AQUATIC / WATER RESOURCES MANAGEMENT PLAN

SEQUOIA & KINGS CANYON NATIONAL PARKS

Prepared by
Sequoia & Kings Canyon National Parks
APRIL 1984

NATIONAL PARK SERVICE / U.S. DEPARTMENT OF THE INTERIOR

AQUATIC/WATER RESOURCES MANAGEMENT PLAN

SEQUOIA AND KINGS CANYON

NATIONAL PARKS

Prepared by
Sequoia and Kings Canyon
National Parks
Western Region
National Park Service
Department of the Interior
April 1984

Recommended by: _____ Date 4/18/84
Superintendent

Approved by: _____ Date 4/27/84
Regional Director

TABLE OF CONTENTS

PART 1

DESCRIPTION

OF

AQUATIC/WATER RESOURCES AND PROBLEMS

I. INTRODUCTION

Aquatic resources are well represented throughout Sequoia and Kings Canyon National Parks. There are about 2,650 lakes and ponds and thousands of kilometers of small rivers, mountain creeks, and intermittant streams. Other aquatic resources include cold-water springs and seeps, warm springs, soda springs, wet meadows, ephemeral pools, and an extensive winter snow-pack that occasionally lingers throughout the summer in small patches. Ground waters occur both in joints in the bedrock as well as in shallow, typically granitic soils. Some park caves contain underground streams, lakes, and small pools; many caves contain active speleothems which are formed secondarily as the result of aquatic processes.

Headwaters in a typical drainage originate between 2,700 and 3,700 m (8,900 - 12,100 ft), and begin either as small seeps and creeks or in cirque lakes. In many areas, water flows through wet meadows and small alpine lakes. From here, the small streams rapidly join to form larger streams and eventually rivers ranging up to 30-50 m (98 - 164 ft) wide. Drainage patterns are usually dendritic and typically flow west (except for the Kern drainage which flows south). Gradients are often steep.

The largely granitic basins have waters with low concentrations of charged constituents. Thus a high potential exists for water to be altered significantly by human activities. Being oligotrophic and poorly buffered, water is particularly susceptible to nutrient contamination (fecal waste, detergents, etc.) and acidic deposition.

Though vulnerable to human abuse, conversely, aquatic/water resources are one of the most hazardous resources that the visitor confronts. Nearly as many people die due to natural aquatic hazards than all other Park hazards combined (Powell, pers. comm.). Visitors seem to take precautions to protect themselves from snakebite and falling off cliffs, but water attracts visitors. They camp close to it, drink from it, swim in it, and fish in it; and when streams are high and the water is cold, the attraction to water causes some people to die in it. Water also can carry harmful disease agents (e.g. Giardia, Campylobacter, and Salmonella), and provide a home for disease bearing organisms to live such as mosquitos which may carry encephalitis. In managing aquatic resources, not only must the fragile aquatic systems be protected, but visitors must be informed of the potential hazards and how to avoid them.

This plan identifies the goal and objectives, and actions for management of aquatic/water resources. To do this, the plan presents an overview of the aquatic/water resources and lists known problems.

An Aquatic/Water Resources Management Program is presented that identifies the minimum standards at which the program should be implemented. An Aquatic/Water Resources Projects Programming Sheet, List of Continuing and Proposed Projects, Project Statements, and 10-237's and 10-238's are attached.

II. INFORMATION BASE

A. Present Status of Parks' Aquatic/Water Resources

Historically water in these Parks had been managed for human consumption and recreation. Maintaining natural aquatic systems was not a consideration, and as a result the aquatic resources are probably among the most altered resources in these Parks.

To this day, fish are one of the few park resources that can be harvested. Beginning in the mid to late 1800's, fish were planted extensively throughout the Sierra Nevada (Christensen 1977). Not only were native species translocated to waters formerly barren of fish, but new species were also introduced (e.g. brook trout from the eastern United States and brown trout from Europe). In so doing, native Little Kern golden trout became threatened by genetic introgression, and today requires special management to protect its survival.

In addition to fish, other exotic organisms were also introduced (e.g. Anacharis canadensis). Some exotics were probably introduced by waterfowl, anglers, or as the result of fish planting (Taylor and Erman 1978), but at least one amphipod (Hyalella azteca) and one alga (Nitella sp.) were intentionally introduced at Rae Lakes by the Department of Fish Culture in 1919 (Colman 1925).

More recently, larger organisms were introduced. From 1949 to 1952, beaver were moved to sites south of Sequoia National Park in the Kern drainage (Townsend 1979). They quickly moved up into the park building dams, altering aquatic habitat, and changing structure of the streamside riparian vegetation.

Other water management activities were related to human consumption. At least nine stream sections used as public water supplies were closed to fishing primarily to protect those streams from human waste. Even today there are water diversions for both public and private use.

As the park was developed, septic tanks proliferated. In the 1950's most old septic tanks were replaced by sewage treatment facilities, but many facilities were not adequate to handle the continuing increase in system demands and aging of the treatment facilities. At Giant Forest, Lodgepole, and Grant Grove, contaminated water leaked into streams.

Effluent monitoring at sewage treatment sites ensures compliance with State regulations and facility permit requirements. The requirements are designed primarily to ensure protection of public health and to avoid unacceptable degradation of surface and ground waters; they do not necessarily guarantee that the effluent from sprayfields will not alter local aquatic environments.

Some waters are captured within the Park and used to generate electricity. A conduit with a capacity of about 90 CFS (Jordan/Avent & Associates 1980) transports water diverted from both the Marble and Middle Forks of Kaweah to the Kaweah No. 3 power plant. Since 1964, permits specified that a minimum flow of 11 to 30 CFS (depending on time of year) would not be diverted. Water has been diverted since 1913; and before the minimum flow requirement was instituted in 1964, operation of the power plant during periods of low flow removed most water and may have caused serious problems with the ecology of the river. Water is also diverted from the East Fork of the Kaweah River for similar purposes. Though diverted below the Parks' boundary, a series of dams was constructed in an upstream area that is currently part of Sequoia National Park. The dams were built to provide partial regulation of flow to the diversion.

B. Legal and Jurisdictional Issues

Though these Parks have exclusive jurisdiction over almost all of the land within its boundaries, all permitted water management facilities are regulated by the local Water Quality Control Board; and as required by the Clean Water Act (P.L. 95-217), our water management is to comply with state and local water quality standards. This is not to suggest that natural conditions that exceed State standards require mitigation, but it might limit use of such waters for public consumption or contact recreation. The Water Quality Control Board recognizes the value of maintaining pristine conditions.

Today, all portions of these Parks, except for the San Joaquin drainage, are located within the water quality management planning unit called the "Tulare Lake Basin". The unit is under the authority of the California Water Quality Control Board, Central Valley Region (5).

The State Water Resources Control Board (SWRCB), operating under the authority of Division 1, Chapter 2 of the Water Code, various provisions of the Porter-Cologne Water Quality Control Act, and other provisions of the Water Code, coordinates statewide

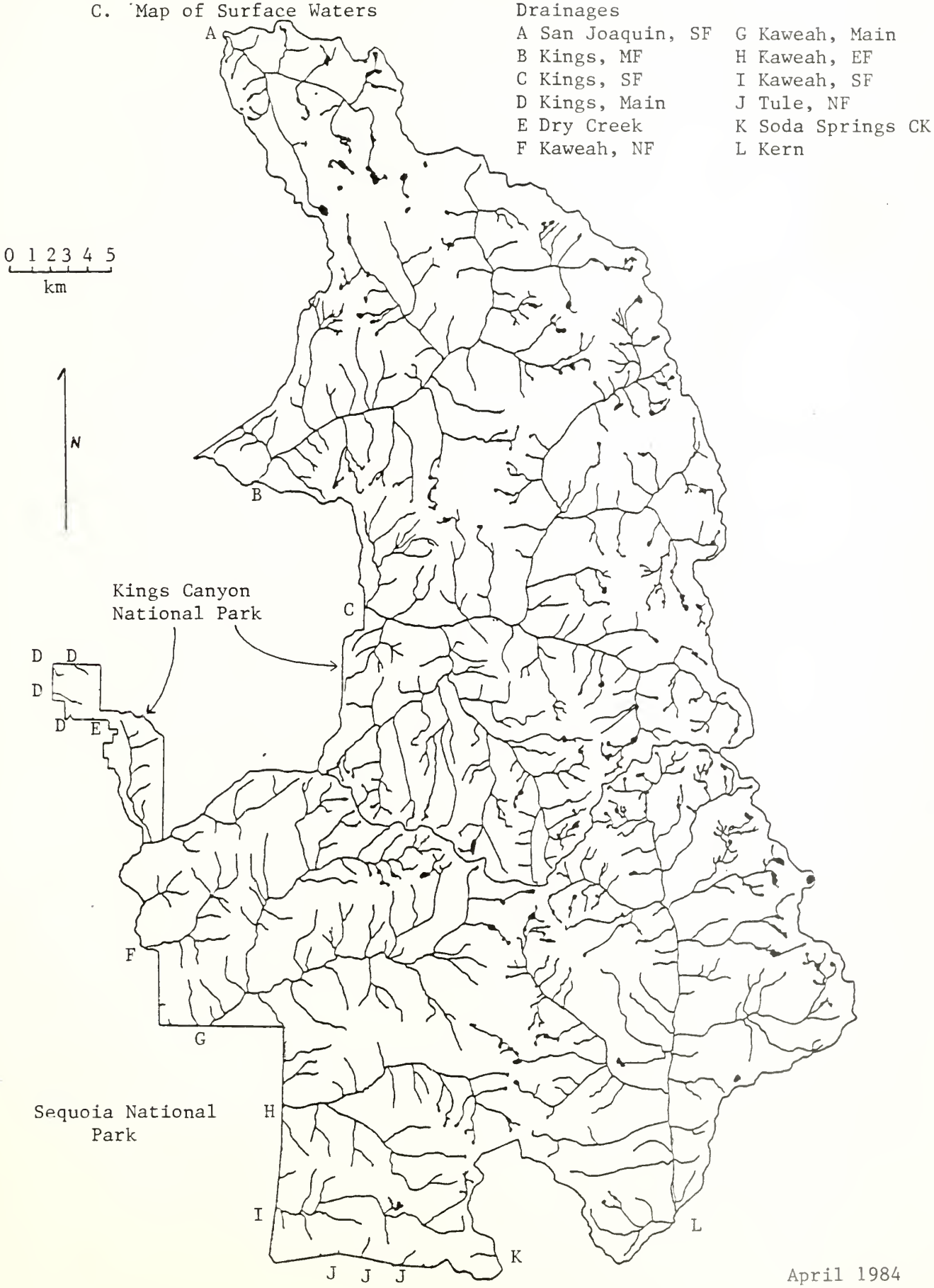
> planning. In addition, the SWRCB exercises adjudicatory and regulatory functions of the State in the field of water resources, administers water rights, provides for consideration of water pollution and water quality, sets statewide water quality control policy and guidelines, conducts water quality research, and administers water quality aspects of the California Water Plan (from State Water Resources Control Board 1975).

Though we have historically been required to monitor permitted facilities, both research and routine monitoring of potential management impacts on aquatic resources is relatively recent. Water quality and limnological investigations have been done in several areas. Several lakes draining into headwaters of the South Fork of the Kings River were studied in the late 1970's (Erman 1977, Erman and Taylor 1978, Silverman and Erman 1979, Taylor and Erman 1979, Taylor and Erman 1980). Water chemistry of East Fork of the Kaweah River was reported by several State and Federal agencies (Dean 1971, 1979; Federal Water Pollution Control Administration 1979; Troyer 1971, 1973). High lakes were surveyed for pH and trace elements in 1965 by Bradford, et al. (1968). This survey was repeated in 1980, 1981, 1982, and 1983. James (1975) studied human impacts on two lakes in the Kaweah drainage, and Hoffman and Ferreira (1976) examined effects of two fires in the Roaring River drainage on water quality.

Need for a parkwide water quality monitoring program resulted from P.L. 92-500 and a Memorandum of Understanding with EPA. A monitoring program was initiated and funded by the NPS, Western Regional Office in 1978. The U.S. Geological Survey in Menlo Park, California, developed the program in collaboration with the NPS. Portions were implemented annually during 1978, 1979, and 1980. This included a reconnaissance of major streams, and continuous measurement of water temperature, flow, and conductivity at those low-elevation streams. Monitoring by the Parks began in 1981, but only occurred during summer. Initially, it was oriented toward providing baseline information for 20 long-term monitoring stations but expanded to include relating management practices and visitor use patterns to water quality impacts and public safety.

In 1982, a major inter-disciplinary program began investigating effects of atmospheric deposition on the Parks' natural resources. This study will provide a limnological investigation of three study areas: one located in an alpine area, another in a mid-elevation mixed conifer forest, and the third at a foothill chaparral site.

C. Map of Surface Waters



April 1984

D. Classification of Surface Water by Existing Uses

Sites applicable to different types of use are identified below. The (p) or (s) in parentheses indicates primary (p) or secondary (s) use.

1. Public Water Supply

a. Alder Creek (s)

b. Atwell Mill (unnamed creek; s)

c. Bearpaw (unnamed spring; s)

d. Cascade Creek (s)

e. Clover Creek Plant (s)

f. Cold Springs (s)

g. Copper Creek (s)

h. Crystal Cave Parking Lot (unnamed creek; s)

i. Dorst (unnamed creek; s)

j. Hospital Rock (unnamed spring; s)

k. Lost Grove (unnamed spring; s)

l. Mineral King Pack Station (unnamed creek; s)

m. Paradise Creek (s)

n. Round Meadow (s)

o. Silliman Creek (s)

p. Silver City (s)

q. Sheep Creek (s)

r. South Fork Kaweah (s)

s. Tharp's Creek (s)

t. Wolverton Creek (s)

2. Non-public Water Supply

   a. Cabin Creek (s)

   b. Lewis Creek (s)

   c. Lookout Point (unnamed spring; s)

   d. Red Fir (unnamed creek; s)

   e. Redwood Mountain Spring (s)

   f. Silver City (unnamed creek; s)

3. Maintenance of Ecosystem, General

   All aquatic resources of natural origin except as otherwise listed (p)

4. Maintenance of Ecosystem, Species of Special Interest other than Threatened and Endangered Species

   a. Kern River (s) - for *Salmo aquabonita gilberti* (Kern trout)

   b. Kaweah River (s) - for *Oroperla barbara* (a primitive stonefly), *Corydalus cognata* (a dobson fly), and undescribed *Denterophlebia sp.* (a mountain midge).

5. Maintenance of Ecosystem, Threatened and Endangered Species Indigenous to Parks

   a. Soda Springs Creek (p) - for *Salmo aquabonita whitei* (Little Kern golden trout)

   b. Coyote Creek (s) - for *Salmo aquabonita whitei*

6. Recreational Purposes, Contact

   a. All rivers, streams, and lakes except as otherwise noted and closed areas.

   b. Kern Hot Springs (s)

   c. Snowpack (s)

7. Recreational Purposes, Non-contact

   a. All natural rivers, streams, and lakes except as otherwise noted and streams closed to fishing (s)

8. Agricultural, Source of Livestock Water Supply

   a. Creek above Ash Mountain rifle range (s)

   b. All rivers, streams, and lakes in areas not closed to stock (s)

9. Disposal of Sewage Effluent

   a. All park sewage ponds (p)

   b. All creeks, seeps, and ground water draining sewage sprayfields (s)

E. Floodplain Management

None of the Parks floodplains have been identified or mapped. Some of the Parks developments, particularly at Cedar Grove, Lodgepole, Mineral King, and Buckeye, could be within floodplain boundaries. A project statement (W-4) has been submitted addressing the need for mapping floodplains.

F. Water Quantity

Most of the Parks' estimated 2,650 lakes and ponds are located at high elevations, above 2,700 m (8,900 ft). Though a few of the lakes exceed 30 ha (74 ac), most are only several hectares to less than a hectare in surface area. They vary in depth from 20 m (66 ft) to less than one meter (3 ft).

There are an estimated 2,453 km (1,524 miles) of mapped rivers and streams. There are probably several times as many kilometers of unmapped, primarily intermittent streams. The size of each drainage and total kilometers of mapped rivers and streams are listed in Table 1.

Two warm springs occur in the Kern drainage and three soda springs in the Kaweah drainage. All of these springs are small. Cold water springs and seeps are common throughout these Parks.

Wet meadows are common in both forested and alpine areas from 1,800 m to 3,600 m (5,900 - 11,800 ft). Wet meadows vary in size from less than one hectare to several hectares.

Though snow occasionally falls at all elevations within these Parks, the snowpack accumulates primarily at elevations above 1,500 m (4,900 ft). From mid-February to mid-March, the snow depth averages about 1 1/2 m (5 ft) at 2,400 m (7,900 ft) and 4 m (12 ft) deep at 3,200 m (10,500 ft) (Kraushaar, pers. com.). Most of the snowpack forms during January through March; but at high elevations (≈3,600 m), it may last into mid-July or early August. Early in the season, the snow moisture is about 30%, this increases to about 50% about May.

