

CASE STUDY REPORT #73
ISABELLA PROJECT
KERN RIVER

I. Project Description

The Kern River drainage lies to the southeast of Bakersfield, California, at the southern end of the Sierra Nevada in Kern and Tulare Counties. As the river flows from the mouth of the Kern Canyon to Bakersfield, most of the water is used for irrigation and the balance, if any, flows into Buena Vista Lake Basin, 20 miles southwest of Bakersfield, where it recharges the groundwater and evaporates.

The Kern River at the Isabella project area drains an area of 2,075 square miles that has an average annual precipitation of 10 inches. Air temperatures range from summer maximums of 100 degrees to winter lows of about 30 degrees.

The Army Corps of Engineers completed the construction of Isabella Dam near the junction of the North and South Forks of the Kern River in 1954. Isabella Reservoir, covering 11,400 acres and storing 570,000 acre-feet of water, is operated by the Corps of Engineers for purposes of flood control power production and irrigation.

The inflow to the reservoir is affected by the Kern Powerhouse Number 3 on the North Fork. Occasionally the inflow from the North Fork is diverted into the old Borel Canal which supplies the Southern California Edison Borel Powerhouse 7 miles below Isabella Dam. When the water level is less than 110,000 acre-feet

in Isabella Reservoir this diversion is used, and at higher water levels common to normal water years an aqueduct at Isabella Dam conveys water to the penstocks of the Borel Powerhouse (see Figure 1).

Below the Borel Powerhouse Southern California Edison (SCE) operates Democrat Diversion Dam supplying Kern River Powerhouse No. 1 (FPC project 1930) and Pacific Gas and Electric operates the Kern Canyon power project (FPC 178) (see Figure 1).

Of the 32 miles of river from Isabella Dam to the San Joaquin Valley, some 19-1/2 miles are subjected to the effects of the diversions and operations of Isabella Dam and the three hydro-electric plants (see Figure 1).

II. Pre-Project Condition

The Kern River channel below Isabella Dam was formed by natural flows ranging from a mean monthly flow of 2,300 cfs in May to an average low flow of about 230 cfs in October (see Figure 2). The lowest flow on record in this portion of the Kern River is about 75 cfs.

The Kern River at the project area was a broad alluvial valley at the junction of the North and South Forks of the Kern River. The stream was a mid-elevation (2,600 feet) coarse-bottomed stream capable of supporting a variety of fish life. The most important fish population present was rainbow trout which had supported a high quality sport fishery. No data were found quantitatively describing the fish populations present or angler use prior to 1955.

