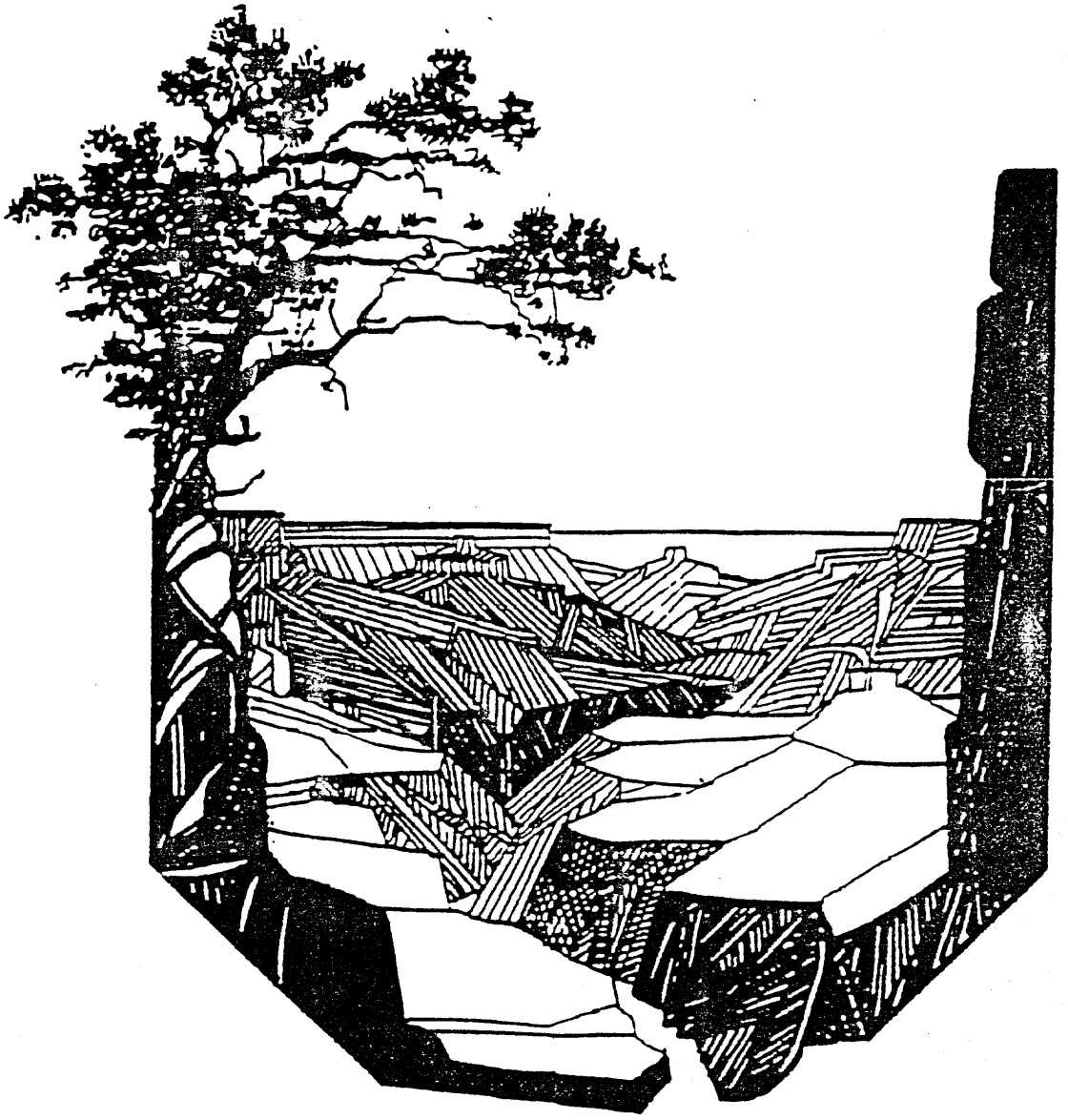
COLORADO RIVER MANAGEMENT PLAN

December 1979



Grand Canyon National Park

National Park Service
United States Department of the Interior

COLORADO RIVER MANAGEMENT PLAN

GRAND CANYON NATIONAL PARK

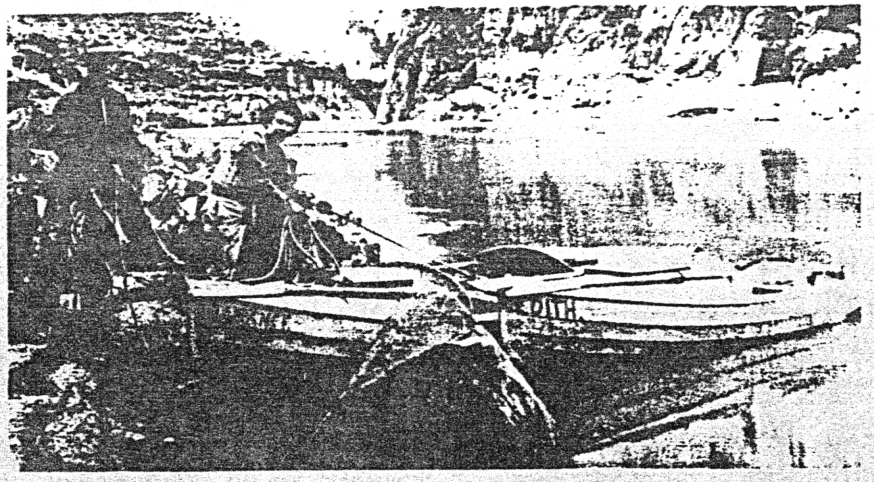
ARIZONA

Prepared by
Grand Canyon National Park
National Park Service
U.S. Department of the Interior

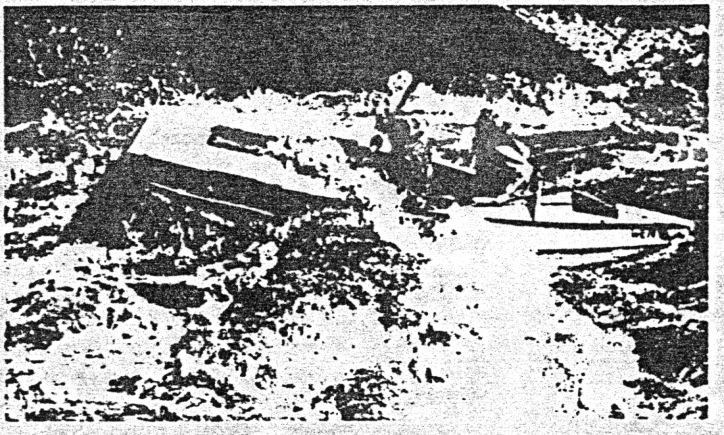
Proposed: _____ 12-20-79
Superintendent, Grand Canyon National Park — Date

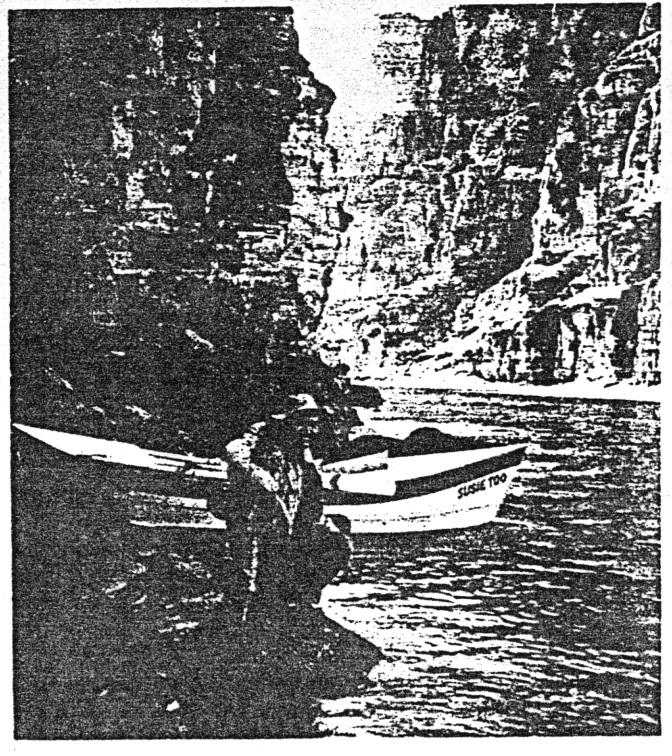
Recommended: Howard H. Chapman 12-20-79
Regional Director, Western Region — Date

Approval: _____ 12/20/79
Director, National Park Service — Date

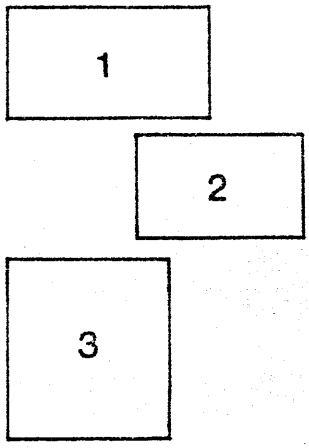


Colorado River Management Plan





Grand Canyon National Park
Arizona



1 The **Edith**, a cataract boat named for Emery Kolb's daughter, was built in 1911 from plans furnished by Julius Stone, and was used by the Kolb brothers on their Grand Canyon photographic expedition.

2 The **Wen**, an improved cataract boat, was designed by Norman Nevills, who pioneered commercial river running in the Grand Canyon. Used until 1949 in twelve river trips, this boat travelled 4,500 miles on the Colorado River.

3 First named the **Susie Too**, this boat was renamed the **Music Temple** for the great vaulted alcove in Glen Canyon now beneath the waters of Lake Powell. Used for ten years after its launching in 1963, the **Music Temple** was replaced with larger, more efficient dories.

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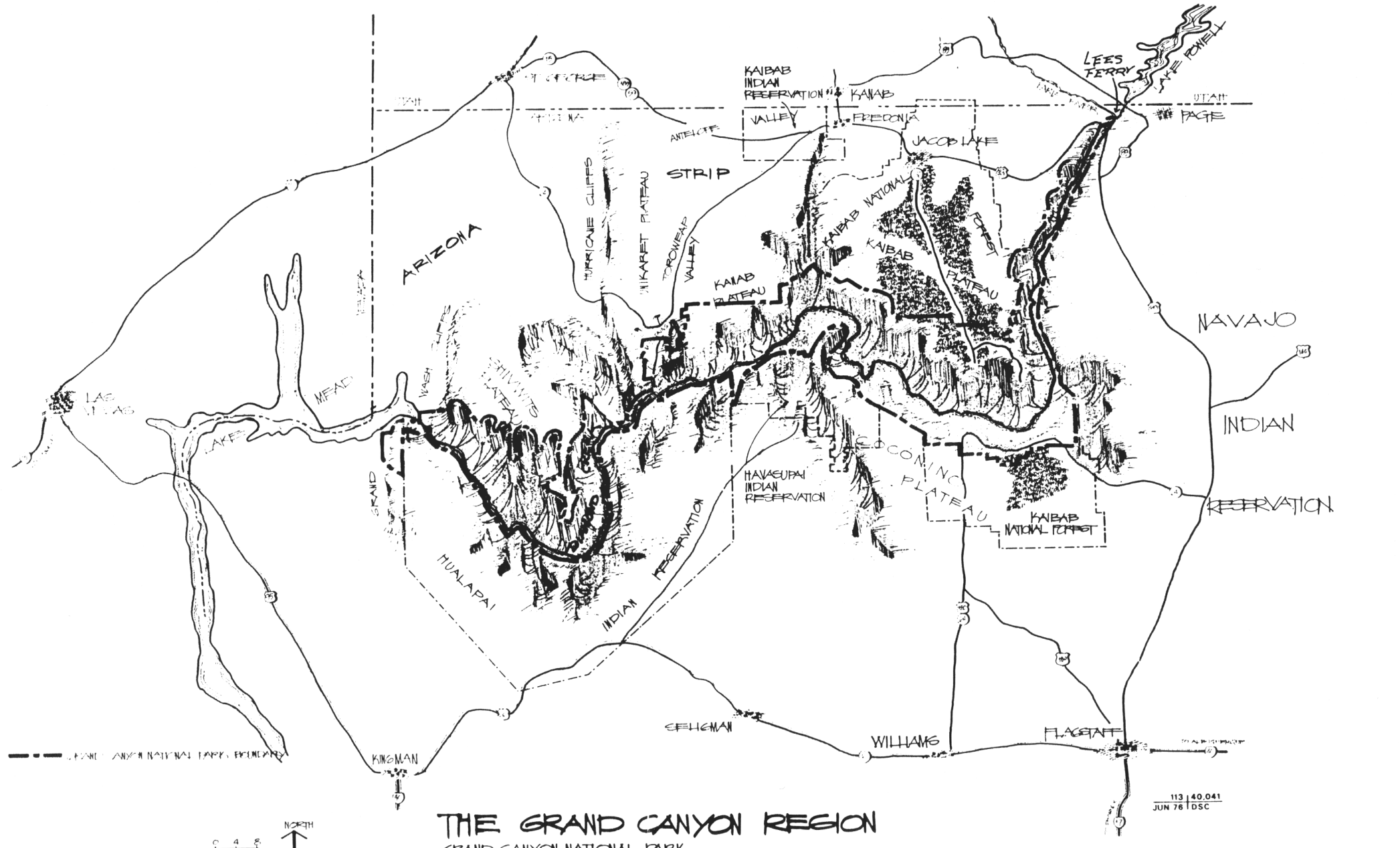

THE GRAND CANYON REGION

GRAND CANYON NATIONAL PARK

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COLORADO RIVER MANAGEMENT PLAN
GRAND CANYON NATIONAL PARK
1980

I. INTRODUCTION

A. Background

"The Colorado Plateau is a vast tableland that covers nearly one hundred fifty thousand square miles in northern Arizona and New Mexico, western Colorado, and eastern Utah. In this area is concentrated some of the outstanding scenery on the continent: the awesome Grand Canyon, the pinnacles of Bryce Canyon, the towering cliffs of Zion, Monument Valley, and Mesa Verde. These fantastic views are but variations on the fundamental theme of the plateau: as the weaker rocks are cut away, resistant remnants are left behind in the form of buttes, natural arches, cliffs, and pinnacles that alternate with extensive flat mesas." (Peter Farb, 1963)

The Grand Canyon of the Colorado River is located in the southwestern portion of the Colorado Plateau. The river runs 1,450 miles from Colorado to the Gulf of California including 277 miles through the Grand Canyon. Until the completion of the first of many dams in 1935, the Colorado River remained fundamentally unchanged. Lake Mead behind Hoover Dam flooded the lower sections of the Grand Canyon. The upper reaches of the canyon remained in a natural state until Glen Canyon Dam was completed in 1963. Since then the environmental responses have been rapid and significant.

The environmental changes were matched by a tremendous increase in the recreational use of the river. Prior to this period, the river required little active management by the National Park Service. By the early 1970's, it was apparent that research studies were needed so that a comprehensive river management plan could be developed. In 1973, commercial and non-commercial river use was frozen at existing levels until the research was completed and the new plan adopted.

The purpose of this plan is to address and resolve the major issues surrounding the management of the river resources and river-running activities.

B. The Problems and the Issues

The Colorado River through Grand Canyon is one of eight stretches of recreational river on the Colorado River system, and one of more than 44 stretches of recreational river in the western United States. The Colorado has characteristics which set it apart from other rivers. It is the longest recreational whitewater river in use. Some 240 miles of free-flowing river and 40 miles of slack water from the headwaters of Lake Mead are contained within Grand Canyon National Park. It is also surrounded by more than one million acres of land that qualifies for wilderness designation.

The presence of Glen Canyon Dam has resulted in drastically changed river flow characteristics. Most of the former sediment load of the Colorado River is

now being trapped behind the dam. Because of the dam, peak water flow during April, May and June (spring runoff) has been reduced to 25 percent of its former volume. In the same way, the impact of summer rainstorms is appreciably less than before the dam's construction. Also, daily water releases are controlled by a computer which responds to a complex program of electrical demand, water storage levels, irrigation needs, and flood control. Consequently, the river channel below the dam is not undergoing the natural deposition and scouring action that formerly took place. Former river terraces and beaches are being eroded and not renewed. Rocks are accumulating in the rapids creating increasingly hazardous conditions and possibly eventual impassable conditions.

The riparian (stream-side) community is rapidly changing. In some cases, native and non-native plants are establishing themselves on former open sandy beaches. At the same time pre-dam biotic communities are disappearing. Where remnants exist they must be actively protected.

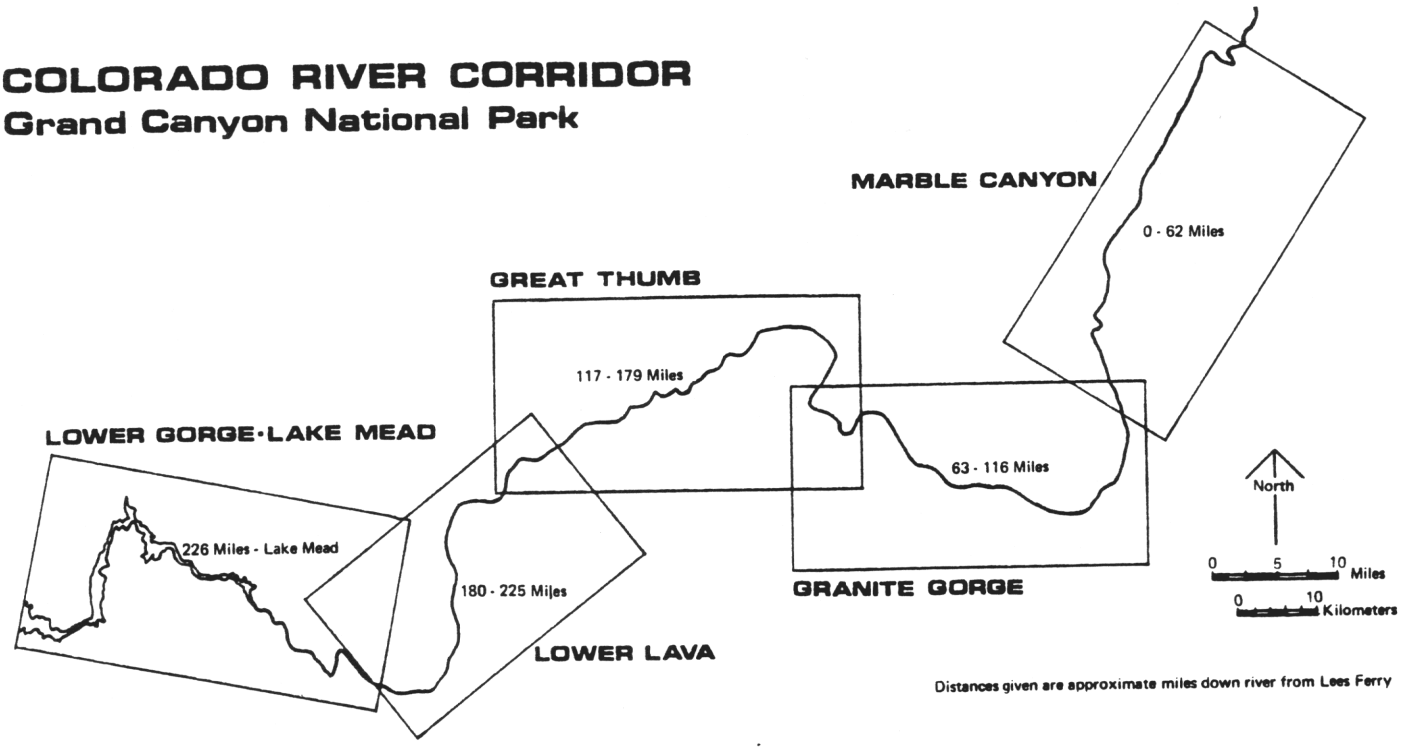
Recreational use along the Colorado River and the Grand Canyon is concentrated within the riparian zone and on beaches. The time and location of visitor use in the river corridor is uneven, causing high density levels at certain locations throughout the river corridor. Crowding and congestion at attraction sites have not only impacted resources but also the river-trip experience for many visitors. Popular sites include geologic features, side canyons, archeological and historical sites, caves, waterfalls, and unusual vegetation. The attraction sites are marked by multiple trails, trampled vegetation, and compacted soils.

There are about four hundred camping beaches within the river corridor, but the majority of river runners use fewer than one hundred of them. At each of the more desirable sites, 30 to 40 people camp almost every night during a 5- to 6-month season. This had resulted in the accumulation of human waste, charcoal, and other litter at these sites.

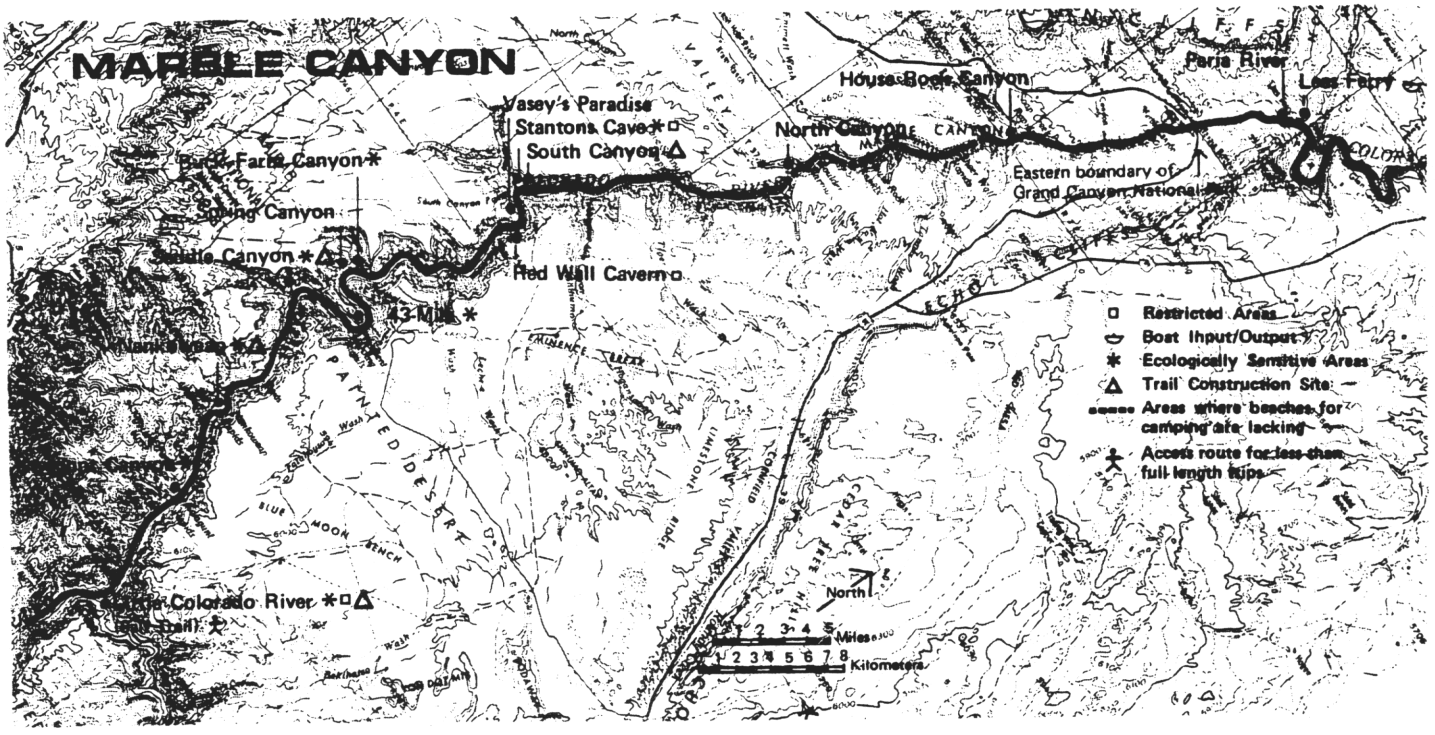
The above problems were a direct result of the increase in the recreational use of the area. In 1973, twenty-one commercial boating companies and non-commercial river runners carried more than 15 thousand people down the river, an increase of almost 700 percent in six years. Colorado River use for 1972 alone exceeded the 100-year period from 1870 through 1969.