Table 1. Size of Drainages and Streams

Drainage	Area (ha)*	Mapped Stream Length (km)*	Estimated Discharge (l/sec.)*
South Fork, San Joaquin	16,816	107	1,000-4,000**
Middle Fork, Kings	63,066	384	1,400-4,000**
South Fork, Kings	100,172	758	1,700-82,000
Main Stem Tributaries, Kings	1,431	5	--
Dry Creek	164	1	--
North Fork, Kaweah	16,479	115	50-10,800
Main Stem, Kaweah	43,236	334	460-26,900
East Fork, Kaweah	20,412	128	300-11,600
South Fork, Kaweah	9,767	57	80-8,200
North Fork, Tulare River	1,389	6	--
Soda Springs Creek	1,216	4	--
Kern River	75,162	544	2,500-44,000
Total	349,310	2,453	

* ha x 2.47 = acres; km x 0.62 = miles; l/sec x 0.0353 = CFS

** Late summer only; spring flows for South Fork San Joaquin and Middle Fork Kings are probably in the range of 10,000 and 40,000 l/sec respectively.

G. Water Quality

The following is a generalized summary of available water quality values and State water quality objectives for all surface and ground water in the Tulare Basin. Water quality values are primarily from unpublished reports and records in the Parks' files. All values should be considered tentative until a comprehensive survey of aquatic/water resources is completed; however, these values are the best information available to date. A project statement (N-23) has been submitted for a complete inventory of aquatic/water resources.

Table 2. Summary of Water Quality Values

Constituent	Concentration				NPS Minimum Standards State Water Quality Control Board Objectives	
	Boundary Sites	Rivers-Streams	Lakes	Ground Water	Maximum Allowable Levels Surface	Ground
Physical Properties						
specific conductance (umhos/cm)						Annual Increase
Kings drainage	20-40	20-30	15-50	19-69	100	≤4/yr
Kaweah drainage	20-140	1-120	5-20	245-566	175	≤3/yr
Kern drainage	≈33	6-55	5-11	N.D.*	200	≤5/yr
Tule drainage	9-19	9-19	9-19	N.D.	450	≤6/yr
other drainages	1-30	1-30	N.D.	N.D.	N.S.**	N.S.
temperature (°C)	5-20	0-20	0-22	16.5-21.5	<5°F increase above mean	N.S.
turbidity (NTU)	0.24-28	0.10-126	0.27-2.2	N.D.	20% increase above mean	N.S.
Major Constituents						
calcium (mg/l)	1-18	0.8-31	0.3-3.0	3.8-66	N.S.	N.S.
magnesium (mg/l)	0-1.8	0-2.5	0.03-0.40	0.2-12	N.S.	N.S.
potassium (mg/l)	0.2-1.6	0.1-1.2	0.1-0.3	0.6-2.6	N.S.	N.S.

* N.D. = No Data ** N.S. = No Standard

Table 2. Summary of Water Quality Values

Constituent	Concentration: Boundary Sites	Concentration: Rivers-Streams	Concentration: Lakes	Concentration: Ground Water	NPS Minimum Standards State Water Quality Control Board Objectives: Maximum Allowable Levels: Surface	NPS Minimum Standards State Water Quality Control Board Objectives: Maximum Allowable Levels: Ground
Major Constituents (cont'd)						
sodium (mg/l)	0.7-5	0.2-3.8	0.2-1.0	5.4-78	N.S.	N.S.
bicarbonate (mEq/l)	0.204-0.851	0.042-1.856	0.042-0.155	0.61-3.8	N.S.	N.S.
chloride (mg/l)	0.1-1.7	0.1-2	0.04-0.43	3.8-64	N.S.	N.S.
sulfate (mg/l)	1.3-6	0.8-8	0.2-0.8	0.8-15	N.S.	N.S.
Other Constituents						
Inorganic Nonmetallic						
ammonia (mg/l)	0-0.08	0-0.19	0.15-0.41	N.D.	25	N.S.
arsenic (mg/l)	N.D.	N.D.	N.D.	ND-0.077	0.1	same
barium (mg/l)	N.D.	N.D.	N.D.	N.D.	1.0	same
boron (ug/l)	0-20	0-10	N.D.	N.D.	N.S.	N.S.
carbonate (mEq/l)	0	0	0	0	N.S.	N.S.
cyanide (mg/l)	N.D.	N.D.	N.D.	N.D.	0.2	same
dissolved oxygen (mg/l)	7.6-12.6	7.4-12.7	5.8-9.6	N.D.	7-9 mg/l*	N.S.

* 9 mg/l in Kings drainage, 8 mg/l in Kern, 7 mg/l elsewhere

Table 2. Summary of Water Quality Values

Constituent	Concentration: Boundary Sites	Rivers-Streams	Lakes	Ground Water	NPS Minimum Standards State Water Quality Control Board Objectives: Maximum Allowable Levels Surface	Ground
Other Constituents						
Inorganic Nonmetallic (cont'd)						
floride (mg/l)	0-0.1	0-0.2	N.D.	0.1-1.8	0.6-1.7*	same
nitrate-nitrite (ug/l)	0-53	0-133	0-115	≤40-200	10,000	same
Orthophosphate (ug/l)	0-38	0-35	0-8	N.D.	N.S.	N.S.
pH	7.0-8.0	6.5-8.0	5.5-8.5	6.7-8.0	±0.3	N.S.
silica (mg/l)	3-20	2-24	5-6	N.D.	N.S.	N.S.
sulfide (as s;mg/l)	N.D.	N.D.	N.D.	N.D.	N.S.	N.S.
Metals						
cadmium (mg/l)	N.D.	N.D.	N.D.	0	0.01	same
chromium (mg/l)	N.D.	N.D.	N.D.	0-0.0003	0.05	same
copper (mg/l)	N.D.	N.D.	N.D.	0-0.0022	N.S.	N.S.
iron (ug/l)	10-80	0-30	5-27	0-0.36	N.S.	N.S.

* See SWRCB 1975

Table 2. Summary of Water Quality Values

Constituent	Concentration: Boundary Sites	Concentration: Rivers-Streams	Concentration: Lakes	Concentration: Ground Water	NPS Minimum Standards State Water Quality Control Board Objectives: Maximum Allowable Levels: Surface	NPS Minimum Standards State Water Quality Control Board Objectives: Maximum Allowable Levels: Ground
Other Constituents						
Metals (cont'd)						
lead (mg/l)	N.D.	N.D.	N.D.	<0.001-0.006	0.05	same
manganese (mg/l)	N.D.	N.D.	N.D.	0-0.02	N.S.	N.S.
mercury (mg/l)	N.D.	N.D.	N.D.	0-0.0001	0.0005	same
selenium (mg/l)	N.D.	N.D.	N.D.	0	0.01	same
silver (mg/l)	N.D.	N.D.	N.D.	0-0.0003	N.S.	N.S.
total hardness (mg/l as $CaCO_3$)	1-80	3-70	3-14	10-205	N.S.	N.S.
zinc (mg/l)	N.D.	N.D.	N.D.	0.01-0.64	N.S.	N.S.
Bacteria						
fecal coliform (per 100 ml)	0-170	0-415	0-1	N.D.	geometric mean 200 and 10% ≤400 for any 30 day period	2.2 for 7 day period

Table 2. Summary of Water Quality Values

Constituent	Concentration: Boundary Sites	Concentration: Rivers-Streams	Concentration: Lakes	Concentration: Ground Water	NPS Minimum Standards State Water Quality Control Board Objectives: Maximum Allowable Levels: Surface	NPS Minimum Standards State Water Quality Control Board Objectives: Maximum Allowable Levels: Ground
Bacteria (cont'd)						
fecal streptococcus (per 100 ml)	0-27	0-6600	0-150	N.D.	N.S.	N.S.
Biocides						
aldrin (mg/l)	N.D.	N.D.	N.D.	N.D.	0.017	same
chlordane (mg/l)	N.D.	N.D.	N.D.	N.D.	0.003	same
DDT (mg/l)	N.D.	N.D.	N.D.	N.D.	0.042	same
dieldrin (mg/l)	N.D.	N.D.	N.D.	N.D.	0.017	same
endrin (mg/l)	N.D.	N.D.	N.D.	0.0001	0.001	same
heptachlor (mg/l)	N.D.	N.D.	N.D.	N.D.	0.018	same
heptachlor epoxide (mg/l)	N.D.	N.D.	N.D.	N.D.	0.018	same
lindane (mg/l)	N.D.	N.D.	N.D.	0.00005	0.056	same
methoxychlor (mg/l)	N.D.	N.D.	N.D.	0.0002	1.0	same
organophosphorus & carbonate compounds (mg/l)	N.D.	N.D.	N.D.	N.D.	0.1	same

Table 2. Summary of Water Quality Values

Constituent	Concentration: Boundary Sites	Concentration: Rivers-Streams	Concentration: Lakes	Concentration: Ground Water	NPS Minimum Standards / State Water Quality Control Board Objectives: Maximum Allowable Levels: Surface	NPS Minimum Standards / State Water Quality Control Board Objectives: Maximum Allowable Levels: Ground
Biocides (cont'd)						
toxaphene (mg/l)	N.D.	N.D.	N.D.	0.001	0.005	same
2,4-D plus 2,4,5-T plus 2,4,5-TD (mg/l)	N.D.	N.D.	N.D.	0.0006	0.1	same
Radioactivity (pc/l)					200	same
gross beta (pc/l)	0-8.1	0-8.1	N.D.	N.D.	200	same
radium-226 (pc/l)	N.D.	N.D.	N.D.	N.D.	3	same
strontium-90 (pc/l)	N.D.	N.D.	N.D.	N.D.	10	same
gross alpha (pc/l)	0-3.5	0-4.2	N.D.	N.D.	N.S.	N.S.
Miscellaneous						
biostimulatory*	N.D.	N.D.	N.D.	N.D.	nuisance	N.S.
carbon-alcohol extract (mg/l)	N.D.	N.D.	N.D.	N.D.	3.0	same
carbon-chloroform extract (mg/l)	N.D.	N.D.	N.D.	N.D.	0.7	same

* Promote aquatic growth

Table 2. Summary of Water Quality Values

Constituent	Concentration: Boundary Sites	Concentration: Rivers-Streams	Concentration: Lakes	Concentration: Ground Water	NPS Minimum Standards / State Water Quality Control Board Objectives: Maximum Allowable Levels: Surface	NPS Minimum Standards / State Water Quality Control Board Objectives: Maximum Allowable Levels: Ground
Miscellaneous (cont'd)						
color	N.D.	N.D.	N.D.	N.D.	nuisance	N.S.
dissolved residue, 180°C	N.D.	N.D.	N.D.	242-298	N.S.	N.S.
foaming agent (mg/l)	N.D.	N.D.	N.D.	N.D.	0.5	same
floating material	N.D.	N.D.	N.D.	N.D.	nuisance	N.S.
oil and grease	N.D.	N.D.	N.D.	N.D.	nuisance/ visable film	N.S.
sediment	N.D.	N.D.	N.D.	N.D.	nuisance	N.S.
settleable material	N.D.	N.D.	N.D.	N.D.	nuisance	N.S.
suspended material	N.D.	N.D.	N.D.	N.D.	nuisance	N.S.
taste and odors	N.D.	N.D.	N.D.	N.D.	nuisance	same
toxicity	N.D.	N.D.	N.D.	N.D.	none	N.S.

H. Park Ecosystems

Sequoia and Kings Canyon National Parks are located between the San Joaquin Valley and the crest of the Sierra Nevada mountains. Elevations extend from 390 m (1,280 ft) at Ash Mountain to 4,418 m (14,494 ft) on top of Mt. Whitney, the highest point in the conterminous United States. The vegetation in the low elevations is primarily oak woodland and chaparral. The mid-elevations from about 1,500 - 3,300 m (4,900 - 10,800 ft) are dominated by a variety of coniferous forest communities, of which the best known are the groves of giant sequoia (Sequoiadendron giganteum). Alpine communities generally occur above 3,300 M (10,800 ft). Most of the parks' lakes and ponds are located in the higher elevation conifer forests above 2,700 m (8,900 ft) and in alpine zones. Flowing waters occur at all elevations.

Most aquatic research within these Parks emphasized water chemistry. There have been few thorough limnological studies that describe flora, fauna, water chemistry, structure of the lake or stream, and how such function and interact. Most data that exists regarding water is of recent origin, and historic conditions are speculative. The most complete ecosystem studies are those in the Rae Lakes-Kearsarge Lakes-Sixty Lakes area (Taylor and Erman 1979, Silverman and Erman 1979) and current studies in progress on the effects of acid deposition.

Virtually all lakes in the Sierra Nevada originally were barren of fish life (Christensen 1977). Pleistocene glaciers excluded fish from the high Sierra. As glaciers retreated, rainbow trout moved upstream from lower elevations along the west side of the Sierra, and golden trout survived in the upper Kern River below the southern edge of the glaciers. However, in most areas the trout were separated from the high lakes by steep impassable canyon walls, waterfalls, and other natural barriers.

Records of fish planting begin in the mid-1800's and fish planting was widespread in the late 1800's and early 1900's. Because of the high elevation and lack of nutrients in the granitic basins, many lakes have relatively low productivity. Once planted, fish prospered on the initial abundance of food; but the productivity was too low to sustain them, and fish became stunted (Pister 1977). In other lakes, the growth rate came into equilibrium with food supply (Pister 1977). Lakes planted with exotic eastern brook trout are particularly prone to the first model. Some

lakes cannot sustain a fish population except by periodic planting. This is usually due to inadequate spawning area but may also be related to low primary productivity. A survey of 137 lakes in these Parks showed that 61 percent were self-sustaining, 10 percent were probably reproducing, 12 percent had little or no reproduction, 4 percent were definitely not reproducing, and 13 percent were barren (Zardus et al. 1977).

In general, the lakes' flora and invertebrate fauna has barely been investigated. Studies in the Rae-Sixty-Kearsarge Lakes area found that those lakes with high visitor use to have extensive macrophyte growth and low nitrate concentrations. Lakes with low visitor use had little to no macrophyte growth and high nitrate concentrations (Erman and Taylor 1978, Taylor and Erman 1979). Taylor and Erman (1979) hypothesized that micronutrients added by people caused the benthic flora to flourish, depleting the nitrate.

As with lakes, most high elevation streams were probably also barren of fish. Today, many of these creeks, as lakes, are populated with eastern brook (Salvelinus fontinalis), rainbow (Salmo gairdnerii), golden (Salmo aquabonito), and hybrid rainbow-golden trout. Brown trout (Salmo trutta) begin to appear in the mid-elevations, and foothill rivers and streams consist primarily of rainbow and brown trout. The Sacramento sucker (Catostomus occidentalis) is common at low elevations. Other non-game species such as California roach (Hesperoleucus symmetricus) and riffle sculpin (Cottus fulosis) barely enter these Parks.

While investigating plankton in 41 lakes in the Sierra Nevada, Kubly (1983) found 129 algal taxa. Desmids (Chlorophyta) were the most diverse group, though diatoms (Bacillariophyta) and Dinobryon (Chrysophyta) were the most abundant. Diatoms present varied from forms having slightly acidic to slightly alkaline pH preferences.

Kubly (1983) found 52 zooplankton taxa of which only about half were typically limnetic; the remainder were typically benthic or littoral. Most abundant taxa were rotifers (19 taxa), cladocerans (14 taxa), and copepods (13 taxa). Within samples, the most frequently encountered species were Keratella testuda (a rotifer), Holopedium gibberum (a cladoceran), and nauplii of certain diatomid copepods.

Zooplankton densities varied from 1 to 388 individuals/liter, but were typically less than 50 individuals/liter. The number of species and abundance decreased with increasing altitude. With decreasing pH, the

number of species decreased.

Over 100 invertebrate taxa have been identified in the Parks' streams. These are primarily aquatic insects. Abell (1977) reported five abundance-diversity groupings for aquatic invertebrates in these Parks. They include:

1. Type A (weak fauna)--These are areas where both the density and diversity of invertebrates is low. Such sites occur on very small streams and some springs.

2. Type B (normal stream series)--These streams have several common or abundant species. Density and diversity are normal with a positive diversity:density trend. These streams are usually small to moderately large.

3. Type B+ (streams with the most diverse fauna)--These streams have a relatively high number of common and abundant species. Most of these are large streams with excellent riffle habitat; though some of the streams are of only moderate size.

4. Type C (typical unproductive streams)--These streams have a normal species diversity but typically have only one common or abundant species. This condition is most likely to be observed in small streams and may be caused by a lack of riffle habitat (Abell 1977).

5. Type D (high density, low diversity streams)--These are streams where there is little diversity but the dominant species are abundant. Abell (1977) referred to these as "putative perturbed faunas". Wherever they were observed, some special conditions that could have altered the normal community structure were also observed. Type D communities were normally observed in larger streams.