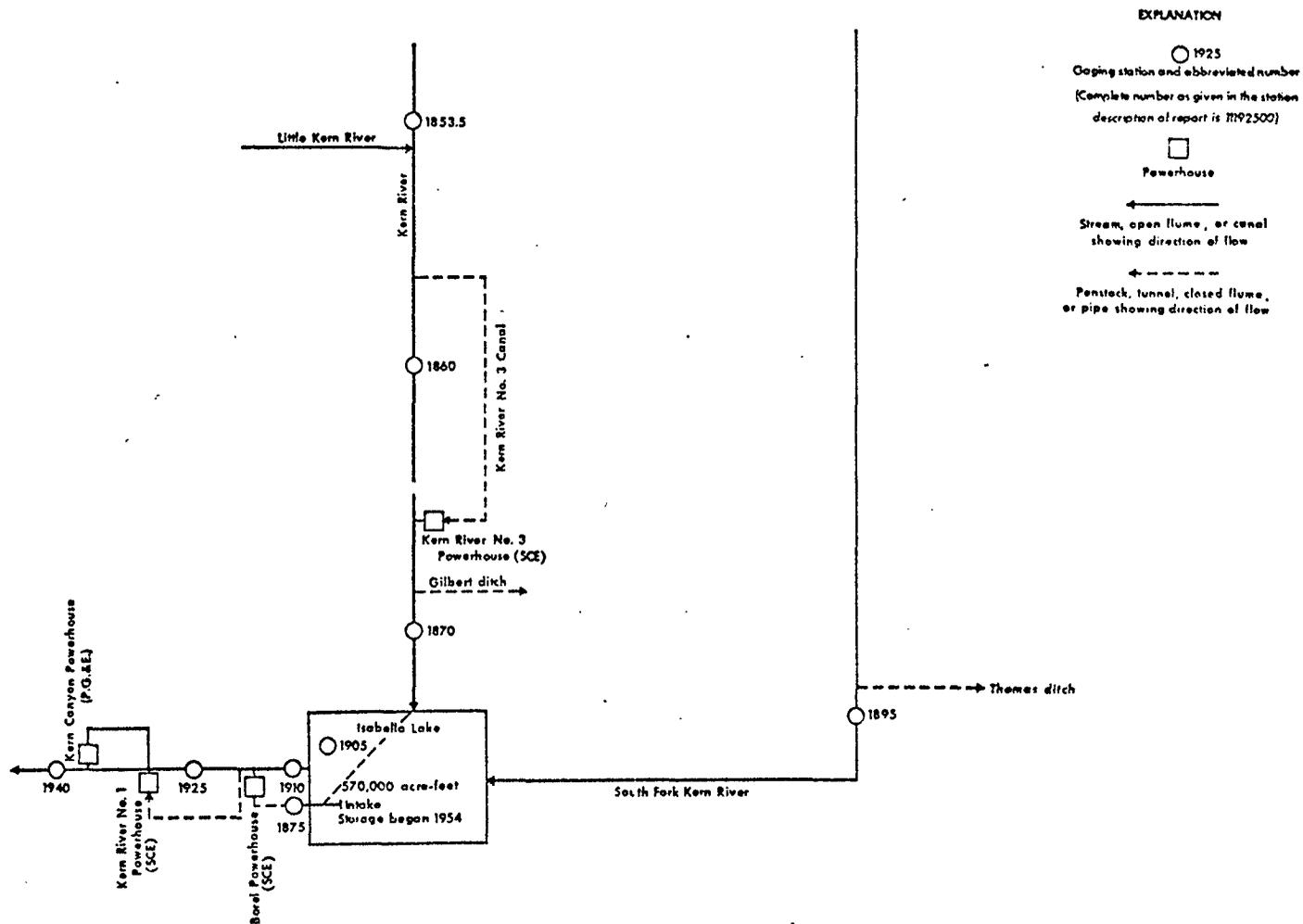
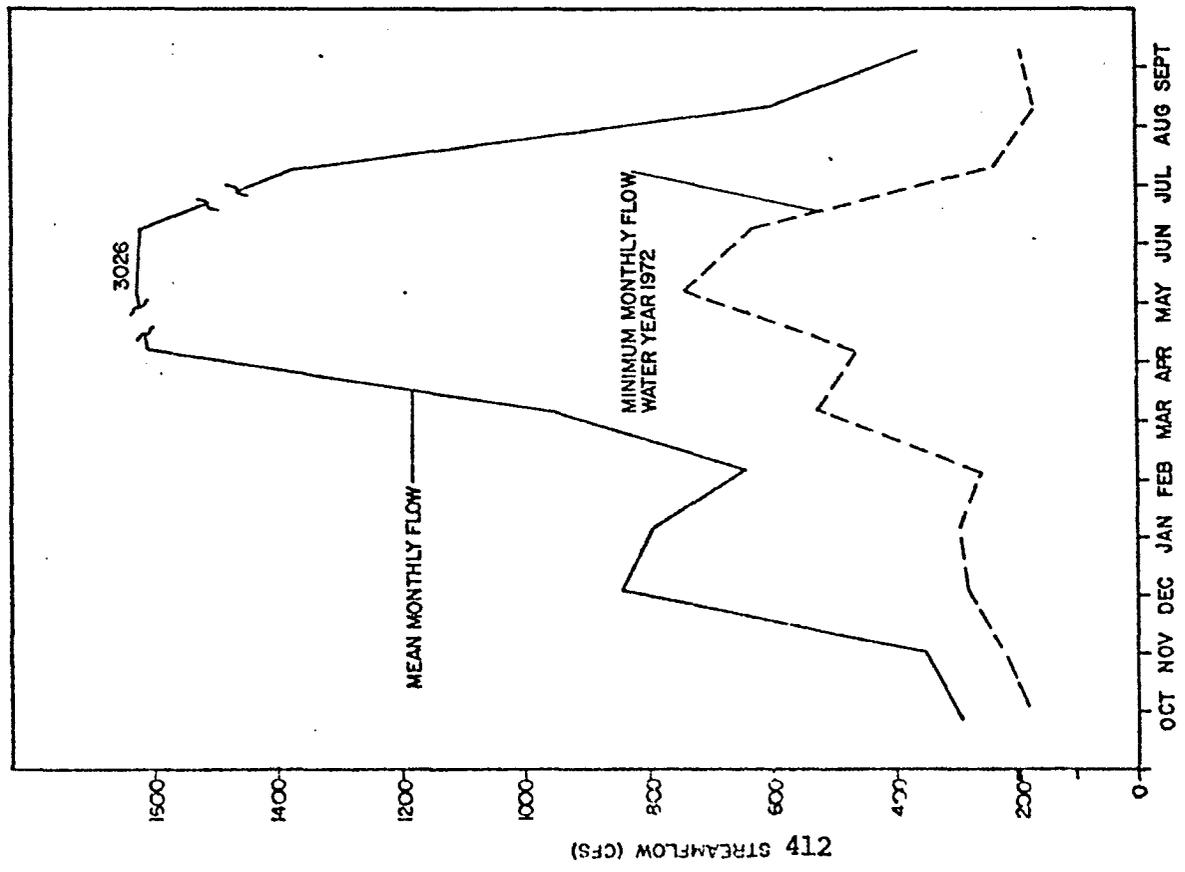
