

CASE STUDY REPORT #64  
PINE FLAT  
KINGS RIVER

I. Project Description

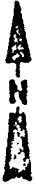
Pine Flat Dam is part of the Kings River project which included construction of Pine Flat, enlargement and rectification of existing levees, channel clearing and modification of control structures on the lower reach of the Kings River in the San Joaquin Valley floor (see Figure 1).

The Kings River watershed lies in Fresno and Tulare counties and drains an area of about 1545 square miles above the Pine Flat damsite. The Army Corps of Engineers completed the dam in 1954; it was operated by the Bureau of Reclamation for flood control and irrigation. Currently the Kings River Conservation District operates the Pine Flat Reservoir. The reservoir stores a maximum of one million acre-feet covering 5970 acres. The inflow from the North Fork to Pine Flat is extensively affected by upstream hydroelectric developments (see Figure 2).

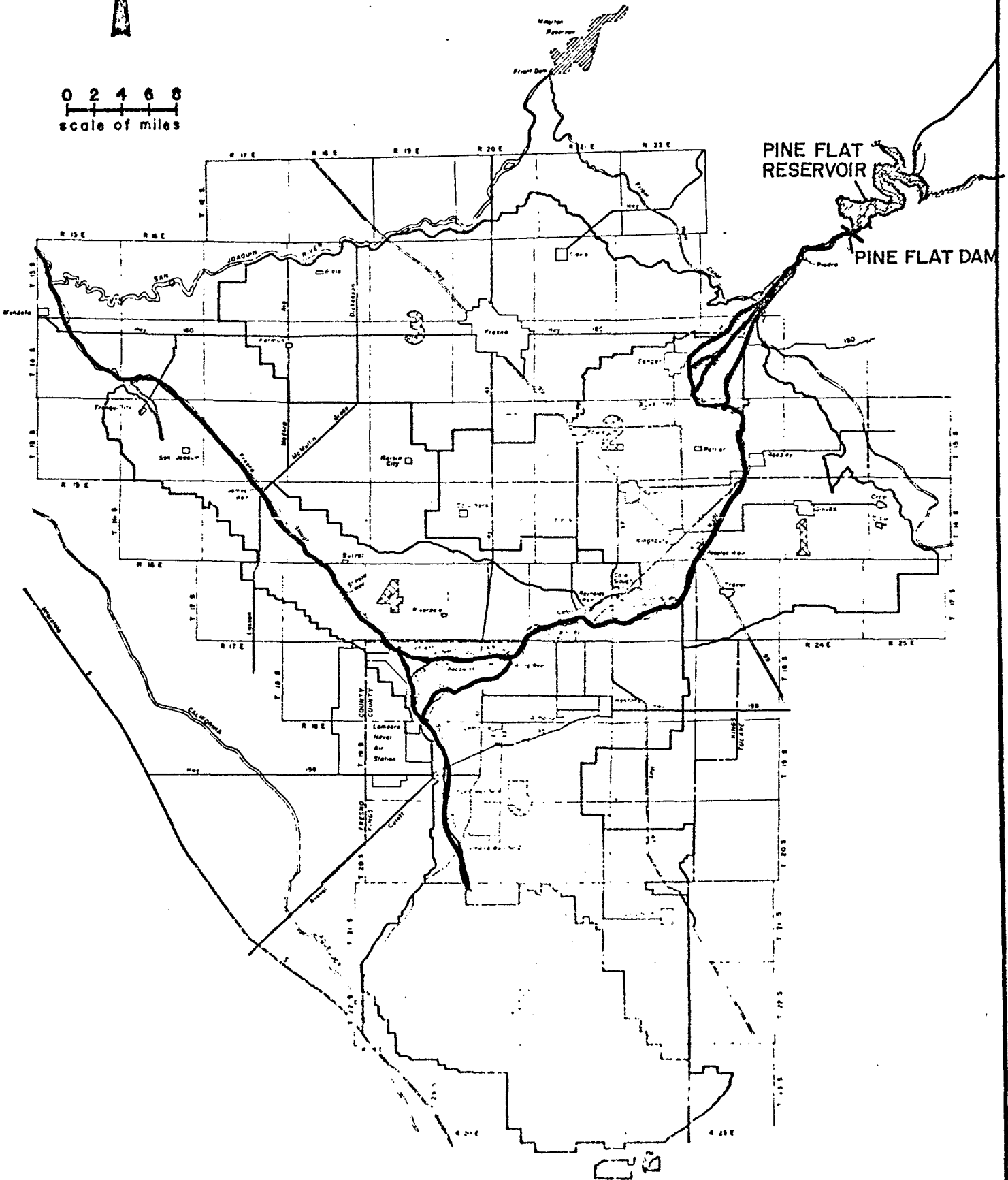
II. Pre-Project Conditions

The natural flow of the Kings River has a seasonal distribution of streamflow roughly similar to other watersheds draining the western slopes of the Sierra Nevadas to the San Joaquin Valley. The annual runoff present in the Kings River watershed differs from the more northern watersheds of the San Joaquin due to greater variability in the amount of annual runoff. The range of the unimpaired runoff on the Kings River as measured at Piedra is from 372,000 acre-feet per year to 3,900,000 acre-feet