Though there were density-diversity patterns, Abell (1977) did not find distinct associations of species. The most frequently encountered taxa were midges (Chironomidae), mayflies (Baetis and Paraleptophlebia), black flies (Simuliidae), and caddis flies (Micrasema and Hydropsyche).

A few of the aquatic fauna are of special interest. There are two rare invertebrates. One is a primitive stonefly (Oroperla barbara) that lives in mountain portions of the Kaweah drainage (Abell 1977, 1984); another is an isolated population of a dobson fly

(Corydalus cognata) which is common in the eastern United States; and the other is a brown mountain midge (Denterophlebia) that may be a new species and occurs from 200 to 2,135 m (660 - 7,000 ft) on the Kaweah River. One of the vertebrates, the Little Kern golden trout (Salmo aquabonita whitei), is the only aquatic species currently listed as "threatened" by the Federal government; none are listed as "endangered".

These Parks are participating in an interagency program to restore Little Kern golden trout to their original range. Their cousin the Kern rainbow (Salmo aquabonita gilberti; Gall et al. 1981), probably occurs in the upper Kern. It is known to exist on the Kern River immediately below the Park's boundary, but its status within the Park is unknown. It too may require special protection for its future management, particularly against genetic introgression.

I. Water Rights

Water rights in Sequoia and Kings Canyon National Parks are primarily resultant of water diversions existing within these Parks prior to their establishment. The most significant existing diversion is for the generation of electric power using water from the Kaweah drainage. This is done under a Special Use Permit issued by the Secretary of the Interior on December 15, 1976 following Congressional authorization (P.L. 93-522). The law also mandated that the NPS study the impacts of the diversion and report to Congress not less than 180 days prior to expiration of the permit. The power plant in question (Kaweah No. 3) has been operating since 1913 and facilities in Sequoia include diversions on the Marble and Middle Forks of the Kaweah River.

Other diversions are smaller and provide water to these Parks, the public, and some private inholders. These Parks have jurisdiction to stop any diversion where required to protect the natural resources of these Parks. The water rights section will be expanded further with assistance from the Western Regional Office and the Water Resources Branch - Ft. Collins.

J. Bibliography

Abell, D.L. 1977. A survey of macroscopic invertebrates of Sequoia Streams. Unpublished report for the Sequoia Natural History Association, Three Rivers, California. 84 pp.

_____. 1984. Section VIII. Invertebrate Studies, pp. 67-96, in A Study to Evaluate the Impacts of Kaweah No. 3 Hydroelectric Facility on the Resources of Sequoia National Park. Prepared by Jordan/Avent & Associates. San Francisco, California.

Ad Hoc Fisheries Task Force. 1979. Review and evaluation of National Park Service policies and practices. Report to the Assistant Secretary of the Interior. 56 pp.

Bradford, G.R., F.L. Bair, and V. Hunsaker. 1968. Trace and major element content of 170 high Sierra lakes in California. Limnology and Oceanography 13:526-530.

Christensen, D. 1977. History of trout introductions in California high mountain lakes. Pp. 9-15 in Management of High Mountain Lakes in California (Hall, A. and May, R., eds.). San Francisco: Ca. Trout Incor.

Coleman, G.A. 1925. Biological survey of Rae Lakes region. Calif. Fish Game 11:56-62.

Dean, W. W. 1969. Water quality and quantity data, East Fork Kaweah River Basin California, 1968. Basic data compilation, U.S. Geological Survey, Menlo Park, California. 27 pp.

_____. 1971. Water quality and quantity data, East Fork Kaweah River Basin, California, 1969. Open-file report, U.S. Geological Survey, Menlo Park, California. 29 pp.

Erman, D. 1977. Ecological evaluation of backcountry lakes subjected to varying amounts of human use. Whiteaker's Forest Cooperative Natural Resources Research Station. Unpublished report. 104 pp.

Erman, D. and T. Taylor. 1978. The response of benthic plants and selected chemical and biological features to past levels of human use in some high mountain lakes in Kings Canyon National Park. Unpublished report for Western Region, National Park Service. Univ. California, Berkeley. 42 pp.

Federal Water Pollution Control Administration (FWPCA). 1969. Water quality and aquatic biology East Fork Kaweah River, Mineral King area, California. U.S. Department of the Interior, Washington, D. C. 36 pp.

Hoffman, R.J. and F.F. Ferreira. 1976. A reconnaissance of the effects of a forest fire on water quality in Kings Canyon National Park, California. Open-file Report 76-497. U.S. Geological Survey, Menlo Park, California. 17 pp.

James, G.J. 1975. Effects of human activities on mountain lakes in California. Unpublished Ph.D. dissertation. Univ. Calif., Irvin, California 85 pp.

Jordan/Avent and Associates. 1980. A study to evaluate the impacts of Kaweah No. 3 hydroelectric facility on the resources of Sequoia National Park, Phase I Report, Volume One: description of project area setting. San Francisco, Calif. 178 pp.

_____. 1984. A study to evaluate the impacts of Kaweah No. 3 hydroelectric facility on the resources of Sequoia National Park. San Francisco, Calif. 177 pp.

Kubly, D.M. 1983. Plankton of high Sierra lakes. Southern California Edison Research and Development Report No. 83-RD-47. Univ. Calif., Riverside. 96 pp.

Lawson, D.R. and J. G. Wendt. 1982. Acid deposition in California. SAE Technical Paper Series 821246. Society of Automotive Engineers, Inc. Warrendale, PA 19 pp.

Maciolek, J.A. 1978. Aquatic resources of Lassen Volcanic, Sequoia-Kings Canyon, and Yosemite National Parks with special reference to trout stocking and the recreational fishery. Unpublished report for California Department of Fish and Game and National Park Service-Western Region. 77 pp.

Pister, E.P. 1977. The management of high Sierra lakes, pp. 27-34 in A Symposium on the Management of High Mountain Lakes in California's National Parks (Hall, A. and May, R., eds). California Trout, Inc. San Francisco, Calif.

Silverman, G. and D.C. Erman. 1979. Alpine lakes in Kings Canyon National Park, California: baseline conditions and possible effects of visitor use. Journal of Environmental Management 8:73-87.

State Water Resources Control Board, 1975. Water Quality Control Plan Report, Tulare Lake Basin (5D), Part I. 217 pp.

Taylor, T.P. and D.C. Erman. 1979. The responce of benthic plants to past levels of human use in high mountain lakes in Kings Canyon National Park, California, U.S.A. J. Environ. Mgmt. 9:271-278.

_____. 1980. The littoral bottom fauna of high elevation lakes in Kings Canyon National Park. Calif. Fish & Game. 66:112-119.

Townsend, W.R. 1979. Beaver in the upper Kern Canyon Sequoia National Park, California. Unpubl. MA thesis. Calif. State Univ., Fresno. 72 pp.

Troyer, J.G. 1971. Water quality survey - Mineral King Lakes. Unpublished Report, Sequoia National Forest, California. 13 pp.

_____. 1973. The East Fork Kaweah River at Mineral King, an analysis of the quantity and quality of the water resource. Unpublished Report, Sequoia National Forest, California. 26pp.

Zardus, M.J. T. Blank, and D. Schulz. 1977. Status of fishes in 137 lakes in Sequoia and Kings Canyon National Parks, California. National Park Service unpublished report. 96 pp.

PART 2

AQUATIC/WATER RESOURCES MANAGEMENT PROGRAM

I. PARK-SPECIFIC OBJECTIVES FOR MANAGEMENT OF AQUATIC/WATER RESOURCES

A. Goal

To restore and/or maintain natural aquatic environments in which physical, chemical, and biotic processes function uninfluenced by human activities; and to inform all visitors and employees of aquatic hazards.

B. Objectives

1. To inventory and classify aquatic environments by physical and chemical characteristics and biotic communities present; identify both common and unique aquatic systems.

2. To maintain long-term monitoring stations in representative aquatic environments to record ambient conditions and to document changes and trends in physical and chemical characteristics and biotic communities; to be able to detect and distinguish between 24 hour, seasonal, and long-term shifts or cycles.

3. To locate and document the magnitude and direction of changes in aquatic environments which are caused by management activities or visitor use patterns; and to develop and implement management programs to mitigate those activities.

4. To detect and evaluate conditions and characteristics of external influences such as acid precipitation.

5. To recognize aquatic conditions that are potentially hazardous to human health and safety; to implement programs to advise visitors of health hazards and to take corrective action where the cause is not natural.

6. To monitor the quality of water entering and leaving these Parks with regard to compliance with local, State and Federal standards for surface water.

7. To comply with State and local water quality requirements at each of the Parks water and sewage systems.

8. To acquire sufficient knowledge about the water quality of these Parks to be able to provide intelligent input into State and local water management planning.

9. To monitor water chemistry within Little Kern golden trout habitat.

10. To develop fishing regulations and other management practices that favor survival and perpetuation of native species over exotic species.

11. To restore extant native species or genetically unique groups to their former range.

12. To allow waters incapable of sustaining fish populations through natural reproduction to become barren of fish.

13. To mitigate human influences affecting the natural densities and age-class distributions of native species.

14. To inventory distribution and abundance of all fish species at 10-year intervals.

15. To monitor the distribution of fishing effort and fisherman success.

16. To enforce and document fisherman compliance with regulations.

17. To monitor effect of existing management practices on fish populations.

18. To control and if possible eliminate exotic beaver and other exotic organisms.

. Specific Problems Involving Management of Park Waters.

1. Effects of Visitor Use/Management of Carrying Capacity

Wherever there is reasonable potential for people to impact the natural environment, there is a need to monitor impacts associated with existing levels of use and develop models for predicting effects of changes in use levels. Unacceptable impacts not only include fundamental changes in the ecology of an area as occurs from human nutrient enrichment, but also includes generation of human health hazards (e.g. high bacteria counts caused by human fecal contamination) and protection of pristine vistas. Abrasion and denuding of the vegetation, formation of social trails

(defined as trails that are not planned or maintained by the National Park Service), and the accumulation of litter and toilet paper are as unacceptable as fecal contamination, detergents, and other forms of anthropogenic deposition. In assessing the carrying capacity of an area, it is necessary to look at the chemistry and biota of a lake or stream, as well as the condition of the adjacent land. Is the brush trampled? Are there social trails? How many? Is there litter? Does it appear pristine or over used? In some areas, it may be possible to increase the carrying capacity by improving the habits of those who use an area.

In establishing biologic carrying capacities, it is necessary to know how much use an area receives, the impacts, and the relationship between use and impacts. Because of fundamental differences in stock and backpacker groups, it is important that these impacts be evaluated separately, and that in establishing carrying capacities, that the overall use and resilience of an area or habitat be considered.

Without the above information, management is in a poor position to manage the future ecologic integrity of our aquatic resources as the demand to use the parks grows.

2. Management of Park Facilities

In developing a park, there is a constant danger of facilities themselves having an unacceptable impact. Every liter of water diverted from a stream would have been used "naturally" downstream. Removing 200,000 l/day (52,834 gal/day) from a stream whose discharge is 5,000 l/sec (176.5 CFS) will certainly cause more impact than from a stream that produces 500 l/sec (17.6 CFS). A sewage plant providing secondary treatment will have far less impact on a naturally high nutrient system than on low nutrient systems as are typical of the Sierra. Even small amounts of phosphate, nitrate, chloride, or other constituent added to the ecosystem from a sewage sprayfield contributes to anthropogenic change. Indirectly the location of facilities affect human use patterns and thus the natural system.

As with carrying capacity, the question is "how much is too much?" As a park is developed, management has a basic responsibility to know how the development is impacting the natural aquatic environment. State and local requirements that are designed to protect human health and safety do not necessarily grant the same protection to the Parks' natural resources.

3. Atmospheric Deposition

Sequoia and Kings Canyon National Parks are located in a polluted airshed. Though some of the material carried aloft is natural, much of it is a result of human activities. Acidic wet deposition with a pH of 3.5 has been measured in Sequoia National Park (Lawson and Wendt 1982). High elevation lakes are poorly buffered and are extremely vulnerable to future acidification. Nature and extent of dry deposition is less well known. Baseline information on existing conditions is beginning to be collected in order to determine actual and potential effects.

The principal known sources of local pollution are automobile emissions, oil fields, and various urban sources, particularly from the San Francisco bay area. Because of the heavy use of agricultural chemicals in the San Joaquin Valley, they could also be present in the deposition. In spite of State air quality regulations, potential population, industrial, and agricultural increases may be posing an ever increasing threat to Park resources. In the future, these Parks may need to experiment with technologies such as liming* in order to mitigate high acidic levels resulting from atmospheric imputs to aquatic systems. However, we must first determine what those impacts are.

4. Management of Exotic Species

The history of aquatic resources management in the Sierra Nevada has led to profound changes in the ecology of much of the area, particularly in regard to the redistribution of native species and introduction of exotics. The problem is confounded by significant public support for the tradition of planting fish in the Sierra and also by the tradition of a consumptive fisheries harvest. Wise management of the Parks' fishery should favor native species over exotic. Regulations need to provide for increased fishing harvest of exotic brown and eastern brook trout, while encouraging the restoration of natural populations of native rainbow and golden trout through increased "catch-and-release" fishing.

Calcium carbonate used as a buffer.

II. ANALYSIS OF ALTERNATIVES

This plan is an extension of Sequoia and Kings Canyon National Parks' Natural Resources Management Plan (1976, and revising in 1981, 1982, 1983 and 1984). The Environmental Assessment for that document included aquatic/water resources. The reader is referred to that document for an analysis of alternative management strategies. Because this document is an extension of the Natural Resources Management Plan and because it proposes no new controversial or significant impacts to the environment, a separate Environmental Assessment will not be prepared on this document. However, an Environmental Assessment will be prepared on the issue of catch limits before any new management action is implemented.

II. MANAGEMENT ACTIONS

A. Monitoring

1. Long-term Monitoring

Long-term monitoring will be conducted wherever major rivers or streams ($\geq$300 l/sec; 10.6 CFS) cross the Parks' boundary and at sites representative of each of the significantly distinctive aquatic systems.

a. Boundary Sites

Monitoring at boundary sites will be conducted to evaluate compliance with State and local standards and to detect changes and trends in the water quality of the drainages those sites represent. Boundary stations will be monitored at five year intervals during spring maximum flow, during summer minimum flow, and following the first major fall storm. Constituents monitored will include temperature, flow, suspended material, turbidity, conductivity, alkalinity, dissolved oxygen, pH, ammonia, nitrate, orthophosphate, major constituents, chlorinated hydrocarbons, organophosphates, carbamates, chlorophenoxy herbicides, trace metals, radioactivity, fecal bacteria, and chlorophyll.

b. Distinctive Aquatic Systems

Monitoring of significantly distinctive aquatic systems will be done to detect long-term changes in the limnology of those systems. These stations will also be monitored at five year intervals, but only at one time of the year based on when (e.g. spring, summer, fall, winter) monitoring will be most meaningful based on previous limnological studies. These sites will be monitored primarily for changes in the structure and composition of their biotic communities. During the preliminary survey of these systems, certain taxa will be selected for long-term monitoring. The actual organisms and associated chemical and physical constituents will vary at each site depending on the recommendations of those who originally surveyed the site. At 10-year intervals, sites will be measured for the same environmental

constituents as at the boundary stations.

2. Environmental Impact Monitoring

This monitoring is directed at specific problems and may be of either long-term or short-term duration depending on the need. Likewise the nature of the problem will determine how frequently the site is monitored (e.g. weekly, monthly, several times a year, etc.).

a. Facilities

Sprayfield and other output from sewage facilities will be monitored for environmental impacts. At the minimum, this will consist of monitoring for downstream nutrient enrichment to determine the extent of effected area and will be conducted at least three times a year: during spring melt, during the peak of summer drought and following the first major fall storm. Other constituents may include fecal bacteria, chlorophyll, DO, chloride, pH, conductivity, and indicator organisms. Every five years additional samples will be collected at sites both upstream and downstream from the sewage facility and analysed additionally for major constituents, indicator organisms, and each of the constituents measured at boundary stations." A minimum of three samples will be collected above the input, directly below the input, and about a kilometer downstream (depending on rate of dilution). This will be done during the late summer.

Normally water diversions would not be monitored, but they may be where some question exists as to ecological impacts associated with the diversion. These will normally be short-term pulse studies that compare flows and biotic communities (particularly aquatic macro-invertebrates) above and below the diversion. Where the diversion is new, such as for a water supply to a new park development, baseline data will be collected prior to construction. Ground water will be the preferred source of water supply to a new park development.

b. Visitor Use/Carrying Capacity

(1). Frontcountry

At least two frontcountry areas that recei heavy visitor use will be monitored for associated environmental impacts. Monitori will include impacts to vegetation (monito by use of photo-points), litter and other shoreline impacts, nutrients, conductivity fecal bacteria, and levels of visitor use. Physical, chemical, bacterial, and vegetat data will be collected a minimum of three times per year (spring, late summer, and following a fall storm), but chemical and bacterial data will be collected about ten times during the course of the summer-fall. Visitor use data will be collected on at least 30 occasions by counting the number people at the study sites between 1300 - 1 on randomly selected days. Data will be stratified into weekends and weekdays. Th sites will be described for major constituents at 10-year intervals.