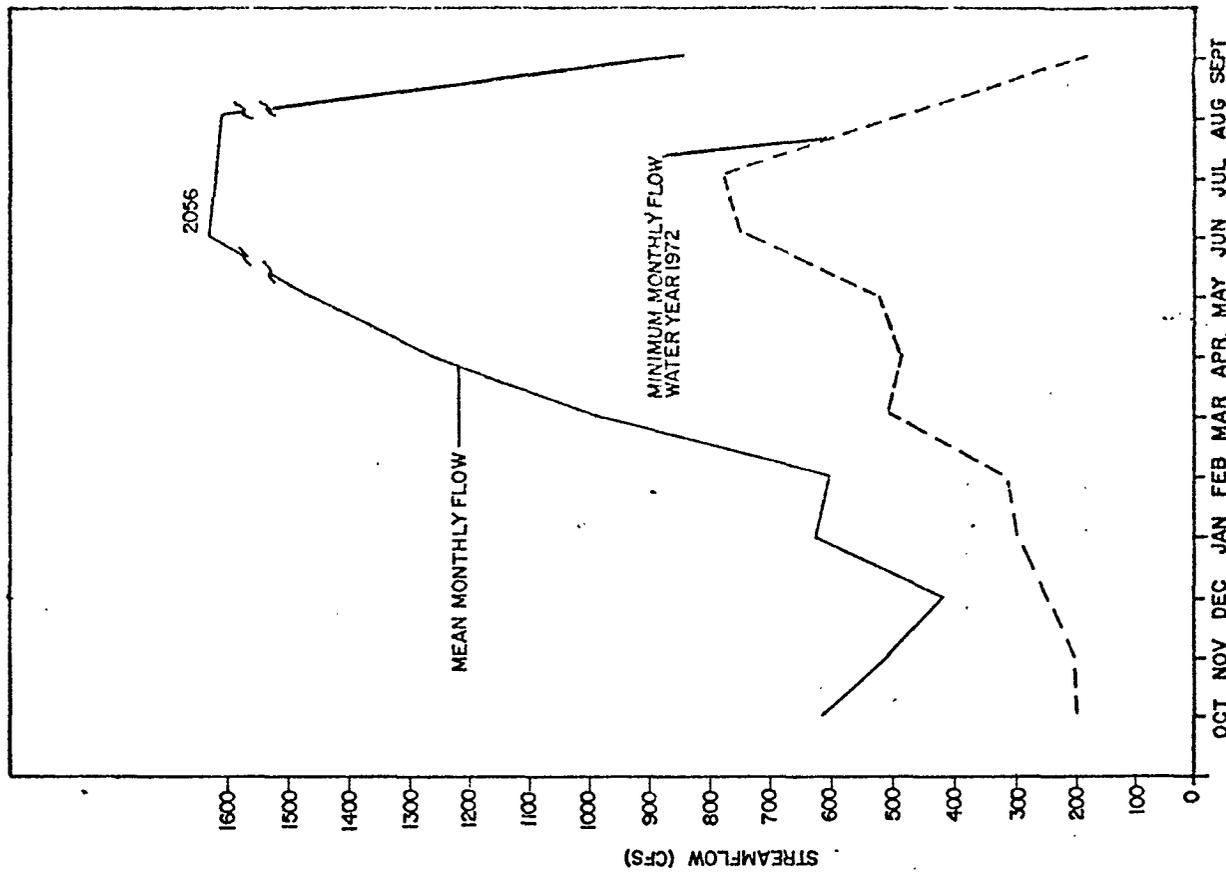