Figure 1  
LOCATION MAP

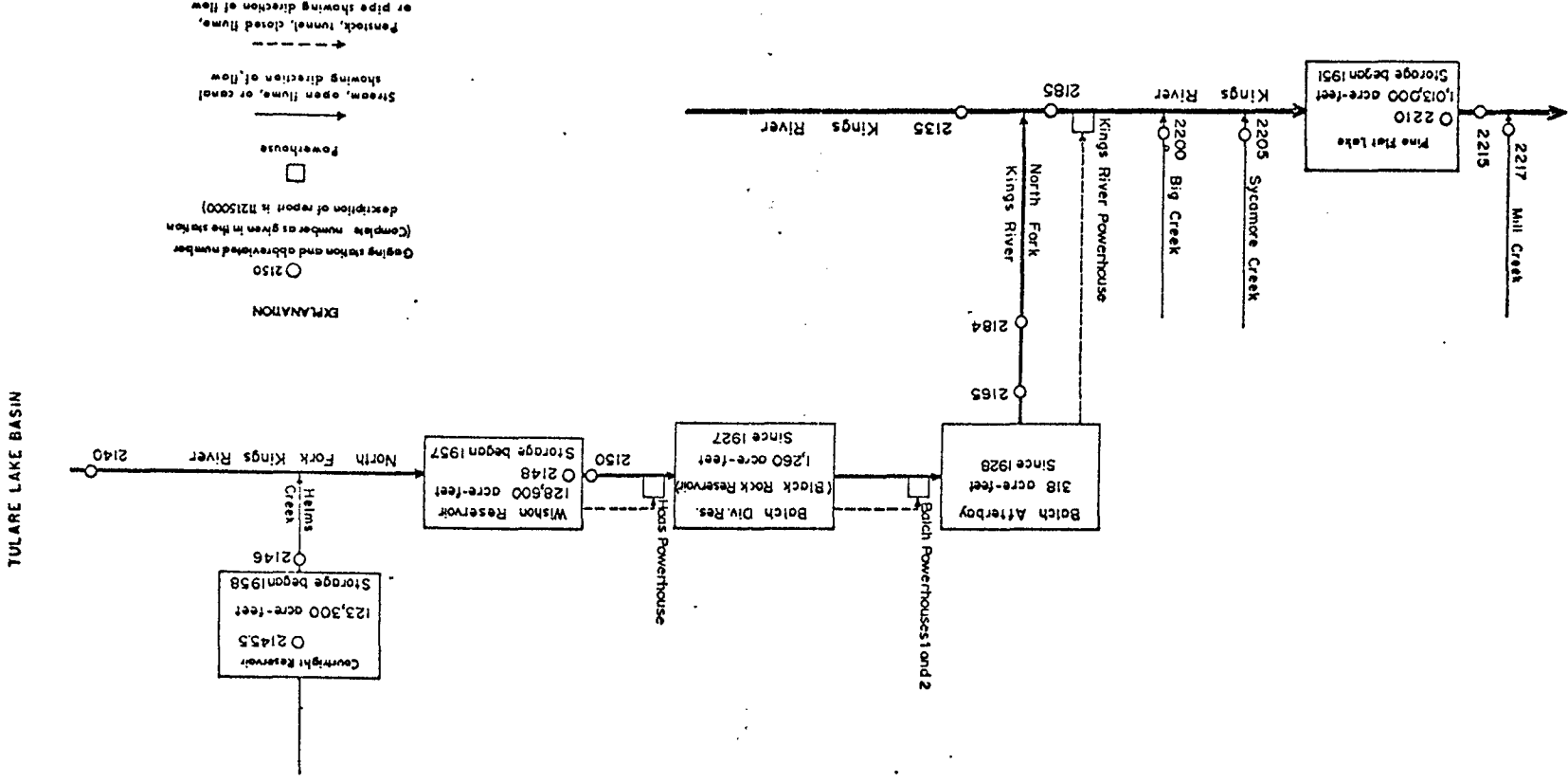


0 2 4 6 8  
scale of miles



Source: U. S. Geological Survey, 1973, water resources data for California.  
 SCHEMATIC DIAGRAM SHOWING DIVERSIONS AND STORAGE IN KINGS RIVER BASIN

Figure 2



per year. Prior to the completion of Pine Flat Dam the annual runoff was relatively unimpaired with only one power development (Balch Diversion) present on the river system. The pre-project hydrograph (Figure 3) displays year round mean monthly flows above 500 cfs (as derived from calculated inflow data).

Historically this streamflow drained into Tulare Lake Basin along the many natural channels of the lower river section. During flood flows some runoff would reach the San Joaquin River, which is the natural outflow of Tulare Lake. When the depth of this intermittent lake was nearly 30 feet and the lake covered an area of 1,000 square miles, outflow to the San Joaquin River would occur. (The last recorded outflow was 1875.)

Thousands of acres of lake and marsh were provided by Tulare Lake, the Oxbow lakes, and vernal channels of the Kings River. These areas were exceptionally valuable to the wildlife and waterfowl found in the San Joaquin Valley.

As demands for irrigation water and flood control increased in the early 1900's cross channels and weirs were constructed. These changed the lower river drainage permitting it to flow to San Joaquin or into Tulare Lake Basin. Generally, water in excess of irrigation demands was prevented from flowing into the Tulare Lake Basin.

The Kings River in the vicinity of the Pine Flat project was a large, low elevation (1,000 feet), coarse-bottomed stream with pools, riffles and perennial streamflows providing habitat for a

