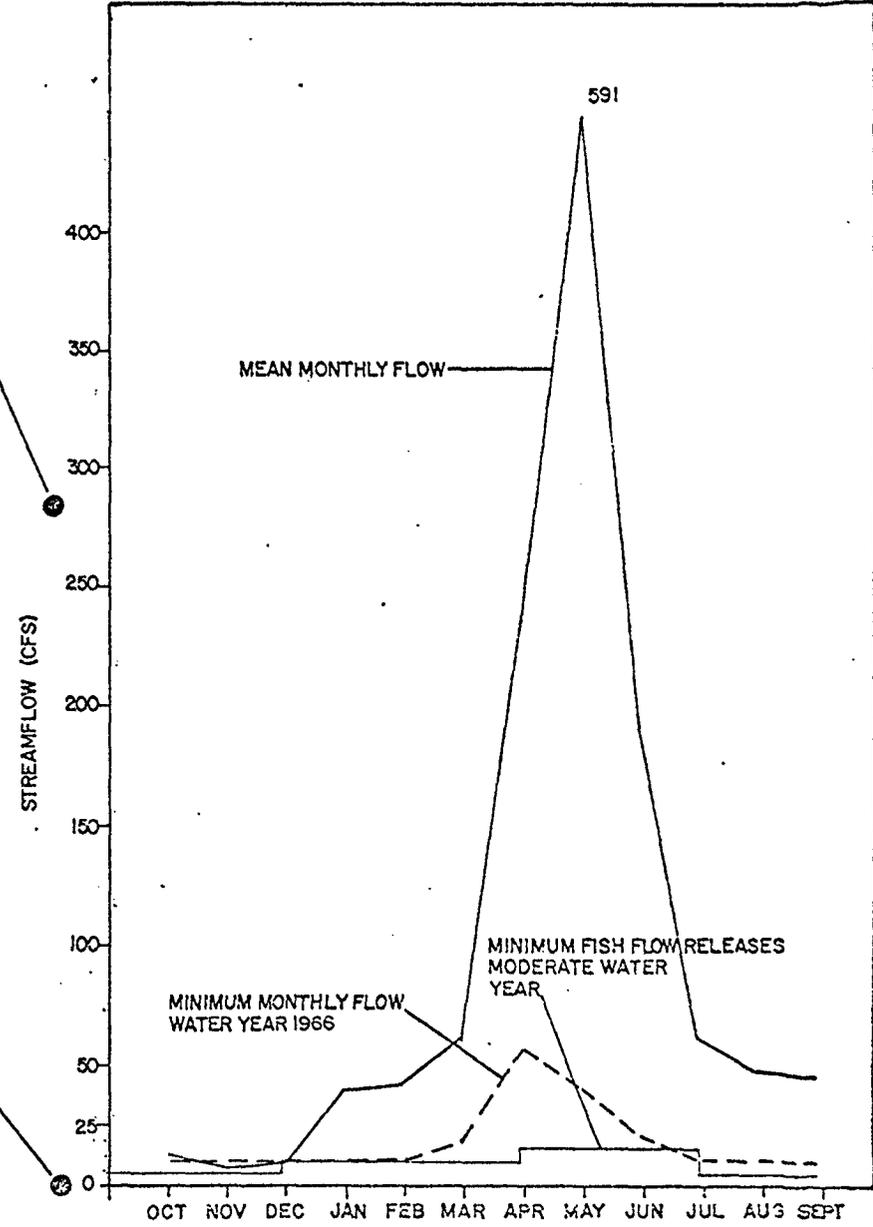
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PRE-PROJECT: JULY 1961-SEPTEMBER 1963
 GAUGE STATION NO.
 SOURCE: DEPARTMENT OF WATER RESOURCES, SURFACE WATER RECORDS
 1961-1963

FIGURE 3
 STREAMFLOW CONDITIONS, INDIAN CREEK
 ANTELOPE DAM

POST-PROJECT: OCTOBER 1964-SEPTEMBER 1973 (Except Water Year 1966)
 GAUGE STATION NO. USGS 11401125
 SOURCE: SURFACE WATER RECORDS VOL. 2



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The stream has been generally quite turbid in lower sections as a result of siltation and pollution from several sources, including erosion of over-grazed range lands, construction of logging roads, dumping of mine wastes, dredging, and dam construction.