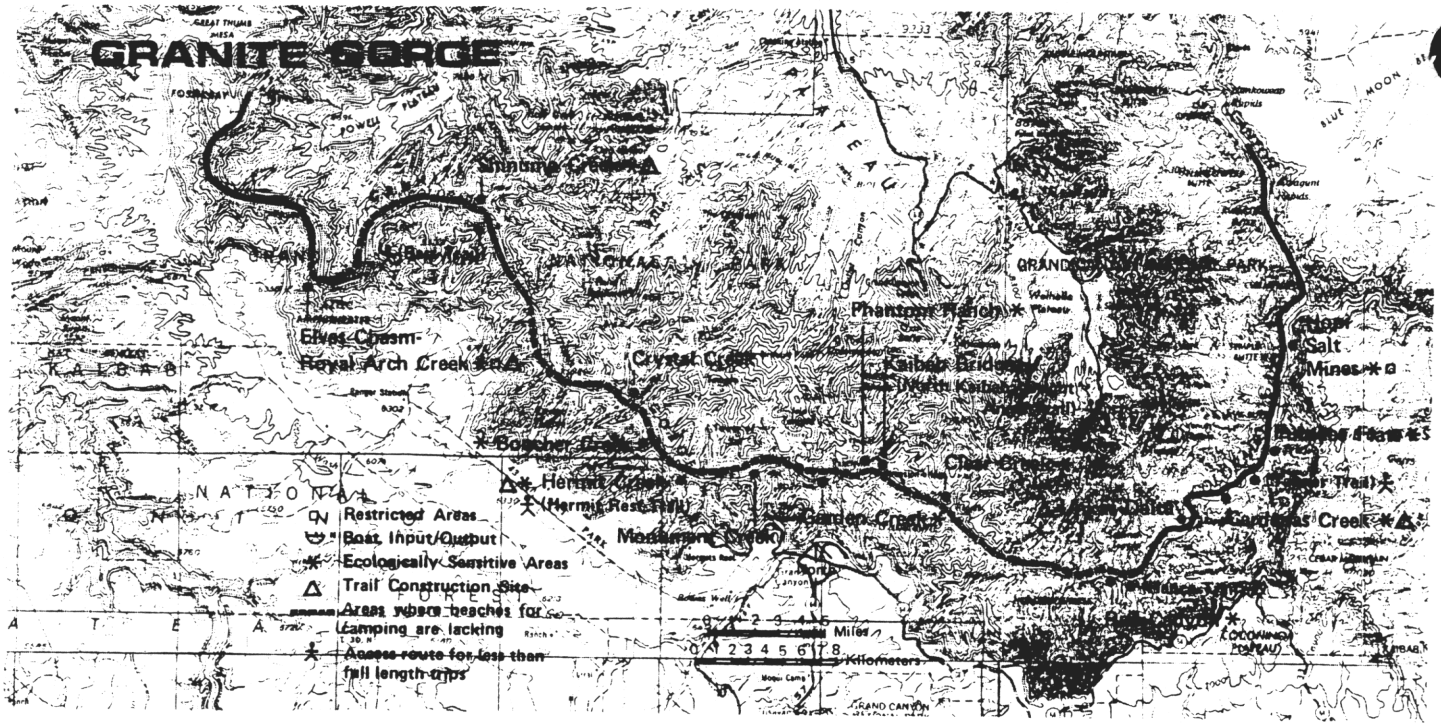
Due to the increase in recreational use and the resultant resource impact, the National Park Service placed a ceiling on the number of user days (one user day equals one passenger on the river for one day). As an interim measure, the commercial allotment for 1972 was set at 105,000 user days. Of these, only 88,135 were used, and in 1973, the commercial allotment was adjusted to 89,000 (not including the commercial crew members). This level has been maintained to the present time. The noncommercial river runners used about 7,600 user days in 1972, and that level has been maintained to the present time. This gives a total of 96,600 user days available for park visitors. An additional 21,000 user days are used by commercial crews, and approximately 1,000 user days are used by management and research personnel. The 96,600 user days translate to about 11,500 commercial and 450 to 500 noncommercial visitors, and 150 management and research personnel, on an annual basis.

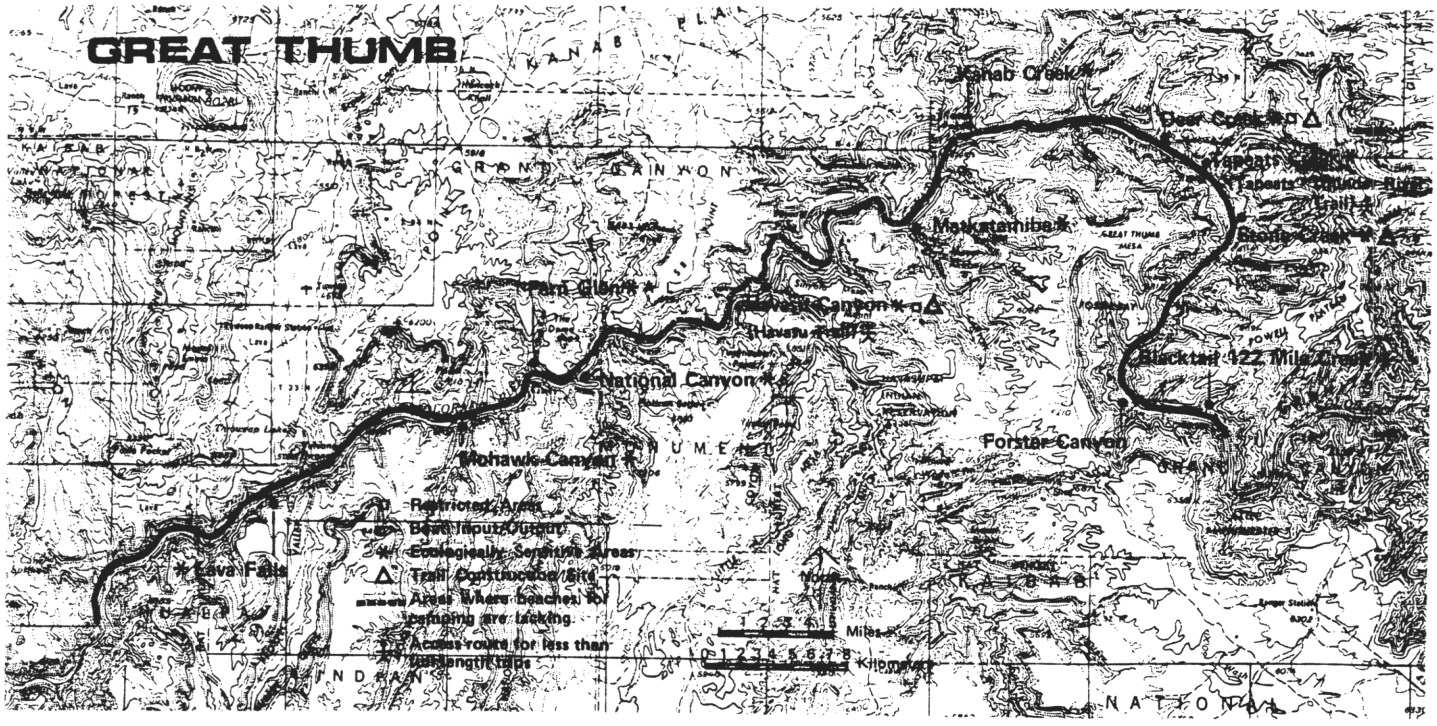
COLORADO RIVER CORRIDOR
Grand Canyon National Park

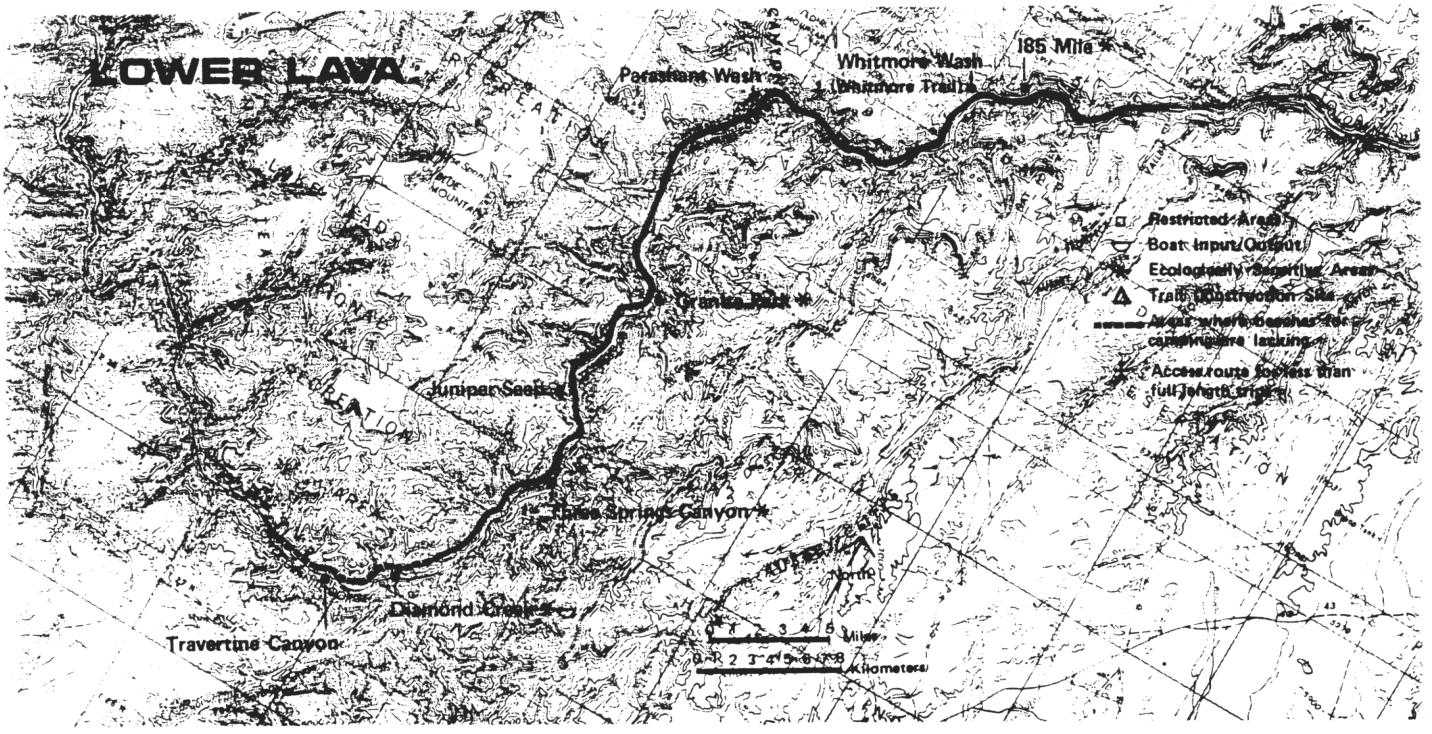


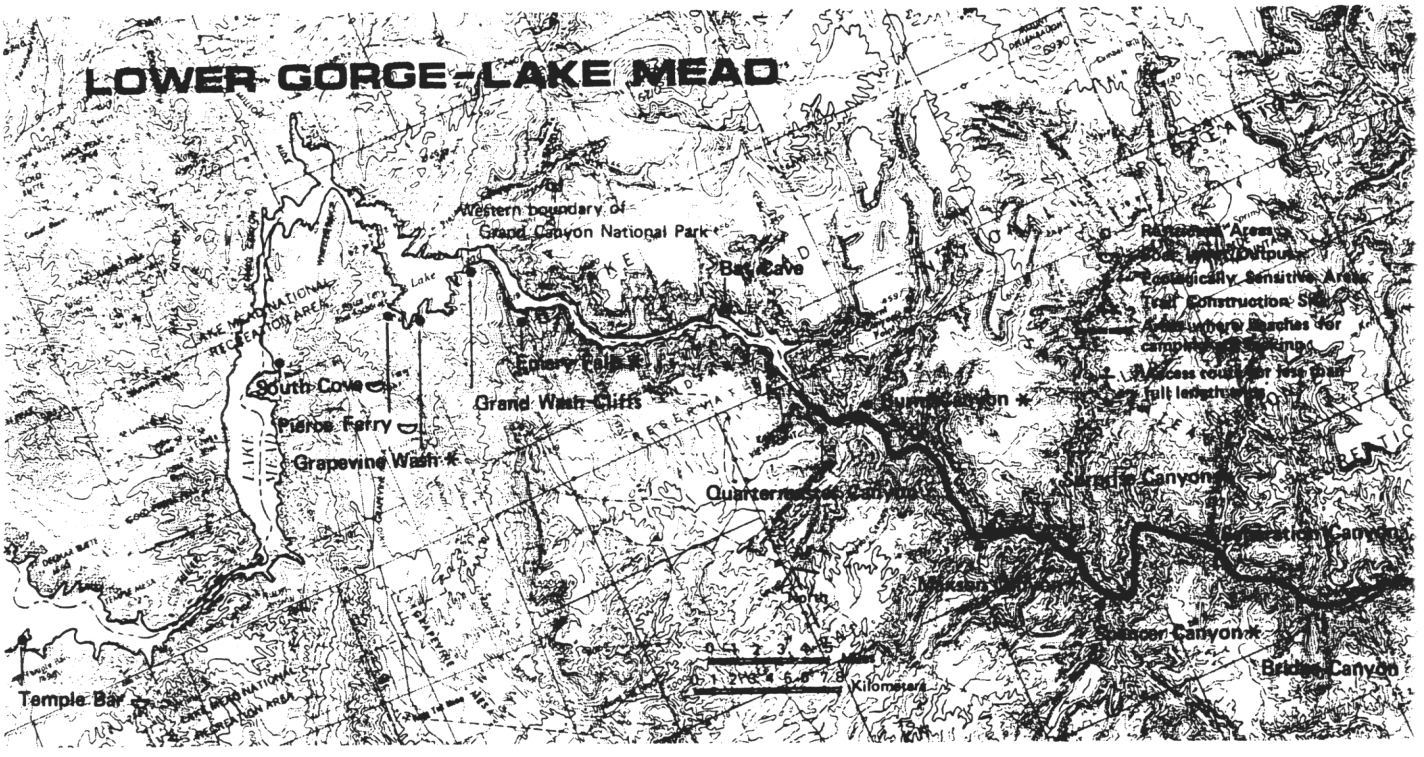
Distances given are approximate miles down river from Lees Ferry




GRANITE GORGE
Shinumo Creek
Boat Trail
Elves Chasm-
Royal Arch Creek
Crystal Creek
Phantom Ranch
Kaibab Bridge
North Kaibab Trail
Bright Angel Creek
Clear Creek
Garden Creek
Monument Creek
Cottonwood Creek
Restricted Areas
Boat Input/Output
Ecologically Sensitive Areas
Trail Construction Site
Areas where beaches for camping are lacking
Access route for less than full length trips
Miles
Kilometers


GREAT THUMB
Kanab Creek
Bear Creek
Matkatamiba
Cheyava Falls
Havasu Canyon
Havasu Trail
National Canyon
Mohawk Canyon
Forster Canyon
Blacktail Canyon
Restricted Areas
Boat Input/Output
Ecologically Sensitive Areas
Trail Construction Site
Areas where beaches for camping are lacking
Access route for less than full length trips
Miles
Kilometers


LOWER LAVA
Parashant Wash
Whitmore Wash
Whitmore Trailhead
185 Mile
Granite Rapid
Juniper Seep
Three Springs Canyon
Diamond Creek
Travertine Canyon
Restricted Areas
Boat Input/Output
Ecologically Sensitive Areas
Trail Construction Site
Access route for less than full length trips
Miles
Kilometers


LOWER GORGE-LAKE MEAD
Western boundary of
Grand Canyon National Park
Bat Cave
Emery Falls
South Cove
Pierce Ferry
Grapevine Wash
Grand Wash Cliffs
Quarteroneal Canyon
Separation Canyon
Spencer Canyon
Bridge Canyon
Temple Bar
Kilometers

This plan uses the terms commercial and noncommercial while recognizing they may be a source of unintentional bias. Commercial boating companies (concessioners) provide a crew, equipment, and supplies for a set fee. Noncommercial boaters are skilled river runners who provide their own crew, equipment, and supplies and run the trip on a cost-sharing basis.

The available takeout points, the capacity of boats, and present park regulations on maximum daily travel also limit the number of users. A commercial river trip may not exceed a 40-mile per day average. Therefore, a minimum of six days are required for a Lees Ferry to Diamond Creek trip. A maximum of 150 commercial passengers plus one group of up to 15 noncommercial users may depart from Lees Ferry each day. Commercial boats carry four to 28 passengers with a maximum of 40 and an average of 21.4 passengers per trip (1978). Records show that from 80 to 940 people depart Lees Ferry each week. Most people depart on Monday and Tuesday with 75 percent of annual use occurring in June, July and August. Approximately 80 percent of the river trips use motorized watercraft and 20 percent use oar-powered craft.

Below Diamond Creek, there are no user day limits and much of the river is slack water. This section of the river has only recently been added to the park by the Grand Canyon National Park Enlargement Act, P.L. 93-620, of January 3, 1975. It has a history of use and management that is substantially different than the river above Diamond Creek. Only one commercial company operates on this Lower Gorge section of the canyon. An estimated 500 passengers took this trip in 1978. An additional estimated 6,000 passengers on trips from Lees Ferry traveled this section. An unknown number of motorboats travel upstream to Diamond Creek from Lake Mead.

Future management of the river corridor must be guided not only by visitor demands, environmental considerations, and public input, but also by the legislative purpose, policies, and goals established for Grand Canyon National Park.

C. Legislative and Planning Influences

Management of recreational boating on the Colorado River in Grand Canyon National Park is influenced directly by legislative mandates. The most significant is the National Park Service Act of 1916 which provides:

> "...The service thus established shall promote and regulate the use of the Federal areas known as national parks, monuments, and reservations, hereinafter specified, by such means and measures as conform to the fundamental purpose of said parks, monuments and reservations, which purpose is to conserve the scenery and natural and historic objects and wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired."

An Act of Congress established Grand Canyon National Park in 1919 but actually included only a portion of the canyon and river corridor. This was modified by the Grand Canyon Enlargement Act of 1975. This Act added Marble Canyon National Monument, Grand Canyon National Monument, and portions of Lake

Mead National Recreation Area to Grand Canyon National Park. All of the Colorado River corridor within Grand Canyon, except adjacent Indian tribal lands on the Navajo and Hualapai Reservations, is now within the national park.

The Grand Canyon National Park Master Plan contains statements which directly influence management of the Colorado River.

- "...preservation of the Grand Canyon natural environment is the fundamental requirement for its continued use and enjoyment as an unimpaired natural area. Park management therefore looks first to the preservation and management of the natural resources of the park. The management concept is the preservation of total environments, as contrasted with the protection of only a single feature or species."

II. RESEARCH AND PUBLIC INVOLVEMENT

A. The Colorado River Research Program

To achieve the mandates in the enabling legislation of the National Park Service and master plan objectives for Grand Canyon National Park, data on the rates and magnitudes of environmental change were needed. Since the riparian zone of the Colorado River did not represent a significant management problem prior to the completion of Glen Canyon Dam, there was little encouragement or support for scientific investigations, and little baseline information was gathered. Decisions concerning river management were needed in the late 1960's and early 1970's, but the existing information base was inadequate. Consequently, in 1973, the National Park Service initiated a comprehensive research program including 29 studies. They addressed the ecology of the riparian zone, visitor interaction with plants and wildlife, social concerns, campsites, waste disposal, recreational carrying capacity, analysis of the economics of river operations, and visitor preference for types of trips.

The three years of research demonstrated that the presence of Glen Canyon Dam resulted in dramatic environmental changes within the river corridor. The research also showed that physical and biological changes are occurring as a result of visitor use patterns and activities and not as a direct function of visitor use levels. Based upon this research, the following measures must be taken to reduce or eliminate these impacts:

- -the removal of solid human waste from the river corridor
- -the replacement of multiple trails with single trails leading to points of interest in the river corridor
- -the reduction of visitor congestion and better dispersal of visitors at points of interest and camping sites
- -the establishment of a National Park Service sponsored education and licensing program to qualify commercial guides and noncommercial river trip leaders

In addition, motorized traffic on the Colorado River was found to be clearly inconsistent with the guidelines provided for management of park resources as outlined in the NPS Grand Canyon National Park Master Plan. Therefore, use of motorized craft will be eliminated.

B. Public Input

Public hearings on the preliminary wilderness proposal for lands within Grand Canyon National Park began in May 1971. The river corridor was an important issue during the hearings and in the 1975 wilderness workshops, as well as in the letters of comment responding to the draft environmental statement for the proposed wilderness plan. Over this 5-year period, there was not significant change in public sentiment. The public strongly favored the inclusion of the river and the surrounding land into the Wilderness Preservation System. They also favored elimination of motorized watercraft, control of aircraft noise, and preservation of the Grand Canyon's natural ecosystems.

Six river management workshops were held in March 1976, in the following cities: Phoenix, Arizona; Grand Canyon, Arizona; Los Angeles, California; San Francisco, California; Salt Lake City, Utah; and Denver, Colorado. The workshops were attended by 365 participants representing over 100 clubs, organizations, and individuals. About 27 percent each came from Arizona, California, and Colorado; 14 percent from Utah; and 5 percent from 8 other states. Ages of the participants ranged from 12 to 69 years, with 66 percent between 20 and 34 years.

The following is a list of issues raised at the workshops:

-allocation of use between commercial, noncommercial and management

-protection of the environment

-elimination or retention of motors

-permit system for river runners

-wilderness designation for the river

-disposal of human waste

-total visitor use of the river

-commercial use of the river

-noncommercial use of the river

-operating requirements for river runners

-regulations for river runners

-dams on the Colorado River

-education for river runners

-research regarding the river corridor

Following the release of the Draft Colorado River Management Plan in 1978, seven public meetings were held and over 90 days were allowed for review and comment. Public interest ran high. Proposals in the plan were well publicized by environmental and recreational groups, commercial outfitters, and various individuals. In all, 2,743 responses were received by the May 1, 1978, deadline. A total of 221 persons spoke at one or more of the seven public meetings and 738 signatures were received on petitions.

The responses received have been reviewed and analyzed. A summary of these responses was incorporated in the final environmental statement (FES) for the Colorado River Management Plan.

The final environmental statement was made available for public review on August 3, 1979. The review period for the final environmental statement

for the Colorado River Management Plan was between August 3 and October 2, 1979. During this period, 1,712 people offered review comments on the plan. Overall, 44 topics of concern were identified in the analysis of the response. The majority of the input concerned the phaseout of motorized watercraft on the Colorado River between Lees Ferry and Separation Canyon.

Issues	Number of Responses	Percent of Total
For proposed phaseout of motors	911	54
Against proposed phaseout of motors	774	46

As with the comments on the draft plan, the major comments mentioned supporting the motor trips included: (a) oar trips are too long, (b) too expensive, (c) too strenuous, and (d) are unsafe. Comments opposed to motors included: (a) motors and wilderness are not compatible, (b) eliminating motors would eliminate noxious fumes, (c) the canyon is too commercialized, and (d) the phaseout of motors was too long.

In addition, 232 letters were received between October 3 and November 1. Two-hundred and thirteen supported the plan and 19 were against the plan or the phaseout of motors.

The subject of second greatest concern was the allocation between commercial and noncommercial (private) trips. The breakdown of these comments and response on other issues is as follows:

Issues	Number of Times Mentioned
General support of total plan	526
For allocation proposals	74
For commercial/noncommercial comprehensive lottery	55
For environmental protection measures	148
Against environmental protection measures	2
For status quo launch schedule	52

Though not of great volume, highly detailed information was given on the economic concerns of the concessioners during the conversion from motor to rowing operations. Also detailed were concerns over scheduling and booking of commercial passengers on the river. A list of these concerns is as follows:

- -Stereotyping of commercial trips if all companies must run a 25-passenger trip to fill their allocation
- -Some provision for pre-scheduling make-up trips or other means of dealing with cancellations
- -Several of the companies with small allocations were interested in receiving more user days/passenger launches to increase the economic bases of their companies
- -Allowing an increase in trip size to more nearly meet the capacities of boats currently used on the river

III. THE PLAN

The plan encompasses the river corridor from Lees Ferry to Grand Wash Cliffs, including beaches, points of interest and hiking routes. Although management of visitor use and activites is a major portion of the plan, protection of natural and cultural resources is equally important and also addressed. The plan also includes standards and requirements for boat types and capacities, river guides, safety equipment and procedures, and public health. The annual Operational Requirements are found in Appendix A.

A. Management Objectives

To comply with Congressional mandates, National Park Service management policies, master plan objectives, public input, and research findings, the following objectives were developed for the management of the Colorado River:

- -perpetuate a wilderness river-running experience in which:
  - .the natural sounds and silence of the canyon can be experienced
  - .relaxed conversation is possible
  - .the river is experienced on its own terms
- -phase out the use of motorized watercraft between Lees Ferry and Separation Canyon
- -establish a total human use capacity and associated limitations on use of the river
- -allocate use equitably between commercial and noncommercial users
- -provide commercially guided trips
- -establish an equitable and efficient method of assigning noncommerical permits
- -protect and preserve the river corridor environment within the National Park Service's ability to do so considering uncontrollable effects of Glen Canyon Dam
- -reduce high visitor density and congestion at points of interest
- -maintain water quality in side streams and in the river
- -adhere to all public health and safety standards
- -increase interpretive services on river trips
- -increase education and information programs for all river runners regarding protection and use of the river environment
- -establish monitoring programs to assess resource conditions and visitor experiences
- -recommend inclusion of the Colorado River in the Wilderness Preservation System

B. Provisions of the Plan

Through the provisions of the plan, the management objectives outlined above will be met and, in addition, the plan will allow for the following:

-An opportunity for visitors to select noncommercial or commercial river trips

-A reasonable allocation of use for commercial and noncommercial river trips

-People of most ages and abilities and those with physical handicaps to take river trips

-Less expensive, partial river trips that enter or exit at various points along the river corridor

-Mule and helicopter transportation for those unable to hike into or out of the canyon at the beginning or end of a partial trip

-Continued commerical operator profitability by increased user day allocations and offering partial river trips, plus spring and fall trips

-Continued benefits for the regional economy due to increased numbers of people taking river trips and more river guides working for longer periods of time

-Control of use patterns to reduce crowding by distributing use over the entire year and more evenly throughout the week, thereby minimizing impacts

-Continued safety requirements (Current records show no significant difference in accidents between motor and non-motorized craft.)

-Increased noncommerical trips to accommodate increased demand

-Revised noncommerical permit processing to provide a more equitable procedure of assigning trips

C. Wilderness Experience

The objectives of a quality wilderness river-running experience is more fully explained by the following definition and philosophy of wilderness, an explanation of its relationship to other existing park planning documents, and an assessment of expected results.

1. Definition

As defined by the Wilderness Act (P.L. 88-577), "A wilderness, ... is ... an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean...an area of undeveloped Federal

land retaining its primeval character and influence, without permanent improvements or human inhabitation, which is protected and managed so as to preserve its natural conditions and which: (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value."

2. Philosophy

The idea of wilderness has been prominent in the formation of the American character and in the early image of America formed by other peoples. Once defined as a threatening place of uncontrolled danger, wilderness has in our time come to be associated with opportunity for respite from an overly complex civilization. The simple existence of wilderness is a psychological boon to many. While escape can represent the main component of the wilderness idea for some, physical and mental challenge and renewal of a sense of wonder are also central to the idea.