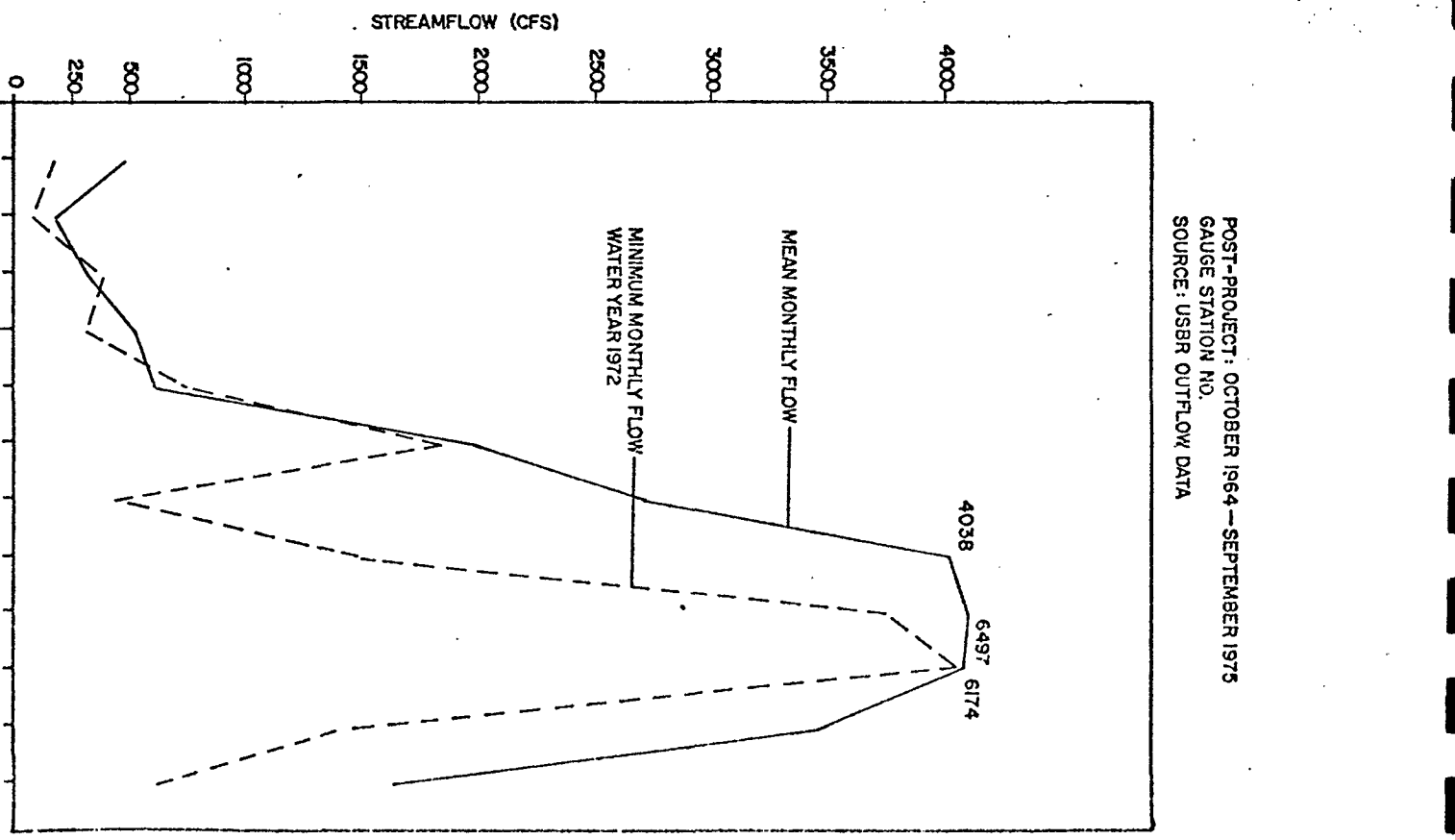