Figure 1

SCHEMATIC DIAGRAM SHOWING DIVERSIONS AND
STORAGE IN KERN RIVER BASIN

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

POST-PROJECT: OCTOBER 1964 - SEPTEMBER 1975
GAUGE STATION NO.
SOURCE: USBR OUTFLOW DATA



PRE-PROJECT: OCTOBER 1964 - SEPTEMBER 1975
GAUGE STATION NO.
SOURCE: UNPUBLISHED INFLOW DATA, USBR.

FIGURE 2
STREAMFLOW CONDITIONS, KERN RIVER
ISABELLA RESERVOIR

III. Project Development

The water rights license for the Isabella project and the Federal Power Commission License for the Borel project (FPC382) do not provide for fishery or recreational releases below the diversions. There also is no release provision for PG&E's Kern Canyon Project that is situated at the mouth of the Kern Canyon. These two power projects (Borel and PG&E Canyon Powerhouse) are scheduled for relicensing in 1975 and are presently operating under annual license from the FPC. The Kern Powerhouse No. 1 project operated by the SCE is scheduled for relicensing in 1996. This license was altered in 1949 to provide for a 50 cfs recreational release from June through September of each year. Since the operation of Isabella Dam began in 1954 this 50 cfs streamflow is dwarfed by irrigation releases from Isabella Reservoir.

The Department of Fish and Game has reviewed Southern California Edison Company's application for relicensing of its Borel project, FPC No. 382 and the actions and recommendations taken by the department are described in the paragraphs below as stated in a DFG 1973 Memorandum.

"For the past several years, the California Department of Fish and Game, in cooperation with the U. S. Forest Service, Bureau of Land Management, Bureau of Sport Fisheries and Wildlife, Southern California Edison Company (SCE), and Pacific Gas and Electric Company (PG&E) has conducted fish and wildlife studies on Kern River below Isabella Dam in order to evaluate the effects of the various water developments.

The primary object of the studies was to determine the optimum fish and wildlife and recreation water releases below Isabella Dam (Borel diversion), Democrat Dam (KRL diversion) and below the Kern Canyon Project diversion dam. The entire lower Kern River (from Isabella Dam to the mouth of the Kern Canyon) including the diverted sections of three hydroelectric projects - SCE's Borel Project (FPC 382) and KRL Project (FPC 1930) and PG&E's Kern Canyon Project (FPC 178) was considered as one interrelated whole rather than several river reaches divided by the various water development facilities."