In a nation whose stock of wilderness is dwindling, the Grand Canyon of the Colorado River stands out as a prime example of wilderness preserved. But any place ceases to be a wilderness as human use increases and natural resources are affected. Wilderness, which is perhaps as much a state of mind as an actual place, is affected by the user's preception of its generally untouched quality and of the naturalness of its plant and animal life as well as of how crowded it appears. This plan seeks to permit human use of the Colorado River corridor in Grand Canyon without sacrificing the aspects of the Grand Canyon environment on which the idea of wilderness depends.

It is recognized that the act of managing is inconsistent with the strictest definitions of wilderness as a place uncontrolled by man. But it is also recognized that under circumstances of uncontrolled and growing use, wilderness may soon cease to exist.

The Grand Canyon provides an exceptional setting for an experience of wilderness. Its rugged topography is a showcase for natural processes of sedimentation and erosion, for desert wildlife and vegetation, for true isolation in a startling setting of immense geologic time, and for feeling the power and life of the river's flow. These things as well as the roar of each rapid, the sight of the clear night sky, and the songs of canyon wrens along the shore are all part of the Grand Canyon wilderness experience which this plan seeks to preserve. Rather that representing an elitist choice among the possible means of enjoying Grand Canyon, this is a plan to preserve and make available the fullness of the unique experience which the Colorado River through Grand Canyon offers to the river runner. Among other provisions of the plan, the elimination of motor use will enhance the experience of wilderness without appreciably changing the demographic characteristics of river users or their total number.

3. Relationship to Planning Documents

Several Grand Canyon National Park plans address the question of the river's role in an experience of Grand Canyon as wilderness.

The Final Master Plan for Grand Canyon National Park (August 1976), in discussing the river, states "that the goal for management of the Colorado River in Grand Canyon will be to perpetuate the wilderness river-running experience, and to attempt to mitigate the influences of man's manipulation of the river." The plan further states that the park's management should "limit mechanized access below the rim to emergency and management use."

The Preliminary Wilderness Proposal for Grand Canyon National Park (July 1976) states that the use of motorized boats "is inconsistent with the wilderness criteria of providing outstanding opportunities for solitude and for primitive and unconfined type of recreation." It suggests that the decision on the river's inclusion within the Grand Canyon Wilderness be deferred until completion of the river management plan.

4. Expected Results

This plan will allow river runners to experience wilderness in the Grand Canyon within the limits of acceptable impact on its resources. It will perpetuate a wilderness river-running experience in which:

-the natural sounds, silence, smells, and sights of the canyon predominate over those which are man-caused

-the flow and power of the river are more fully experienced

-wildlife and vegetation in the riparian zone and side canyons are viewed in a state as little affected as possible by people, given the existence of dams on the Colorado River

-the effect of the river runner's presence is temporary rather than long lasting

IV. SPECIFIC ELEMENTS OF THE PLAN

A. Phase Out Motorized Craft

Use of motorized watercraft between Lees Ferry and Separation Canyon will be phased out over a 5-year period. This will achieve the objective of this plan to make available the high quality wilderness river-running experience which is inherently offered by the unique nature of the Colorado River through the Grand Canyon. This is also the objective of the Grand Canyon National Park Master Plan for the Colorado River Corridor, and corresponds with the park wilderness proposal. The decision is also based on the extensive Colorado River Research project for the Grand Canyon and considers public input from the two series of public meetings on river management. Motorized watercraft are allowed below Separation Canyon and on to Lake Mead. The timetable and method for phasing out motorized watercraft is outlined in Table 1. Winter trips will be oar-powered.

Table 1. TIMETABLE FOR REMOVAL OF MOTORS

	April	May	June	July	August	September
1980	Oars	Motors/ Oars	Motors/ Oars	Motors/ Oars	Motors/ Oars	Motors Oars
1981	Oars	Motors/ Oars	Motors/ Oars	Motors/ Oars	Motors/ Oars	Oars
1982	Oars	Motors/ Oars	Motors/ Oars	Motors/ Oars	Oars	Oars
1983	Oars	Motors/ Oars	Motors/ Oars	Motors/ Oars	Oars	Oars
1984	Oars	Motors/ Oars	Motors/ Oars	Motors/ Oars	Oars	Oars
1985	Oars	Oars	Oars	Oars	Oars	Oars

B. Annual Use

Total annual use is increased both in numbers of people and user days. This is accomplished primarily by lengthening the summer season and allowing winter use.

A review of the river-runner contact research indicates that the number of contacts between river trips is the most important single factor leading to crowding and congestion and resulting negative impacts on the environment and trip experience. Therefore, it is essential to limit the number of groups on the river at any one time by setting a maximum daily number of trips or groups allowed to launch. The summer season is lengthened from about 4 to 6 months to allow use during times when little or no use is currently being made.

Also summer use is redistributed to reduce crowding in peak midsummer months. Individual group size is important in enhancing the quality of the wilderness river-running experience. Therefore, group sizes for commercial and noncommercial trips are established. Trip length has some bearing on trip experience as well as use levels. Minimum trip length is set to enhance trip quality and maximum trip length is set to maintain reasonable overall use levels. Average trip lengths used in this plan for commercial and non-commercial trips are estimates based on past experience and judgments as to what is likely to happen.

User days are not the key limiting factor in this plan as they have been in the past. Rather, the number of daily launches from Lees Ferry and trip size are the key factors in limits and distribution of use. A maximum annual total user day limit is established in this plan but is much higher than expected levels. Expected user day levels are based on average trip lengths. Two separate use seasons are established for this plan. The summer season will begin on April 16th and end on October 15th. The winter season will begin October 16th and end on April 15th.

1. Summer Season (April 16 through October 15)

Total use and allocation is based on number of trip launches and group sizes. For the summer season the number of commercial trips authorized will be 404. The base number of trips will be two commercial trip launches per day, or 14 per week. However, in order to allow for an increased allocation for small concessioners, two extra trips will be allowed each week, thereby modifying the daily launch capacity to three trips for two days of each week. Also, as the launch schedule for each year is established, there may be some adjustment in daily launch capacity in order to provide flexibility to achieve an even distribution of weekly launches. Commercial trip group size will vary from about 15 to 36 in order to coincide with boat capacities and logistical capacities of individual concessioners as well as providing for a variety of trip offerings for the visitor. Total number of people launching on commercial trips during the summer season will be approximately 10,550. Noncommercial use during the summer season will be based on a maximum of one trip launched each day with a maximum of 15 people or 2745 people. The other use parameters for the summer season are outlined in Table 2.

2. Winter Season (October 16 through April 15)

Winter season use is restricted to no more than three trips and an average of 60 people per week. This will keep use at a level low enough to allow the natural cleansing of beaches to continue and provide for a wilderness river trip where the likelihood of encountering other trips is remote. It has been well documented by researchers (Carothers, et al. 1976) that heavily used beaches are significantly cleaner when visited in the spring than when last visited in the fall. However, little is known about the details of this cleansing process. Until the natural processes contributing to this cleansing are investigated, winter use will be kept at a relatively low level.

Table 2. CURRENT AND NEW USE LIMITS
(During the 5-year phaseout)

COMMERCIAl	1979 Limits		This Plan	
	Summer	Winter	Summer	Winter
Average Miles Per Day	40	40	40	40
Minimum trip length (days)	6	6	6	6
Maximum trip length (days)	No Limit	No Limit	18	21
Average trip length (days)	9	9	10	10
Passengers per day (max)	150	150	100	36
Launches per day	No Limit	No Limit	2-3	1
Launches per week	No Limit	No Limit	16	up to 3
Passengers per group	40	40	15-36	25
Number of people	11,792	*	10,550	1000
Number of trips	497	*	404	39
Projected user days	89,000	*	105,500	10,000
Maximum user days	89,000	*	164,700	20,475
NONCOMMERCIAL				
Minimum trip length	No Limit	No Limit	No Limit	No Limit
Maximum trip length (days)	No Limit	No Limit	18	21
Average trip length (days)	17	17	16	18
Launches per day	1	1	1	1
Launches per week	**	**	7	7
Participants per group	15	15	15	15
Number of people	473	***	2,745	585
Number of trips	43	***	183	39
Projected user days	7,600	***	43,920	10,530
Maximum user days	7,600	***	49,410	12,285

* The previous number of people, trips, and user days for commercial river running was allocated annually with no distinction as to season. Therefore, winter use is included in the summer use figures.

** Launches per week was limited by the number of people that could launch each day, and the annual limit.

*** The previous annual noncommercial use allocation of 7,600 user days has worked out to about 40± trips each year. No more than 1 noncommercial trip could launch each day. Theoretically, 7 trips could launch each week. This rarely occurred because of the overriding limit of about 40 trips each year, based on the annual user day limit.

The previous number of people, trips, and user days for noncommerical river trips was allocated annually with no distinction as to season of use. Some winter use is included in the 1978 summer use figures.

It is important to understand that maximum user day levels will not be allowed to happen. In order for maximum user day levels to occur, every trip would have to be at maximum group size and trip length. It is very unlikely that this would occur within the framework of the use limits outlined in Table 2. However, additional limits will be placed in effect if use levels at any time appear to be escalating beyond an acceptable level. Acceptable level of use at this time is that amount shown in Table 2 as the average user day level. The average user day level is based on the total number of people allowed in a given season multiplied by average trip length. The river monitoring studies will provide data to assist management in adjusting future use levels.

There was substantive input to the FES regarding the need for an economic base for small concessioners and variable group sizes among the concessioners. The plan is modified to recognize these latter two points, and in doing so the base number of trips must be increased. The original summer season base outlined in FES was 366 trips plus approximately 52 makeup trips, or a total of 418. The plan now provides for 404 trips during the summer season leaving no reasonable room for makeup trips. There will be no provision for commercial makeup trips, since the total number of trips are increased to accommodate an economic base and variable group size. However, concessioners will be allowed to overbook each trip by from 5 to 10 percent during the phaseout in order to compensate for cancellations and/or no shows.

The number of commercial passengers allowed to launch from Lees Ferry is 10,550 during the summer season and 1,000 during the winter season. However, the number of individual passengers is expected to increase by 3,000 or more through partial river trips. Concessioners are encouraged to provide partial Canyon trips as they have done in the past. Table 3 shows the number of people who took partial trips with concessioners in 1978.

Table 3. PARTIAL TRIPS TAKEN WITH CONCESSIONERS IN 1978

	Passengers In	Passengers Out
Lees Ferry	11,335	
Phantom Ranch	1,271	1,251
Little Colorado	10	1
Hance	17	0
Tapeats	0	13
Havasu	89	56
Lava Falls	419	3,097
Whitmore Wash	109	664

Counting those who joined river trips below Lees Ferry and those who took out above Diamond Creek, there were almost 7,000 people who took partial river trips in 1978. Those people who started at Lees Ferry and took out at Lava Falls by helicopter are considered by some to have taken full river trips. Technically, they ran the river only 2/3 of its length through the canyon. Without counting these 3,097 people who took out at Lava Falls, there were 3,900 people who took partial river trips in 1978. There were 3,481 people who either hiked into or out of the canyon in connection with their partial river trip.

The primary location for passenger exchange is at Phantom Ranch (Mile 87) using the Kaibab and Bright Angel Trails for access. Other access trails are available and can be used but are generally more difficult because of trail conditions and trailhead access. Exchanges at Lava Falls involve a helicopter ride into or out of the canyon to an airstrip just outside the park boundary. Table 4 shows the most commonly used passenger exchange location and the expected level of use for each one.

Table 4. LAUNCH, TAKEOUT AND EXCHANGE POINTS

	Name	Location	Launch	Takeout	Exchange
1.	Lees Ferry	Mile 0	M	-	-
2.	Little Colorado River	Mile 61.5	-	-	X
3.	Tanner Trail	Mile 69	-	-	X
4.	Hance Trail	Mile 76.5	-	-	X
5.	Phantom Ranch	Mile 87	X	X	M
6.	Hermit Trail	Mile 95	-	-	X
7.	Boucher Trail	Mile 96.5	-	-	X
8.	Bass Trail	Mile 108	-	-	X
9.	Tapeats Creek	Mile 134	-	-	X
10.	Havasu Creek	Mile 157	-	-	X
11.	Lava Falls	Mile 179	-	M	X
12.	Whitmore Wash	Mile 188	X	X	M
13.	Diamond Creek	Mile 225.5	M	M	-
14.	Pierce Ferry	Mile 280	-	M	-

M shows a major use area and X a minor use area.
Launch is where boats and/or passengers start a river trip.

Takeout is where boats and/or passengers leave a river trip.
Exchange is where passengers board and/or leave a river trip.

In addition to the noncommercial trip participants and commercial passengers outlined in Table 2, there are commercial crew members, National Park Service patrol, administrative, and research trip personnel. The number of commercial crew on each trip varies from company to company and trip to trip depending on type of boats used and the type of trip offered. Generally, the more specialized trips require more crew. Crew members are not counted against concessioner allocations and are in addition to the basic number of passengers per group. National Park Service patrol and administrative trips are not under a use limit but will normally be approximately 12 in the summer season and 6 during winter. These trips will usually consist of small groups of 10 or less people. There will generally be less than 10 research trips each year. Research trips are usually very small groups of about 10 people. Table 5 (below) provides information on the extent of this use and completes the total use picture.

Table 5. COMMERCIAL CREW, NPS PATROL, ADMINISTRATIVE, AND RESEARCH TRIPS

	1978		This Plan	
	No. of People	User Days	No. of People	User Days
Commercial Crew	2,626	24,105	3,000	30,000
NPS Patrol & Admin.	100	800	180	2,500
Research	50	700	50	700

Total use including commercial passengers, commercial crew, noncommercial trip participants, National Park Service patrol, administrative, and research trips, in terms of user days based on projected trip lengths is 203,160. Total maximum use (which will probably not occur due to restrictions on maximum trip length and maximum group size on every trip) would be 280,070 user days.

C. Allocation of Use for Commercial and Noncommercial Trips

Commercial companies currently provide river trips for those without the expertise, time, or equipment to run the Colorado River themselves. A commercial trip, then, is defined as one where services are afforded to the visitor for a fee. These services include operating the boats, preparing meals and setting up camp, as well as providing educational opportunities to learn more about the area. These are currently both motorized and non-motorized trips. Passengers on either type of trip do not operate the boats; therefore, an oar-powered commercial trip is no more strenuous than a motorized commercial trip.

Noncommercial trips, on the other hand, consist of a private group organized to run the river and are participatory in nature. The group members share the responsibilities and cost of operating the boats, along with meals and camp

duties. No fees are paid for guide services or collected above the actual cost of the trip. School and other non-profit groups may qualify for these trips (see Private Trip Affidavit, Appendix D).

The allocation between commercial and noncommercial use outlined in Table 6 is based on the best available information on the demand for commercial and noncommercial trips. Figures on potential passengers turned away by commercial concessioners may count individuals more than once as they are turned away by successive companies. When certain dates are full, some companies issue brochures indicating this fact. There is no way to count potential passengers turned away in this manner. Figures on the demand for noncommercial trips are complicated by duplicate applications, false applications, failure of interested but discouraged river runners to apply, etc.

The allocation ratio is, because of the above factors, a best estimate based on experience and on interpretation of the available data. This ratio will be reviewed and adjusted as more reliable information becomes available.

Allocation ratio for commercial and noncommercial river running varies depending upon whether one is considering the number of trips, number of people, or user days.

Table 6. COMPARISON OF COMMERCIAL AND NONCOMMERCIAL USE

	1979				This Plan			
	Commercial		Noncommercial		Commercial		Noncommercial	
	No.	%	No.	%	No.	%	No.	%
Participants	11,792	96.6	473	3.4	11,550	78	3,330	22
Number of Trips	497	92.0	43	8.0	443	67	222	33
Projected User Days	89,000	92.0	7,600	8.0	115,500	69	54,450	31

User day figures are based on projected 10-day average trip lengths for commercial and 16 days for noncommercial trips. These projected trip lengths are based on five years of actual experience in observing trip lengths and the expectation that during the phaseout of motor trips the average trip length will be lower. As the number of rowing trips increases, the average trip length is expected to increase. As this occurs, it may be necessary to reduce group size for commercial trips in order to keep overall user days within acceptable levels.

No maximum limit existed for either commercial or noncommercial trips under the previous management situation. The minimum trip length for commercial

length was allowed to fluctuate at the discretion of the concessioner and noncommercial trip participants.

The plan provides for significant increases in noncommercial participants, number of trips and user days. There will be little change in the number of commercial trip passengers and some decrease in the number of trips but a considerable increase in commercial user days. The percentage changes are outlined in Table 7.

Table 7. A COMPARISON OF COMMERCIAL AND NONCOMMERCIAL USE

	Participants	Trip Numbers	Projected User Days
Commercial	10.5% decrease	3.0% decrease	130% increase
Noncommercial	843% increase	600% increase	718% increase

Information based on verbal and written reports indicates that non-commercial river runners are less likely to comply with operating regulations. During patrol trips in 1977, 1978, and 1979, National Park Service Rangers recorded proportionately more incidents of noncompliance with regulations on the part of noncommercial river runners than commercial. Noncommercial use will be phased in to allow time to implement the information and education programs for these river runners. Half of the noncommercial allocation will be allowed and monitored in 1980 and 1981. The remainder of noncommercial user days will be granted in 1982, if monitoring indicates that resource impacts are within acceptable limits by the end of the 1981 summer season.

D. Commercial Permit Management

It is essential that concessioner-guided river trips be available to that segment of the public who do not have the expertise, equipment, or interest to run the river on their own. River-running concession permits will be granted for a 5-year period beginning in 1980 and ending in 1984. When granting permits, preference will be given to those companies who have provided satisfactory service over the term of their existing permits. This is required by the Concession Policy Act of October 9, 1965 (P.L. 89-249; 79, Stat. 969; 16 U.S.C. 20):

> "SECT. 5. The Secretary shall encourage continuity of operation and facilities and service by giving preference in the renewal of contracts or permits and in the negotiation of new contracts or permits to the concessioners who have performed their obligations under prior contracts or permits to the satisfaction of the Secretary. To this end, the Secretary, at any time in his discretion, may extend or renew a contract or permit, or may grant a new contract or permit to the same concessioner upon the termination or surrender before expiration of a prior contract or permit. Before doing so, however, and before granting extensions, renewals or new contracts persuant to the last sentence of section 4 of this Act, the Secretary shall give

and before granting extensions, renewals or new contracts persuant to the last sentence of section 4 of this Act, the Secretary shall give reasonable public notice of his intention to do so and shall consider and evaluate all proposals received as a result thereof."

As indicated in the Concession Policy Act, public notice will be given of the intention to renew permits. Anyone who so desires may submit a proposal for a permit with the assurance that it will be evaluated.

Table 8 shows the proposed method of allocating use among concessioners. This is based on historical user day allocations. Each concessioner was allocated a certain number of user days in 1973, which amounts to a specific percentage of the total 89,000 user days. That percentage multiplied by the total number of people to be allowed under this plan results in each respective concessioner's new allocation. However, each of the concessioners whose new allocations would be less than 400 people using this formula will be granted an additional 100 people to their allocation in order to provide them with an economic base of operations. This adds 1,500 more people to the total number to be taken through the canyon by concessioners. By adjusting this group size and eliminating makeup trips this can be an accomplished without increasing overall number of trips.

Table 8. EXAMPLE OF CONCESSIONER ALLOCATIONS -- SUMMER SEASON

Concessioner	1978 Number of User Day Allocations	Trip Percent of User Days	Passengers This Plan	Launches This Plan
Company A	10,000	11.2%	1,025	41
Company B	8,500	9.6%	875	35
Company C	7,000	7.9%	650	26
Company D	4,000	4.5%	400	16
Company E	2,500	2.8%	350*	10
Company F	1,500	1.7%	250*	6
Company G	1,000	1.1%	200*	4
etc.	etc.	etc.	etc.	etc.
Totals	89,000	100.0%	10,550	404

* This includes the 100 additional people added to the base allocation to provide an economic base to these smaller companies.

Actual river companies were not used in the example of Table 8 to avoid charges of preselection bias. "Etc." was placed at the bottom of each column to indicate that there would likely be more than seven companies. In fact, 21 companies for full-canyon trips, plus the Hualapai Tribe for Lower Gorge trips, is the maximum number that will be granted permits under this plan. Based on the past five years of operation, the National Park Service believes that from 15 to 18 companies would be preferable. This would maintain the variety of trip offerings desired and yet provide an opportunity for those existing small companies to increase their operations to the point of being

more economically viable. With fewer than 15 companies, the variety of services offered would decrease significantly. Concessioners will be limited to a maximum allocation of 1,025 people per company.

Each concessioner will be given the opportunity for at least one winter trip. The remaining trips will be available on a first-come, first-served basis. If there are any concessioners who do not want a winter trip, their trip will be made available to other concessioners on a first-come, first-served basis. There are 39 winter trips available to concessioners with group size of 25 passengers per trip and up to 21-day trip lengths.

Commercial launch schedules will be established by February for the next year's boating season. An example is February 1980 for the 1981 summer boating season and the 81-82 winter season. Concessioners will submit proposed launch schedules to the National Park Service by January 31 and the National Park Service will prepare a calendar showing proposed schedules. The National Park Service will schedule a meeting in mid-February to be attended by all concessioners where the final schedule will be established. If changes in the schedule are necessary after that time, the National Park Service will work out needed modifications with the companies involved. Any company who sends launch schedules in late will be assigned the closest launch dates available to those it proposes.

If a company ceases operation, its use allocation will be reallocated at the discretion of the National Park Service. The National Park Service reserves the right to adjust or reallocate use allocation. Concession permits will be assigned through a bid procedure, considering the proposals submitted by all applicants. River-running concession permits cannot be transferred without prior written approval from the National Park Service.

Concessioners will be charged a franchise fee based on a percentage of the annual gross revenue.

National Park Service policy requires that all concessioners be evaluated at lease three times annually. Therefore, all river-running concessioners operating in Grand Canyon National Park will be evaluated as required by policy. Evaluations will cover on-river activities as well as compliance with permit conditions such as financial reports, nondiscrimination, insurance, etc. On-river evaluations will be conducted both by National Park Service personnel accompanying concessioner river trips and by National Park Service patrol people contacting trips on the river, at attraction sites and at camps.

E. Noncommercial Permit Management

Noncommercial permits will be granted on a first-come, first-served basis. A waiting list will be maintained. A beginning date for receiving noncommercial permit applications will be established. It is expected that the number of applications received on the beginning date under the new plan will be more than can be accommodated during the first season. A lottery will be operated for this first block of applications. As applications are drawn, they will be granted permits until all launch dates for the first season are filled. The lottery will be continued for all initial applicants, and as they are drawn

they will be placed on a waiting list for the subsequent season. Thereafter, applications will be accepted in the River Unit Office at any time and placed first-come, first-served at the end of the waiting list.

In submitting an initial application, the applicant need not include a list of participant names. A trip participant list will be required when the applicant's name comes to the top of the waiting list and is granted a permit. If any persons on the participant list are also applicants on the waiting list, their names will be removed from the waiting list. After the trip is completed, participants may again apply for a river trip permit and be placed at the end of the list.

When a trip application comes to the top of the list, the applicants are assigned, as nearly as possible, a launch date of their choice. If they cannot meet the assigned launch date, they will have the choice of any unassigned launch dates for the remainder of the season. If there are no available dates, the permittee is placed on the top of the waiting list to be assigned the next available launch date. Cancellations will be filled by the next available person on the list until three weeks prior to launch date. The waiting list is periodically up-dated through the mailing of interest cards. If no response is received from the interest card, the permittee's application is removed from the file.

F. Launches from Diamond Creek

A river-running permit is required for any noncommercial parties launching at Diamond Creek. A quota and reservation system will not be established at this time, but the permit system will make boaters aware of equipment requirements, safety procedures, and environmental considerations. It also allows the National Park Service to monitor visitor use levels. These river-running permits are issued by the River Unit or the Pierce Ferry ranger prior to a trip leaving Diamond Creek. Commercial and noncommercial river runners must meet all operational requirements for river trips as outlined in this plan. All commercial trips launching at Diamond Creek must have a current concession permit with Grand Canyon National Park. All river runners launching at Diamond Creek will have to arrange permission with the Hualapai Tribe to use the Diamond Creek road and launch ramp , as well as for any off-river activity on Hualapai Tribal land.

G. Launches Between Lees Ferry and Diamond Creek

Any noncommercial river trip launching between Lees Ferry and Diamond Creek is required to obtain a permit through the system outlined in IV. E. All commercial river trips launching at any point within the canyon must have a current concession permit or contract with the National Park Service.

V. ENVIRONMENTAL MANAGEMENT

A. Fires

Use of fires on river trips is limited because of the environmental impacts this activity causes. Those impacts are the buildup of charcoal and ash on beaches, and stripping of native trees and shrubs for firewood due to the lack of natural driftwood.

Fires are limited to esthetic and warming purposes during a specified portion of the summer season. That specified time during which this requirement applies will be designated in the annual operating requirements. Wood must be carried into the canyon for summer fires. Driftwood from along the river may be used for winter fires. Gas stoves must be carried for most cooking purposes. Charcoal briquettes may be used for dutch ovens, grilling meat, etc. All wood or charcoal must be contained in a fire pan. No fires are allowed when away from the river corridor.

The annual operating requirements contain specific details for the use of fires, fire pans, stoves, etc. (see Appendix A)

B. Human Waste Disposal

All river trips are required to haul human waste generated by their group. This procedure is necessary due to the potential health hazard to the park visitor, impact on natural resources, esthetic impacts (sight and smell) and the potential destruction of irreplaceable archeological resources resulting from burial of waste in the canyon. National Park Service experience indicates that human waste can be removed at an acceptable cost and with little inconvenience to the visitor. The procedure is outlined in Appendix C.