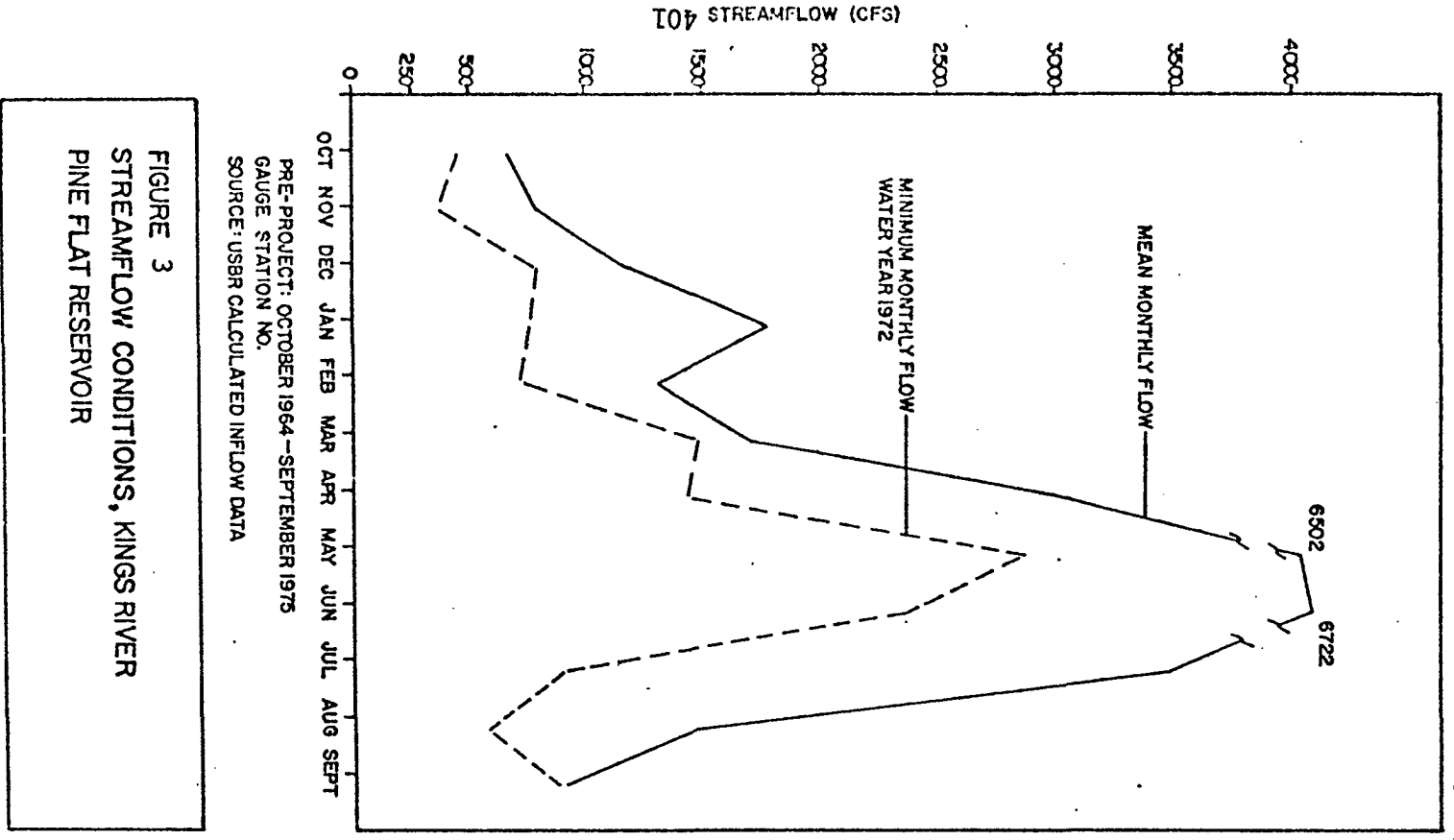