(2). Backcountry

At least two backcountry areas with varyin levels of visitor use will also be monitor to establish sensitivity and biological carrying capacity for either specific site or generalized backcountry environments. This monitoring will be conducted at the beginning of the summer, late in the summe and following an early fall front or late-summer shower causing surface runoff. Nearly the same data will be collected as frontcountry sites, but the visitor use da will be collected by a combination of registers and/or opportunistic counts by backcountry rangers. At lake sites, data will also be collected on benthic macrophy to include density, species composition, evidence of physical trampling from swimme and waders. Sites will be selected to distinguish between impacts typical of backpackers and stock parties.

c. Distribution and Abundance of Exotic Species

Distribution and abundance of identified exotic plants, invertebrates, and vertebrates will be monitored. In some cases, this will be accomplished as a by-product of other monitoring, such as fisheries monitoring discussed below. In other instances, separate or supplemental monitoring sites may be required. Such monitoring will be conducted at five-year intervals. The principal objective is to determine whether the species is expanding, declining, or reasonably stable.

d. Monitoring of Rare, Threatened, and Endangered Species

Such monitoring will be conducted annually for the distribution and abundance of Federally listed species. Currently this includes only one species, the Little Kern golden trout which will be monitored in cooperation with California Department of Fish and Game. Each year an index of its population is devised by an empirical survey. The distribution and abundance of unlisted but rare species will be monitored opportunistically as a by-product of other studies and reports except where species may be safely and easily subjected to periodic reconnaissance.

e. Fisheries

The effects of various fishing regulations on fish populations will be monitored at five-year intervals in designated transects. Furthermore, data will also be collected on catch-rates, species caught, distribution of fishing effort, and fisherman compliance. The first data base will be acquired using fish population transects. The next three data bases will be developed from creel census and the last from law enforcement encounters.

f. Environmental Trouble-Shooting

The Parks' aquatics and wildlife personnel will coordinate a response to monitor or investigate any observed or anticipated

2. Visitor Safety Program

Water is the most hazardous natural resource in these Parks. Visitors will be warned of these hazards through signs and printed information. Major trails leading to fast cold water will be signed in English and Spanish to warn people of the danger. In addition to being warned of the danger of fast cold water, visitors will be advised of Giardia, bacterial hazards like Campylobacter, and recommended methods of treating water prior to consumption. Such information will be provided at visitor contact stations (visitor centers, ranger stations, museums, etc.), in the Parks' Newspaper, and printed information will be included with Backcountry Use Permits.

3. Facility Design

Facilities will be located and designed for minimum impact on the aquatic environment. As technologies improve, existing structures will be reevaluated for upgrade as a means of further reducing environmental degradation. Whenever existing facilities are found to be causing unacceptable impacts, funds will be sought to correct the problem. If necessary, the facility will be closed.

4. Fishing Regulations

Fishing regulations that favor native species over exotics will be developed and enforced with the long-term goal of restoring the natural distribution and abundance of native species.

5. Wet Meadows Management

See Stock Use and Meadow Management Plan.

6. Mitigate Effects of Acidic Deposition

If the problem of acidic deposition is shown to be escalating and lake and stream biota begin to change, experimental management technologies used elsewhere may be considered within these Parks on a small experimental scale (e.g. liming). The immediate and long-term threats and benefits of such actions will be carefully evaluated prior to any broadscale rehabilitation effort.

No secondary action to mitigate acidic deposition is as acceptable as eliminating the cause. Even if

actions like liming did not themselves cause a fundamental change in the aquatic environment, the cost of such management could be prohibitive.

7. Public Education

Though there are often a few easily identified point sources of pollution such as a failing sewage system or an oil refinery dumping sulfur into the skies, much of the problem is less tangible such as the cummulative exhaust emissions of too many automobiles. Controlling such sources requires a broad base of public support for legislation that controls automobile emissions and other non-point problems. Providing the public solid information about sources and effects of pollutants on the Parks' resources is an important management tool.

8. Participation in Establishment of State and Local Water Quality Standards

The Park's staff will take advantage of opportunities to participate in the revision or development of State and local water quality standards. Personnel will seek standards that are realistic and compatible with NPS objectives for the management of pristine conditions. Standards for NPS waters must not only consider human health and safety but also protection of ambient natural conditions.

C. Research

These Parks will maintain an active research program that can provide management solutions to aquatic resources management problems. Also needed is a thorough inventory and classification of the Parks' aquatic resources. This inventory will be used to select the most important sites for long-term monitoring; it will identify which aquatic environments are most vulnerable to various threats and where the most serious management problems already exist. Until a comprehensive study is funded, this information will continue to be acquired by the existing monitoring program and from other related studies.

IV. MINIMUM STANDARDS

At minimum standard, the aquatic/water resources program will retain the ability to detect and evaluate changes in aquatic systems resulting from management actions or visitor use. It will recognize water which is unsafe to drink and identify inconsistencies between ambient conditions and water quality standards.

Components	Standards	Responsibilities
Health	Areas that management suspects (based on heavy visitation) as being biologically unsafe to drink will be tested for fecal coliform and fecal streptococcus using a minimum of two replicates taken during late summer, spring melt, and when possible, one day after a rain, and the public using such areas will be advised of unhealthy conditions.	Res. Mgmt. (monitoring) Rangers (advise public of hazards) Mgmt. Assist. (media releases)
	Recognize environmental conditions that cause waters to be generally unhealthy for consumption in the high, mid, and low Sierra, and advise the public.	Res. Mgmt. (monitoring) Rangers (advise public) Safety (prepare brochures) Mgmt. Assist. (media releases)
	Sample all known warm and soda springs for heavy metals, toxic substances or concentrations, and bacteria; post areas that are not safe. Samples will be taken once during a high flow condition and again during a low flow condition using a minimum of two replicates.	Res. Mgmt. (monitoring) Rangers (post)
Park Mgmt.	Streams associated with Park facilities with any potential to pollute will be monitored at a minimum of one station both upstream and downstream of the site with a min-	Res. Mgmt.

Components	Standards	Responsibilities
	imum sampling of once during the spring, late summer, and during or immediately following a major (≥3 cm; 1.2 in) fall storm. A minimum of two replicates will be sampled for fecal coliform, fecal streptococcus bacteria, and nutrients. Every five years additional sampling shall include major constituents and other constituents appropriate for the site (e.g. pesticides, heavy metals, etc.).	
Visitor Use	Sample a minimum of one heavily used frontcountry stream at one site upstream and one site downstream of the zone of heaviest use with a minimum sampling of once during spring, late summer, and during a major (≥3 cm; 1.2 in) fall storm using a minimum of two replicates and sampling for fecal coliform and fecal streptococcus bacteria, major constituents on a 10-year interval, physical qualities and chlorophyll.	Res. Mgmt.
	Sample as above a minimum of one lake heavily used by backpackers and a similar unused lake as a control.	Res. Mgmt.
	Sample as above a minimum of one lake heavily used by stock, a control lake, and one meadow-stream heavy-use site at an upstream and downstream location.	Res. Mgmt.
Standards	All major (≥300 l/sec; 10.6 CFS) streams flowing either into or out of these Parks will be sampled at 5-year intervals during the spring, late summer, and after the first major fall storm using a minimum of two replicates per site and	Res. Mgmt.

Components	Standards	Responsibilities
	sampling for all surface water standards in effect for the basin.	
	All facilities will be monitored for compliance with State and local requirements.	Maintenance
Long-term Monitoring of Natural Systems	All natural aquatic systems need to be inventoried and classified on the basis of chemical composition, physical characteristics, and biota.	Research
	A minimum of one long-term monitoring station sampled at least once every five years needs to be established in each major type of aquatic system. Minimum monitoring to use same strategy as visitor-use component plus heavy metals and other trace constituents.	Res. Mgmt.

V. AQUATIC/WATER RESOURCES PROJECTS PROGRAMMING SHEET

April 1984

Sequoia and Kings Canyon National Parks

NPS Costs Expressed in $1,000

Inc. No.	Pkg. No.	NRMP Pri.	Plan Pri.	RM* No.	Fund** Source	Ref. No.	Project Title	Action Type***	Year 1 (85) Base	Year 1 (85) New	Year 2 (86) Base	Year 2 (86) New	Year 3 (87) Base	Year 3 (87) New	Year 4 (88) Base	Year 4 (88) New	Year 5 (89) Base	Year 5 (89) New
Ongoing ONPS Park and Servicewide Acid Precipitation Base Programs																		
					1	RM-40	Water Quality Monitoring	Monit.	19.5		19.5		19.5		19.5		19.5	
					4	N-27	Effects of Acid Rain on Vegetation and Aquatic Ecosystems	Res.	99.0		99.0		99.0		99.0		99.0	
					1	RM-27	Fish and Wildlife Management	Mit./ Monit.	22.9		22.9		22.9		22.9		22.9	

* RM No. - Indicates natural resources management project(s) to which research applies.

** Fund Source - Indicates funding sources: 1 Park Base, 2 Regionwide Natural Resources Base, 3 Servicewide Air Quality Program Base, 4 Servicewide Acid Precipitation Program Base, 5 Servicewide Water Resources Program Base, and 6 Servicewide Natural Resources Preservation Program Base.

*** Action Type - Mit. - Mitigation, Res. - Research, and Monit. - Monitoring

V. AQUATIC/WATER RESOURCES PROJECTS PROGRAMMING SHEET

April 1984

Sequoia and Kings Canyon National Parks

NPS Costs Expressed in $1,000

Inc. No.	Pkg. No.	NRMP Pri.	Plan Pri.	RM* No.	Fund** Source	Ref. No.	Project Title	Action Type***	Year 1 (85) Base	Year 1 (85) New	Year 2 (86) Base	Year 2 (86) New	Year 3 (87) Base	Year 3 (87) New	Year 4 (88) Base	Year 4 (88) New	Year 5 (89) Base	Year 5 (89) New
Programs Requesting ONPS Funding																		
161		2	1		1	RM-34 (Part of RM-42 NRMP)	Support for Water Quality Monitoring Program	Monit.			48.6/19.5 (RM-40)		48.6/19.5 (RM-40)		48.6/19.5 (RM-40)		48.6/ 19.5 (RM-40)
44 263		11	2	RM-40	5	W-6	Impact of People on Backcountry Lakes	Monit.			23.0		23.0					
269		13	3	RM-29	4	N-25	Determine Ecological Impacts of Acid Precipitation on Selected Ecosystems	Res.			60.0/99.0 (N-27)		60.0/99.0 (N-27)		60.0/99.0 (N-27)		60.0/ 99.0 (N-27)	

* RM No. - Indicates natural resources management project(s) to which research applies.

** Fund Source - Indicates funding sources: 1 Park Base, 2 Regionwide Natural Resources Base, 3 Servicewide Air Quality Program Base, 4 Servicewide Acid Precipitation Program Base, 5 Servicewide Water Resources Program Base, and 6 Servicewide Natural Resources Preservation Program Base.

*** Action Type - Mit. - Mitigation, Res. - Research, and Monit. - Monitoring

V. AQUATIC/WATER RESOURCES PROJECTS PROGRAMMING SHEET

April 1984

Sequoia and Kings Canyon National Parks

NPS Costs Expressed in $1,000

Inc. No.	Pkg. No.	NRMP Pri.	Plan Pri.	RM* No.	Fund** Source	Ref. No.	Project Title	Action Type***	Year 1 (85) Base	Year 1 (85) New	Year 2 (86) Base	Year 2 (86) New	Year 3 (87) Base	Year 3 (87) New	Year 4 (88) Base	Year 4 (88) New	Year 5 (89) Base	Year 5 (89) New
	264	15	4	RM-27 & 33	2 or 5	N-23	Inventory of Aquatic Resources	Res.						40.0		40.0		40.0
164		16	5		1	RM-33	Aquatic/ Fisheries Management	Monit.						37.0/1.2 (RM-27)		32.0/1.2 (RM-27)		32.0/ 1.2 (RM-27)
	252	28	6	RM-40	5	W-1	Study Impacts of Sewage on Mid-Sierran Streams	Monit.						36.0		36.0		36.0
		29	7		2	RM-11	Exotic Beaver Control	Mit.								20.0		20.0
	265	30	8	RM-40	5	W-4	Floodplain Studies	Res.						30.0		30.0		

* RM No. - Indicates natural resources management project(s) to which research applies.

** Fund Source - Indicates funding sources: 1 Park Base, 2 Regionwide Natural Resources Base, 3 Servicewide Air Quality Program Base, 4 Servicewide Acid Precipitation Program Base, 5 Servicewide Water Resources Program Base, and 6 Servicewide Natural Resources Preservation Program Base.

*** Action Type - Mit. - Mitigation, Res. - Research, and Monit. - Monitoring

VI. LIST OF CONTINUING AND PROPOSED PROJECTS
Sequoia and Kings Canyon National Parks

The following is a list of continuing and proposed projects. Resources management projects are coded "RM" and natural sicence projects are coded "N", and aquatic/water resources management project statements "W".

Reference No.	Project Title	Status of Project
RM-11	Exotic beaver control	Proposed FY-88
RM-27	Fish and wildlife management	Continuing
RM-33	Aquatic/Fisheries Management	Proposed FY-87
RM-34	Support for water quality monitoring program (Included as part of RM-42 on Programming Sheet)	Proposed FY-86
RM-40	Water quality monitoring	Continuing
N-23	Inventory of aquatic resources	Proposed FY-87
N-25	Determine ecological impacts of acid precipitation on selected ecosystems	Proposed FY-86
N-27	Effects of acid rain on vegetation and aquatic ecosystems	Continuing
W-1	Study impacts of sewage on mid-Sierran streams	Proposed FY-87
W-4	Implement floodplain studies	Proposed FY-87
W-6	Measure impact of people on backcountry lakes	Proposed FY-86

VII. AQUATIC/WATER RESOURCES PROJECT STATEMENTS

NATURAL RESOURCES PROJECT STATEMENT

1. SEKI-RM-11 - EXOTIC BEAVER CONTROL:

2. STATEMENT OF PROBLEM:

A. Current Conditions:

In the Kern Canyon, exotic beaver are altering the natural environment by constructing dams and restricting the natural flow of the river, backing up vast quantities of water, changing the vegetation and aquatic environments. In one area a trail was flooded by backed up water. Changes in the stream could adversely affect fish populations by silt deposition on spawning gravel. Both the composition and abundance of aquatic invertebrate species would change as riffles with rich faunal assemblages become depauperate pools. Dams may break during high water causing unusual erosion downstream. The structure of the raparian vegetation has been altered by their feeding habits.

The current status of the population is unknown since there is no monitoring program yet.

(1) Goal:

Extirpate the population of exotic beaver from the Kern drainage.

(2) Objectives:

a. To control and attempt extirpation beaver from the Kern drainage of Sequoia National Park.

b. To destroy dams and other beaver construction.

c. To rehabilitate, where practical, areas altered by beaver.

d. To monitor the size and impact of the beaver population.

e. To encourage an interagency effort to eliminate beaver from the Kern drainage.

B. Past Actions:

A reduction program was executed by U.S. Fish and Wildlife Service personnel in 1969 and 1970. Survey of the area in

1974 revealed that the beaver population now approximates the pre-1969 level.

3. ALTERNATIVE ACTIONS AND THEIR PROBABLE IMPACTS:

A. No Action:

Exotic beaver will continue to occupy the bottom of the Kern Canyon altering both the river and riparian vegetation. Whether the population will remain near its current level, shrink due to a low of food, or expand into new habitat is unknown.

B. Monitor the Beaver Population:

The environmental effects would be the same as above, but we would learn the true seriousness or lack of urgency to controlling the beaver population. This would not help the natural environment, we would only know more about how it is being changed.

C. Control and Monitor the Beaver Population:

The beaver will either be extirpated or kept at low numbers. Beaver structures will be obliterated as they are discovered, and altered areas will be obliterated.

4. RECOMMENDED COURSE OF ACTION:

Alternative C which includes:

A. Management Actions:

Additional temporary Park Technicians would provide necessary manpower to control beaver and their dams in the Kern Canyon and restore once-flooded areas. Since it is difficult, if not impossible, to remove all of the beavers in the Park, reduction will be aimed at removing as many beavers as possible. The Parks will encourage the expansion of the project to an interagency cooperative project that would include Sequoia National Forest, increasing the potential for complete extirpation.

B. Monitoring Actions:

Efficient application of remedial measures requires monitoring and surveying to determine the effects of beaver tree cutting, water impoundment, vegetation and stream ecology impacts.