C. Trash, Litter, Soap

All trash and litter must be carried out of the canyon. Use of soap is not allowed in side streams. Any soap used must be biodegradable. Specific details may be found in the Annual Operational Requirements, Appendix A.

D. Trails

Single trails are to be designated and maintained from the river to points of interest and other environmentally sensitive areas. To continue the present haphazard multiple trail system is unacceptable. Closure of existing trails and areas presently visited would not be feasible as it would require more effort to effectively patrol the closures than is reasonable. Reduction of visitor use would not accomplish desired goals since this, along with other trampling damage, is not a function of numbers of people as much as of where they walk. Establishing or designating single trails may require occasional minor amounts of construction.

A total of 12.1 miles are to be defined and maintained at the specific locations listed below:

Area	River Mile	Miles of New Trail	Total Miles of Trail Maintenance
South Canyon	32 (N)	0.5	1.5
Saddle Canyon	47 (N)	1.0	2.5
Nankoweap	52 (N)	1.5	2.0
Little Colorado	61.8 (S)	1.5	3.0
Cardenas Creek	72 (S)	1.0	2.0
Unkar Delta	72.5 (N)	0.5	2.0
Hermit Creek	95 (S)	2.6	4.0
Shinumo Creek	108 (N)	0.5	0.5
Elves Chasm	116 (S)	0.5	0.5
Stone Creek	132 (N)	0.5	2.0
Tapeats Creek	134 (N)	0.5	3.0
Deer Creek	136 (N)	1.0	7.0
Havasu Creek	157 (S)	0.5	1.5
		12.1	31.5

E. Historical and Archeological Resources

Specific Indian religious sites are closed to hiking and/or camping. These sites are identified in the Annual Operating Requirements, Appendix A. No archeological or historic site may be disturbed. No artifact may be removed from the canyon.

The following archeological sites are subject to heavy visitation and will be monitored, evaluated, stabilized, and protected as necessary to preserve their values in compliance with the mandates of the National Historic Preservation Act of 1966, and following consultation with the Advisory Council on Historic Preservation.

Site Number	Type of Site	Work Needed
1. C:5:1	Pueblo Ruins	Stabilization
2. C:5:3	Stanton's Cave*	Repair Fence
3. C:9:1	Pueblo Ruins	Stabilization
4. C:13:4	Prehistoric Midden*	Test Excavation

Site Number	Type of Site	Work Needed
5. C:13:66	Rock Shelter*	Full Excavation
6. C:13:2	Pueblo Ruins	Stabilization
7. C:13:10	Pueblo Ruins*	Test Excavation
8. C:13:11	Masonry Granary	Stabilization
9. B:16:3	Pueblo Ruins	Stabilization
10. B:15:1	Pueblo Ruins	Stabilization
11. B:10:4	Pueblo Ruins	Stabilization
12. B:10:1	Pueblo Ruins	Stabilization
13. A:16:1	Pictographs*	Test Excavation
14. G:3:3	Rock Shelter*	Test Excavation

* Regular inspection of sites with research potential may show that active preservation or data recovery measures (stabilization or emergency excavation) may be necessary.

F. Restricted Sites

There are many ecologically sensitive areas identified in the FES which will require special attention as part of the monitoring program. Some of these areas have already been placed off limits to camping and/or visitation in order to protect their inherent unique qualities. A list of those that have been protected from use or visits is found in the annual operating requirements.

G. Monitoring and Continued Research

Data from research projects completed in 1976 have been used in evaluating impacts of current visitor use levels and patterns, and in developing the management plan. It is recognized that additional data will be needed. Continued effort will be required in the following areas.

1. Sociological

Further refinement of information regarding relative demand by the public for noncommercial and commercial trips is essential. Existing data have provided groundwork for setting initial allocations. However, a more reliable process is needed to accurately assess the demand for commercially guided trips, taking into account the number of turn-aways and cancellations, and the effect of advertising activities.

Analysis of noncommercial permit demand is needed to determine duplicate applications, false names, and number of people that do not apply due to the tremendous competition for permits. The data can then be compared and a more responsive allocation made.

It must be recognized that demand for commercial vs. noncommercial trips is not static. Continual monitoring and adjustments in allocations will be required.

Monitoring of contacts and crowding under the new management plan is essential. Also important is continued assessment of visitor perception of the trip experience.

2. Biological

There is need for further data and monitoring of ecological changes to ensure that the resource is being protected and to assess the effects of changing use patterns.

The environmental health of campsites and points of interest including off-river camping sites must be monitored. The data gathered will be used to adjust visitor use levels to mitigate longer term resource impacts.

3. Other

Monitoring of economic impacts on concessioners and visitors resulting from the restrictions, limitations, and requirements established by the plan is also important.

To comply with Executive Order 11593, it is imperative to evaluate cultural and historic resources within the river corridor and related use areas that are or may be affected by river travelers, and to monitor impacts on these resources resulting from river runners. Protective measures will be taken as required.

VI. GENERAL GUIDELINES

A. Plan Review and Revision

It is expected that periodic modifications of the plan will be necessary. Future modifications will be based on data and information from monitoring studies and from public input. Normally, specific detailed requirements concerning boat types, boat capacities, safety and emergency equipment and procedures, trip leader and guide standards, resource protection procedures, public health standards, etc., will be reviewed and modified where needed on an annual basis. Use, allocation, scheduling, and related matters will normally be modified on a longer term basis of from three to five years. However, in any situation where a critical need for modification arises, the Superintendent reserves the right to make such a modification whenever it is necessary.

The procedure for modification will include:

- -Conducting research and evaluating data
- -Determining alternate management directions
- -Considering public review and comment
- -Notifying all river-running permit holders of proposed changes
- -Notifying the general public through local and/or Federal Register publication

B. Education of Commercial Guides, Noncommercial Trip leaders and Visitors

It is essential that commercial guides, trip leaders, and passengers are fully educated as to river management requirements. The educational provisions are listed below:

- -Annual written operating requirements for every guide and trip leader
- -An audio-visual program on resource protection for all commercial and noncommercial river passengers
- -Commercial guide and trip leader training programs in minimum impact behavior, safety, sanitation and interpretation. A minimum of two 1-week commercial boatman training sessions per year will be planned, providing funds and manpower are available to the National Park Service. Commercial guides and trip leaders should attend at least one of the 1-week sessions during the first year of employment. Alternate or additional methods and sources of training guides may be arranged by concessioners. Ability, knowledge, and willingness to impart information gained through training or other sources to passengers will be noted on concessioner evaluations. All noncommercial trip leaders must attend a one-day training session at Lees Ferry.

Commercial guides and noncommercial trip leaders must ensure that members of their group follow all applicable National Park Service rules, regulations and guidelines.

C. Boating and Safety Requirements

Based on past experience, current boating and safety requirements have been found to be adequate and will be continued. A summary of those standards are outlined below and a complete description can be found in Appendix A.

There are specific types of watercraft and corresponding load capacities (numbers of people) that are allowed to run the river. Exception to the rules outlined in the annual operating requirements must be approved by the National Park Service.

Wearing of U.S. Coast Guard approved life jackets at all times while on the river is required. Types of life jackets and other flotation devices to be worn or used by commercial passengers, boatmen, and non-commercial river runners are described in Appendix A.

All river trips are required to carry first aid supplies and equipment. A list of recommended supplies and equipment can be obtained from the River Unit at Grand Canyon National Park. All trips are required to carry some emergency communications and signaling equipment in the event of any emergency medical or other situation arising on the river. Other emergency repair and spare parts are required on all trips, such as extra oars or paddles, boat patching kits, pumps, ropes and maps.

D. Guide and Trip Leader Standards

Standards for commercial trip leaders and guides have been established. These include sufficient previous experience on white water rivers, including the Colorado in Grand Canyon, to ensure that a person has the skill to successfully negotiate the rapids, as well as to provide information and interpretation for the visitor. In addition, the guide must be able to: meet and cope with first aid situations and emergency evacuation procedures, deal with boat maintenance and repair, and be especially knowledgeable and actively work to protect the canyon's resources. A commercial trip leader must have had at least six trips through the canyon (as a guide) in the type of craft being used. A guide must have had three trips through the canyon in the type of craft to be run, having run all rapids in the river in this craft at least twice.

Standards for noncommercial trip leaders are less stringent regarding previous experience on the river in Grand Canyon, but it is required that they attend a one-day training session to learn the proper procedures regarding resource protection, safety and emergency evacuation, as well as some interpretation (see Appendix A for details).

E. Special Transportation Regulations

1. Helicopters

Helicopters used to transport passengers to and from the river must operate from lands outside the boundaries of Grand Canyon National Park. Commercial river-running companies will be required to schedule passenger exchanges at designated times and places specified by the National Park Service. These

flights will be coordinated with commercial outfitters and those in control of the lands being used.

2. Mules and Horses

The park will arrange for a concessioner to provide mule takeouts at two points in the canyon. These areas will be Whitmore Wash and Phantom Ranch. This will be done through the existing mule concession permits. These concessioners will provide transportation for passengers and baggage to and from river trips.

River concessioners must make arrangements with mule concessioners. Up to 10 mules a day will be available, by prior arrangement, for river passengers at Phantom Ranch. Up to 30 mules or horses will be available, by prior arrangement, at Whitmore Wash.

3. Hiking

Visitors may hike in or out of the canyon to meet or leave a river trip. However, overnight hiking trips require a permit obtainable through the River Unit Manager.

F. Health and Sanitation

The proper storage and handling of food on river trips is important to minimize the spread of communicable diseases. Personal cleanliness of food handlers, proper type and temperature of storage boxes, cleanliness of cooking equipment, and washing dishes properly are some of the most important items. Further details are found in Appendix C.

Applicable Federal, State and local government laws and regulations will govern health and sanitation procedures on all river trips.

VII. COORDINATION WITH OTHERS

A. Bureau of Reclamation

Bureau of Reclamation has responsibility for management of Glen Canyon and Hoover Dams including water storage and releases. Water releases from Glen Canyon Dam and water storage in Lake Mead have direct effect on river running in Grand Canyon. When Lake Mead is at a maximum volume there are approximately 5 miles of free-flowing river below Diamond Creek, with the remaining 47 miles to the park boundary (Grand Wash Cliffs) being lake waters. Although there is a current to Grand Wash Cliffs, it is very slow and for the most part not perceptibly moving.

The Colorado River Front Work and Levee System Act of March 3, 1925, as amended, authorizes the Bureau of Reclamation to investigate, operate, and maintain the Colorado River from Lees Ferry to the International Boundary between the United States and Mexico. In addition to regulating water releases, the Bureau studies potential hydroelectric and water storage sites, investigates water quality and techniques of improvement, and carries out miscellaneous operational functions associated with river flow, including gauging, sedimentation, side wash inflow, and monitoring rockslides.

The Bureau of Reclamation has released approximately 8.23 million acre-feet of water annually from Lake Powell in recent years. This flow in terms of daily releases in cubic feet per second (cfs) fluctuates considerably. The daily fluctuations require adjustments in river-running schedules as the high and low flows arrive at different times of the day, depending upon location in the canyon. Also, in years of low precipitation and run-off, the timing of water release is set to correspond with power demands. Generally, when there is no power demand only minimum flows are released. Low water release periods make it difficult and sometimes impossible to run the river, especially for the larger motorized boats. It is generally accepted by most river runners that minimum daily flows of less than 3,000 cfs make boating very difficult. This is especially so if those flows are constant at that level. Large motor boats operate best at flows of 5,000 cfs or more but can continue when minimum flows are less than that, provided daily highs are above 5,000 cfs. Oar boats can continue to operate on flows of 1,000 to 3,000 cfs. However, if daily flows are below 1,500 cfs, larger oar boats (22'+) cannot continue and smaller oar boats (18'or less) have difficulty. During high precipitation years, high flows are common. High flows are less of a problem for boating than low flows. However, high flows do erode beaches in the canyon more rapidly. It has been clearly shown that daily fluctuation of water releases erodes beach sands more rapidly than stable or consistent flows.

Coordination with the Bureau of Reclamation allows the National Park Service to be informed on water release levels from Glen Canyon Dam and the level of Lake Mead and to transmit that information to the river-running public. It also provides an opportunity to give the Bureau of Reclamation input to operating plans for Colorado River storage projects.

B. Glen Canyon National Recreation Area

Most Grand Canyon river trips launch at Lees Ferry. Lees Ferry is located just above the mouth of the Paria River within Glen Canyon National Recreation Area and is administered by the National Park Service. The boundary between Grand Canyon National Park and Glen Canyon National Recreation Area is less than one mile below Lees Ferry at the mouth of the Paria River.

The major public use at Lees Ferry is the launching of Colorado River trips through the Grand Canyon. There are, in addition to the commercial guides, passengers, and noncommercial river travelers, a considerable number of logistical personnel who drive shuttle cars, buses, or trucks and assist with boat launching.

Grand Canyon National Park has a ranger located at Lees Ferry. This ranger is responsible for checking out all river trips that launch at the Ferry to insure compliance with river-running permit conditions. The ranger also compiles data including date of launch, number of passengers, number of crew, noncommercial trip participants, length of trip, camp areas to be used, off-river hiking areas and dates. This data is critical to management of river running use. Information and education programs for noncommercial trips and commercial passengers will also be conducted at Lees Ferry. Since all of these activities take place within Glen Canyon National Recreation Area it is esssential that close coordination be maintained between the Grand Canyon and Glen Canyon rangers stationed at Lees Ferry. It is also important that close coordination be maintained between the Superintendents of the two areas in order that the necessary support for these activities is provided to the rangers. This coordination is outlined in a cooperative agreement for management of Lees Ferry. This agreement will be updated as needed to reflect changing conditions.

C. Navajo Indian Reservation

The 12.5-million acre reservation of the Navajo Nation borders the east bank of the Colorado River in the Marble Canyon section of the park from River Mile 0 at Lees Ferry to River Mile 61.8 at the confluence of the Little Colorado River. The area from the river to and beyond the rim is an undeveloped tribal park.

The only significant visitor activities in this area are occasional camping above high waterline, side canyon hikes (mostly to Silver Grotto) and infrequent hiking into and out of the canyon at the Little Colorado River. The route leads up the Little Colorado River gorge and north out of the canyon via the Salt Trail onto the Navajo Reservation. The use of this access route is expected to increase slightly for less than full-length river trips. This future use will be coordinated with the Navajo Tribe as fees for use of tribal land may be involved.

D. Havasupai Indian Tribe

The Havasupai Traditional Use Lands in Grand Canyon National Park are located between the south bank of the Colorado River from River Mile 116 to River Mile 165 and 1/4 mile back from the canyon rim around Great Thumb Mesa from Royal

Arch Creek to National Canyon. Use of these lands by the Havasupai is subject to agreement between the Havasupai Tribe and the National Park Service. The National Park Service regulates all public use. Many river trips exchange passengers at Havasu Creek. Hiking into or out of Havasu Canyon to meet or leave the trip usually necessitates an overnight stay. No camping is allowed in Havasu Canyon on national park lands, which extend about four miles back from its confluence with the Colorado River.

On the Havasupai Indian Reservation, a fee is charged for crossing tribal lands. In addition, there is a per person, per night camping fee. All arrangements should be made with the Havasupai Tourist Enterprises, Supai, Arizona.

Arrangements for park ranger patrol of hiking and other activities in the traditional use lands will be established through consultation with the Havasupai Tribal Council.

E. Hualapai Indian Reservation

The Hualapai Tribe occupies a 992,000-acre reservation bounded on the east by the Havasupai Reservation and on the north by the river from River Mile 165 near National Canyon on the south bank to River Mile 273.

Diamond Creek at River Mile 225, located on the reservation, provides the first road permitting vehicles access to the river below Lees Ferry. This road is used by a majority of river users, especially nonmotorized parties, as a takeout point. It is also a launching point for trips running only the Lower Gorge. The Hualapai Tribe charges a fee for river takeouts at Diamond Creek and helicopter landings on tribal land above Diamond Creek. This fee is subject to change and will be published yearly along with the annual operating requirements.

All river runners will be notified in permit conditions or operating requirements that the Hualapai Tribe owns the land within the Grand Canyon above the river high water line on the south bank to the south rim between River Mile 165 and River Mile 273. Any hiking, camping or other use of the Hualapai Tribal lands must be approved by the Hualapai Tribal Council. Helicopter landings for river trip takeouts on Hualapai Tribal lands require prior approval of the Tribal Council.

The Hualapai Tribe depends on the National Park Service and the river operators to provide an advance schedule of proposed takeouts at Diamond Creek. This information must be accurate and timely.

F. Lake Mead National Recreation Area

Lake Mead National Recreation Area is located adjacent to the lower end of the Grand Canyon and is administered by the National Park Service. When filled to capacity, Lake Mead backs into Grand Canyon National Park about 47 miles. There is considerable boating and fishing on these waters. Many river running expeditions continue through the Lower Gorge into Lake Mead and terminate at Pierce Ferry about three miles beyond the Grand Wash Cliffs. Some trips go on to South Cove or Temple Bar. Use of launch ramps and facilities

at Pierce Ferry, South Cove, and Temple Bar by river runners requires close coordination with the National Park Service at Lake Mead. Management activities that change river runner use levels on Lake Mead, or river runner need for more or less logistical facilities, will be communicated to Lake Mead National Recreation Area in a timely manner.

A National Park Service ranger resides at Meadview near Pierce Ferry, and patrols the Lower Gorge of the Grand Canyon. This ranger is responsible for visitor protection, law enforcement, search and rescue, and visitor use statistics. The rangers for Lake Mead National Recreation Area and Grand Canyon National Park maintain close liasion and coordinate patrol efforts.

G. State of Arizona

The river management program will require continuous cooperation and coordination between the National Park Service and the appropriate agencies and offices of the State of Arizona. Each will keep the other informed of changes necessary in accordance with laws, regulations, and protection of resources and visitors. Such offices include (but are not limited to):

-Air Quality Control

-Department of Economic Security

-Game and Fish Department

-Health Services

-Water Quality Control

APPENDIX A - ANNUAL OPERATIONAL REQUIREMENTS

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APPENDIX A
ANNUAL OPERATIONAL REQUIREMENTS

The following are the annual operational requirements for river trips. The requirements are subject to annual revisions as resource monitoring and experience dictate and as the phaseout of motor-powered craft continues.

I. WATERCRAFT

A. Types

Type of boats and their capacities will be established for each commercial outfitter. Noncommercial trips must use one of the types listed below unless special approval is granted by the Superintendent or his appointed representative.

1. The minimum size of an approved inflatable raft will normally be 12' x 5'. However, each request will be considered on its own merits and smaller boats may be allowed depending on the particular raft and the skill or experience of the boatmen. For river trips consisting of a single boat, it is strongly suggested that the minimum size be 15' x 7'. Any river trip of a single boat must demonstrate the ability to carry the required equipment for resource protection, safety, repair, and other gear plus food. Experience of the participants will also be considered.

2. The hard-hulled boat or dories must be able to carry the required equipment for resource protection, safety, and repair as well as food and other gear. A minimum of two boats should travel together for this purpose. Single dory trips may be allowed if all requirements are met and the people involved have sufficient experience to conduct the trip.

3. Whitewater canoes, kayaks, and sportyaks may also be allowed. Such boats should generally be accompanied by support craft. Proposals for trips using these boats, without support craft, will be considered and may be allowed if equipment for resource protection, safety, and repair can be carried and the experience of the people involved appears to be adequate. Single boat trips may be allowed based on this same criteria.

B. Capacities

No combination of people will exceed these totals (per craft) unless special approval is granted by the Superintendent or his appointed representative:

1. Dories, 5 people including crew
2. Inflatable rafts and pontoons:

    a. G-Rig and J-Rig, 37 feet long - 20 people including crew.
    Pontoon rafts, 33-37 feet long - 15 people including crew.

    b. All other rafts and pontoons 27 feet long:
    - with outriggers - 12 people including crew
    - without outriggers - 8 people including crew

c. Rafts and pontoons 22-27 feet long:
- 8 people including crew

d. "Snouts" - 22 feet long, 8 people including crew.

e. Rafts 17-18 feet long with 21-24 inch tubes - 6 people including crew triple operation - 18 people including crew.

f. Rafts 15-17 feet long with 19-21 inch tubes - 5 people including crew, triple operation - 15 people including crew.

g. Rafts 22 feet long with 24-28 inch tubes - 7 people including crew.

C. Registration

All watercraft on the Colorado River within Grand Canyon will be registered and will display numbers and decals and otherwise comply with all applicable Arizona State Boating Laws.

II. EMERGENCY EQUIPMENT PROCEDURES

A. Life Preservers and Regulations

1. Each passenger MUST have a U.S. Coast Guard approved personal flotation device (PFD) either Type I or V. Boatmen may use USCG PFD approved for personal use (Type II, III, or V). One extra PFD for every 10 passengers and a minimum of one extra PFD per boat or raft must be carried. They must be in good and serviceable condition in compliance with the U.S. Coast Guard Standards, and must be worn and properly fastened, at all times while on the river (36 CFR (b)(2)). PFD's are subject to testing prior to departure at Lees Ferry, and those found to be nonserviceable will be marked and set aside or discarded in an appropriate manner. Each commercial passenger will be assigned a jacket with an identifying mark to be fitted and worn while on the river during the entire trip. If a jacket becomes defective during a trip, another serviceable, marked jacket will be assigned.

2. Each boat over 16 feet in length must carry and have available a USCG approved Type IV PFD (to be thrown to a person in the water).

3. Rafts/boats operating on Lake Mead at night must comply with USCG running light requirements.

B. First Aid

A major first aid kit shall be carried on each trip with a smaller kit on each additional boat. (See Guide and Leader, Section III, for first aid training requirements.)

C. Communications and Signalling

1. Emergency signalling equipment will include a signal mirror of the United States Air Force type and a set of signal panels, 3' x 10' of international orange. In the event of an emergency, the symbol X" marked or placed on the

ground with these panels or by any means will signify that help or emergency aid is needed. Upon notification by observers, a helicopter will be dispatched by the National Park Service. (See Part F, Helicopter Evacuation.)

2. Additional recommended equipment is a ground-to-air radio transceiver on frequency 122.8 or 122.9 MHz, which is generally for plane-to-plane communication but may be used by boat operators. Frequency 123.05 is the local frequency used by Scenic Airlines.

D. Other Emergency Items

1. A minimum of one extra set of oars must be carried on each oar-powered boat or raft. An extra set of paddles are acceptable for paddle boats or for small craft listed in Section I.A(3) and other cases where specifically approved.

2. On motorized trips, an extra motor must be carried for each raft. Also required are spare parts of the types most commonly needed, such as propellers, water pumps, shafts, lower units, etc.

3. Each river trip will carry an air pump when neoprene rafts or pontoons are used.

4. Every river trip will carry a boat repair kit.

5. All motorized craft are required to carry fire extinguishers which conform to current USCG regulations.

6. An adequate supply of ropes and canteens should be carried.

7. One or more of the following maps or guides should be carried on each boat: The Les Jones Scroll Map of the Colorado River Trip from Lees Ferry to Temple Bar; Grand Canyon River Guide by Buzz Belknap; Pictorial Color Map of Grand Canyon by Jack Currey; appropriate USGS quadrangles; Brigham Young University Guidebooks to the Colorado River Part II and III by Kenneth Hamblin and J. Keith Rigby, or the Colorado River Guidebook by Troy L. Pewe.

E. Incident Reports

Section 2.22, Title 36 of the Code of Federal Regulations (36 CFR 2.22) states: "All incidents resulting in injury to persons or damage to property (other than those specified in Parts 3 and 4), must be reported by the person or persons involed as soon as possible to the Superintendent. This report does not relieve persons from the responsibility of making any other accident report which may be required under State Law."

Section 3.13(b) (36 CFR) also applies: "A report of collision, accident, fire, or other casualty that results in property damage or any personal injury or death to any person must be made by each operator of the vessels involved to the Superintendent as soon as possible, and in any event within 24 hours. This report does not relieve the responsibility of making boating accident reports as may be required by States or the U.S. Coast Guard."

Incident forms or reports must be given to a National Park Service Ranger at the time of evacuation or to a Park Ranger at Phantom Ranch or Pierce Ferry. Incident forms will be supplied by Grand Canyon National Park and carried on each trip.

F. Helicopter Evacuation

1. In the event of an emergency, the trip leader or guide will contact the National Park Service. 2. The National Park Service will arrange for the helicopter evacuation and notify the home office of the river concessioner. 3. The concessioner will be responsible for the cost of the evacuation.

When the helicopter evacuation of a passenger is requested by a friend or relative (as in the case of an emergency at home), arrangements will be made through Grand Canyon National Park. The National Park Service will not bear the cost of such evacuations.

III. TRIP LEADER AND GUIDE REQUIREMENTS

A. Certification

The following requirements must be met before guiding or leading a commercial trip on the Colorado River through the Grand Canyon.

1. Commercial Guide

An individual who meets the following qualifications:

a. Must be age 18 or older.

b. Must have made at least three river trips through Grand Canyon on the Colorado River as a trainee under a qualified guide. Must have run every rapid in Grand Canyon at least twice in the type of craft to be used.

c. Can demonstrate ability to navigate the river and operate a boat accordingly.

d. Has operated the emergency communications equipment carried on the trip.

e. Knows National Park Service, State, and USCG regulations applicable to river running.

f. Demonstrates a knowledge of the natural and human history of Grand Canyon National Park and, in particular, the river corridor. Has the ability and shows a willingness to impart this knowledge to passengers.

g. Has a working knowledge of safety, sanitation, and equipment repair.

h. Has an American Red Cross Standard First Aid Certificate or equivalent.