"These studies include fish catch and angler use surveys, fish population studies, fish habitat surveys, water temperature studies and wildlife population and utilization surveys from South Creek (3 miles above the KR3 diversion dam) to the San Joaquin Valley floor at Kern Canyon Powerhouse.

"As a result of the cooperative studies the State has developed preliminary recommendations for flow releases below the effective diversion points of the SCE's Borel Project and PG&E's Kern Canyon Project. In addition, preliminary recommendations have been developed for modification of the currently stipulated flow release below SCE's KRL diversion. We (DFG) propose that the new licenses of SCE's Borel Project and PG&E's Kern Canyon Project be issued for a 20 year period to terminate coincident with the expiration of the existing license of SCE's KRL Project on April 30,

1996. These recommendations are subject to revision after discussion and review with the concerned agencies.

"The following recommendations are based on a twenty year study-evaluation period. Flows of 40, 80 and 120 cfs would be released for periods of 5 years each for the first 15 years. For the last 5 years of the 20 year period the median flow of 80 cfs would be the minimum flow released. During this latter period, all concerned parties including the public agencies and SCE and PG&E would cooperatively review and evaluate the study data as the basis for 'permanent' flow recommendations in project licenses issued after April 30, 1996." (see Table 1)

IV. Post-Project

Under the present operating conditions of Isabella Dam, the high flow period on the lower river is generally from March to about mid-September when irrigation releases from Isabella cause streamflows to range from 100 cfs to over 1,500 cfs (see Figure 2). During the remainder of the year (fall and winter months) the flows in the section below Isabella are drastically reduced from natural conditions. In the period 1955 to 1968 there were 70 days with flows less than 5 cfs in this first section of river (Isabella to Borel).

Other adverse effects of the Kern River developments that have been noted by the DFG are:

1. Sand and silt deposits below diversions.

Table 1

PRELIMINARY FLOW AND STUDY RECOMMENDATIONS
 LOWER KERN RIVER HYDROELECTRIC PROJECTS
 BOREL (FPC 382), KRI (FPC 1930) AND KERN CANYON (FPC 178) PROJECTS

<u>Year</u>	<u>Year-Around Flow</u>	<u>Activities</u>
1975	-	Borel and Kern Canyon Project licenses expire Reopen KRI license
1976 to 1980	40 cfs (except 80 cfs May 1 through Sept. 30)	Water temperature monitoring Angler use counts Creel census (determine catch rates and return) Tag studies Game fish growth studies Studies of bottom fauna Fish population sampling Fall, 1980 - Establish controls on fish populations for evaluation of next 5 year trial-flow period such as fish marking and recapture studies, age and growth studies or fish eradication.
1981 to 1985	80 cfs	Studies same as during first study flow Fall, 1985 - same as Fall, 1980
1986 to 1990	120 cfs	Studies same as during first study flow Fall, 1990 - same as Fall, 1980
1991 to 1996	Return to 80 cfs	Review all data Finalize permanent flow
April 30, 1996		Borel, KRI and Kern Canyon Project licenses expire Begin permanent flow

All studies would be cooperatively planned, conducted, and evaluated by Department of Fish and Game, U. S. Forest Service, Bureau of Land Management, U. S. Fish and Wildlife Service, Southern California Edison Company and Pacific Gas and Electric Company. Each power company would finance the studies in proportion to the effects of its projects on lower river fish and wildlife.

Additional recommendations:

- (1) SCE or the U. S. Corps of Engineers should provide a fish screen for Borel Canal.
- (2) SCE should provide safety devices (such as effective fencing or safety ropes or ladders) for Borel Canal and Borel Forebay.
- (3) Sudden flow changes below Isabella Dam, Democrat Dam and the Kern Canyon Project diversion dam should be avoided to the maximum extent possible.

2. Loss of spawning gravel recruitment.
3. The occasional blockage of trout spawning migration from Isabella Reservoir at the North Fork headgates for old Borel Canal.
4. Occasional loss of North Fork inflow causing depleted oxygen levels to occur in the reservoir.