5. FUNDING:

A. Recurrent Funds Available in Parks' Base - None

B. O.N.P.S. Funds Requested - $20,000

C. Funds Source Requested - Regionwide Natural Resource Base (Cyclic)

NATURAL RESOURCES PROJECT STATEMENT

1. SEKI-RM-33 - AQUATIC/FISHERIES MANAGEMENT:

2. STATEMENT OF PROBLEM:

A. Current Conditions:

The need to maintain natural fish population, yet sustain a viable sport fishery requires a thorough knowledge of: (1) sport fishing intensity, (2) angler success, (3) distribution of fishing pressure, (4) local fish population dynamics, and (5) the relationships of the preceding to these Parks' fishing regulations and management objectives. Maintaining a natural sport fishery is further complicated by a long tradition of stocking that has complicated futuremanagement options by: (1) populating numerous naturally barren lakes, (2) altering the natural distribution of fish, (3) introducing competitively superior exotic species, (4) modifying and sometimes destroying the original population through genetic introgression, and (5) creating a precedent which is socially and politically difficult to alter. Furthermore, these Parks have a federally listed threatened species, the Little Kern golden trout. The Little Kern golden trout needs full time involvement. Currently, the Fish and Wildlife Specialist is involved in administering many other programs and can devote only a portion of his time to the fisheries program. Additional personnel are needed to adequately implement and monitor the program.

(1) Goal:

To restore the natural distribution and abundance of native fish.

(2) Objectives:

a. To develop regulations and other management practices that favor the survival and perpetuation of native species over exotic fish.

b. To restore extant native species or genetically unique groups to their former range.

c. To allow waters incapable of supporting fish populations to become barren.

d. To mitigate human influences that effect the

natural density and age-class distribution of native species.

e. To inventory the distribution and abundance of all fish species at 10-year intervals.

f. To monitor the distribution of fishing effort and fisherman success.

g. To enforce and document fisherman compliance with regulations.

h. To monitor effect of existing management practices on fish populations.

B. Past Actions:

Creel census and fish population studies began in 1980 to provide some management information. However, the data is preliminary and insufficient for a sound management program. These Parks collaborate with the California Department of Fish and Game on fisheries management issues and works with several agencies on the management of Little Kern golden trout.

3. ALTERNATIVE ACTIONS AND THEIR PROBABLE IMPACTS:

A. No Action:

These Parks will not be able to adequately evaluate existing fishing regulations or other fish management activities (such as stocking) and will be poorly equipped to either improve the sport fishery or move toward a more natural fish population. Where stocking occurs, mistakes in selecting sites may continue to be a problem due to insufficient pre-stocking information as most of the survey data used now is outdated. These Parks will not be able to identify the distribution of exotic species, evaluate their actual impact upon native species and, where necessary, take action to stop their spread. There would be relatively little information on fisheries success or the population fished. Likewise, these Parks would be poorly equipped to respond to the occasional requests it receives for information on Park fisheries.

B. Abandon Fishing and Fish Stocking to Allow Fish Populations to Attain their Natural Equilibrium:

Many fishermen would be outraged about losing their

right to fish, and this action would require a variance from current NPS policy regarding sport fishing in natural areas. Exotic species would continue to proliferate, and in some areas they would continue to displace native species. There would be no cost to managing the program, but law enforcement activities would have to be stepped up to enforce the closure. These Parks' staff would not have the inventory data needed to respond to public inquiries.

C. Provide Staff and Support for the Program:

Technicians will collect field data on distribution of fishing activity and fisherman success. Fish populations will be sampled to monitor seasonal and long term trends of fished and unfished populations. Technicians will maintain an inventory of the fishery resources (lakes and streams). Fish and Wildlife personnel will continue to collaborate with the California Department of Fish and Game on fishery programs. This information will be used to evaluate and revise (as necessary) existing fisheries management practices and regulations. The (PLTFT) Biological Technician will provide annual continuity, supervise field operations, and insure that the equipment is properly maintained.

4. Recommended Course of Action:

Alternative C which includes:

A. Resources Management Actions:

(1) Continue to participate in the program to restore the Little Kern golden trout to its former range.

(2) Develop and implement a program to manage Kern rainbow if they are present within these Parks.

(3) Develop and impose regulations that favor the natural abundance and size class distribution of native rainbow and golden trout and which are adverse to exotic brook and brown trout.

(4) Avoid planting any additional Park waters except as part of a restoration program.

(5) Develop program of public education regarding the fisheries management program.

(6) Actively enforce fishing regulations.

B. Monitoring Actions:

(1) Monitor the effect of existing regulations on fish populations.

(2) Monitor the distribution of fishing effort and fishermen success.

(3) Monitor the distribution and abundance of all fish species.

(4) Monitor level of compliance with regulations.

C. Reasearch Actions:

(1) Conduct initial inventory on the distribution and abundance of all fish.

(2) Determine how fish alter ecosystem of high elevation streams and lakes.

(3) Determine the distribution and abundance of Kern rainbow in the Kern drainage.

5. FUNDING:

A. Recurrent Funds Available in Parks' Base - $1,200

B. O.N.P.S Funds Requested - $32,000 Recurring
$ 5,000 Non-recurring - (FY)
$32,000 Recurring thereafter

C. Funding Source Requested - Park Base

NATURAL RESOURCES PROJECT STATEMENT

1. SEKI-RM-34 - SUPPORT FOR WATER QUALITY MONITORING PROGRAM (Included as part of RM-42):

2. STATEMENT OF PROBLEM:

   A. Current Conditions:

   A sound water quality program examines both chemical and biological indicators. Measurement of chemical properties provides an indicator of selected compounds at one point in time and does not show the impact of changes in the overall aquatic environment. The organisms that live in a stream are responding to their total environment. As fluctuations occur (due to changes in flow or chemical compounds), the organisms are present. While some organisms have wide tolerances for change, others have very narrow tolerances, and as such, are excellent indicators that a change in water quality occurred. This can indicate a possible change in one or several substances not measured (thus not detectable) in the chemical monitoring. However, without chemical monitoring, sources of change in aquatic systems cannot be identified. Both are needed: biologic monitoring to identify change, and chemical monitoring to identify what changed and attempt to locate its source or cause.

   These Parks are not sufficiently equipped or staffed to measure all major chemical constituents or any biologic indicators except bacteria. Many samples currently have to be sent to other laboratories for analysis of constituents, and there is no capability for using algae and invertebrates as indicator organisms.

   The current program is only funded for four months. Some stations should be monitored throughout the year.

   The impetus for a water quality monitoring program comes from the Federal Water Pollution Control Act Amendments of 1972 (PL92-500), the Clean Water Act of 1977 (PL95-217), Executive Order 11752 for prevention, control, and abatement of environmental pollution at federal facilities, and an Interangency Memorandum of Understanding between the EPA and NPS that provides for:

   - "Identification of ambient conditions necessary for naturally balanced populations. . . "

- "Participate in review and revision of State water quality standards," water quality criteria, and development and implementation of water quality management plans.

- "Participate is assessment of water quality impacts of both point and non-point sources. . . "

- "Provide . . . technical material pertinent to NPS resource management concerns. . . "

- Compliance with State water quality standards and to "advise EPA and State agencies of NPS monitoring results which indicate pollution that threatens areas. . . under Service jurisdiction.

- ". . . to recommend to EPA, State and local agencies, the specific water quality standards and criteria necessary to protect such listed (threatened or endangered) species and their natural environment."

- Encourage exchange of information.

(1) Goal: To restore and/or maintain natural aquatic environments in which physical, chemical, and biotic processes function uninfluenced by human activities.

(2) Objectives:

a. To inventory and classify aquatic environments by physical and chemical characteristics and biotic communities present; identify both common and unique aquatic systems.

b. To maintain long-term monitoring stations in representative aquatic environments recording ambient conditions to document changes and trends; be able to detect and distinguish between diel, seasonal, and long-term shifts.

c. To locate and document the magnitude and direction of changes in aquatic environments which are caused by management activities or visitor use patterns; and to develop and implement management programs to mitigate those activities.

d. To detect and evaluate conditions characteristic of external influences such as acid precipitation.

e. To recognize aquatic conditions that are potentially hazardous to human health and safety, and implementing

programs to advise visitors of health hazards and taking mitigating action where the cause is not natural.

f. To monitor the quality of water entering and leaving these Parks with regard to compliance with State and Federal standards for surface water.

g To acquire sufficient knowledge about these Parks' water quality to be able to provide intelligent input into State and local water management planning.

h To monitor water chemistry within Little Kern Golden Trout habitat.

B. Past Actions:

A monitoring program began in 1978 and funded by the NPS Western Regional Office. The USGS implemented the program in 1978-1980, collecting data on 20 constituents at 65 stream stations (1978 and/or 1979) and establishing three stations that continuously monitored temperature, conductivity, and flow. In 1981, the USGS maintained their continuous monitoring stations, and these Parks' staff initiated monitoring water quality constituents with funds from the NPS Western Regional Office. In 1982, the program received ONPS base funding to support monitoring for four months of the year. With those funds, twenty permanent monitoring stations were established and additional monitoring was initiated on impacts associated with visitor use management.

3. ALTERNATIVE ACTIONS AND THEIR PROBABLE IMPACTS:

A. No action:

These Parks will not have adequate information to achieve its water quality objectives. The monitoring program will continue to be limited to physical properties, several chemical constituents, and bacterial counts during four months of the year and limited primarily to one major drainage. Funds will be inadequate to send samples to commercial laboratories to perform analyses that cannot be performed in-house. Technician support will be unavailable to respond to unanticipated events such as fish kills, spray field problems, etc., during eight months of the year.

B. Increase Staff and Support Costs to Provide for Water Quality Monitoring Throughout the Year:

Staff and support costs will be available to maintain long-term monitoring stations, monitor waters crossing these Parks' boundaries, monitor aquatic impacts associated with various types of management practices, and have support to deal with unanticipated events such as fish kills. Tests that cannot be conducted at these Parks will be sent to commercial or other government labs. The program will gain long-term continuity, and employees will be able to deal with aquatic communities and indicator organisms as well as provide much better support on monitoring of physical and chemical properties.

C. Perform All Monitoring On Contract:

Monitoring would continue to be limited by existing budget. The interval between sample collection and reporting of results could extend from several hours to over one year. Response to unanticipated events, such as fish kills, would be difficult and sometimes impossible. In general, flexibility would be lost and costs per sample would increase. Much of the data collected might be of little value because of the sample's age when finally analyzed or deficiencies in the analyzing labs quality control.

Furthermore, personnel would be lacking on these Parks' staff to provide technical support on water management needs. This alternative would place these Parks in a very poor position to respond to its legislative mandates for water quality management.

4. RECOMMENDED COURSE OF ACTION:

Alternative B which includes:

A. Resources Management Actions:

(1) Planning and implementation of management actions to mitigate human-caused problems identified by the monitoring program.

(2) Provide personnel and support to upgrade the existing monitoring program to become parkwide and operational during twelve months of the year.

(3) Provide input to State and local water management planning.

(4) Advise visitors of unsafe surface water conditions.

B. Monitoring Actions:

(1) Maintain long-term monitoring stations in representative aquatic communities to document changes and trends.

(2) Monitor effects of management activities and visitor use patterns on aquatic environmentsidentify man-caused problems and help establish carrying capacities. Maintain surveillance for external threats to Parks' water quality.

(3) Monitor the quality of water crossing the Parks' boundary.

(4) Monitor water quality withing Little Kern golden trout critical habitat.

(5) Monitor for surface water conditions potentially hazardous to public health and safety.

5. FUNDING:

A. Recurrent Funds Available in Parks' Base - $ 19,500

B. O.N.P.S. Funds Requested - $48,600 (Included as part of Inc. No. 161 on Natural Resources Programming Sheet)

C. Funding Source Requested - Park Base

NATURAL SCIENCE PROJECT STATEMENT

1. SEKI-N-23 - INVENTORY OF AQUATIC RESOURCES:

2. STATEMENT OF PROBLEM:

A. Current Conditions:

There are about 2,650 lakes and ponds and thousands of miles of mapped rivers and streams within these Parks. Yet very little of this resource has ever been surveyed or studied. At a glance, the studies listed below seem like a significant amount of data; they provide very useful information. However, most of them were very limited in scope, being oriented at very specific problems. Techniques often were not comparable; and viewed holistically, all of the data combined provide a very sketchy description of the aquatic resources. Also, without a comprehensive inventory, there is no way to know how representative a particular site is of other park areas. One comprehensive survey is needed to measure the physical and chemical characteristics and biotic structure of each of the aquatic environments. This survey shall include lakes, ponds, rivers, streams, ephemeral pools, intermittent streams, wet meadows, warm springs, cold water springs, seeps, soda springs, cave pools and streams, snow pack, and ground water.

(1) Goal:

Survey and classify each of the Parks aquatic environments.

(2) Objectives:

a. To inventory and classify aquatic environments by physical and chemical characteristics and biotic communities present.

b. To identify both common and unique aquatic systems.

c. To make recommendations regarding the location of long-term monitoring sites, the frequency at which they should be surveyed, and what should be surveyed.

d. To identify potential and unknown existing aquatic resources management problems.

e. To make management recommendations regarding aquatic resources.

B. Past Actions:

The U.S. Geological Survey sampled 65 stream sites in 1978-79 primarily for major constituents; Zardus, et al. (1977) sampled the fish fauna in 137 lakes in 1977; Bradford et al. (1968) sampled 101 lakes for trace elements in 1965 and is repeating surveys in 1980-83; Dana Abel surveyed much of the Kaweah drainage for aquatic insects; Dennis Kubly (1983) and John Stoddard have surveyed plankton in many high lakes; John Melack measured pH and buffering capacity of lakes at several alpine sites; the Parks' water quality monitoring program has collected some data at 20 long-term monitoring stations and several facility-visitor use impact monitoring sites; and there have been several very local studies: the work of Don Erman and graduate students in the Rae-Sixty Lakes area; the current acid precipitation studies at Emerald Lake, Log Meadow, and Elk Creek; the effects of a forest fire on water quality (Hoffman and Ferreira 1976); a survey of visitor use impacts on two park lakes (James 1975); and water quality data collected in the Mineral King area by a variety of different agencies. The above list is not comprehensive, but probably represents better than 99% of all aquatic research in these Parks.

3. ALTERNATIVE ACTIONS AND THEIR PROBABLE IMPACTS:

A. No Action:

These Parks will continue to be unaware of the true nature of aquatic resources. Some management problems or potential problems may never be discovered, and sites selected for long-term monitoring of these resources may not be properly located. Unique, rare, or extremely fragile aquatic resources could be altered without management even being aware that they existed.

B. Conduct an Intensive Survey of the Aquatic Resources:

This will provide a firm foundation for all future management and monitoring actions regarding aquatic resources. Such a survey will also identify future aquatic research needs.

4. RECOMMENDED COURSE OF ACTION:

Alternative B which includes:

A. Research Actions:

Inventory and classify these Parks' aquatic environments for physical properties, chemical constituents, and biotic community structure and compostiion. Chemical sampling shall include major constituents, selected ions and trace elements biocides, and radioactivity. Biotic measurements will include productivity, community structure, and biota of special interest (e.g. fecal coliform bacteria).

5. FUNDING:

A. Recurrent Funds Available in Parks' Base - None

B. O.N.P.S. Funds Requested - $40,000/yr for three years.

C. Funding Source Requested - Servicewide Water Resources Base

6. REFERENCES:

Bradford, G.R., F.L. Bair, and V. Hunsaker. 1968. Trace and major element content of 170 high Sierra lakes in California. Limnology and Oceanography 13:526-530.

Hoffman, R.J. and F.F. Ferreira. 1976. A reconnaissance of the effects of a forest fire on water quality in Kings Canyon National Park, California. Open-file Report 76-497. U.S. Geological Survey, Menlo Park, California. 17 pp.

James, G. J. 1975. Effects of human activities on mountain lakes in California. Unpubl. Ph.D. dissertation. Univ. Calif., Irvine, California. 88pp.

Kubly, D.M. 1983. Plankton of high Sierra lakes. Southern California Edison Research and Development Report No. 83-RD-47. Univ. Calif., Riverside. 96pp.

Zardus, M.J., T. Black, and D. Schulz. 1977. Status of fishes in 137 lakes in Sequoia and Kings Canyon National Parks, California. National Park Service unpublished report. 96 pp.

NATURAL SCIENCE PROJECT STATEMENT

1. SEKI-N-25 - DETERMINE ECOLOGICAL IMPACTS OF ACID PRECIPITATION ON SELECTED ECOSYSTEMS:

2. STATEMENT OF THE PROBLEM:

   A. Current Conditions:

   Sequoia National Park has been recently selected as the site of a long term research program on the effects of acid precipitation on Western ecosystems. This program is part of a major interagency research project designed to quantify both input levels and effects on Parks' ecosystems of acid rain and snow. The project has been funded at a level that allows implementation of basic long term monitoring of precipitation chemistry and selected aquatic and terrestrial ecosystem parameters. In order to fully evaluate the ecological effects of acid precipitation it will be necessary to supplement this work with specific process level ecosystem research studies.