2. Commercial Trip Leader

Individuals in charge of river parties shall possess the character, personality, and capabilities of responsible leaders. They must also:

a. Have made at least six river trips through the Grand Canyon of the Colorado River as a guide running the entire trip in the type of craft to be operated as a leader.

b. Hold a current American Red Cross Advanced First Aid certificate or the equivalent.

c. Give an accurate orientation talk to all passengers. This orientation will cover life preservers, boating safety, swimming, hiking safety, drinking water, sanitation, cultural and natural history, and resource management.

3. Noncommercial Trip Leader and Participants

Must have experience navigating the type of boat to be used on one of the other western whitewater rivers or the equivalent. Because of the unique nature of the Grand Canyon portion of the Colorado River, the trip leader, or another member of the party, must have made a previous trip. Controlled water releases from Glen Canyon Dam result in daily water fluctu- ations between 1,000 and 32,000 cubic feet per second, a considerably greater fluctuation than most whitewater rivers.

The severity of the rapids, water temperatures ranging from 42-1/4 to 58-1/4 degrees F., 100-plus degrees F. air temperatures, and the degree of isolation require that the trip leader and guides have a working knowledge of whitewater safety, first aid, and repair of river equipment. Also needed are the techniques of whitewater navigation and map reading.

IV. ENVIRONMENTAL PROTECTION AND SANITATION

A. Refuse

All refuse must be carried out. Cans, rubbish, and other refuse MAY NOT BE DISCARDED IN THE WATER OR ALONG THE SHORE OF THE RIVER. This restriction applies to any portion of Grand Canyon National Park. Refuse cannot be left at Phantom Ranch, Diamond Creek, Pierce Ferry, or South Cove. Refuse and garbage attract red ants, flies, and animals, and result in fouled beaches. Liquid garbage such as coffee, soup, and dishwater must be strained; solids should be placed in garbage bags, and liquids dumped into the river. Grease must be carried out. The trip leader must make sure that participants are aware of proper disposal of all litter including pop tops and cigarette butts.

B. The Use of Soap

Biodegradable (low phosphate) soap may be used in the Colorado River only. Use of any soap or detergent in side streams or within 100 yards of any side stream is prohibited.

C. Portable Toilets

It is the responsibility of each boat party to remove its solid human waste from the Canyon. The system that must be used is described in Appendix C. Other systems must be approved by the Superintendent or his appointed representative. These facilities will be set up upon arrival and remain until the party breaks camp. No toilet paper should be burned: it should be placed in a plastic sack and deposited with other human waste. Between camps, when the toilet is not set up, people are encouraged to defecate or urinate as far away as possible from potential camping areas. When unavoidable, urination should take place in the wet sand below high water mark.

D. Fires

Gas stoves (propane, white gas, etc.) for cooking are required on all trips. Charcoal briquettes may also be used for cooking. Diminishing driftwood, destruction of native vegetation and deposition of charcoal on beaches make this restriction necessary. Wood fires may be used for warmth or esthetics, but not for cooking. However, from May 1 through September 30, all wood for fires must be carried into the canyon from an outside source. From October 1 through April 31, driftwood from beaches may be used for warming and esthetic fires. Within the park, gathering of wood from standing or fallen trees (dead or alive) is prohibited. All fires must be contained in a fire pan that is at least 2 feet by 2 feet with a 3 inch-high lip around its edge. Smaller fire pans (12" x 12" x 3" minimum) may be used for charcoal briquettes. A fire permit is required and all fire pans must be approved by the Lees Ferry Ranger. All ash and charcoal residue must be carried out of the canyon, not left on the beach or dumped in the river as in the past.

The kindling of open fires is prohibited at any time when away from beaches. Gas stoves for cooking are required for overnight trips away from the river.

E. Public Health

All river trips will comply with the requirements found in the Public Health Supplement in Appendix C.

V. RESTRICTED AREAS

Areas along the Colorado River closed to either camping, open fires, or vistation:

A. Redwall Cavern - no camping and no fires.

B. Little Colorado - no camping from River Mile 60.5 to River Mile 65.0 on the south side of the river. The Sipapu is a Hopi religious site. Please honor it as such and do not disturb.

C. Hopi Salt Mine - no visitation is allowed on the east side of the river from River Mile 63 to River Mile 64. This area contains another Hopi religious site.

D. Phantom Ranch - no camping or fires are allowed one-quarter mile upstream from Kaibab Bridge to one-quarter mile downstream from Pipe Creek (Garden Creek). Emergency camping in this area may be approved by the Phantom Ranch ranger. Passengers exchanging on trips at Phantom and wishing to camp at either Bright Angel Campground or Indian Gardens must have an overnight permit (which requires advance reservations) for these areas.

E. Elves Chasm - no camping or fires within one mile of Royal Arch Creek's confluence with the river.

F. Deer Creek Falls - no camping or fires within one-half mile of the confluence of Deer Creek and the Colorado River on north side of the river.

G. Matkatamiba Canyon - day use only, no camping or fires.

H. Havasu Creek - no camping or fires within one-half mile of Havasu Creek's confluence with the river. Overnight use is permissible at the Havasupai campground only. (See Part VIII. F. Backcountry or Off-River Camping.) For reservations at Havasu Campground, call or write the Havasupai Tourist Enterprises, Supai, Arizona (telephone: 602-448-2121). A $5.00 fee is charged for any hiking on the Havasupai reservation. An additional fee of $2.00 per person, per night is charged for camping.

I. Emergency closures - as listed on the bulletin board at Lees Ferry.

VI. COMMERCIAL LAUNCH DATES

Commercial launch schedules will be established by February for the next year's boating season. An example is February 1980 would be the date for establishing the 1981 summer boating season and the 81-82 winter season schedules. Concessioners will submit proposed launch schedules to the National Park Service by January 31 and the National Park Service will prepare a calendar showing proposed schedules. The National Park Service will schedule a meeting in mid-February to be attended by all concessioners where the final schedule will be established. If changes in the schedule are necessary after that time, the National Park Service will work out needed modifications with the companies involved. Any company who sends launch schedules in late will be assigned the closest launch dates available to those it proposes.

VII. OTHER RIVER TRIP LIMITATIONS

A. The maximum number of commercial passengers per trip is 36. River trips traveling or camping together may not exceed 36 passengers. See Part VIII.F. for off-river camping information.

B. One hundred commercial passengers may depart from Lees Ferry daily for the summer season. A maximum of 15 noncommercial passengers may depart daily.

C. No person shall operate a vessel engaged in predominantly upstream travel between Lees Ferry and Diamond Creek. No vessel shall be operated that has more than 55 horsepower.

D. Subjects that must be covered in mandatory orientation talks are outlined in Appendix B.

E. Subletting of Commercial Allocations

Use allocations belong to the United States and may not be sublet for commercial or noncommercial purposes. To avoid subletting charges, commercial river companies should follow these guidelines:

1. All monies go directly to the concessioner. A booking agent can advertise and organize, but not operate the trip. A person or organization may not collect fees for a trip and then pay a concessioner a franchise fee to physically run the trip.

2. All trip participants must be under the regular insurance coverage of the concessioner company. Additional insurance may be provided by charter groups, etc.

3. A river concessioner using rental equipment must not have any company names on the boats, gear boxes, etc., other than its own or another authorized concessioner or the name of the equipment manufacturer.

4. In order to avoid the appearance or charge of sublet, all crew must be salaried or paid employees. Freelance river guides must be paid in a similar manner as all other company employees. All commercial crew members must meet the standards outlined in Section III and must be registered with the National Park Service prior to their arrival at Lees Ferry.

In summary, a sublet exists when persons operate a trip with their own equipment, personnel, and insurance, and pays a river concessioner a fee for its use allocation.

VIII. MISCELLANEOUS PROVISIONS

A. A fee is charged for each person, boat and truck using the Diamond Creek Road. Permits are required in advance. For further information contact:

Monroe Beecher, Director
Hualapai Wildlife & Outdoor Recreation Department
P. O. Box 216
Peach Springs, Arizona 86434

B. Rafts and boats operating at night must comply with USCG and State of Arizona requirements for running lights.

C. No cats dogs, or other animals are permitted on river trips.

D. River parties will, when possible, avoid heavily used campsites.

E. A copy of the current Operational Requirements must be carried on each trip and all river guides must have a sound knowledge of them.
F. Overnight permits are necessary for off-river camping in all areas of Grand Canyon National Park. All backcountry areas have group and individual overnight limits. The maximum number in any one group is fifteen (15) people, with camping in one spot limited to two nights.

There is a reservation system for the Phantom Ranch, Cottonwood, Indian Gardens, Deer Creek, Tapeats Creek, and Thunder River areas. Advance notice and an overnight permit is necessary for all overnight use.

Permits will be issued by the Backcountry Reservations Office through the River Unit manager. The written permit must accompany each off-river party. To receive permits mail your requests to the River Unit Manager. A letter of confirmation with the overnight permits will be mailed back to you if the requested areas are available.

G. All land on the south side of the canyon above the river high water line on its south bank, between Mile 165 and 273 is Hualapai Tribal Land. Any activities in this area such as hiking or camping requires the permission of the Hualapai Tribe.

H. It is the responsibility of the Lees Ferry Ranger to see that conditions in Appendix A are met prior to approving a launch.

APPENDIX B
ORIENTATION TALKS FOR CONCESSIONER GUIDED TRIPS

All companies must give orientation talks to their passengers. To ensure that each company covers the points stressed by the National Park Service, an outline and description of the items that must be covered before launching from Lees Ferry are listed below. Orientation talks may be given while traveling to Lees Ferry or at other times or locations, if approved in advance by the River Unit Manager.

I. All passengers should be informed that within Grand Canyon National Park all natural, historical, and archeological objects and wildlife are protected and must not be disturbed.

II. The river guides on motor-powered trips will be willing to shut down the motor and interpret natural features when safe to do so.

III. Purified drinking water will be available.

IV. Life jackets must be worn at all times when on the river and be kept properly fastened and adjusted. Passengers must be given a demonstration of how to wear the life preserver and what to do if they fall overboard.

V. Chemical toilets or other means of containerization of human waste will be provided and must be used while they are set up. The reasons for the human waste disposal system will be explained. The proper means of disposing of human waste when this system is not set up will also be explained.

Avoid camping areas, trails, and points of interest when urinating. At popular spots such as Havasu Creek go "high and far" to avoid the displeasing buildup of feces and urine. Passengers should be informed that the boats will occasionally be stopping above points of interest to prevent the buildup of human waste at popular areas, such as Havasu Creek, Deer Creek and Redwall Cavern.

VI. A crew member will use a single trail while leading passengers to popular areas.

VII. For winter trips, passengers will be informed of the proper methods and places to gather firewood.

VIII. The Lees Ferry ranger will make spot checks to ensure that the orientation talks are occurring prior to departure at Lees Ferry and that they include the preceding points. Failure to give proper orientation talks will be documented on the trip check out sheet and reflected in the concession evaluation report.

APPENDIX C
HEALTH AND SANITATION GUIDELINES

I. Human Waste Removal

With the porta-potti burial system of human waste disposal, over 5,000 burials took place in the river corridor each year. It is now required that all solid human wastes be carried from the canyon because of resource impact and the hazard to human health. The cheapest and, so far, most effective means of transporting solid human waste out of the canyon is by the use of air-tight military surplus ammunition boxes and plastic bags. The necessary items are:

a. Surplus ammo cans (rocket boxes) that measure 18" x 8" x 14".

b. A toilet seat.

c. Large, heavy duty plastic garbage bags.

d. Deodorant chemical, such as Aqua Chem, chlorine bleach, or quick lime.

e. Toilet paper, water dispenser and hand soap.

The system is set up as follows: one of the rocket boxes serves as the toilet container. It is first lined with one of the heavy duty large garbage bags with the excess folded around the outside edge of the can. Pour the deodorant into the open bag and place the toilet seat on top of the can. The water dispenser and the hand soap can be placed nearby. Used toilet paper, tampons, and sanitary napkins can be placed directly in the toilet. After use, the toilet should be covered with a large heavy duty garbage bag to discourage flies. To dismantle the toilet, squeeze the excess air out of the bag and tie it off. This may be done by placing the lower part of the bag into a wash bucket and allowing the water to force out excess air. Then place the bag into another bag and store subsequent wastebags with it. Tie off the storage bag and place it into the rocket box. After the lid is sealed, the container is ready for storage on the boat until the next use. The toilet seat, plastic bags, toilet paper, and deodorant are then stored in another rocket box. It is necessary to remove only two cans from the boat each time the toilet is set up.

The amount of chemical needed depends on the type used and the number of people on the trip. With liquid deodorant, a few ounces at the bottom of the bag is sufficient for six or seven people. With bleach, approximately twice as much is required. Quick lime should be sprinkled over the waste after each use. The deodorant reduces bacterial growth and the production of methane gas. The number of rocket boxes needed dependent on the number of people and the length of the trip. It has been found that it is possible to containerize about 70 to 90 person-days of human waste in one rocket box. One additional rocket box is needed for equipment.

A human waste receptable is provided at Pierce Ferry. Human waste contained in plastic bags may be deposited in that receptable. There are no receptables at any other of the take out locations. Therefore, trips taking out at

locations other than Pierce Ferry are required to deposit the containerized human waste in an approved solid waste landfill. Locations that will accept this material are, Flagstaff, Arizona; Kingman, Arizona; Fredonia, Arizona; nd Lees Ferry, Arizona.

Toilet paper is a significant source of litter along the river corridor. When the toilet is set up, all paper will be put in the toilet bag. At other times, place all toilet paper in a small plastic bag or other container and place it later in the toilet bag. Numerous fires have been caused by the careless burning of toilet paper. River guides are responsible for any fires caused by any member of their group by burning toilet paper.

II. Food and Water Sanitation

Certain sanitation practices are necessary to prevent the contamination of food and subsequent human illness. These are:

a. Before handling and preparing foods after going to the toilet or handling raw meat or poultry, wash hands with soap and water.

b. Cooked or other prepared foods should come in contact only with clean and sanitized surfaces, equipment, and utensils. Equipment used for raw foods should be washed and sanitized before using it on cooked foods.

c. Persons with communicable diseases, infected wounds on the hands and arms, or boils, should not prepare food.

d. Perishable foods should be kept at temperatures below 45 degrees F.

e. Foods such as meat and poultry products should be well cooked to destroy disease organisms.

f. After preparation and prior to serving, keep hot foods hot and cold foods cold.

g. Leftover perishable food should be discarded or refrigerated immediately in clean and protected containers.

h. Leftover perishable food should be thoroughly reheated before eating.

The most effective means of sanitizing dishes and utensils is the three-bucket system. The system is as follows:

a. Use three buckets large enough to immerse the largest utensils with one bucket heated to near boiling.

b. Add detergent to the heated bucket. Fill the second bucket with clear water for rinsing. Add chlorine to the third bucket at the rate of two teaspoons per gallon of water.

c. Wash dishes and utensils in the first bucket to remove grease and food particles. Water temperature should be 120 degrees F.

d. Rinse by dipping in the second bucket.

e. Immerse articles in the third bucket for sixty (60) seconds, twice as long if towel dried. The effectiveness of chlorine for disinfection is directly related to the time of exposure. Be sure to allow time for the chlorine to act.

f. Use a rack for air drying or wipe dry with clean paper towels.

Store the articles in a clean, dry location.

For safe drinking water, follow these two steps:

a. Add eight (8) drops of chlorine per gallon of water, adding a few drops more if the water is muddy.

b. Mix the water and chlorine and let stand uncovered in a wide-mouthed container for 30 minutes. Proper standing time will disinfect as well as dissipate the objectionable chlorine taste.

APPENDIX D
NONCOMMERCIAL RIVER TRIP AFFIDAVIT

Your signature on this affidavit indicates that you have considered the permit conditions and that your trip is organized in the spirit, as well as the intent, of the following conditions (36 CFR 5.3, Business Operations; 36 CFR 7.4(h), Grand Canyon National Park, Colorado Whitewater Trips). Failure to abide by these conditions will jeopardize future applications and will result in permit cancellation.

1. A private river trip must be participatory. Trip preparation (including logistics, food purchase, equipment assembly, transportation and vehicle shuttle) and conduct of the trip (including food preparation and sanitation) must be shared by members of the group. Collecting a set fee (monetary conpensation), payable to an individual, group or organization, for conducting, leading, guiding or outfitting a private river trip is not allowed. The trip leader should delegate responsibility (financial and otherwise) for various aspects of trip preparation and conduct.

2. The purpose of the trip must be for its recreational and/or educational values. The trip will not be conducted for monetary gain (either as a direct or indirect result of the trip) or acquisition of new equipment to the advantage of an individual, group or organization or for the purpose of amortizing equipment.

3. Media or direct mail or other advertising is not permissible.

4. Estimated overall trip cost:
(based on trip members)

5. A complete itinerary including off-river days and a list of boatmen, their experience, equipment, and other information ensuring compliance with the Appendix A of the permit application criteria must be provided at least sixty (60) days prior to trip launch. A National Park Service form will be provided for this purpose.

I have given complete and accurate descriptions and answers to all questions. I agree to comply with all park rules and regulations as stated in Appendix A of this application, and appropriate parts of the Code of Federal Regulations, AND ASSUME FULL RESPONSIBILITY FOR THE CONDUCT OF MY ENTIRE PARTY IN OBEYING THESE RULES AND REGULATIONS. To the best of my knowledge, my name and those of the trip participants appear on only one application and I understand that duplication of names or incomplete answers will make my permit application invalid. I also acknowledge that I have read and agree with all terms in the above noncommercial river trip affidavit.

It is unlawful to knowingly and willfully falsify or conceal by any scheme or by any false, fictitious or fraudulent statements or representations or to make use of any false writings or documents knowing them to contain any false, fictitious, or fraudulent statement or entry. Violators will be subject to a fine of not more than $10,000.00 or imprisonment for not more than five (5) years or both (18 U.S.C. 1001, 1970).

Applicant's Signature _____

APPENDIX E
GLOSSARY OF TERMS

Artifact Broadly defined to include any natural object or any man-made object more than twenty years old. No such object may be collected without a permit issued by the Superintendent, Grand Canyon National Park, or the Secretary of the Interior in the case of archeological objects and vertebrate fossils.

Attraction Sites Popular locations along the river that attract river runners and are at times crowded. These include geologic features, side canyons, archeological and historic sites, caves, waterfalls, and unusual vegetation.

Boatman Synonym for "river guide," and includes men or women who operate river-running boats.

Commercial Refers to boating companies who are concessioners operating under a permit from the National Park Service. These companies arrange river trips which provide a crew, equipment, and supplies to visitors for a fee. The crew operates the boats, prepares meals, sets up camp, and provides educational opportunities to learn about the area. "Commercial outfitter" is synonymous with "commercial river-running company."

Concession Permit A form of contract, issued to commercial river companies by the National Park Service. This permit allows them to provide a specific public service, in this case, river trips. In contrast, a concession contract, in the strict sense, requires that a specific service be offered for a certain period. The National Park Service may regulate practices and rates under both permits and contracts.

Concessioner A commercial company operating under contract or permit from the National Park Service to provide the public with service which the National Park Service has deemed necessary for the visitors use and enjoyment of the park. All concession operations must be consistent to the highest degree possible with the preservation of the park. Federal laws and National Park Service policies include the National Park Service Concessions Act of October 9, 1965 (P.L. 89-249; 79 Stat. 969) and National Park Service Management Policies, Chapter VIII.

Contact The sighting or hearing, by one or more members of a group running the river, of a boat belonging to another group. If a group is using more than one boat, the visibility from one boat of other boats belonging to the same group does not constitute a "contact".

Contact Time For a given group traveling the river, the amount of time during which one or more boats of other groups are visible or audible.

Full-length Trip A river trip undertaken by a passenger or participant who joins the river trip at Lees Ferry and travels to Diamond Creek. Some feel that a trip from Lees Ferry to Lava Falls, River Mile 179, or to Whitemore Wash, River Mile 188, constitutes a full-length trip. Others feel that a full-length trip is to Grand Wash Cliffs at Mile 277. For purposes of this plan it will be to Diamond Creek.

Hiking Permit A permit required for all hikes in Grand Canyon National Park involving an overnight stay below the rim. Such permits are issued by Grand Canyon National Park's Backcountry Reservations Office and are nontransferable. The only overnight stays below the rim not requiring hiking permits are those of river runners camping on beaches and visitors staying in the Grand Canyon National Park Lodges accommodations at Phantom Ranch.

Use Capacity The number of people who can be present at a location in a given unit of time without damage to plants, animals, and soil beyond what can recover in a reasonable period and without such crowding as would detract from the natural, esthetic qualities of the place. This capacity varies with the type of use; a given area being able to accommodate fewer people camping, for example, than simply visiting.

Interpretation "An educational activity which aims to reveal meaning and relationships through the use of original objects, by first-hand experience, and by illustrative media, rather than simply to communicate factual information." (Freeman Tilden) Interpretation is necessarily supported by a sound knowledge of facts and of techniques for presenting them.

Launch The beginning of a river trip, involving up to 36 passengers on a commercial trip or 15 participants on a noncommercial trip, from any point along the river. In almost all cases this point is Lees Ferry. The term does not generally refer to trips launched at Diamond Creek by the Hualapai company as the National Park Service does not restrict the date or number of launches from that location. Sometimes called a "put in".

Noncommercial Refers to boaters who are skilled river runners organizing river trips with their own crew, equipment, and supplies. On these trips, the participants share the responsibilities and cost of operation of the boats, along with meal preparation, and other camp duties. No fees are paid for guide services or are collected above the actual cost of the trip. Also termed "private."

Overnight Hikes Any hike below the rim of the Grand Canyon involving at least one night spent below the rim. Such hikes require a permit issued by the Backcountry Reservations Office of Grand Canyon National Park. River users camping elsewhere than on beaches are considered to be on an overnight hike and must have a permit.

Partial Trip Any river trip undertaken by a passenger or participant who joins the trip below Lees Ferry, or leaves a river trip above Diamond Creek.

Participants The people taking part in a noncommercial river trip. See "Noncommercial" for a description of their role in such a trip. One participant is designated the Trip Leader.

Passengers All people taking commercial river trips who are not members of the crew. They pay a set fee for the services of the company providing the trip.

Resource Protection Specifically refers to those provisions of the Colorado River Management Plan designed to mitigate human impact on the river corridor. These provisions include the restrictions on fires, the requirement that all human waste be removed from the canyon, and others.

Resources The interrelated components of an ecosystem including the plants, animals, and the soil upon which these depend. Includes the quality of these with emphasis on their natural condition, with little if any human effect evident. Also includes historical and cultural remains such as ruins, abandoned mining tools, and artifacts.

Resource Impact Noticeable evidence of recent human presence as revealed by the appearance, smell, behavior, etc., of components of the ecosystem including plants, animals, and soil. Also, evidence of recent human presence seen in the condition of historical or cultural resources such as ruins.

Riparian Zone The area from the river's edge to the highest point of the pre-Glen Canyon Dam silt-sand terraces and silt-sand eolian deposits.

River Corridor The Colorado River in Grand Canyon, its shore, and the adjacent portions of side canyons. Refers to parts of Grand Canyon National Park, Glen Canyon and Lake Mead National Recreation Areas, and parts of the Navajo, Havasupai, and Hualapai Reservations used by people running the Colorado River.

River Guide A member of the crew on a commercial river trip who has sufficient previous experience on whitewater rivers, including the Colorado River in Grand Canyon, to successfully negotiate the rapids as well as to provide information and interpretation for the visitor. See Plan, VI. D., for additional required qualifications.

River Mile Distances along the Colorado River in Grand Canyon as measured in miles beginning at Lees Ferry, Arizona.

River Runner General term referring to any person using a boat on the Colorado River. Includes river guides, trip leaders, participants, and passengers.

Sublet The unauthorized transfer of user days. A sublet exists when persons operate a trip with their own equipment, personnel, and insurance and pay a river concessioner a fee for its user days. See Appendix A for details.

Summer Season Defined by the Colorado River Management Plan as April 16th through October 15th. Previously defined generally as June 1st through August 31st.

Takeout The end of a river trip including the act of removing the boat from the river. The "takeout point" is the location at which this is done, such as Diamond Creek or Pierce Ferry. "Takeout" and "river takeout" are synonymous.

Trip Leader The individual in charge of a river trip. Commercial trip leaders must meet the qualifications for river guides and, in addition, must have worked as river guides on a least six trips through the Grand Canyon in the type of craft being used on the trip that the "leader" is to lead. Noncommercial trip leaders must have previous experience on the Colorado River in Grand Canyon and must attend a one-day training session.

Use Allocation For this plan it is the assignment of number of people and trip launches to commercial companies with concession permits and to non-commercial river runners.

User Days A unit of use equivalent to one person on the river for one day. When computing user days for commercial trips, crew members are not included in the calculations.

Visitor Any person using any part of the park, except employees of the park or its concessioners while carrying out their responsibilities.

Winter Season October 16th through April 15th.

DRAFT

ENVIRONMENTAL STATEMENT

DES 77-37

Proposed

COLORADO RIVER MANAGEMENT PLAN

GRAND CANYON NATIONAL PARK

ARIZONA

Prepared by

Grand Canyon National Park
National Park Service
Department of the Interior

Howard D. L. Chapman

Regional Director, Western Region

SUMMARY

(X) DRAFT ( ) FINAL ENVIRONMENTAL STATEMENT

Department of the Interior, National Park Service, Western Region

1. Type of Action: (x) Administrative ( ) Legislative

2. Brief Description of Action: A river management plan for the Colorado River between Lee's Ferry and Pierce Ferry (277 miles) within Grand Canyon National Park, Mohave and Coconino Counties, Arizona. The plan proposes to eliminate motorized craft; to increase total use of the river; increase noncommercial allocations; increase use of the river in the winter season; and establish measures for resource protection.