Historically Indian Creek was a rainbow trout stream of undocumented quality. Indian Creek was first planted with catchable trout in 1951 from the Almanor Hatchery with a single seasonal plant of 2,200 rainbow trout. This allotment was increased to 10,000 rainbow trout in 1953. A creel census was conducted in 1955 on the lower section from Crescent Mills to the mouth of the stream. The survey indicated very little use in the turbid water area. In 1959, the allotment was reduced to 6,000 catchables annually. About that time, the upper reaches of the stream from Hungry Creek to Boulder Creek Range Station, above Taylorsville, became a prominent recreational area. This stream section includes 30 miles of water suitable for planting fish.

The Department of Fish and Game began to assess the fishing needs of Indian Creek as construction of Antelope Valley Dam began. A creel census and use count covering the lower Indian Creek area was undertaken for the season preceding the completion of Antelope Valley Dam. This survey was to determine the adequacy of the proposed operational program for the dam and to evaluate the enhancement potential of Antelope Valley

Reservoir. Results of this survey indicated a marked increase in the recreational use of Indian Creek, thus a high demand for an increase in the current allotment of catchable trout.

III. Project Development

Upon notice of the proposed project the California Department of Water Resources began investigations to determine its effect upon the fish and wildlife resources of Indian Creek and the Feather River.

USGS surface water flow records were examined to determine annual flow characteristics of Indian Creek prior to the construction of Antelope Valley Dam. A hydrograph of pre-project stream conditions indicates a mean monthly maximum flow of 238 cfs in June and a mean monthly minimum flow of 3 cfs in September (Figure 3). These minimum and maximum flows were taken into consideration prior to the development of instream flow release recommendations.

The California Department of Water Resources developed several transect locations to study stream depth, spawning areas, food production and habitat type under varied stream flow conditions.

Information generated by the transect study, historic streamflow conditions and the Department of Fish and Game's general knowledge of fishery conditions in the river were used to formulate instream flow release schedules.

The Department of Fish and Game and the Department of Water Resources with the approval by the U.S. Forest Service and the U.S. Fish and Wildlife Service agreed upon an instream flow release from Antelope Dam.

Planning criteria used to formulate instream flow releases were designed to provide optimum flows for trout production.

The results of these investigations indicated that:

"Heavier flows are desirable during the spring months to optimize the spawning potential for trout. Lower flows may be used during the remainder of the year after spawning season, but these flows should be adequate to provide habitat needed to maintain trout populations. Fisheries biologists of the Department of Fish and Game determined that the flows of 20 cubic feet per second during the spring spawning months and 10 cubic feet per second thereafter would provide excellent trout conditions in Indian Creek from the dam downstream to Genesee Valley.

"A modification of these downstream releases is necessary to prevent undue drawdown of the reservoir during years of less than average precipitation. The 'dry year clauses' listed in Sections 2 and 3 of the following operating criteria provide the means to balance dry year effects between stream and reservoir so that neither need bear the full brunt of low precipitation."
(Department of Water Resources, 1962)

"Operating Criteria

Release schedules are based upon the water surface elevation on May 1 each year:

1. Reservoir full (water surface elevation 5,002 feet), releases as follows:

May and June	20 cfs
July through March	10 cfs
April	20 cfs

2. Reservoir water surface elevation between 4,998 to 5,002 feet, releases as follows:

May and June	15 cfs
July through November	5 cfs
December through March	10 cfs
April	15 cfs

3. Reservoir water surface elevation below 4,998 feet, releases as follows:

May and June	10 cfs
July through March	5 cfs
April	10 cfs

"The effects of these releases upon reservoir recreation and the downstream fishery will be observed for a five-year period. These observations may indicate the desirability of modifying this release schedule to better fit conditions at this later time." (Department of Water Resources, 1962)