   Available data on precipitation chemistry documents the fact that summer and fall precipitation events are often highly acidic containing compounds of nitrogen and sulfur. In addition, the Sierra Nevada is especially susceptible to effects from atmospheric pollutants due to its poorly buffered granitic soils and low alkalinity lakes and streams. The existing acid precipitation research program will allow more complete documentation of both rain and snow chemistry, as well as lake and stream chemistry and selected vegetation parameters. These studies are designed to collect long term baseline data which will be of value in determining whether changes in ecosystem structure or function may occurr at some point in the future. Existing funding is insufficient to carry out such studies as the effects of acid precipitation on stream biota, fisheries, soil chemistry, soil hydrology and melt, litter decomposition, and fauna. In addition, natural fires are an integral part of Sierran Ecosystems. Since fire is known to have profound effects on biogeochemistry, including soil pH and levels of nitrogen and other elements, it is also essential to document the interaction of fire with acid precipitation.

B. Past Actions:

Sequoia National Park has been the site of an NADP monitoring station at Giant Forest for the past 2-1/2 years. This station is part of a national network documenting the acidity and ionic concentrations of rain and snow throughout the year. In 1982 Sequoia became one of three National Parks to be included in the National Acid Precipitation Assessment Program. Funding has been provided to implement a series of basic long term monitoring studies. In addition, such other groups as the USFS, USGS, and NASA are assisting in a cooperative effort to understand selected aspects of three major ecosystems in Sequoia National Park. Primary study sites have now been established in the chaparral, giant sequoia-mixed conifer forest and subalpine ecosystems.

3. ALTERNATIVE ACTIONS AND THEIR PROBABLE IMPACTS:

A. No Action:

The no action alternative would still allow for continued baseline monitoring of precipitation and water chemistry. Certain other baseline data on ecosystems at the three primary study sites will also be collected. A tremendous opportunity to fully document the long term impacts of acid precipitation across the elevation gradient found in the southern Sierra Nevada would be missed if no additional funds were made available to supplement ongoing studies. The lack of this additional information would prohibit conclusions regarding long term impacts which might occur within these Parks should current or projected increased levels of anthropogenic atmospheric contamination occur. If this alternative were chosen an opportunity to collect complete ecosystem data on potential impacts from acid precipitation would be lost. A situation similar to that which occurred in the Northeast where a lack of early research did not allow prediction of later problems before it was too late could be repeated.

B. Carry Out Research Projects on Specific Ecosystem Components:

Studies of the effects of acid precipitation on selected ecosystem components will be funded on a priority basis. Such data would allow for integrated analysis of long term impacts on park ecosystems. Priority studies would include effects of acid precipitation on aquatic biology, including stream biota and fisheries, snow hydrology and melt, soil

chemistry and microbiology, litter decomposition, and fauna. The type of data collected to be on the same primary study sites will allow for an integrated analysis and modeling of long term threats of acid deposition on park ecosystems as well as similar ecosystems around the world.

4. RECOMMENDED COURSE OF ACTION:

A. It is recommended that contract studies be carried out on selected high priority topics (Alternative B). Only this approach will allow for complete understanding of the susceptibility and potential effects of acid precipitation on park ecosystems. Since park ecosystems consist of complex interaction between a variety of species and trophic levels, it is important that no aspect be overlooked. For example, effects of increased acid deposition on forest productivity might prove to be a function of decreased nitrogen fixation by soil microorganisms. If nitrogen fixation rates are not understood, it could be impossible to predict future decreases in forest growth. All studies contracted under this program will be coordinated and integrated into the overall park research program on acid deposition. Funding will be required for a five year period.

5. FUNDING:

A. Recurring Funds Available from National Acid Precipitation Research Program - $99,000

B. O.N.P.S. Funds Requested - $60,000 for each of five years

C. Funding Source Requested - Servicewide Acid Precipitation Base

NATURAL RESOURCES PROJECT STATEMENT

1. SEKI-W-1 - STUDY IMPACTS OF SEWAGE SPRAYFIELD ON MID-SIERRAN STREAMS:

2. STATEMENT OF PROBLEM:

A. Current Conditions:

There are several sewage treatment plants in Sequoia and Kings Canyon National Parks. The older plants have an advanced form of primary treatment and new plants process sewage by secondary treatment. The processed wastewater is returned to the environment at sprayfields. Though the water is treated to remove pathogens, the water is rich in nutrients.

Nutrient concentrations in mid-Sierran granitic-soils are typically very low. Though secondary treatment of effluent may meet health and safety standards, there may be unacceptable effects on the natural aquatic environments. At the Giant Forest facility, measurable nutrient enrichment occurs at least downstream from the sprayfield.

(1) Goal:

Protect Park waters from nutrient enrichment caused by facilities.

(2) Objectives:

a. To study the limnologic effects of the effluent from a sewage facility using secondary or primary treatment.

b. To evaluate the duration and reversability of sewage impacts should input be terminated.

c. To evaluate potential benefits and impacts of tertiary treatments in the same environment.

d. To make recommendations regarding the most significant environmental monitoring that should be done at sewage facilities.

B. Past Actions:

Related studies were done in the Lake Tahoe basin, but there is a general lack of such studies elsewhere in the Sierra Nevada. The existing environmental assessments for

developments involving sewage facilities within these parks contain little to no substantive information regarding environmental impacts of either secondary or tertiary facilities. There has been some intermittent water quality monitoring downstream the Giant Forest sprayfield since December 1982 and at the Clover Creek sprayfield since the fall of 1982.

3. ALTERNATIVE ACTIONS AND THEIR PROBABLE IMPACTS:

A. No Action:

Without this study, we will continue to not know how we are altering the natural system that we are mandated to protect, and we will continue to propogate possible mistakes of the past.

B. Study Effects of Sprayfield:

Park management would have a better understanding of the extent and duration of adverse ecological effects associated with secondary sewage treatment in the mid-Sierran environment. Such information could be important when making decisions about what types of facilities to install in the future (secondary versus more expensive tertiary treatment), and whether existing facilities should be upgraded.

4. RECOMMENDED COURSE OF ACTION:

Alternative B which includes:

A. Monitoring Actions:

Conduct a thorough study of the environmental effects of an existing sewage facility. The study should:

a. Identify the extent of measurable effects during mid-winter, late spring-early summer high-flow conditions, during late summer minimum-flow conditions, and following major fall storms;

b. Compare density and diversity of benthic invertebrates and periphyton taxa in affected area with nearby controls;

c. Quantify major constituents and selected trace elements in affected and unaffected areas; characterize seasonal changes;

d. Measure nutrients and other selected ions in the soil at both an old abandoned sprayfield and in a nearby active sprayfield; evaluate the effects of the abandoned sprayfield on water quality, and estimate how long the abandoned site may be causing measurable effects on downstream aquatic communities after it is abandoned;

e. Make recommendations regarding the placement and level of treatment at future sewage facilities in these Parks;

f. Make recommendations regarding environmental monitoring at sewage facilities.

5. FUNDING:

A. Recurrent Funds Available in Parks' Base - None

B. O.N.P.S. Funds Requested - $36,000/yr for three years

C. Funding Source Requested - Servicewide Water Resources Base

NATURAL RESOURCES PROJECT STATEMENT

1. SEKI-W-4 - IMPLEMENT FLOODPLAIN STUDIES:

2. STATEMENT OF PROBLEM:

A. Current Conditions:

Executive Order 11988, Floodplain Management, requires that "Before taking an action, each agency shall determine whether the proposed action will occur in a floodplain," and consider alternatives if the action would be within the floodplain. "If property...is located in an identified flood hazard area, the responsible agency shall provide on structures, and other places where appropriate, conspicuous delineation of past and probable flood height in order to enhance public awareness of and knowledge about flood hazards." There are also many other requirements (e.g. construction standards) pertinent to areas within the floodplain.

These Parks have several major developments in low valley bottoms or with rivers and streams flowing through the developed site. Areas of particular concern are Cedar Grove, Lodgepole, Mineral King, and Buckeye Flats. In some areas some campsites have been reported to flood. The location of the 100-year and 500-year floodplains are unknown.

(1) Goal:

Determine the location of all 100 and 500-year floodplain boundaries.

(2) Objectives:

a. To conduct floodplain studies in a developed area of concern and in other areas where management actions may be affected by flooding.

b. To prepare maps delineating 100 and 500-year floodplains.

B. Past Actions:

Some employees thought that some floodplain work may have been done here, but no records were found in park files or through inquiries to the Western Regional Office.

3. ALTERNATIVE ACTIONS AND THEIR PROBABLE IMPACTS:

A. No Action:

This could result in violation of EO 11988, particularly if there is any future construction at any of the areas of concern; and floodplain hazards will continue to be poorly known.

B. Conduct Floodplain Studies of Entire Park:

Such studies would certainly make it possible to meet the requirements of EO 11988. However, such a study would probably far exceed the true management need and could be cost-prohibitive.

C. Conduct Floodplain Studies of Developed Areas of Concern and other Selected Areas:

Such studies would provide for the most cost-effective approach to complying with EO 11988 and providing for public safety.

4. RECOMMENDED COURSE OF ACTION:

Alternative C which includes:

A. Research Actions:

Conduct a thorough floodplain study in each developed area of concern and other areas selected by management.

5. FUNDING:

A. Recurrent Funds Available in Parks' Base - None

B. O.N.P.S. Funds Requested - $30,000/yr for two years

C. Funding Source Requested - Servicewide Water Resources Base

NATURAL RESOURCES PROJECT STATEMENT

1. SEKI-W-6 - MEASURE IMPACT OF PEOPLE ON BACKCOUNTRY LAKES:

2. STATEMENT OF PROBLEM:

A. Current Conditions:

Sometimes over 40 people per night camp by some of the more heavily used backcountry lakes during the summer. Because these lakes are located in high elevation granitic basins, their waters have extremely low natural concentrations of nutrients and other ions. The natural ecology of such ultra-oligotrophic environments is extremely vulnerable to adverse modification by anthropogenic contaminants such as feces, urine, soap, and dishwater. Furthermore there are less conspicuous impacts such as the stirring of bottom sediments by swimmers and waders; this liberates nutrients, increases turbidity, and dislodges benthic flora. In addition to ecological impacts, aesthetic impacts include social trails, denuded campsites, litter, and health hazards caused by human waste. At some of the lakes, the impacts are not only caused by visitors, but also by their pack animals.

1. Goal:

To manage human use of backcountry lakes for compatibility with preserving integrity of the natural environment and maintenance of their pristine appearance.

2. Objectives:

a. To monitor effects of human use on nutrient concentrations, productivity, benthic fauna, fecal bacteria, and aesthetic characteristics.

b. To monitor the quantity of human use at each monitoring site.

c. To determine carrying capacity and mitigating measures for lake sites.

B. Past Actions:

Preliminary investigations were initiated in 1983 at two backcountry lakes that receive heavy use relative to other

backcountry lakes and at nearby controls that receive virtually no visitation. The one lake (Guitar) receives heavy backpacker use, and the other lake (Forrester) is often visited by stock parties during the summer.

3. ALTERNATIVE ACTIONS AND THEIR PROBABLE IMPACTS:

A. No Action:

The effects of current management practices on one of the more fragile backcountry resources will continue to be unknown. Since adverse impacts often are not empirically detectable, serious management problems could be perpetuated because they were never investigated.

B. Monitor Effects on Human Use on Representative Backcountry Lakes:

These parks would acquire information useful for establishing carrying capacities at popular backcountry lake sites. It will also help evaluate the effectiveness of mitigating measures, such as use of pit privies.

4. RECOMMENDED COURSE OF ACTION:

Alternative B which includes:

A. Monitoring Actions:

To monitor levels of human use and effects on water quality constituents at several backcountry sites representative of a gradient of different levels and types of human use.

5. FUNDING:

A. Recurrent Funds Available in Park Base - None

B. O.N.P.S. Funds Requested - $23,000/yr for two years

C. Funds Source Requested - Servicewide Water Resources Base

VIII. REVIEW AND REVISION

All persons with responsibilities for management of aquatic/water resources will review this plan annually. Proposed changes will be submitted to the Fish and Wildlife Specialist in writing. The Fish and Wildlife Specialist will compile changes and route them through the Chief of Resources Management for review and comments. If the Superintendent accepts the changes it will be incorporated into the plan and the revised plan will be sent to the Regional Office for review and approval. Grammatical corrections and changes in the Appendix will be updated by the Fish and Wildlife Specialist as necessary. All revised pages will have the date of revisions typed in the lower right hand corner of the page. Revised pages will be sent to each Divison, District, and Subdistrict Office, the Western Regional Office, and the other persons upon request.

IX. APPENDIX

I. RESPONSIBILITIES

A. Superintendent

1. Responsible for the Aquatic/Water Resources Management program.

2. Approves/disapproves helicopter trips required to support the program.

B. Management Assistant

1. Prepares media releases.

C. Sanitarian

1. Coordinates monitoring of facility compliance with State and local requirements.

2. Investigates and evaluates potential health problems and seeks solutions.

3. Manages public health problems.

D. Maintenance Division

1. Operates facilities for sewage and water systems.

2. Monitors compliance with State and local facility requirements.

E. Safety Officer

1. Prepares and supplies brochures regarding health and safety threats regarding aquatic resources.

2. Reviews and monitors lab safety.

3. Oversees Hazard Waste program.

F. Ranger Division

1. Enforces fishing regulations.

2. Helps prepare Special Regulations for the CFR.

3. Advises backpackers and other visitors of health and safety problems and the appropriate way to prepare water for drinking in the backcountry.

4. Enforces closures and restrictions.

G. Interpretive Division

1. Provides public information on aquatic/water resources to include both safety and information about the aquatic resources.

H. Chief of Resources Management

1. Oversees the aquatic/water resources management program.

I. Fish and Wildlife Specialist

1. Manages the water quality monitoring program.

2. Develops and reviews the Aquatic/Water Resources Management Plan.

3. Manages the Research-Resources Management wet lab.

4. Recommends changes to existing regulation regarding aquatic/water resources management.

J. Water Quality Technicians

1. Implement aquatic resource monitoring programs.

K. Research Division

1. Conducts aquatic resources inventories.

2. Uses research to find solutions to aquatic/water resource management problems.

Detail of Annual Operating Requirements

50	16.1	A	86	105.04	0.040

Concise Description & Justification — Line 1

PROTECT HUMAN LIVES AND RESOURCE...

Line 3

MAGING HAZARD TREES, BEARS, AND...

Line 5

Concise Description & Justification — Line 2

INTEGRITY BY MONITORING AND...

Line 4

AIR AND WATER POLLUTION.

Line 6

ACT	Cost Ctr	Net Amount (In Thousands)	T/A	FTE Perm Pos	FTE Other	Par Plan	Grade	Position Title / Cost Component	PI S	PI S
A	0.12	30	R		.9	GS	07	PHYSICAL SCIENCE TECHNICIAN	B	B
A	0.12	25	R	1		GS	07	BIOLOGICAL TECHNICIAN	B	B
A	0.12	4	R	.3		GS	03	CLERK TYPIST	B	B
A	0.12	38	R		2.3	GS	05	PARK TECHNICIAN	B	B

TOTAL:
157,000 ✓
18,000 ✓
$175,000

Full Description and Justification

1. Full Increase Description: Annual activities include managing and monitoring of black bears, surveillance and removal of hazard trees from developed areas, monitoring and assessing threats of air and water pollution to man and natural resources, and administrative support for the above activities.

2. Summary of Ongoing Activities: On-going activities include the following:
   a. Bear Management--$38,800, FTE = 1.4
   b. Hazard Tree Surveillance and Removal--$136,200, FTE = 4.9
   c. Air and Water Pollution Monitoring--$39,600, FTE = 1.5
   d. Administrative support--$73,400, FTE = 2.6

3. Increase Justification/Consequences:
   a. Management Problem: Once bears learn to associate food with people, their normal behavior is modified and they routinely exploit park visitors' food. This problem is further enhanced by uniformed or careless visitors and a general lack of bear-proof facilities where food can be stored. The lack of trunks in many modern vehicles appears to have contributed to the problem by making the food more visible. The interaction between bears and visitors in recent years has created serious problems (1,215 incidents in 1982/83) and resulted in high property losses ($128,000 estimated damage in 1982/83) and potential for serious personal injury (eight injuries in 1982/83) and 14 bears killed including intentional and accidental, in 1982/83. The objective of the bear management program is to minimize this

k or Office	Superintendent or Office Chief	Regional Director
equoia and Kings Canyon National Park	(Signature & Title)	(Signature & Title)
	Date 1/1/__	Date

Concise Description & Justification	Line	Concise Description & Justification	Line
	Line 3		Line
	Line 5		Line

	A/C	Cost Ctr	Net Amount (in thousands)	P/T	FTE Perm Pos	FTE Other	Pay Plan	Grade	Position Title / Cost Component	PIS	PIS
5	A	0L2	3	R		2	WG	07	MOTOR VEHICLE OPERATOR	B	B
6	A	0L2	3	R		2	WG	07	TREE CLIMBER	B	B
7	A	0L2	6	R		4	WG	05	SAWYER	B	B
8	A	0L2	3	R		2	WG	04	FAYEMAN	B	B

Full Description and Justification

a. Interaction with elimination of all available unnatural food sources and education of park visitors as a primary BO

During 1982/83, 38 trees failed in developed areas causing an estimated $213,000 damage to structures. The three trees that were identified hazards caused $182,000 of this damage. Because of inflation, budget cuts and the loss of USFS funds since 1980, removal of the originally identified hazard trees (6,000) from developed areas has not been accomplished. In addition, 200 - 300 hazard trees must be removed annually to provide an essential level of safety for people and structures.