3. Summary of Environmental Impact and Adverse Environmental Effects: Elimination of motorized craft will enhance the river running experience for most visitors; those preferring a motorized trip will be disappointed. Both private and commercial parties will receive larger use allotments. Extension of the river running season and longer average stays in the river corridor will allow greater opportunities for interpretation and education. Scheduling and increased regulations will protect sensitive resources, but may inconvenience some users.

4. Alternatives Considered: A. No action; B. Increase the visitor use levels; C. Reduce visitor levels by 50 percent; D. Provide exclusive periods for non-motorized use; E. Eliminate motorized use in the Lower Gorge; F. Allocation options.

5. Comments Have Been Requested From the Following:

Advisory Council on Historic Preservation
Department of Agriculture
    Forest Service
Department of the Interior
    Bureau of Indian Affairs
    Bureau of Land Management
    Bureau of Outdoor Recreation
    Bureau of Reclamation
    Fish and Wildlife Service
    Geological Survey
Department of Transportation
    Coast Guard
    Federal Aviation Administration
Environmental Protection Agency

Arizona State Clearinghouse
    Arizona State Historic Preservation Officer
    Northern Arizona Council of Governments
Havasupai Tribal Council
Hopi Tribal Council
Hualapai Tribal Council
Navajo Tribal Council

6. Date Draft Statement Made Available to CEQ and the Public: DEC 8 1977

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I. DESCRIPTION OF THE PROPOSAL

Grand Canyon National Park, located on the vast, semi-arid Colorado Plateau in Mohave and Coconino Counties, Arizona, contains 277 miles of the Colorado River system. Stretching from Glen Canyon National Recreation Area to the backwaters of Lake Mead National Recreation Area, the river provides a unique and popular river running experience for thousands of people each year.

Management of the Colorado River corridor and the riparian ecosystems has become an issue of major importance in recent years. The number of persons floating the river increased dramatically between 1967 and 1972 (from 2,099 to 16,432 visitors). By 1973, more than 22 commercial boating companies were operating on the river. As visitation increased, it became apparent that the canyon resources were deteriorating, but the degree or severity of change was unknown. To provide a firm basis for future management of the river corridor and to quantify the kinds of impact inflicted on the resources, a comprehensive research program, including 29 separate studies was initiated in 1973 and completed in June 1976 (See Appendix A for the complete list).

In addition, several major issues were raised by the public during hearings on the wilderness proposals for Grand Canyon National Park and during workshops on the future management of the river. The following major issues were identified during the course of the research studies and the public involvement process:

1. Mode of travel (motorized versus non-motorized watercraft)
2. Total use capacity
3. Allocation of use to commercial and noncommercial river runners
4. Allocation of use among commercial operators
5. Permit systems
6. Disposal of human waste
7. Use of cooking and camping fires
8. Multiple trails and site damage
9. High visitor density and congestion at attraction and camping sites
10. Lack of adequate education/interpretive programs
11. Need for research and monitoring programs

The Grand Canyon National Park Master Plan contains some specific statements concerning management of the Colorado River which have had a direct influence on the development of the river plan.

> ". . .preservation of the Grand Canyon natural environment is the fundamental requirement for its continued use and enjoyment as an unimpaired natural area. Park management therefore looks

first to the preservation and management of the natural resources of the park. The management concept is the preservation of total environments, as contrasted with the protection of only a single feature or species.

"The goals for management of the Colorado River in Grand Canyon will be to perpetuate the wilderness river running experience and to attempt to mitigate the influences of man's manipulation of the river."

In order to achieve the management goals outlined above, specific objectives must be established to further define the nature and extent of resource protection and what a quality river running experience consists of. Objectives for the river management plan have been developed through consideration of the management framework stated above, public input and research data provided by the 29 research projects recently completed.

- Allow only non-motorized watercraft
- Establish a total use capacity and related use limitations
- Allocate use equitably to commercial and noncommercial users
- Provide commercially guided trips consistent with a quality wilderness river running experience
- Establish an equitable and efficient method of handling noncommercial permits
- Protect and preserve the river riparian environment within our ability to do so considering uncontrollable effects of Glen Canyon Dam
- Reduce high visitor density and congestion at attraction sites
- Preserve water quality in side streams and the river
- Maintain public health and safety standards
- Increase interpretive opportunities
- Increase education and information for all river runners regarding protection and use of river environment
- Establish research monitoring programs

The Colorado River Management Plan covers the 277 miles of river, beaches, and side canyons from Lee's Ferry to Grand Wash Cliffs. It will establish total use, mode of travel, use patterns, distribution of use, and other limits, restrictions and requirements necessary to meet goals and objectives for management of the resource. The plan will be implemented over a 3-year period, will be assessed annually, and will be modified as needed to accomplish management objectives (see page I-22 for specific phasing).

A. MODE OF TRAVEL

At present, approximately 80 percent of the river users float the Colorado on motorized craft. The remaining 20 percent use either oar or paddle-powered watercraft. The plan proposes to phase out all motorized travel over a 3-year period. By 1981 motorized craft will be eliminated from the 240 miles of river from Lee's Ferry to Separation Canyon. Motorized traffic will be allowed to continue below Separation Canyon and on to Lake Mead. To ensure commercial outfitters adequate time for replacement of motorized rafting equipment, the following phase-out schedule is proposed:

1978 - Status Quo

1979 - 30 percent reduction of 1977 motorized trips by company

1980 - 60 percent reduction of 1977 motorized trips by company

1981 - 100 percent of trips on Colorado River non-motorized

B. LEVEL AND DISTRIBUTION OF USE

The present visitor use level on the Colorado River is about 96,000 user days (user day = one person on the river for one day). The total number of visitors reflected by the 96,000 user days is approximately 11,500 depending on the lengths of the trips. Commercial crews (21,000) and research and administrative personnel (5,000) bring total user days to 122,600 user days or approximately 14,000 persons per year (1976 data). Visitor use levels are the ancillary issues of trip length, group size, repeat use, and launch schedule. Presently, the only limitation on trip length is the maximum of 40 miles per day which limits a full length trip to no less than 6 days. Group size is limited to 40 commercial passengers plus crew (per group) and 15 total persons for the private group. The repeat rule states that a person may take only one recreational trip per year. Scheduling is limited to a policy of allowing a maximum number of 150 commercial passengers and 15 private passengers to depart each day from Lee's Ferry. The river running season extends from May 1 through September 30.

The plan proposes to increase the visitor use to approximately 193,320 user days. The number of passengers will increase to 12,800 persons per year. Total use will be set at 225,320 user days or approximately 15,000 persons per year (includes crew and administrative personnel).

Visitor use will be computed as outlined below, based on two separate use seasons each year, group size, trip launches per day and average trip length (summer maximum 18 days, winter maximum 30 days). The repeat rule will change from one trip every year to one trip every two years.

Summer Season - April 1 to September 30 (183 days)

Commercial:

2 trips per day x 183 days = 366 trips per summer season

366 trips per season x 25 passengers per trip = 9150 passengers per season

9150 passengers per season x 50% - 12 days per trip = 54,900 user days
25% - 14 days per trip = 32,025 user days
25% - 16 days per trip = 36,600 user days
Total 123,525 user days

Noncommercial:

1 trip per day x 183 days - 183 trips per summer season

183 trips per season x 15 participants per trip = 2745 par. per season

2745 par. per season x 18 (average) days per trip = 49,410 user days per season

Winter Season - October 1 to March 31 (182 days)

Commercial:

1 trip per company per season x 21 companies - 21 trips per winter season

21 trips per season x 25 passengers per trip = 525 passengers per season

525 passengers per season x 21 (average) days per trip = 11,025 user days per season

Noncommercial

1 trip per week x 26 weeks per season = 26 trips per season

26 trips per season x 15 participants per trip = 390 par. per season

390 par. per season x 24 (average) days per trip = 9360 user days per season

Total - 193,320 user days

C. ALLOCATION OF USE

Current distribution of available user days is divided between two groups, commercial concessions and the noncommercial boater. The available user days total 96,600. Of these, the commercial allocation is 89,000 (92 percent) and the noncommercial allocation is 7,600 (8 percent). The 89,000 commercial user days are allocated among 21 separate concessioners.

To establish a better balance between commercial and noncommercial use, the plan proposes the following breakdown of use by percentage.

Commercial - 70 percent (134,550 user days)

Noncommercial - 30 percent (58,770 user days)

Amount of use allocation to commercial passengers appears to be less when looking at the percentage figures. User days are increased by 50 percent even though annual number of passengers will be 12 percent (1325) less. Noncommercial user days will be increased by 673 percent from 7600 to 58,770. Commercial crew days will increase from 21,000 to 27,000.

Use will be allocated by number of trips to commercial and noncommercial river runners as follows:

Commercial

Summer	Winter	Total
25 passengers per trip	25 passengers per trip	
12-14 and 16-day trips	21-day trip	
2 trips per day	1 trip per company	

Commercial (continued)

Summer	Winter	Total
366 trips per season	21 trips per season	387 trips per year
9150 passengers per season	525 passengers per season	9675 passengers per year
123,525 user days per season	11,025 user days per season	134,550 user days per year

Noncommercial

Summer	Winter	Total
15 participants	15 participants	
18-day trip	24-day trip	
1 trip per day	1 trip per week	
183 trips per season	26 trips per season	209 trips per year
2745 participants per season	390 participants per season	3135 participants per year
49,410 user days per season	9,360 user days per season	58,770 user days per year

Grand Total 193,320 user days

Administrative, management, and research allocations will be set at 26 trip launches each summer season, not to exceed 5000 user days. National Park Service administrative and management trips will not be under a quota during the winter season. Maximum group size will be 15 people. Research trips will be scheduled as needed to monitor the use and impact during the winter season. Administrative trips will represent 3 percent of the total user day allocation.

National Park Service patrol trips are not included in the above allocation. Patrols must be flexible in order to respond to problem situations and other needs related to resource protection and visitor management. Patrol trips will be separated from other administrative and management or research trips. There will be at least one patrol trip on the river (3 per month minimum) at all times during the

winter season, for a total of approximately 24 trips per year. Maximum group size will be 10 people.

D. COMMERCIAL ALLOCATIONS

In 1973, at the same time a total use ceiling was imposed, permit requests in excess of the already operating 21 concessions were denied and individual concession limits were established. The concession limits were based on the actual use of each individual company during the 1972 river running season. The current allocation system is based on historic use rather than performance.

To redistribute use among concessioners and to ensure appropriate service to the public, the plan proposes to readvertize for river concession permits.

Concession permits will be negotiated with the applicants selected as the ones submitting the best offers in the judgment of the National Park Service. In making selections, offers will be evaluated on the basis of experience and background of offerer. Primary consideration in providing river trips is that the natural resources of the canyon be preserved and protected while providing the public the opportunity for a quality wilderness river running experience. It is essential that a variety of services be available to the public desiring river trips. Therefore, offers will be judged both individually and as a group. That is, certain offers may be accepted for providing speciality trips, such as emphasis on side canyon hikes to natural features, and others for providing variable trips that cater to desires of individuals and groups. Also, safety.

The concession fact sheet is found in Appendix B. However, the primary selection factors are:

- Experience and background in resource protection.
- Trip variety as to services offered in interpretation, side canyon hiking, etc.
- Trip length

  Summer Season: 50 percent of trips will be 12 days
  25 percent of trips will be 14 days
  25 percent of trips will be 16 days (average)

  Winter Season: Trips may range from 12 to 30 days.

  Individual offers may be for all 12-day trips or for all 14- or 16-day trips or a combination thereof. In selection, the

National Park Service will consider the aggregate of offers so that a company may be selected regardless of whether they prefer all 12-day trips or the combination as above.

- Maximum passenger group size, 25 people
- Boats and related equipment
- Menu and food handling experience
- General river running experience and background including managerial experience and background
- Financial status of company or individual
- Trip prices related to services offered, franchise fee, insurance coverage.

The amount of use allocated to each concessioner will depend on the offers received. Allocations will be by number of trips. Launch days will be assigned by the National Park Service and a company may launch only one trip per day. Consideration will be given to size of allocation in terms of service to the public and a reasonable rate of return to the concessioner.

Concession permits will be for a 5-year period. Permits will be non-transferrable either by direct sale or by change of major stockholder. Franchise fees will be established by the National Park Service, and could fluctuate during the term of the permit.

E. NONCOMMERCIAL PERMITS

Permit applications for noncommercial river trips will be accepted on a first-come-first-served basis. The applicant will list a given week of the season that would be preferred for a launch date. A second and third launch week will also be listed. When this system is initiated there will undoubtedly be more requests than can be accommodated. Therefore, there will be a lottery to establish who will be given permits for the requested week in the first year, and a waiting list for subsequent years. In the event that not all dates are filled for a given week, an opportunity will be given to other applicants of that particular year to use the date. If those other applicants do not wish to take the trip at that time, later applicants will be considered. In addition, there will be a no repeat rule for all river runners. Only one (1) trip may be taken in any two years. Whenever a person takes a trip they may not take a trip in the next year. This rule will apply to commercial and noncommercial river runners equally. Computer technology will be used to process permits and to detect duplicate applications.

Table 1. Summary of Proposed Statistical Use Changes on Colorado River Grand Canyon National Park

Subject	Present Status	Proposed Status	Percent(%) Change
Number of commercial trips launched at Lee's Ferry per year	533	387	-27
Number of noncommercial trips launched at Lee's Ferry per year	36	209	+481
Number of commercial passengers launched at Lee's Ferry per year	11,000	9,675*(1)	-12
Number of noncommercial passengers launched at Lee's Ferry per year	475	3,135*(2)	+560
Number of commercial user-days	89,000	134,550*(3)	+52
Number of noncommercial user-days per year	7,600	58,770*(4)	+673
Research and Administrative Trips	30	26	-13
Research and Administrative Trips - People	450	390	-13
Research and Administrative Trips - User Days	5,000	5,000	- 0 -
Commercial Crew User Days	21,000	27,000	+29
Number of commercial passengers launched per day	150 (crew not included)	50 (crew not included)	-66
Number of noncommercial passengers launched per day	15	15	- 0 -
No repeat rule	1 trip per year (all visitors)	1 trip every other year (all visitors)	

Table 1 (continued)

Subject	Present Status	Proposed Status	Percent (%) Change
Total user days	122,600	225,320	+62
Total number of visitors launched at Lee's Ferry per year	11,475	12,800	+12
Commercial % of total user days	92	70	-24
Noncommercial % of total user days per year	8	30	+275
Total Number of Users	14,000	15,000	+7

*(1) Calculated on 25 passengers per trip.
*(2) Calculated on 15 passengers per trip.
*(3) Calculated on 25 passengers for a 12-, 14- and 16-day trips during summer and 21 average day trips during winter.
*(4) Calculated on 15 passengers for an 18-day trip during summer and 24-day trip during winter.

Table 2. Summary Chart of Proposed Management Changes on Colorado River Grand Canyon National Park

Subject	Present Status	Proposed Status
Use of motor craft	80% of trips	0% of trips
Use of non-motorized craft	20% of trips	100% of trips
Wood fires	Allowed	Not allowed April 1 - September 30
Sewage	Buried in canyon	Hauled from canyon
Patrols	3 patrols per year	Increase to 24 patrols per year
Trails	No designated trails	Trail construction in sensitive areas
Historic sites	Minimal protection	Protect/evaluate/stabilize/interpret

F. RESOURCE PROTECTION

Rules and regulations are necessary to ensure that esthetic and environmental degradation does not continue to occur along the river corridor which includes beach areas, riparian vegetation, sensitive ecological zones, attraction sites, and archeological sites. The following regulations and construction and monitoring activities are proposed to ensure environmental quality:

1. Human Waste Disposal

The present policy of the National Park Service is to allow the river parties (14,000 persons per season) to bury their consolidated human wastes in the canyon. Assuming an average of 8.7 days per trip and 150 grams (5 ounces) of feces per day per person, this represents approximately 20 tons of solid human body wastes which are deposited in the beach sands annually.

The plan proposes that all commercial and noncommercial river parties carry out all the human wastes generated during their visit to the canyon. This would be achieved by containerizing the waste materials in holding tanks on the boats.

2. Cooking and Recreation Fires

The plan will prohibit wood fires and require the use of gas stoves or charcoal during the summer season (April 1 through September 30).

Wood fires will be allowed during the winter season for warming and cooking provided the following rules are followed:

- Only driftwood along the river (or wood hauled into the canyon) may be used. Fires must be built in leak proof containers (fire pans) and any ash or unused charcoal must be carried out as trash.

- Charcoal briquettes may be used during any season but must be contained in a specially designed, leak proof fire pan and the unused charcoal disposed of as above.

3. Use of Soap

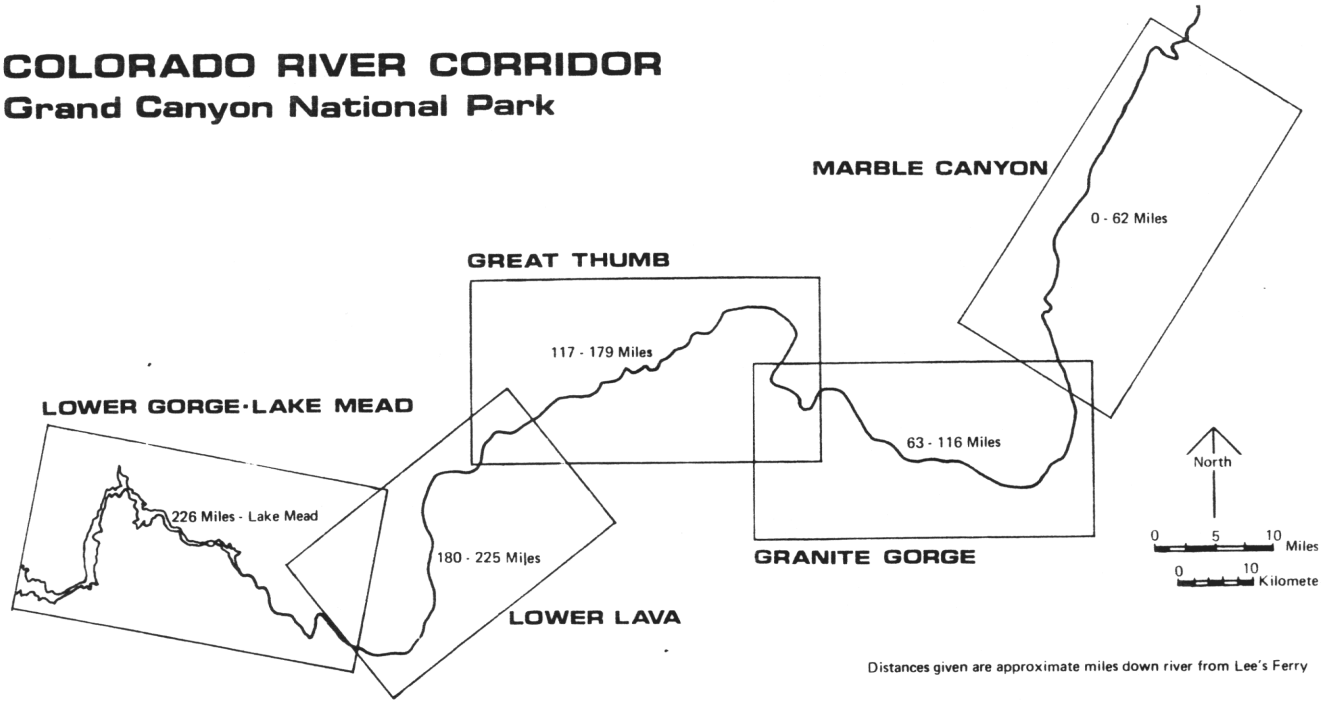
Use of soaps in, or at the mouth of side streams is prohibited. This includes the main river for 100 meters in either direction from the respective banks of any side stream. Swimming in side streams is allowed. Soaps are allowed in the main Colorado River.

4. Restricted Areas

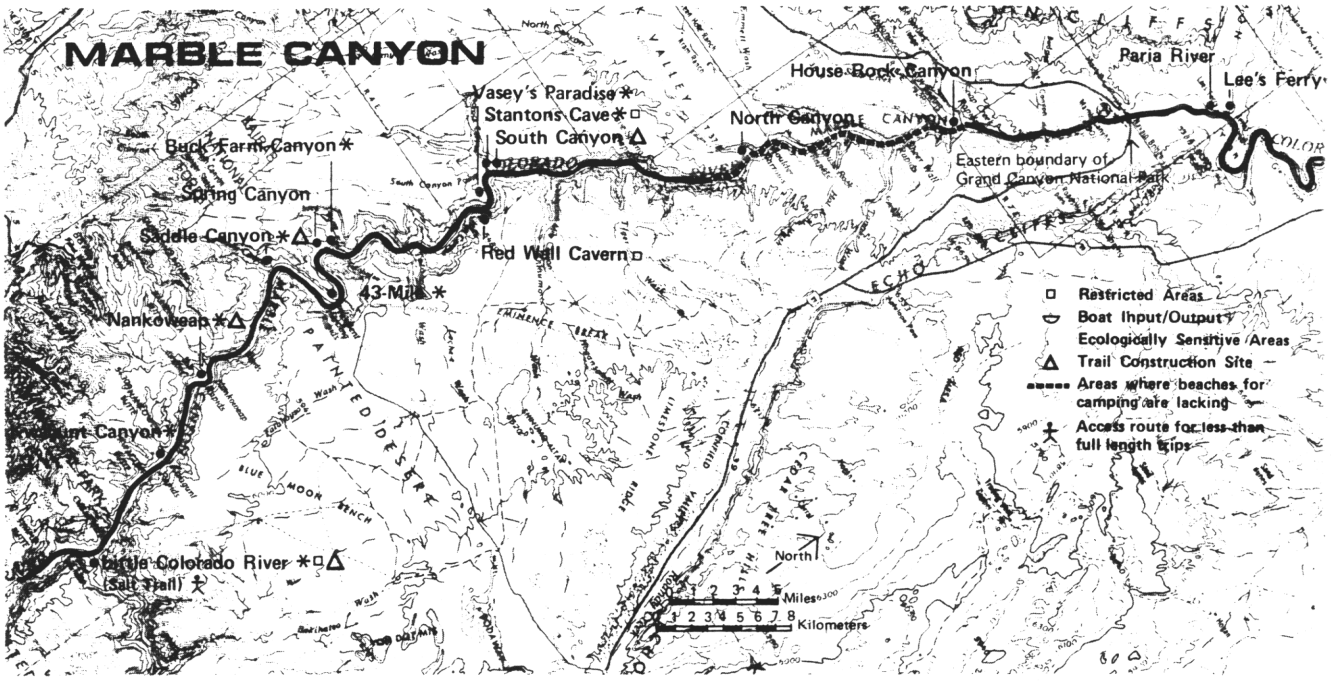
The following areas along the Colorado River will remain closed to either camping or visitation.

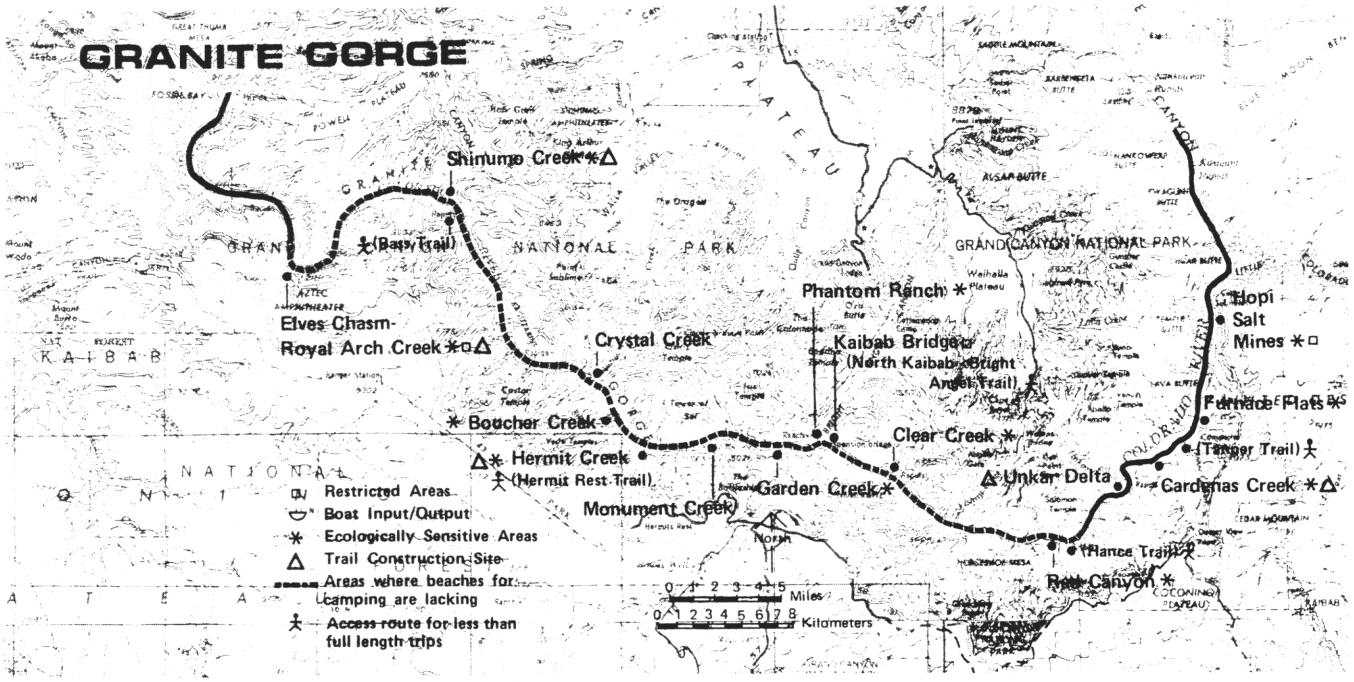
River Corridor Section (See page I-15)	Site	Restriction
Marble Canyon	Red Wall Cavern	No camping and no fires.
	Stanton's Cave	No visitation
	Little Colorado	No camping or fishing within 1/2 mile of stream's confluence. The Sipapu is a sacred Hopi religious site. No visitation.
Granite Gorge	Prehistoric Bridge	No visitation (not shown in corridor section)
	Hopi Salt Mine	No visitation, east side of river from Mile 63 to Mile 64. Closure necessary due to misuse of s[illegible] Hopi religious site.
	Kaibab Bridge	Above Bright Angel Creek to Pipe Creek. No camping except for emergency use. Fires not allowed during emergency use. Passengers leaving trip at Phantom Ranch and camping at Bright Angel Campgroun[illegible] or Indian Gardens must have an overnight permit.
	Elves Chasm	No camping within 1 mile of Royal Arch Creek's confluence with river.
Great Thumb	Deer Creek Falls	North side of river. No camping on the beach below the falls.
	Havasu Creek	No camping within 1/2 mile of Havasu Creek's confluence with river. Overnight use of upper Havasu (within boundary) requires a backcountry use permit.