FIGURE 3  
STREAMFLOW CONDITIONS, KINGS RIVER  
PINE FLAT RESERVOIR

variety of fishlife. Rainbow trout was the principal resident fish population present in a 48 mile section of stream below the damsite and also in the reach above the damsite. These areas provided an excellent sports fishery which the DFG estimated had received an average annual use of 10,000 angler days per year. The fishery was maintained by natural propagation and by stocking of catchables and fingerlings by the DFG. Other game species present were brown trout and smallmouth bass, neither of which were as common as rainbow trout. Non-game species include Sacramento Squawfish, western sucker, hardhead, and sculpin. The occurrence of king salmon in the lower Kings River was reported during the period prior to the construction of Friant Dam on the San Joaquin River (1947) (see Case Study #63).

### III. Project Development

The Kings River project, including Pine Flat Dam and downstream channelization, was authorized under the Federal Flood Control Act of 1944. The Bureau of Reclamation operated the dam and administered the storage of irrigation water under a series of interim contracts with the Kings River Conservation District. The district entered into a permanent contract with the Bureau in 1963, giving them exclusive and perpetual rights to use of storage subordinate only to flood control purposes. There were no required releases for fishlife during the initial post-project period.

In 1964 the District (KRCB) applied to the State Water Resources Control Board for a permit to appropriate more water on the upper Kings River watershed through an enlargement of Courtright Reservoir on Helms Creek (see Figure 2). The DFG protested this application and agreed to withdraw its protest in exchange for certain minimum releases in the Kings River below Pine Flat Dam. At this time there were already terms requiring minimum releases for fishlife at Courtright Dam included in the state water rights permit (No. 16469) and the Federal Power Commission license (FPC 1988). In the final agreement between DFG and the district it was required that these terms be included in the new water rights permit issued for the Courtright project and that certain minimum flow releases for Pine Flat be established.

The DFG determined the minimum instream flow requirements for the Kings River using the usable width method (DFG 1964). A series of measurements were made at four riffle areas. Controlled releases from the dam were not provided during the study. The criteria that were applied during the survey are listed below as described by the DFG (1964).

1. Approximately 50 percent of the bottom area exposed to an average velocity of .7 cfs (temperature was not considered a critical factor).
2. Wetting of 75 percent of normal riffle width.
3. An average depth of .5 feet.

As a result of the department's study and negotiations with the district, the flow schedule shown on Table 1 was designed and included in the terms of the final 1964 agreement.