Air and water pollution are recognized as having the potential to seriously impact park natural resources. For example, high ozone levels have already injured yellow pine, black oak, and possibly sequoia seedlings. Summer rain storms have had a ph as low as 4.5. Also, since these Parks' surface waters are low in nutrients and poorly buffered, nutrients from human wastes and acidic deposition could cause major changed in the ecological structure of these Parks' aquatic communities. These Parks' waters are particularly vulnerable to high levels of visitor use and certain types of facilities like sewage spray fields. Present funding allows for summer and fall monitoring only, but not winter and spring. The levels and nature of air and water pollution at these times are unknown. The influence of particulates on visibility and dry acid deposition are also unknown.

or Office	Superintendent or Office Chief	Regional Director
	(Signature & Title) Date	(Signature & Title) Date

550 L61A 86 Z0504 004C

National Park Service
Detail of Annual Operating Requirements

Concise Description & Justification		Concise Description & Justification	
	Line 1		Line 2
	Line 3		Line 4
	Line 5		Line 6

A/C	Cost Ctr	Net Amount (in thousands)		FTE Perm Pos	FTE Other	Pay Plan	Grade	Position Title/Cost Component		
A	012	8	R		5	WG	03	LABORER	B	B
A	012	8	R					TRANSPORTATION	B	B
A	012	39	R					SUPPLIES AND MATERIALS	B	B
A	012	10	N					COMPUTER	B	B

Full Description and Justification

a. Administrative and clerical support, that includes a computer for data management and quarters, are needed to support the posposed increase for activities listed. Without this support; the additional activities could not be done.

b. Management Need: Bear problems exist in five frontcountry areas and in much of the backcountry. Existing staff cannot cover more than one of the frontcountry areas. Increase will provide personnel to implement programs designed to improve public safety and decrease bear incidents, property damage, and losses to the bear population to acceptable levels.

Some 500 new hazard trees and 1,900 backlog hazard trees will be removed. Staff available can only remove 300 hazard trees annually. Increase will bring program to an adequate level of safety for visitors.

Provide support to increase the air and water quality monitoring program from a five month program to year-round. This will provide assessment of air and water pollution effects on visitor safety and park resources. Administrative and clerical support will assure that data is managed properly and typing and other administrative duties are adequately performed.

Office	Superintendent or Office Chief		Regional Director	
	(Signature & Title)	Date	(Signature & Title)	Date

National Park Service

Detail of Annual Operating Requirements

Concise Description & Justification	Line 1	Concise Description & Justification	Line
	Line 3		Line
	Line 5		Line

A/C	Cost Ctr	Net Amount (In Thousands)	O/N	FTE Perm Pos	FTE Other	Pay Plan	Grade	Position Title / Cost Component	PMIS	PMIS
3	0012	8	W					QUARTERS	D	B

Full Description and Justification

Project Type: Mitigation--Project Type 79 - .6
Monitoring--Project Type 80 - .4

Immediacy: Additional personnel, trained in interpretive skills, wildlife biology, and animal handling and immobilization along with support (supplies, transportation and quarters) are required to meet the bear problem. Without these corrective measures, we must accept a high number of bear incidents risking public property and safety or kill 6 to 15 bears annually. Severity of damage is estimated to be 7-8. The bear problem is parkwide.

Since 1970, 4,100 of the original identified hazard trees have been removed. There remains1,900 trees, plus new hazard trees which may fail if not removed. Natural tree failures in developed areas can be expected to increase as evidenced in 1982/83, and inflict serious property damage to government or concession facilities estimated at a value of $50,000,000 and/or personal injury or death to visitors or employees. Since 1970, there have been two fatal injuries, ninepersonal injuries, and a total of $311,000 in property damage. Expensive tort claims could result from such additional failures. Maintenance of the program at the current substandard level invites additional potential personal injuries and property damage. Severity of the problem is estimated to be 5, since the problem occurs on 3,300 acres of developed areas, including concession areas.

or Office	Superintendent or Office Chief	Regional Director
	(Signature & Title) Date	(Signature & Title) Date

National Park Service

Detail of Annual Operating Requirements

8550 1669 | 186 | 105 04 | 0040

Concise Description & Justification	Concise Description & Justification
Line 1	Line 2
Line 3	Line 4
Line 5	Line 6

A C T	Cost Ctr	Net Amount (In thousands)		FTE Perm Pos	FTE Other	Pay Plan	Grade	Position Title/Cost Component	P I S	P I S

Full Description and Justification

These Parks cannot completely manage the air and water resources if the problem cannot be fully defined. Since these Parks are a Biosphere Reserve, it is essential that impacts of air and water pollution are known. Air pollution and acid deposition could be adversely impacting the giant sequoia. An expanded water quality monitoring program will handle these Parks to better establish carrying capacity for backcountry use, recognize potential environmental effects related to visitor use and management practices, and identify potential health hazards. The program also provides baseline data that will be important in evaluating future acidic deposition and air pollution trends, which is critical for the regulatory process that protects park air quality related values, AQRV's. To conduct the existing monitoring program will miss critical levels and patterns of air and water pollution. Severity of the problem is estimated to be potentially 10 on a scale of 10, because all ecosystems could be impacted by air and water pollution.

... or Office	Superintendent or Office Chief		Regional Director	
	(Signature & Title)	Date	(Signature & Title)	Date

1555d164A | 1 | 86 | 10505 | 0100 | Col. | Park | Region

National Park Service
Detail of Annual Operating Requirements

Concise Description & Justification — Line 1
AQUATIC/FISHERIES MANAGEMENT IS ... Line 3
NATURAL DISTRIBUTION, SIZE AND ... Line 5

Concise Description & Justification — Line 2
REQUIRED FOR THE RESTORATION OF ... Line 4
ABUNDANCE OF NATIVE SPECIES. ... Line 6

Num	A/C	Cost Ctr	Net Amount (In thousands)	P/T	FTE Perm Pos	FTE Other	Pay Plan	Grade	Position Title / Cost Component	PI S	PI S	TOTAL:
01	A	013	27	R		15	GS	05	PARK TECHNICIAN	B	B	$32,000
02	A	013	5	R					SUPPLIES AND TRANSPORTATION	B	B	5,000
03	A	013	5	N					CAPITALIZED EQUIPMENT	B	B	$37,000

Full Description and Justification

1. Full Increase Description: Technicians will collect field data on distribution of fishing activity and fisherman success. Fish populations will be monitored to determine the effects of current management practices on the distribution, size, and abundance of native and exotic species. This information will be used to evaluate and revise existing fisheries management practices in collaboration with personnel from California Department of Fish and Game. Park personnel will continue to work with other agencies in the recovery of a "threatened" species (Little Kern golden trout) by restoring them to their historic range.

2. Summary of Ongoing Activities: The existing program consists of responding to visitor and agency inquiries and about one week of field work annually to assist California Department of Fish and Game and US Forest Service with recovery of Little Kern golden trout and partial monitoring of pure populations on park land. A small fisheries population monitor program was initiated in 1980; those sites will be resampled in 1985 if sufficient volunteers are available. Estimated amount of base funds used annually for fisheries management and FTE is $1,200 (0.1 FTE).

3. Increase Justification/Consequences:
a. Management Problem: The need to maintain natural fish population, yet sustain a viable sport fishery requires a thorough knowledge of: (1) sport fishing intensity, (2) angler success, (3) distribution of fishing pressure, (4) local fish population dynamics, and (5) the relationships of the preceeding to these Parks' fishing regulations and management

k or Office	Superintendent or Office Chief	Regional Director
Sequoia and Kings Canyon National	(Signature & Title) Date	(Signature & Title) Date

Detail of Annual Operating Requirements

Concise Description & Justification — Line 1

Concise Description & Justification — Line

Line 3

Line

Line 5

Line

Cost Ctr	Net Amount (in thousands)	FTE Perm Pos	FTE Other	Pay Plan	Grade	Position Title/Cost Component	PDS	PDS

Full Description and Justification

a. objectives. Maintaining a natural sport fishery is further complicated by a long tradition of stocking that has complicated future management options by: (1) populating numerous naturally "barren" lakes, (2) altering the natural distribution of fish, (3) introducing competitively superior exotic species, (4) modifying and sometimes destroying the original population through genetic introgression, and (5) creating a precedent which is socially and politically difficult to alter.

b. Management Need: This information will make it possible to monitor the effectiveness of existing fisheries practices to achieve objectives and provide information on where and how the fisheries program should be changed. Failure to implement this program will eliminate feedback and will perpetuate aquatic communities that have been unacceptably altered by previous importation and planting of exotic species.

Project Type: Research--Project Type 78 - 0.2
Mitigation--Project Type 79 - 0.3
Monitoring--Project Type 80 - 0.5
1.0

Immediacy: Most of the change has already been done and probably will not get much worse. As a result, the Parks' rivers and lakes are some of the most extensively altered communities. Severity of damage estimated at 8.

Office	Superintendent or Office Chief	Regional Director
	(Signature & Title) Date	(Signature & Title) Date

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

DEVELOPMENT/STUDY PACKAGE PROPOSAL

PAGE ___ OF ___ FOR THIS PACKAGE

PACKAGE NO. 252
REVISION NO. 1

ORG. NO.	PARK (OR OTHER ORIGINATOR)	DEVELOPED AREA (NAME)	D.A. CODE	REGION
8550	Sequoia and Kings Canyon NP	Park General	PG	WRO

STATE	STATE CODE	COUNTY(S)	CONGRESSIONAL DISTRICT
California	CA	Tulare, Fresno	17

PACKAGE TITLE: STUDY IMPACT OF SEWAGE ON MID-SIERRAN STREAMS

STUDY PACKAGE ☐
NEW CONSTRUCTION B ☐
REHABILITATION A ☐
NEW PACKAGE ☐
REVISION ☒

CRITERIA (INSERT X's)	PARK PRIORITY	DATE	REGION PRIORITY	DATE
220	28	3/12/84		

PROGRAM THRUST, STATUS AND OTHER INFORMATION

PROTECTION OF NATURAL SYSTEMS

WILL ADDITIONAL OPERATING FUNDS AND POSITIONS BE NEEDED UPON COMPLETION OF THIS PACKAGE? YES ☐ NO ☒
(IF "YES" EXPLAIN NEEDS IN SECTION XI OUTLINE OF PLANNING AND MANAGEMENT REQUIREMENTS)

FULL PACKAGE DESCRIPTION

Y1: Initiate study that will: (a) identify extent of measurable effects; (b) determine seasonal differences; (c) compare density and diversity of benthic invertebrates and periphyton with those in unaffected areas; (d) measure effects on major constituents, trace elements, nutrients, and heavy metals; and (e) evaluate soil-effluent interact and leach rates.

Y2: Continue with work from previous year.

Y3: Complete field work and final report with recommendations for long-term monitoring downstream sewage facilities.

PACKAGE JUSTIFICATION/CONSEQUENCES

- Management Problem: Is secondary treatment of sewage effluent in a mid-Sierran granit environment adequate to protect natural ecological processes.

- Management Needs: Mid-Sierran waters are extremely low in nutrients. Most of the nutrients are not removed by either primary or secondary treatment. Nutrient enrichmer has been measured as much as 0.6 km downstream of one sprayfield. The nature and magnitude of ecological impacts caused by this enrichment is not known. Without this study, we will continue to not know how we are altering the natural system that we are mandated to protect, and we will continue to propagate possible mistakes of the pas

PLANNING AND MANAGEMENT REQUIREMENTS *(Follow instructions and outline provided in Program Formulation Guideline)*

ignificant Issues and Influences:

- Available Information: Existing monitoring during the past year below the Clover Creek Sprayfield has demonstrated possible measurable nutrient enrichment. A stream origina at the bottom of the new Clover Creek sprayfield and is likely to be affected by operation of that spray/leach field.

(continued next page)

REQUESTED BY (Signature and Title)	DATE	CONCURRENCE (Signature of Superintendent or Equivalent Official)	DATE
William L. Bancroft, Chief Resources Mgmt.	3/14/84		3/14/84

REGIONAL DIRECTOR (Signature and Title) | DATE

PROJECT TITLE: STUDY IMPACT OF SEWAGE ON MID-SIERRAN STREAMS

Significant Issues and Influences:

2. Project Type: Monitoring--Project Type 80

3. Mandated Project: No

4. Park Resources: The affected sites are natural riparian areas that are virtual uninfluenced by humans except for the sewage.

5. Immediacy: This is monitoring that will assess the effects of the secondary treatment plants at Clover Creek and Grant Grove on mid-Sierran granitic environments. Whether irreversible damage is caused, will not be known until the monitoring is done. The consequences of deferral is the possibility of installation of inadequately designed treatment facilities.

6. Magnitude: Unknown; this is why monitoring is needed.

7. Health/Safety: Probably no effect.

8. Scope of Contribution: Yes. These data would be applicable to other parts of the Sierra Nevada and other areas with similar substrate and climate.

9. Data Collection: This monitoring would primarily create new baseline data, but would also add to some existing nutrient records.

Cost/Staffing Estimates:

1. Cost: $108,000 (estimated total). FY1--$36,000; FY2--$36,000: FY3--$36,000

2. Funding/Staffing Commitments: The park will be able to provide limited use of the existing research facility lab, and both research and resources management personnel who can provide assistance with technical and logistical problems.

3. Other Funding Sources: None anticipated.

4. Benefits of Immediate Funding: The sooner this project is done, the sooner we be able to determine the impacts of sewage treatment systems.

Field Office Contact:

1. Contact: Resources Management, Harold W. Werner, Fish and Wildlife Specialist, (209-565-3341, ext. 221).

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

DEVELOPMENT/STUDY PACKAGE PROPOSAL

PACKAGE NO. 263
REVISION NO.

ORG NO	PARK (OR OTHER ORIGINATOR)	DEVELOPED AREA (NAME)	DA CODE	REGION
8550	Sequoia & Kings	Park General	PG	WRO

STATE	STATE CODE	COUNTY(IS)	CONGRESSIONAL DISTRICT
California	CA	Tulare, Fresno	17

PACKAGE TITLE: MEASURE IMPACT OF PEOPLE IN BACKCOUNTRY LAKES

STUDY PACKAGE ☐
NEW CONSTRUCTION B ☐
REHABILITATION A ☐
NEW PACKAGE ☒
REVISION ☐

CRITERIA (INSERT X s)	PARK PRIORITY	DATE	REG'N PRIORITY	DATE
220	11	3/12/84		

PROGRAM THRUST, STATUS AND OTHER INFORMATION
DETERMINE CARRYING CAPACITY

WILL ADDITIONAL OPERATING FUNDS AND POSITIONS BE NEEDED UPON COMPLETION OF THIS PACKAGE?
(IF YES EXPLAIN NEEDS IN SECTION XI OUTLINE OF PLANNING AND MANAGEMENT REQUIREMENTS)
YES ☐
NO ☒

WILL PACKAGE DESCRIPTION.

1: Refine and apply the visitor impact concepts developed by Don Erman and graduate students in the Rae-Charlotte-Sixty Lakes basins to developing a generalized biotic carrying capacity for backcountry lakes. The work will involve developing an index of use and taking a series of measurements like nutrients, benthic flora, iron, productivity, etc. Surveys will be conducted at a large number (@ 30-100) of lakes representing different levels of use.

2: Continue field work from previous year and prepare final report.

PACKAGE JUSTIFICATION/CONSEQUENCES

Management Problem: How many people can camp or otherwise recreate in the vicinity of various types of Sierran lakes before there are significant changes in the lakes' ecol

Management Need: Sierran lakes are typically, extremely low in nutrients and other constituents. As such, they are extremely vulnerable to being altered by anthropogeni wastes.

PLANNING AND MANAGEMENT REQUIREMENTS *(Follow instructions and outline provided in Program Formulation Guideline)*

Significant Issues and Influences

Available Information: Don Erman's work showed that as visitation increased, nitrate concentrations decreased and benthic flora increased. More recent monitoring in other lakes by park staff produced results consistent with Erman's findings, implying that h work could be used as the basis for developing a generalized model for carrying capaci at lake sites.