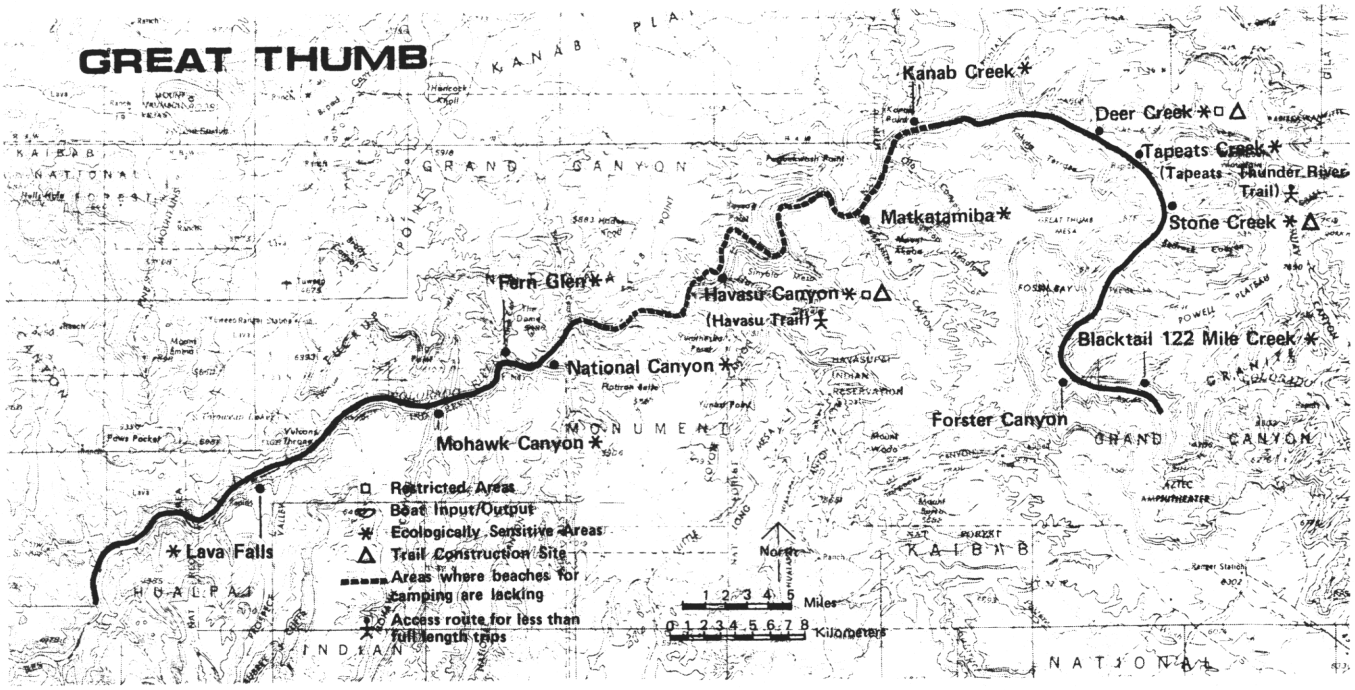
COLORADO RIVER CORRIDOR
Grand Canyon National Park

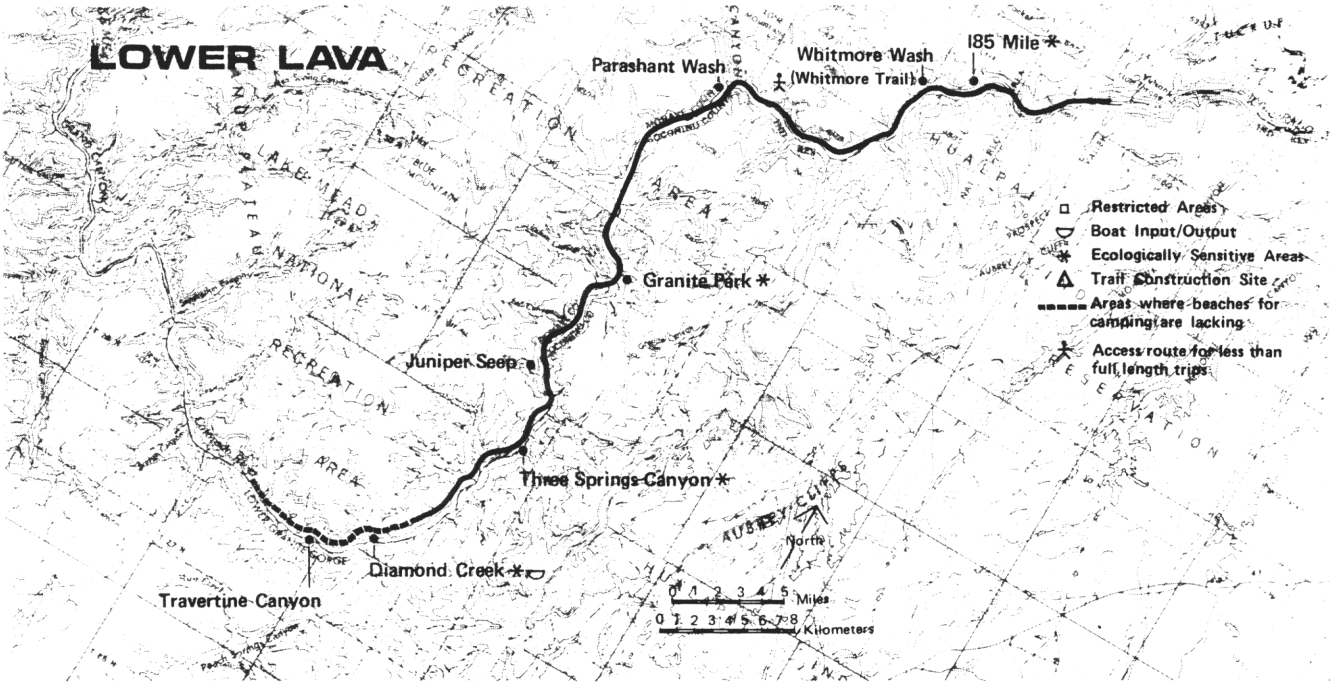


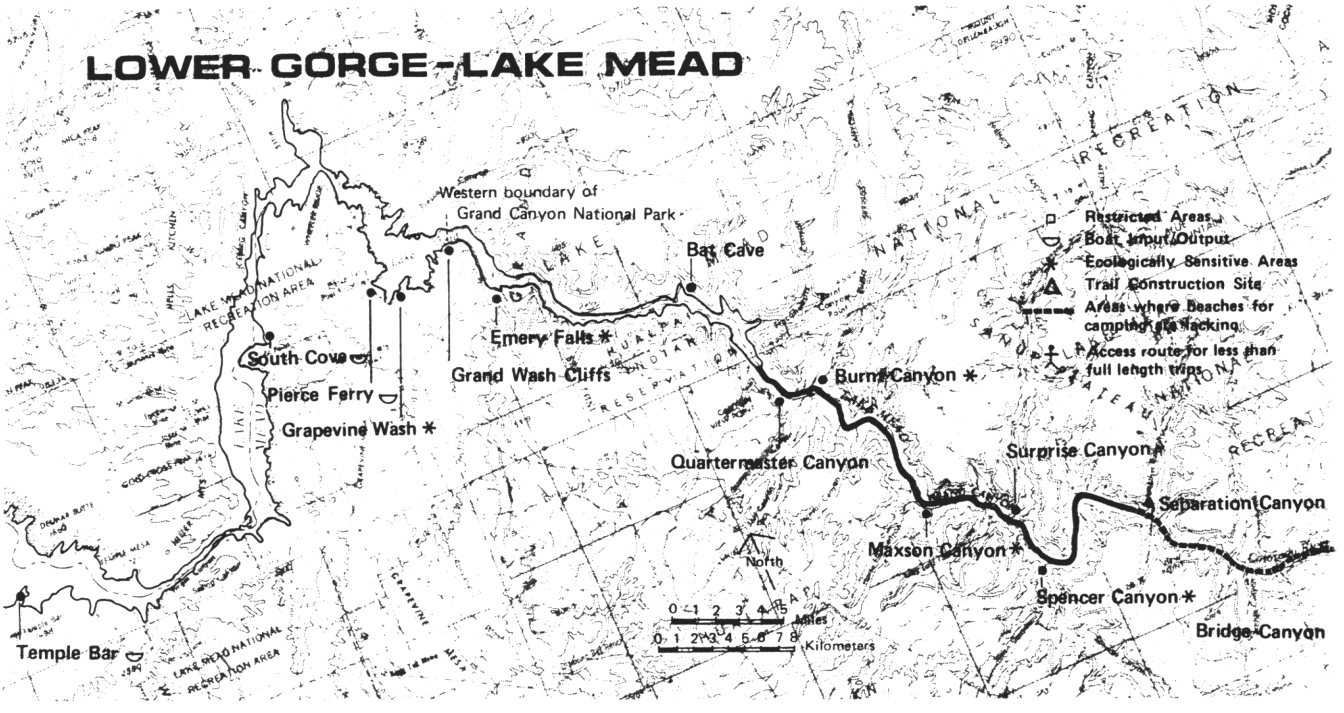
Distances given are approximate miles down river from Lee's Ferry




GRANITE GORGE
Shinumo Creek
(Bass Trail)
Elves Chasm-
Royal Arch Creek
Crystal Creek
Boucher Creek
Hermit Creek
(Hermit Rest Trail)
Monument Creek
Garden Creek
Clear Creek
Kaibab Bridge
(North Kaibab-Bright
Angel Trail)
Phantom Ranch
Hopi
Salt
Mines
Furnace Flats
(Tanner Trail)
Cardenas Creek
Unkar Delta
Nankoweap Creek
(Nankoweap Trail)
Nankoweap Mesa
Hance Trail
Red Canyon
GRAND CANYON NATIONAL PARK
KAIBAB NATIONAL FOREST
COLORADO PLATEAU
Restricted Areas
Boat Input/Output
Ecologically Sensitive Areas
Trail Construction Site
Areas where beaches for camping are lacking
Access route for less than full length trips
North
0 1 2 3 4 5 Miles
0 1 2 3 4 5 6 7 8 Kilometers


GREAT THUMB
Kanab Creek
Deer Creek
Tapeats Creek
(Tapeats-Thunder River
Trail)
Stone Creek
Matkatamiba
Havasu Canyon
(Havasu Trail)
Fern Glen
National Canyon
Mohawk Canyon
Blacktail 122 Mile Creek
Forster Canyon
Lava Falls
GRAND CANYON
GRAND CANYON NATIONAL PARK
KAIBAB NATIONAL FOREST
HUALAPAI INDIAN RESERVATION
HAVASUPAI INDIAN RESERVATION
Restricted Areas
Boat Input/Output
Ecologically Sensitive Areas
Trail Construction Site
Areas where beaches for camping are lacking
Access route for less than full length trips
North
1 2 3 4 5 Miles
0 1 2 3 4 5 6 7 8 Kilometers


LOWER LAVA
Parashant Wash
Whitmore Wash
(Whitmore Trail)
185 Mile *
Granite Park *
Juniper Seep
Three Springs Canyon *
Diamond Creek *
Travertine Canyon
Restricted Areas
Boat Input/Output
Ecologically Sensitive Areas
Trail Construction Site
Areas where beaches for camping are lacking
Access route for less than full length trips
North
0 1 2 3 4 5 Miles
0 1 2 3 4 5 6 7 8 Kilometers


LOWER GORGE-LAKE MEAD
Western boundary of
Grand Canyon National Park
Bat Cave
Emery Falls *
Grand Wash Cliffs
South Cove
Pierce Ferry
Grapevine Wash *
Burnt Canyon *
Quartermaster Canyon
Surprise Canyon *
Separation Canyon
Maxson Canyon *
Spencer Canyon *
Bridge Canyon
Temple Bar
Restricted Areas
Boat Input/Output
Ecologically Sensitive Areas
Trail Construction Site
Areas where beaches for camping are lacking
Access route for less than full length trips
North
0 1 2 3 4 5 Miles
0 1 2 3 4 5 6 7 8 Kilometers

5. Trail Construction and Maintenance

A total of 12.1 miles of trail will be either designated or constructed; if needed, and maintained at the following specific locations:

Area	Corridor Section	River Mile	Miles of New Trail	Total Miles of Trail Maintenance
South Canyon	Marble	32 (N)	0.5	1.5
Saddle Canyon	Canyon	47 (N)	1.0	2.5
Nankoweap		52 (N)	1.5	2.0
Little Colorado		61.8 (S)	1.5	3.0
Cardenas Creek	Granite	72 (S)	1.0	2.0
Unkar Delta	Gorge	72.5 (N)	0.5	2.0
Hermit Creek		95 (S)	2.6	4.0
Shinumo Creek		108 (N)	0.5	0.5
Elves Chasm		116 (S)	0.5	0.5
Stone Creek	Great	132 (N)	0.5	2.0
Tapeats Creek	Thumb	134 (N)	0.5	3.0
Deer Creek		136 (N)	1.0	7.0
Havasu Creek		157 (S)m	0.5	1.5
			12.1	31.5

6. Historical and Archeological Resources

The following archeological sites subject to heavy visitation will be monitored, evaluated, stabilized, and protected as determined necessary to preserve their values.

Site Number	Type of Site	Potential Protective Measures
1. C:5:1	Pueblo Ruins	Stabilization
2. C:5:3	Stanton's Cave*	Repair Fence
3. C:9:1	Pueblo Ruins	Stabilization
4. C:13:4	Prehistoric Midden*	Test Excavation
5. C:13:66	Rock Shelter*	Full Excavation
6. C:13:2	Pueblo Ruins	Stabilization
7. C:13:10	Pueblo Ruins*	Test Excavations
8. C:13:11	Masonry Granary	Stabilization
9. B:16:3	Pueblo Ruins	Stabilization
10. B:15:1	Pueblo Ruins	Stabilization
11. B:10:4	Pueblo Ruins	Stabilization
12. B:10:1	Pueblo Ruins	Stabilization
13. A:16:1	Pictographs*	Test Excavations
14. G:3:3	Rock Shelter*	Test Excavations

* Regular inspection of sites with research potential may show that active preservation or data recovery measures (stabilization or excavation) may be necessary.

The following historic sites will be preserved through evaluation, protection and/or stabilization.

Name of Site

1. Brown Inscription
2. Cave Springs Rapid Historic Site
3. Bert Loper's Boat
4. Grave's of Peter Hansbrough (1889) and Boy Scout (1946)
5. Grave of Willie Taylor
6. Beamer's Cabin
7. Tanner Mining Camp
8. Hance Cabin
9. Asbestos Canyon Mining Camp
10. Bass' Winter Camp and Cable Crossing
11. Hakatai Canyon Mining Camp

7. Off-River Use

To prevent resource deterioration, current regulations for off-river use will continue. These rules and regulations are as follows:

Permits for off-river backcountry overnight hiking are required. There are certain areas where camping limitations are established and advance reservations are necessary. Reservations will be handled through noncommercial permit procedures and commercial launch requests. Areas where advance reservations are required are: the Tonto Rim area between Tanner Creek and Hermit Creek, Indian Gardens, Phantom Ranch, Cottonwood, Roaring Springs, Clear Creek, Tapeats-Thunder River, Deer Creek, and Havasu Creek.

There are also limitations and requirements for backcountry hiking that differ somewhat from river running. The most important of these are:

- Group size is limited to 16 for all groups, commercial and noncommercial
- Camping in one location is limited to no more than 2 nights
- Use in the Tonto Rim area is limited to 7 nights and 8 days
- No fires are allowed--only backpack stoves may be used

When less than full-length river trips are taken and an overnight hike in or out is planned, reservations are required. Guides or trip leaders must accompany all commercial passengers on overnight hikes either in or out of the canyon.

8. Education of Commercial Trip Leaders, Guides, Noncommercial Trip Leaders and Visitors

To ensure that regulations and guidelines are implemented, it is essential that commercial trip leaders, guides, noncommercial trip leaders, and visitors fully understand resource protection requirements. The methods of and vehicles for this education are outlined below:

- Provide written guidelines for every guide/trip leader.

- Provide an audio/visual education program on resource protection at Lee's Ferry; this will be designed for viewing by all commercial and noncommercial passengers, and will be mandatory for all noncommercial trip leaders. Noncommercial trip leaders who have attended the two-week boatman training session within the previous year will be exempted from this requirement.

- Provide guide/trip leader training programs in resource protection/safety/sanitation at a National Park Service facility. A minimum of two one-week boatman training sessions per year will be held. All guides and trip leaders will be required to attend at least one training session within the first year of employment.

In addition, it is the responsibility of the commercial guide or the noncommercial trip leader to ensure that members of his or her group follow the NPS guidelines on resource protection.

9. Monitoring and Research

It is essential that monitoring of use levels and patterns established by this plan be conducted in order to allow managers to continually evaluate the need for adjustments. In addition, there is need for additional baseline data information. Therefore, the following resource monitoring projects are proposed:

- Monitor environmental health of campsites and attraction sites. This will provide data relative to use levels and patterns and longer term impacts incurred by the change in water flow from Glen Canyon Dam.

- Monitor social impacts of use limitations, restrictions, requirements, and allocations. For instance, demand figures for commercial vs. noncommercial trips will be monitored through the use of computer technology.

- Monitor economic impacts on concessioners and visitors resulting from the restrictions, limitations, and requirements, established by this plan.

- To comply with Executive Order 11593, it will be imperative to inventory cultural and historic resources within the river corridor and related use areas that are or may be affected by river travelers, and monitoring impacts on these resources resulting from river runners. Refer to pages II-36 to 37 for further discussion.

- Inventory aquatic and terrestrial species of fish and birds and mammals with particular emphasis on rare, threatened or endangered species, and monitor any impacts that may occur as a result of use allowed by the management plan.

G. OTHER STANDARDS AND REQUIREMENTS

1. Boating and Other Safety Requirements

Current boating and safety requirements, developed in the past, have been found to be adequate. Therefore, these standards will be continued. A summary of those standards are outlined below and a description found in Appendix C.

- Type of watercraft and their respective capacities

- Type of life preserver approved for use

- First-aid kits

- Emergency communications signaling equipment, and procedures

- Other emergency equipment and spare parts, such as extra oars, paddles, boat patching kit, pumps, ropes, canteens, and maps

2. Commercial Boatman and Trip Leader Requirements and Noncommercial Trip Leader Standards

Minimum standards for commercial trip leaders and guides have been established. These standards include sufficient previous experience on white water rivers, including the Grand Canyon, to ensure that a person has the skill to successfully negotiate the rapids of the river as well as provide a minimum of interpretation to the passenger, meet and cope with first aid situation, emergency evacuation procedures, boat maintenance and repair, and be especially knowledgeable and actively working to protect the various resources in the canyon.

Standards for noncommercial trip leaders are somewhat less stringent in the areas of previous experience on the river in Grand Canyon, but it is essential that they attend the one-day seminar at Lee's Ferry in order that they may be educated in proper procedures of resource protection, safety, emergency evacuation, and some interpretation (see Appendix D for details).

H. PHASING

The plan includes the following items and will be implemented on the following time schedule:

Removal of Motorized Use

Year	Action
1978	Maintain status quo. On October 1, implement winter use portion of the plan.
1979	1978 motorized use by commercial operators will be reduced 30 percent. All noncommercial trips will be by non-motorized craft.
1980	Motorized use will be reduced 60 percent from the 1977 level.
1981	All trips on the river will be non-motorized.

Total Use and Allocation

Year	Action
1978	Maintain status quo. Begin winter use October 1.
1979	Begin limit of 183 noncommercial launches and 366 commercial launches per season April 1. Begin limit of 26 noncommercial launches and 21 commercial launches October 1. The summer use period will begin April 1 and end September 30. The winter use period will begin October 1, 1978, and end March 31, 1979.

	Two commercial trips will be authorized per day during the summer season. One noncommercial trip will be authorized every day during the summer season Trip launch (three trips) and trip size limitations (75 persons launched per day maximum) will begin April 1. Minimum trip length from Lee's Ferry to Diamond Creek will be 9 days after April 1. Variable trip lengths, lasting from 1 to 18 days, will be available depending on origin and destination of river visitor. Such trips will include Lee's Ferry to Phantom Ranch. Phantom Ranch to Diamond Creek, Diamond Creek to Pierce Ferry, and others.
Year	Action
1981	Minimum trip length 12 days after motor phase out is complete. Maximum trip length 18 days summer, and 30 days winter.

Resource Protection

Year	Action
1978	Continue to ask for compliance with planned requirements of no wood fires in the summer season and the carrying out of human solid waste.
1979	All wood fires will be restricted to the winter use season by April 1. All human solid wastes will be carried from the canyon after April 1. Trail construction in sensitive areas and/or closure of areas, where needed, will begin April 1.

	Begin enforcement of other rules and regulations as outlined in the plan for protection of natural, cultural, and historical resources.
	Increase patrols and interpretive programs by January 1.

Visitor Health and Safety

Year	Action
1978	Continue existing river user health and safety requirements.

I. INTERRELATIONSHIP WITH OTHER PLANS AND PROPOSALS

1. National Park Service

The Final Environmental Statement for the Grand Canyon Master Plan (FES 75-97) was made available for public review in November 1975. The final master plan was approved in June 1976. The plan provides a framework for the development and management of visitor facilities on the rims and the use of the backcountry and river corridor. The river management plan has been prepared in conjunction with the master plan and takes into consideration visitor use within the transcanyon corridor (Phantom Ranch) and that of the backcountry adjacent to the river.

Certain lands within Grand Canyon National Park have been studied and evaluated for incorporation in the National Wilderness Preservation System. The proposed Wilderness Classification for Grand Canyon, Draft Environmental Statement (DES 76-28) recommends that the river corridor be placed in wilderness at such time as the lands so qualify. The total area of the river unit, including the water surface, would be approximately 17,000 acres. Existing use of motorized craft is inconsistent with the wilderness criteria of providing outstanding opportunities for solitude and for a primitive and unconfined type of recreation.

The backcountry management plan is the river management plan's conterpart in the management of the park's roadless area. The river plan is designed to be a workable document compatible with the standards, requirements, and limits for use established in the backcountry management plan.

A natural resource management plan is in the process of being developed for Grand Canyon. This plan is complementary and will consider portions of the river environment as well as the rest of the park lands. The plan will contain research proposals coinsiding with river management actions pertaining to endangered fish species, exotic plant removal, and noise control.

A burro management plan and draft environmental statement are under preparation. The plan will evaluate the effects of burro populations on natural and cultural resources along the river corridor and propose measures to control burro numbers and reduce adverse impacts. The draft plan is scheduled for completion in December 1977.

A general management plan and wilderness proposal are under preparation for Glen Canyon National Recreation Area. The river management plan will affect operations within the national recreation area at Lee's Ferry. Glen Canyon personnel will undertake added responsibilities due to the expanded education/interpretive programs proposed in the plan. These programs and personnel will be provided by the national recreation area.

A revised wilderness proposal for Lake Mead National Recreation Area is now under preparation. Although lands immediately adjacent to Grand Canyon, such as the Shiviwits Plateau and those in the Whitmore Canyon area are being evaluated, wilderness designation would not affect river running activities. Visitors do leave the float trips at Whitmore Canyon and travel through national recreation lands via a jeep road, but this access road would remain open to permit other uses such as grazing.

2. Havasupai Reservation

A study of the traditional use lands, consisting of 95,335 acres within the national park boundary is currently being headed by the Bureau of Indian Affairs, together with the Havasupai Tribe and the National Park Service. The study will determine what traditional uses were made of the area below Great Thumb on the south slope of the Grand Canyon to the high water line of the river. These lands will be managed by the Havasupai Tribe and the National Park Service to ensure both traditional Indian use and appropriate visitor use. Of primary importance is the coordination of off-river hiking in Havasu Creek.

3. Bureau of Reclamation

The Bureau of Reclamation has prepared an environmental assessment for the operation of Glen Canyon Dam. The amount of water released from the dam affects the river running activities in Grand Canyon, as well as the natural resources along the river corridor. The volume of water released at any given time will depend upon water and power demands in the region. Coordination has been established between the Bureau of Reclamation and National Park Service personnel to obtain water flow predictions.

II. DESCRIPTION OF THE ENVIRONMENT

A. GENERAL

The Colorado Plateau, with Flagstaff at its southwest edge, is the regional setting for the Grand Canyon. The plateau is a vast, semi-arid land of raised plains and basins typical of the Southwestern United States. To the south lies the Phoenix/Tucson metropolitan area. Approximately half of the land on the plateau is Federally owned and is administered by the Bureau of Land Management, Forest Service, and National Park Service. The remaining land is primarily Indian owned. Within the Colorado Plateau, dramatically displayed in a south central position, lies the Grand Canyon National Park.