#### IV. Post-Project

The operation of Pine Flat Dam for irrigation and water conservation created a change in the seasonal distribution of streamflow patterns. Irrigation demands in the summer months generally maintain streamflows above 2,000 cfs (see Figure 3). Reduction of this flow regime occurs in October when irrigation demands cease. During the period prior to the release agreement (1955-1964), streamflows were reduced to less than 50 cfs and occasionally no release was made at the dam, resulting in dewatering of the channel.

Below the dam where streamflows empty onto the San Joaquin Valley floor water is immediately distributed into irrigation canals. As a result there is no streamflow in the lower river channels during most years and Tulare Lake Basin is kept dewatered. The channelization of this lower section and the operation of Pine Flat has eliminated riparian habitat along with numerous oxbow lakes and vernal channels.

The operation of Pine Flat Dam has also influenced the upper river watershed by making it possible to re-regulate streamflows, thereby permitting construction of upstream reservoirs and power plants. The modulation of outflow from Courtright and Wishon power plants is accomplished by means of a contract between



Table 1

MINIMUM INSTREAM FLOW RELEASE REQUIREMENT  
SCHEDULE FOR PINE FLAT DAM

Unimpaired runoff of Kings River at Piedra for water year in acre-feet	Minimum Flows for Period		
	Oct. 1 - Nov. 15	Nov. 16 - Mar. 31	Apr. 1 - Sept. 30
1,000,000 or less	50 cfs	50 cfs	50 cfs
1,100,000	60	50	60
1,200,000	70	50	70
1,250,000	75	50	75

Pacific Gas and Electric Company and the Secretary of the Army.

The Kings River supports a mixed trout and warmwater fishery. Prior to the establishment of the minimum release schedule in 1964 rainbow trout populations were difficult to maintain due to periodic dewatering and the presence of large nongame fish populations. The nongame species, more tolerant to low flow conditions, were so abundant that the lower river was chemically treated in 1961 to control the large populations. Shortly after chemical treatment, the river was stocked with approximately 200,000 rainbow trout and 20,000 brown trout.

Presently the DFG manages the lower section of the river as a catchable trout stream with annual stocking. Angler use of the river below the dam is estimated by the department at approximately 40,000 angler days per year.

The Kings River immediately above Pine Flat Reservoir supports significant populations of nongame fish. These populations are difficult to control due to the presence of the warm reservoir that is highly suitable for propagation and rearing of many nongame species. Presently the river at the headwater of the reservoir is open to underwater spearfishing from July 1 to December 31 of each year.

#### V. Conclusion

The operation of Pine Flat Dam for the primary purpose of supplying irrigation water generates large instream flows (greater than 2,000 cfs) during the irrigation season (April through

September) while in the fall and winter limited releases are made. Until 1964, none of the reservoir storage was allocated for instream flow reservations for fish and wildlife in the Kings River. Consequently, the river was occasionally dewatered and subjected to periods of low flow leading to the death of fish populations below the dam.

In 1964, the DFG managed to reenter the Pine Flat project for purposes of acquiring an instream flow reservation by a rather indirect method, which consisted of protesting a water rights application for the enlargement of another Kings River project (Courtright Dam) that has the same sponsor as Pine Flat (KRCD). The protest was to be dismissed if an instream flow reservation for Pine Flat could be established. As a result of negotiations an enlarged Courtright Reservoir was required to provide water for release below Pine Flat.

The DFG employed a usable width method in the determination of minimum instream flow for the river below Pine Flat. The minimum instream flow reservation has four basic schedules that depend upon the annual natural runoff of the Kings River during the course of the water year.

The flow schedule is effective in preserving the fishery resource below the dam downstream to the lower river where irrigation canals capture all the flow. Although the river does not support large self-propagating populations of wild trout, a catchable trout fishery is maintained by the instream flow reservation and annual stocking to offset the effects of heavy angling pressure on the river (40,000 angler days per year).

BIBLIOGRAPHY

Personal Communications

Toffoli, Eugene. 1976. California Department of Fish and Game.

References

California. Department of Fish and Game. 1964. Initial follow-up report of North Fork Kings River - Cartright, Wishon and Pine Flat Reservoirs downstream effects. 40 pp.

Kings River Conservation District. 1974. Kings River Conservation District report. 28 pp.

U. S. Federal Power Commission. 1965. Kings River Basin, California, planning status report. 9 pp.