(continued next page)

SIGNATURE: Signature and Title of Originator	DATE	CONCURRENCE (Signature of Superintendent or Equivalent Official)	DATE
William L. Bancroft, Chief of Resources Mgmt.	3/13/84		3/14/84

SEE ... Signature of Regional Director or Equivalent Official | DATE

U.S. GOVERNMENT PRINTING OFFICE: 1978-634-966/401

PROJECT TITLE: MEASURE IMPACT OF PEOPLE ON BACKCOUNTRY LAKES

Significant Issues and Influences:

2. Project Type: Monitoring--Project Type 80 or Research--Project Type 78.

3. Mandated Project: No

4. Park Resources: The affected sites are all park lakes and ponds as well as strea draining from them. There are 2,648 lakes and ponds on the Parks' inventory. Lak are popular destinations for backpackers and stock parties.

5. Immediacy: This spatial survey is needed now as complementary information to the existing temperal monitoring of visitor use impacts at several selected sites. De of this work will decrease how quickly biotic carrying capacities can be establis

6. Magnitude: Affects all park lakes and ponds.

7. Health/Safety: Yes. This work will test for fecal bacteria and use the results in evaluating their origin (human vs. natural). Indirectly, this work will ident areas where existing use may be contributing to a potential health problem in addition to environmental changes. The results of this work will help provide a management mechanism to correct any existing health problems.

8. Scope of Contribution: Yes. These data should be applicable to other Sierra Nevada parks because of the similarity of lakes and climate throughout the Sierra Nevada.

9. Data Collection: This project will produce baseline data at most of the sites an also contribute to monitoring changes. The data will be an important contributio to the existing water quality data base.

Cost/Staffing Estimates:

1. Cost: $46,000 (estimated total). FY1--$23,000; FY2--$23,000.

2. Funding/Staffing Commitments: These Parks have a professional staff of research resources management personnel that will either implement the project "in house" coordinate a contract for its completion. The park will be able to provide limit use of the existing research facility lab.

3. Other Funding Sources: None anticipated.

4. Benefits of Immediate Funding: Immediate funding would facilitate establishment of biotic carrying capacities at backcountry lakes improving protection of the lakes' ecology and reducing health and safety risks. Also, immediate funding would dove-tail nicely with existing temperal monitoring of backcountry lake site

Field Office Contact:

1. Contact: Resources Management, Harold W. Werner, Fish and Wildlife Specialist, (209-565-3341, ext. 221).

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

DEVELOPMENT/STUDY PACKAGE PROPOSAL

FOR THIS PACKAGE

PACKAGE NO. 264
REVISION NO.

ORG NO	PARK (OR OTHER ORIGINATOR)	DEVELOPED AREA (NAME)	DA CODE	REGION
8550	Sequoia and Kings Canyon NP	Park General	PG	WRO

STATE	STATE CODE	COUNTY(S)	CONGRESSIONAL DISTRICT
California	CA	Tulare, Fresno	17

PACKAGE TITLE: COMPLETE INVENTORY OF AQUATIC RESOURCES

STUDY PACKAGE ☐
NEW CONSTRUCTION B ☐
REHABILITATION A ☐
NEW PACKAGE ☒
REVISION ☐

CRITERIA (INSERT X s): 2 2 0

PARK PRIORITY	DATE	REGION PRIORITY	DA
15	3/12/84		

PROGRAM THRUST, STATUS AND OTHER INFORMATION: ESTABLISH BASELINE DATA

WILL ADDITIONAL OPERATING FUNDS AND POSITIONS BE NEEDED UPON COMPLETION OF THIS PACKAGE? YES ☐ NO ☒
(IF YES EXPLAIN NEEDS IN SECTION XI OUTLINE OF PLANNING AND MANAGEMENT REQUIREMENTS)

FULL PACKAGE DESCRIPTION:

Y1: Initiate inventory and classification of all aquatic environments by physical and ch characteristics and by biotic communities present. Inventoried resources will inclu lakes, ponds, rivers, perennial streams, intermittant streams, soda springs, warm sp cold water springs, wet meadows, seeps, ground water, cave pools, and snow pack.

Y2: Continue work from previous year.

Y3: Complete field work and prepare final report with recommendations for long-term moni and management.

PACKAGE JUSTIFICATION/CONSEQUENCES:

- Management Problem: What physical and chemical characteristics and biotic communities acterize these Parks' aquatic resources, and what would be the most cost-effective way to monitor for anthropogenic influences caused by management practices and long-term c in ambient conditions?
- Management Needs: This information is essential for identifying management priorities aquatic resources and for developing the most cost-effective monitoring program. With this research, unique, rare, or extremely fragile aquatic resources could be altered without management even being aware they exist.

PLANNING AND MANAGEMENT REQUIREMENTS *(Follow instructions and outline provided in Program Formulation Guideline)*

Significant Issues and Influences:

- Available Information: The U.S. Geological Survey sampled 65 stream sites in 1978-79 primarily for major constituents; Maurice Zardus (SEKI) sampled the fish fauna in 137 lakes in 1977; Gordon Bradford (U. C. Riverside) sampled 101 lakes for trace elements 1965 and repeated surveys in 1980-83; Dana Abel surveyed much of the Kaweah drainage f

(continued next page)

ORIGINATOR (Signature and Title)	DATE	CONCURRENCE (Signature of Superintendent or Equivalent Official)	DATE
William L. Bancroft, Chief Resources Mgmt.	3/13/84		3/14/84

CONCURRENCE: Signature of Regional Director or Equivalent Official — DATE

U.S. GOVERNMENT PRINTING OFFICE: 1976-634-968/401

PROJECT TITLE: COMPLETE INVENTORY OF AQUATIC RESOURCES

Significant Issues and Influences:

1. aquatic insects; Dennis Kubly and John Stoddard have surveyed plankton in many high lakes; John Melack measured pH and buffering capacity of lakes at several alpine sites; the Parks' water quality monitoring program has collected some d at 20 long-term monitoring stations and several facility-visitor use impact mo ing sites; and there have been several very local studies: the work of Don En and graduate students in the Rae-Sixty Lakes area; the current acid precipitat studies at Emerald Lake, Log Meadow, and Elk Creek; the effects of a forest fire on water quality; a survey of visitor use impacts on two park lakes and water quality data collected in the Mineral King area by a variety of differen agencies. The above list is not comprehensive, but probably represents better than 99% of all aquatic research in these Parks.

2. Project Type: Research - Project Type 78

3. Mandated Project: No

4. Park Resources: This project affects the future management and monitoring of aquatic resources. The Parks' aquatic resources may be some of the most alter resources due to a long history of introducing exotic fish and various inverte and plants. Anthropogenic pollutants from heavy visitation, facilities, and atmospheric deposition and physical alteration of some natural waters for recr or economic use have all contributed to altering aquatic resources. Because m the Parks waters are poorly buffered and ultra-oligotrophic, they are extremel vulnerable to human influences.

5. Immediacy: Becuase of the sensitivity of aquatic resources to human influence historic impacts to aquatic resources, this inventory needs to be done as soon as possible so that appropriate management and monitoring programs can be developed. Deferral would result in some sensitive or rare aquatic resources be altered without management being aware of the problem, particularly as new facilities are constructed.

6. Magnitude: Park-wide aquatic resources.

7. Health/Safety: Yes. Some of the constituents measured (e.g. arsenic, fecal b etc.) also relate directly to standards for health and safety. Waters that ar not safe for human consumption will be identified.

8. Scope of Contribution: Yes. The classification developed for the inventoried waters will be largely applicable to other Sierra Nevada parks.

9. Data Collection: Most of the data collected would be baseline data. This inve would become the "common thread" that would link data from previous aquatic research.

Cost/Staffing Estimates:

1. Cost: $120,000 (estimated total). FY1--$40,000; FY2--$40,000; FY3--$40,000.

PROJECT TITLE: COMPLETE INVENTORY OF AQUATIC RESOURCES

Cost/Staffing Estimates:

2. Funding/Staffing Commitment: These Parks' will be able to provide for limited of the existing research-facility lab. Both research and resources management personnel are available to provide assistance with technical and logistical pr

3. Other Funding Sources: None anticipated.

4. Benefits of Immediate Funding: Completion of this inventory will improve the cost-effectiveness of the existing monitoring program by assuring that certain aquatic resources are not overly sampled while other aquatic resources not monitored at all. Also, this inventory should generate a prioritized comprehensive list of aquatic resources management problems for which programs need to be developed.

Field Office Contact:

1. Contact: Resources Management, Harold W. Werner, Fish and Wildlife Specialist (209-565-3341, ext. 221).

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

DEVELOPMENT/STUDY PACKAGE PROPOSAL

PAGE ___ OF ___ FOR THIS PACKAGE

PACKAGE NO. 265
REVISION NO.

ORG. NO.	PARK (OR OTHER ORIGINATOR)	DEVELOPED AREA (NAME)	DA CODE	REGION
8550	Sequoia & Kings Canyon NP	Park General	PG	WRO

STATE	STATE CODE	COUNTY(S)	CONGRESSIONAL DISTRICT
California	CA	Tulare, Fresno	17

PACKAGE TITLE: IMPLEMENT FLOODPLAIN STU DIES IN DEVELOPED AREAS

STUDY PACKAGE ☐
NEW CONSTRUCTION B ☐
REHABILITATION A ☐
NEW PACKAGE ☒
REVISION ☐

CRITERIA (INSERT 'X's)	PARK PRIORITY	DATE	REG'N PRIORITY	DATE
2 2 8	30	3/12/84		

PROGRAM THRUST, STATUS AND OTHER INFORMATION:
SAFETY

WILL ADDITIONAL OPERATING FUNDS AND POSITIONS BE NEEDED UPON COMPLETION OF THIS PACKAGE? (IF 'YES' EXPLAIN NEEDS IN SECTION XI OUTLINE OF PLANNING AND MANAGEMENT REQUIREMENTS)
YES ☐
NO ☒

FULL PACKAGE DESCRIPTION:

F1: Conduct floodplain studies at Cedar Grove and Lodgepole.

F2: Conduct floodplain studies at Mineral King and Buckeye Flats/Potwisha

PACKAGE JUSTIFICATION/CONSEQUENCES

- Management Problem: What are the boundaries of the 100 and 500 year floodplain in developed areas adjacent rivers.

- Management Need: Some existing structures could be within the floodplain. Knowing the boundaries is pertinent to any future construction in those areas as required by Executive Order 11988.

PLANNING AND MANAGEMENT REQUIREMENTS (Follow instructions and outline provided in Program Formulation Guideline)

Significant Issues and Influences

- Available Information: In some of the developed areas, some campsites have been report to flood. Though various flooding is not known to have ever occurred in the parks, in areas developments are close to the rivers and could be within the 100 or 500 year floo plains.

- Project Type: Research - Project Type 78

(continued on next page)

ORIGINATOR (Signature and Title)	DATE	CONCURRENCE (Signature of Superintendent or Equivalent Official)	DATE
William L. Bancroft, Chief Resources Mgmt.	3/13/84		3/14/84

APPROVAL (Signature of Regional Director or Equivalent Official) DATE

U.S. GOVERNMENT PRINTING OFFICE: 1978-634-966/401

PROJECT TITLE: IMPLEMENT FLOODPLAIN STUDIES IN DEVELOPED AREAS

Significant Issues and Influences:

3. Mandated Project: Yes

4. Park Resources: This effects floodplains in all developed areas.

5. Immediacy: Required prior to implementing any management action which could be within a floodplain. Also required for delineating maximum flood heights on existing facilities which could be within the floodplain.

6. Magnitude: The likelyhood of existing facilities being in jeopardy of a dangerou flood seems to be low.

7. Health/Safety: Yes. This information would be used to either warn people using facilities within floodplains or to insure that future facilities are not built within floodplains, unless they have to be located there and are built to flood standards.

8. Scope of Contribution: Site specific.

9. Data Collection: These studies would probably both produce some new data and analyze both new and historic data to determine floodplain boundaries.

Cost/Staffing Estimate:

1. Cost: $60,000 (estimated $15,000/drainage). FY1--$30,000; FY2--$30,000.

2. Funding/Staffing Commitments: Maintenance and resource management personnel will assist with locating historic data and construction plans.

3. Other Funding Sources: None

4. Benefits of Immediate Funding: Project affects safety and future development. The sooner this information is known, management can take whatever action is required.

Field Office Contact:

1. Contact: Resource Management, Harold W. Werner, Fish and Wildlife Specialist.
Maintenance, Ken Bachmeyer, Chief of Maintenance
Phone: 209-565-3341

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

DEVELOPMENT/STUDY PACKAGE PROPOSAL

PACKAGE NO. 269
REVISION NO.

ORG. NO.	PARK (OR OTHER ORIGINATOR)	DEVELOPED AREA (NAME)	D.A. CODE	REGION
8550	Sequoia and Kings Canyon NP	Park General	PG	WRO

STATE	STATE CODE	COUNTY(S)	CONGRESSIONAL DISTRICT
California	CA	Tulare/Fresno	17

PACKAGE TITLE: DETERMINE ECO IMPACT OF ACID PRECIPITATION ECOSYSTEM

STUDY PACKAGE ☐
NEW CONSTRUCTION B ☐
REHABILITATION A ☐
NEW PACKAGE ☒
REVISION ☐

CRITERIA (INSERT X s)	PARK PRIORITY	DATE	REG'N PRIORITY	DATE
220	13	3/12/84		

PROGRAM THRUST, STATUS AND OTHER INFORMATION

ESTABLISH BASELINE DATA

WILL ADDITIONAL OPERATING FUNDS AND POSITIONS BE NEEDED UPON COMPLETION OF THIS PACKAGE? YES ☒ NO ☐
(IF 'YES' EXPLAIN NEEDS IN SECTION XI OUTLINE OF PLANNING AND MANAGEMENT REQUIREMENTS)

FULL PACKAGE DESCRIPTION.

FY1: Solicit proposals and issue contracts for baseline studies on stream biota, fisheries snow hydrology and snow melt.
FY2: Continue FY1 studies and initiate litter decomposition study.
FY3: Continue FY2 studies and initiate soil microbiology and fauna studies.
FY4: Continue FY3 studies.
FY5: Wrap up contract studies.

PACKAGE JUSTIFICATION/CONSEQUENCES

anagement Problem: The Sierra Nevada has been identified as one of the areas of the count ensitive to acid precipitation. Poorly buffered soils and water and increasing pollutant uction threaten the health of natural biotic communities in the parks and wildernesses of

anagement Need: This project will provide for the additional studies needed to fully docu he sensitivity of key ecosystems to acid precipitation as well as the potential for future amage. It will fund contract studies necessary to complement ongoing work in establishing n "integrated watershed" type study that looks at all key ecosystem components and process

PLANNING AND MANAGEMENT REQUIREMENTS *(Follow instructions and outline provided in Program Formulation Guideline)*

Significant Issues and Information

- Available Information: Information is basically lacking on the areas to be studied und this project. Acid precipitation research in other areas has identified these as key elements for such a study.

- Project Type: A. Research - Project Type 78

(continued on next

ORIGINATOR Signature and Title	DATE	CONCURRENCE (Signature of Superintendent or Equivalent Official.)	DATE
William L. Bancroft Chief of Resources Mgmt.	3/13/84	Fuson	3/14/84

CONCURRENCE: Signature of Regional Director or Equivalent Official

U.S. GOVERNMENT PRINTING OFFICE: 1978-834-966/401

ACKAGE TITLE: DETERMINE ECO IMPACT OF ACID PRECIP ON ECOSYSTEM

ignificant Issues and Information:

- Mandated Project: This project complements research mandated in the Federal Acid Precipitation Act but is not specifically mandated itself.

- Park Resources: All park resources as well as similar resources throughout the Sierra Nevada and the rest of California are threatened.

- Immediacy: If there is to be an understanding of the magnitude and causes of the probl it is essential that the data be collected in the very near future.

- Magnitude: The magnitude and potential severity of the problem are thought to be seric as evidenced by recent State of California legislation mandating additional acid precip research in the Sierra Nevada. This research must be carried out before the severity c be truly documented.

- Health and Safety: The threats of acid precipitation to human health are essentially u known. This project will not elucidate such information.

- Scope of Contribution: This project will be of value to management agencies throughout the Sierra Nevada. Sequoia has been selected as the center of such research in Califor Interest and cooperation from state, federal, university and private interests is well established.

- Data Collection: This project will collect and analyze baseline data necessary to mon: potential future change.

ost/Staffing Estimates:

- Cost: $300,000 (estimated total) FY1--$60,000; FY2--$60,000; FY3--$60,000: FY4--$60,(FY5--$60,000.

- Funding/Staffing Commitment: The park will contribute time and support of two researcl scientists (0.2 FTE) and an ecologist (0.1 FTE) to supervise the project.

- Other Funding Sources: Cooperative funding of aspects of the acid precipitation resear program is expected from the State of California, the Electrical Power Research Institu the US Geological Survey and the National Park Service.

- Benefits of Immediate Funding: Immediate funding would allow maximum benefits from int gration with cooperative projects.

ield Office Contact:

- Contact: Research, David Parsons, Research Scientist (209-565-3341, Ext. 270)

7
8
9
10
6
7
8
9
10
11
90
Simulation of the ColorChecker® chart from GretagMacbeth™