The streamflow alteration and other detrimental effects have favored the development of nongame fish population (mostly hardhead, suckers and squawfish) while the production, abundance and year round carrying capacity for game fish has been greatly reduced. The table presented below shows estimated weights per mile of nongame and game fishes for each of the sections of the Kern River from Kern Canyon Powerhouse as described by the DFG in 1971.

KERN RIVER FISH BIOMASS, 1971

	<u>Non-game Fish Biomass per mile (lbs.)</u>	<u>Game fish Biomass per mile (lbs.)</u>
Kern Canyon Powerhouse to KRI Powerhouse (diversion point for PG&E)	3,287	27
KRI Powerhouse to Democrat Dam	3,209	148
Democrat Dam to Borel Powerhouse*	4,552	162
Borel Powerhouse to Isabella Dam	1,804	244**

* Full-flow section

** Includes 209 lbs./mile of planted trout

Source: California Department of Fish and Game, 1971.

The Department of Fish and Game is attempting to rehabilitate the fishery on the lower Kern River by a program of eradication and restocking which was initiated in November, 1972. These reaches, under existing conditions cannot support the usual high demand for fishing without heavy stocking of hatchery-reared trout. In the fall and winter months the fishery cannot be maintained even with supplemental stocking due to the almost total dewatering of these reaches (DFG Memorandum).

As a result of its proximity to population centers, good access and favorable year-around weather and other factors, the Kern River below South Creek is subject to probably the highest angling pressure, per mile, of any stream in the southern half of the state. In 1971, during the general angling season, May 1 to November 15, the 56 miles of Kern River from South Creek to the San Joaquin Valley floor at Kern Canyon Powerhouse received an estimated 120,730 angler-days of use (this figure does not include angling use on Isabella Reservoir) in 1971. Thirty-six percent of the total, about 43,570 angler-days, were expended between Isabella Dam and Kern Canyon Powerhouse. The breakdown of this use by stream section is as follows:

KERN RIVER ANGLER USE MAY 1 - NOVEMBER 15, 1971 *

	<u>Use in Angler Days</u>	<u>Miles of Stream</u>	<u>Angler Days Per Mile For Season</u>
Kern Canyon Powerhouse to KR1 Powerhouse	714	1.8	397
KR1 Powerhouse to Democrat Dam	25,343	10.3	2,460
Democrat Dam to Borel Powerhouse **	12,714	13.0	978
Borel Powerhouse to Isabella Dam	4,800	7.4	649
Isabella Reservoir to KR3 Powerhouse **	25,343	5.3	4,782

* One angler-day was assumed to consist of 3.5 angler-hours. This figure was based upon angler surveys conducted since 1963 on the Kern River.

** "Full-flow" sections of the river.

Source: California Department of Fish and Game Memorandum Report.

V. Conclusions

The operation of Isabella Dam to supply irrigation water generates large instream flows (greater than 900 cfs) during the irrigation season (April through September), while in the fall and winter the instream flow is greatly reduced. None of the storage in Isabella reservoir is allocated for downstream fish and wild-life needs and as a result the downstream fisheries are subjected to extreme degradation during flows less than 5 cfs. Instream flow variations and other influences have favored the development of non-game fish populations and greatly reduced rainbow trout populations.

The Federal Power Commission is currently considering an application for the relicensing of Southern California Edison Company's Borel Project (FPC 382) which is closely associated with the operation of the Isabella Project. Resulting from cooperative studies conducted by DFG, USFWS and the power company, a recommendation for a 20-year instream study evaluation period was proposed for inclusion in a new 20-year license to be issued for the Borel project and the Kern Canyon project (licenses for both projects expired in 1975). The studies conducted and future planned studies constitute a rather comprehensive ecological investigation of the Kern River and will include habitat surveys of water temperature, fish growth, and benthic invertebrate studies along with angler use, catch rate and tagging studies. The effectiveness of this type of long-term ecological investigation in preserving the fish and wildlife resources of the Kern

River area will be analyzed in a series of 5-year periods if all the proposed terms are included as a stipulation to the new FPC license.

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