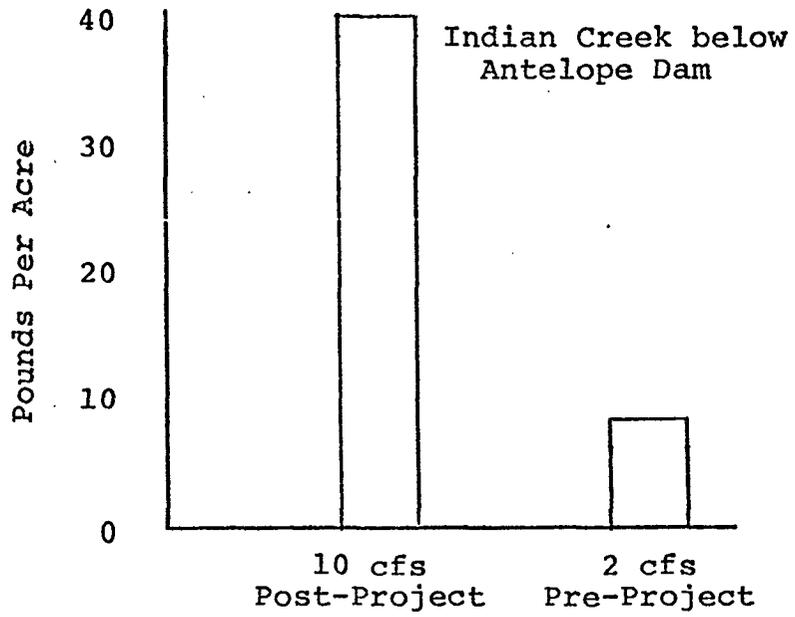
Examination of Department of Water Resources and Department of Fish and Game records did not reveal any record of the methodology used to determine the final instream flow release schedule. Personal communication with Eric Gerstung (Department of Fish and Game, Fishery Biologist) provided most of the description of the Indian Creek fishery.

IV. Post-Project

Antelope Valley Dam began impounding the water of Indian Creek in 1964. Since that time the minimum flows have remained at levels which are much higher than the historic flows. This increase in the minimum flows was designed by California Department of Fish and Game to improve the downstream fishery (see Figure 4).

Figure 4

EFFECTS OF STREAM FLOW CHANGES
ON TROUT POPULATIONS



Source: Gerstung, 1975.

Transect studies conducted by the Department of Water Resources between 1962 and 1964 prior to the construction of Antelope Valley Dam indicated that the creek supported an average of 8 pounds of trout per acre. In 1968 after four years of increased minimum streamflow the trout population supported by Indian Creek increased to an average of 43 pounds per acre (Gerstung, 1975). Figure 4 illustrates this change in trout supported by Indian Creek. Planted catchable trout were not included in the above estimate.

Indian Creek was investigated by Department of Fish and Game biologists approximately 6 months after the dam began impounding water. The purpose of this investigation was to determine the immediate effects of the maintenance of higher instream flows on the trout fishery. Department of Fish and Game biologists electroshocked three sections of Indian Creek each approximately 200 feet long and 6 to 10 miles below Antelope Dam in October 1964. The results of this investigation indicated the trout population averaged 8.5 pounds per acre and was primarily made up of brown trout.

Antelope Reservoir has become a popular lake for fishing. However, bait minnows, primarily golden shiners used by anglers have taken over the reservoir. Their populations have exploded to levels which are considered inhibitory to trout populations. Brown bullheads are also abundant in the reservoir and below Antelope Dam although they are unable to

spawn successfully in the stream. The California Department of Fish and Game has chemically treated the reservoir twice to reduce the golden shiner and brown bullhead population. The latest effort was in 1973 when Roteone was used to kill nongame fish in the reservoir. A detoxification station was established directly below the dam to protect the downstream trout fishery.

Several spot-check, creel censuses conducted on Indian Creek revealed that a good brown trout fishery exists. The results indicated a success ratio of 2.4 fish per angler hour. This figure varied considerably in each census. The success variation was due in part to the frequency of fish planting by the Department of Fish and Game. Indian Creek has an annual allotment of 6,000 catchable trout.

V. Conclusion

Antelope Valley Dam was constructed as a recreational development on Indian Creek by the California Department of Water Resources. The project includes an instream flow reservation allocated for the enhancement of fishlife in Indian Creek. The operation of the project provides mean monthly flows greater than minimum instream flow releases and increased the summer streamflow regime (see Figure 3).

The investigation conducted by the California Department of Fish and Game and the California Department of Water Resources to determine instream flow needs utilized results from transect studies along with historic streamflow data and information describing the fisheries of the stream that was gathered from previous Department of Fish and Game field studies.

The minimum instream flow schedule designed for the project enhanced the trout fishery in Indian Creek. A comparison of pre-project population estimates with post-project population estimates displays an increase by a factor of five in the biomass of trout naturally supported by the stream (see Figure 4). This enhancement of the fisheries would indicate that the methods applied to designing an instream flow schedule have been effective. However, the minimum flow requirements have not been tested as instream flows have been in excess of the minimum requirement.

BIBLIOGRAPHY

Personal Communications

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