The 1,211,104 acres of the park lie adjacent to the Colorado River in northern Arizona. The park extends for 277 miles along the Arizona portions of the Colorado River, from Glen Canyon National Recreation Area at Lee's Ferry to the Grand Wash Cliffs. The park, thus, extends east-west across the southern portion of the Colorado Plateau. Dividing the park into north and south portions is the 217-mile-long Grand Canyon, which ranges from 1 to 25 miles in width and is up to one mile in depth. The 60-mile-long Marble Canyon forms the eastern boundary of the park and extends the entity known as "Grand Canyon" to a total length of 277 miles. Elevation within the park ranges from 1,200 feet at the western portion where the Colorado River enters Lake Mead, to 9,165 feet on the North Rim. Public Law 93-620, dated January 3, 1975, incorporated Marble Canyon National Monument; Grand Canyon National Monument; portions of Lake Mead National Recreation Area, the Kaibab National Forest, national resource lands (Bureau of Land Management); and other lands into the present park.

The park is bounded on the north by Kaibab National Forest and the Arizona Strip, on the east by the Navajo Reservation, on the south by Kaibab National Forest and the Havasupai and Haulapai Reservations, and on the west by the upper reaches of Lake Mead National Recreation Area.

1. Access

Access to the Colorado River for boat launching and takeout occurs in only a few places. Lee's Ferry can be reached by U.S. Highway 89. Diamond Creek can be reached by a gravel road from Interstate 40 at Peach Springs. This 25-mile road is maintained by the Hualapai Indians. Pierce Ferry, South Cove, and Temple Bar can all be reached from roads originating on U.S. Highway 93 and U.S. Interstate 40. The Pierce Ferry access is a gravel road, Temple Bar and South Cove both have paved roads leading to them.

Passengers may also hike or ride a mule into the canyon to meet a float trip. Nine trails are available for ingress or egress by river runners: (1) Salt Trail from the Navajo Indian Reservation to the Little Colorado River, (2) Tanner Trail from Desert View, (3) Hance Trail from the South Rim, (4) Kaibab Trail both North and South, and Bright Angel from the South Rim to Phantom Ranch, (5) Hermit Trail from Hermits Rest, (6) Bass Trail from the South Rim, (7) Tapeats-Thunder River from the North Rim, (8) Havasu Trail from the Havasupai Indian Reservation, and (9) Whitmore Wash Trail from Lake Mead National Recreation Area. Mule rides are available along the Kaibab, Bright Angel and Whitmore Wash Trail systems. For major access points and circulation, see map, page II-3. (For specific river locations, refer to maps, and pages I-15 to 17.

2. Adjacent Lands and Jurisdictions

Although the Colorado River corridor is the area of concern in this document and largely surrounded by lands within the national park, the corridor and its use are influenced to varying degrees by other entities that administer or manage adjacent areas or resources.

a. Bureau of Reclamation

Bureau of Reclamation has responsibility for management of Gle Canyon and Hoover Dams including water storage and releases. Water releases from Glen Canyon Dam and water storage in Lake Mead have direct effect on river running in Grand Canyon. When Lake Mead is at maximum capacity, there is only about 5 miles of free flowing river below Diamond Creek, with the remaining 42 miles to the Grand Wash Cliffs being lake waters. Although there is a current to Grand Wash Cliffs it is very slow and for the most part not perceptibly moving. Water releases from Glen Canyon Dam fluctuate daily. According to the operating criteria of Glen Canyon Dam (Section 602 of Colorado River Basin Act of 1968, P. L. 90-537) the Bureau of Reclamation is required to release 8.23 million acre feet of water annually from Lake Powell. This flow in terms of daily releases in cubic feet per second (cfs) fluctuates considerably. The daily fluctuations require adjustments in river running schedules as the high and low flows arrive at different times of the day depending upon location in the canyon. Also in years of low precipitation and run off timing of water release is set to correspond with power demands and when there is no power demand only minimum flows are released to conserve as much water as possible. Low water flow periods make it difficult and sometimes impossible to run the river, especially for the larger motorized boats. During years of excess water, continued high flows are common,

c. Navajo Indian Reservation

The 9-million-acre reservation of the Navajo Nation borders the east bank of the Colorado River in the Marble Canyon section of the park from Mile 0 to Mile 61.5 at the confluence of the Little Colorado River. The area from the river to the rim is a tribal park. The primary land use on the reservation adjacent to the park is sheep grazing and the sale of native arts and crafts to tourists who stop at the overlook to the Little Colorado River along State Route 64.

The only significant uses in this area are occasional camping above high water line, side canyon hikes (mostly of Silver Grotto) and hiking into and out of the canyon at the Little Colorado (up the Little Colorado and north out of the canyon via the Salt Trail) onto the Navajo Reservation. The use of this access route is expected to increase for less than full length river trips due to the river plan proposals. Information as to the extent of this activity will need to be conveyed to the Navajo Tribe as fees for use of Tribal land may be involved.

d. Havasupai Indian Tribe

The traditional use lands of the Havasupai are located between the south bank of the Colorado River and the canyon rim around Great Thumb mesa from Mile 116 to Mile 165. These lands are within Grand Canyon National Park, but uses to be allowed and management of the resources are subject to traditional uses of the Havasupai Indians. That is, no uses can be allowed that would interfere or conflict with traditional uses of the Havasupai. Regulation of camping and hiking and other uses will be handled by the National Park Service. Since many river trips, both noncommercial and commercial involve hiking into or out of Havasu Canyon to meet or leave a trip and include an overnight stay, a hiking permit and reservation is necessary if the camping is within the traditional use lands area. Camping does occur within the Havasupai Reservation Lands for which there is a $2 fee. In addition, there is a $5 fee for crossing Havasupai land. It is also possible for a person to day-hike either into or out from a river trip through Havasu Canyon. For these people it will be important to maintain use records. The National Park Service will inform the Havasupai of all

river trips planning ingress or egress through Havasu Canyon. Encouragement should be given the Supai to maintain use records for their use and for management purposes. Also, an arrangement for patrol of hiking and other activities in the traditional use lands will be established.

e. Hualapai Indian Reservation

The Hualapai Tribe occupies a 992,000-acre reservation bounded on the east by the Havasupai Reservation and on the north by the river from Mile 165 near National Canyon on the south bank to Mile 273. Diamond Creek at Mile 225, located on the reservation, is the first road access to the river below Lee's Ferry. This access is used by a majority of river travelers, especially those using oar-powered watercraft, as a takeout point. It is also the only access for trips running only the Lower Gorge. The Hualapai charge a fee for travel over their Tribal lands. Those fees are as follows (subject to change):

Commercial River Runners Rates:

Service Vehicles	$45 per season
Additional Vehicles	$25 per season
Any Other Vehicles	$10 each trip
Company owned Buses	$10 each trip

Private Party Rates:

Service Vehicles	$10 each trip
Additional Vehicles	$ 5 each trip

Take-Out Fees:

$5 per person
$5 per watercraft (rafts, kayaks, etc.)
Garbage $1 per sack

The Hualapai Tribe depends on the National Park Service and the river operators to provide the dates when river trips will be taking out at Diamond Creek. It is important to maintaining a cooperative relationship with the Tribe that this data be provided accurately and in a timely manner.

f. Lake Mead National Recreation Area

Lake Mead National Recreation Area is located adjacent to the lower end of Grand Canyon and is administered by the National Park Service. In fact, the Lower Gorge was within the Lake

Mead National Recreation Area until January 3, 1975, when Grand Canyon National Park boundaries were changed by Public Law 93-620, to include all of the Grand Canyon to the Grand Wash Cliffs. When filled to capacity, the lake will back up into the Grand Canyon about 47 miles. There is considerable lake boating and fishing on lake waters. Also, many of the river running expeditions continue through the Lower Gorge onto Lake Mead and to Pierce Ferry about 3 miles beyond the Grand Wash Cliffs, and occasionally an additional 18 miles to South Cove or 35 miles to Temple Bar.

A National Park Service ranger resides at Meadview near Pierce Ferry. The Pierce Ferry ranger patrols the lake near the Lower Gorge, and his duties include resource and visitor protection, law enforcement, and search and rescue. He also maintains use statistics which will be important for the management of this part of the river

Grand Canyon will station a ranger at Pierce Ferry beginning May 1977. The rangers for Lake Mead and Grand Canyon will maintain close liaison and coordinate management efforts.

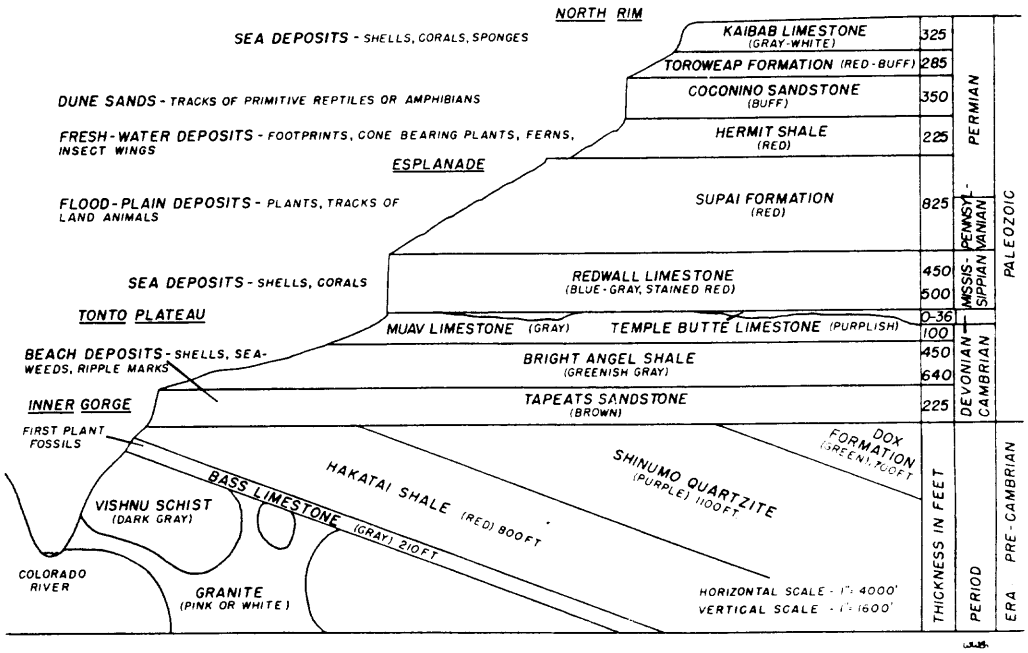
B. GEOLOGY

The mile-deep Grand Canyon is the deepest and most extensive canyon found in the plateau country, and is a world-reowned scenic spectacle. The exposed rock layers represent all of the eras of geologic time and contain evidence of the evolution of life through more than 600 million years of earth history. The oldest dated rocks in the Inner Canyon approach 2,000 million years in age, and, thus, the observer comes metaphorically face to face with the beginnings of time.

All of the individual plateaus within the Plateau Province are elongated in a north-south direction and bounded on the east and west by sharp structural breaks and folds. These major zones occur at intervals ranging from 15 to 40 miles apart across northern Arizona. In carving the Grand Canyon, the Colorado River cut a clean, east-west cross section through several of these plateaus, providing a window through which the geologic history of the region may be viewed.

Chemical weathering is minimal in the semi-arid climate of the canyon, and horizontal strata erode into a series of alternating steep slopes and near-verticle cliffs. The metamorphic rocks of the deep Inner Canyon present a relatively uniform face to erosion and form nearly unclimable cliffs and steep, jagged slopes.

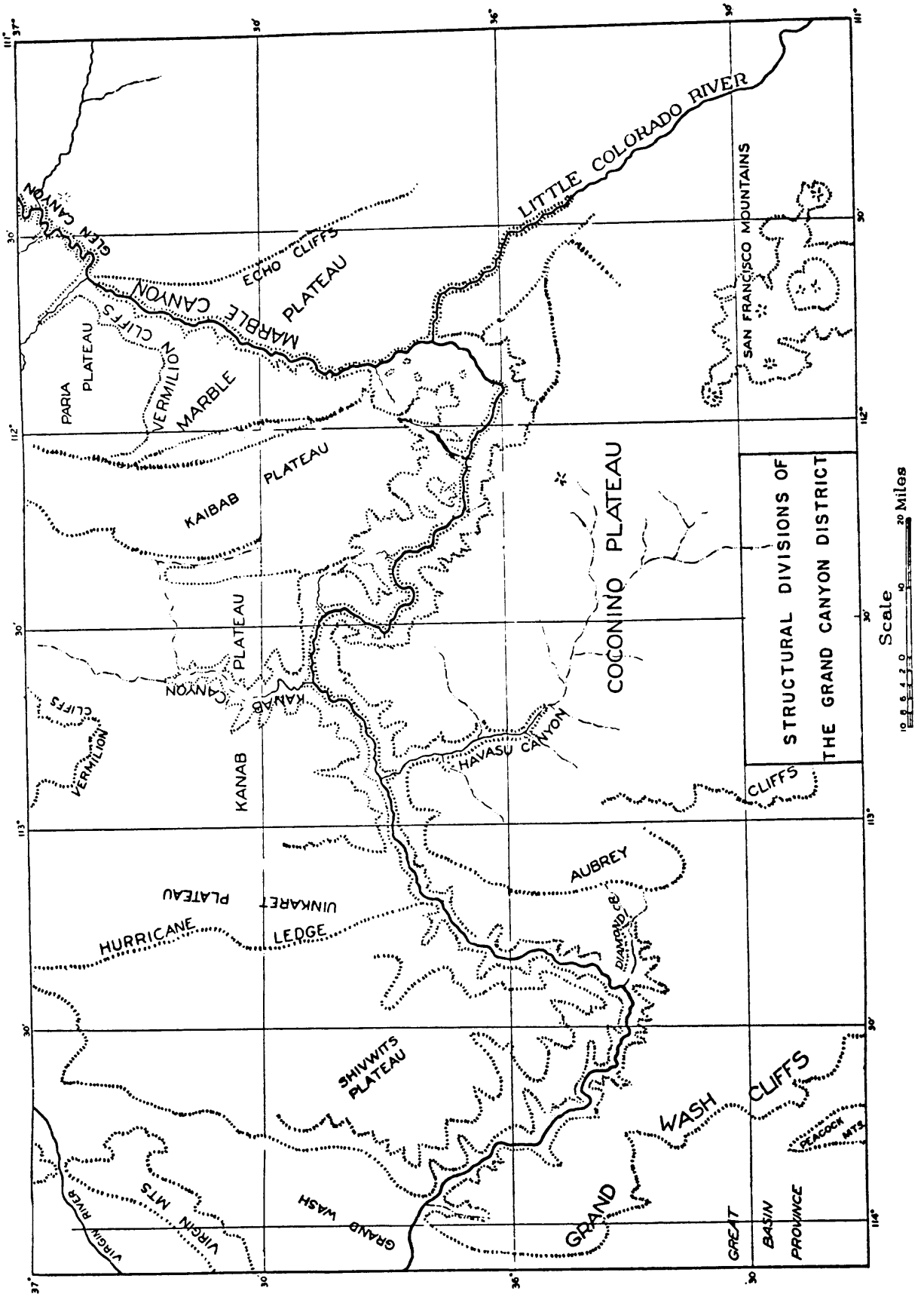
A generalized geological cross section of the canyon is illustrated on page II-8 and the structural divisions of the canyon on page II- 9.



GENERALIZED

GEOLOGIC SECTION

AT GRAND CANYON VILLAGE


STRUCTURAL DIVISIONS OF THE GRAND CANYON DISTRICT
Scale
20 Miles
LITTLE COLORADO RIVER
SAN FRANCISCO MOUNTAINS
GLEN CANYON
ECHO CLIFFS
MARBLE CANYON
PLATEAU
PARIA PLATEAU
VERMILION CLIFFS
MARBLE
KAIBAB PLATEAU
COCONINO PLATEAU
KANAB CANYON
KANAB PLATEAU
VERMILION CLIFFS
KANAB
HAVASU CANYON
CLIFFS
AUBREY
UINKARET PLATEAU
HURRICANE LEDGE
DIAMOND CR.
SHIVWITS PLATEAU
GRAND WASH CLIFFS
PEACOCK MTS.
GRAND WASH
VIRGIN MTS.
VIRGIN RIVER
GREAT BASIN PROVINCE

The topography of the canyon and extent of the river corridor act as a constraint on both visitor and commercial river runners. Ingress and egress are difficult and points of access are few. Disregarding the entrance point at Lee's Ferry and exit points on Lake Mead, there is no other entrance and only one exit (Diamond Creek) for river craft. Visitors, if they do not begin their trip at Lee's Ferry, must hike or ride a mule down through rugged terrain to the river. Only nine major trail access points are available to river runners within the 277-mile corridor.

C. SOILS

Few areas within the park have well developed soil profiles. A shallow skin of dirt covering bedrock is an appropriate description of the soils throughout the area.

Alluvial deposits along the Colorado River combine with colluvial deposits to form the major transported soils of the Inner Canyon. The large areas of bedrock, shallow soils and relatively sparse vegetation cover create an ideal situation for sheet wash, flash flooding and high erosion potential. Once disturbed, the soils erode easily and regenerate slowly.

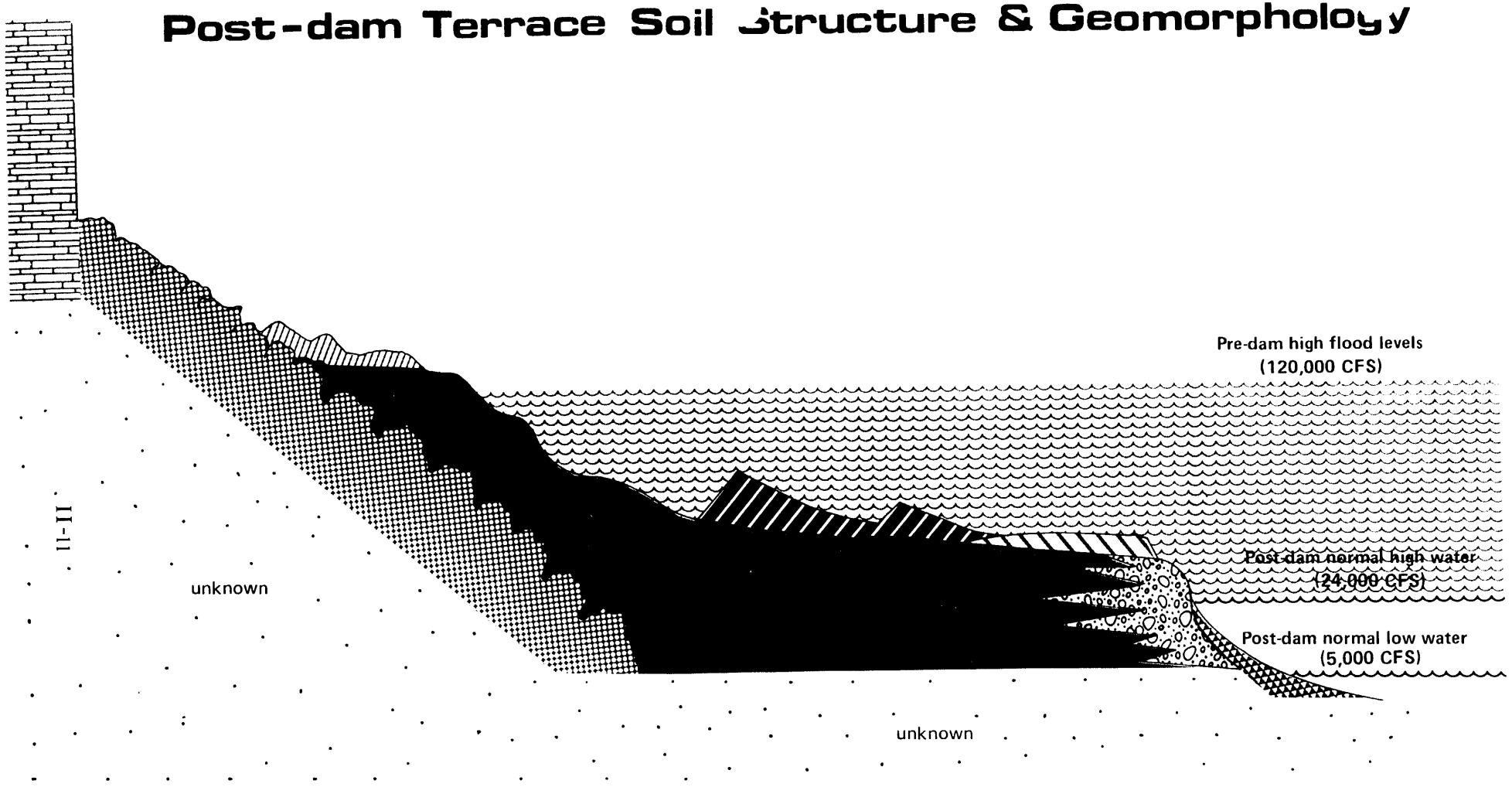
The areas in immediate association with the river are characterized by fine-grained fluvial terraces (beaches) and coarse-grained cobble bars and tributary fan deposits. The fine-grained deposits found on the terraces of the river may be classified according to age of deposition (pre- or post-Glen Canyon Dam), agent of deposition (floods, eolian action, or fluvial reworking in the zone below present normal high water), and grain size (cohesive silts, dominately silt with a small percentage of clay; silt-sand, with about 30 percent silt content; and sands, with negligible silt). The normal spatial relationships of the various deposits are shown on page II-11. Several regularities may be observed among these deposits, which respond differently to environmental stresses induced by post-dam conditions and human impact:

1. Pre- and post-dam flood terraces are usually silt-sand.

2. Pre-dam eolian deposits are but little coarser than the flood terraces from which they are derived.

3. Pre-dam cohesive silt was deposited by mild summer floods resulting from summer runoff carrying high percentages of clays and silts. These deposits seldom extend more than a few feet above present high water levels, and, because of the abundance of water and the fine substrate, have been covered to a great extent by a dense vegetative growth since the dam.

Post-dam Terrace Soil Structure & Geomorphology



- Bedrock
- Talus
- Pre-dam cohesive silts
- Pre-dam silt-sand terraces
- Pre-dam silt-sand eolian deposits
- Post-dam flood silt-sands
- Post-dam eolian sands
- Post-dam beach sands

(after Howard and Dolan, 1976)

4. Post-dam beach deposits, reworked by swash and current from pre-dam terraces and bed material, are dominantly sand, with noticeable silt content only along the wide, quiet sections of the river. These deposits are well-sorted, and are the predominant source for post-dam eolian deposits, which are likewise coarse-grained.

Measurements made using an 8-year aerial photographic record (Howard and Dolan, 1976) indicate an average rate of back wasting (erosion of beach surface) of about 0.9 feet per year along the river. It has been determined, however, that the lateral erosion caused by the clear post-dam river is not uniform along the fine-grained beaches. Input of sediment from the Paria River and the Little Colorado River, and ungaged tributaries below Lee's Ferry may be sufficient to sustain a temporary equilibrium between sediment supply and removal.

The relatively low rates of lateral erosion by the Colorado River suggest that abundant fine-grained beaches will remain for several tens of years, however, a few beaches will gradually disappear. After several decades, dam related erosion may result in a virtual lack of sandy beaches on the Colorado River.

D. WATER RESOURCES

1. The Colorado River

The Colorado River originates in the Colorado Rockies in Rocky Mountain National Park. It is 1,450 miles long from its source to the Gulf of California. A major tributary is the Green River which begins in the Wind River Mountains of Wyoming and travels 720 miles to join the Colorado in Canyonlands National Park, 1,100 miles before the Colorado River reaches the Gulf. Other major tributaries above its entrance into Grand Canyon National Park include the Gunnison, the Dirty Devil, and the San Juan. The Colorado system drains 245,000 square miles or one-twelfth the continental United States.

The mainstream flow of the Colorado River through Grand Canyon National Park is water that has been previously impounded by Lake Powell. Water is released from Glen Canyon Dam through gates which are located about 200 feet below the fluctuating surface of the lake. Waters originating from this depth (the hypolimnion) are extremely cold, resulting in a yearly maximum range of temperature of 42° F to 48° F at Lee's Ferry.

One of the most notable characteristics of the river is its degree of turbidity. At Lee's Ferry, the mean concentration of suspended sediment ranges from 2-124 mg/1. At Phantom Ranch, approximately 87 river miles below Lee's Ferry, and below several important tributaries

(Paria River, Little Colorado River and Clear Creek), the turbidity ranges from 6 to 47,100 mg/1. The amount of turbidity of the river is dependent upon the annual runoff in the Colorado River at Lee's Ferry, at the head of Marble Canyon. It has ranged from 5.6 to 24.0 million acre-feet. The 10-year means have ranged from 11.6 to 18.8 million acre-feet. Opinions thus differ concerning the period of record that best predicts future runoff. The significance lies in the fact that a period of about 25 years (1906 - 1930) of predominantly above-average runoff has been followed by a 40-year period (1931 - 1970) of predominantly below-average runoff.

In Article III, the Colorado River Compact requires that "the States of the Upper Division will not cause the flow of the river at Lee's Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of ten consecutive years." Projected depletion requirements for the Upper Basin to the year 2020 have been made by the Pacific Southwest Interagency Committee for the U.S. Water Resources Council. These indicate that by that year the streamflow at Lee's Ferry will be reduced by 6.5 million acre-feet. Current usage accounts for much of the nearly complete utilization of the Colorado River, when the mean flow at Lee's Ferry is near the level at which it has been for the last 40 years, with the balance of usage caused by the initial filling of Upper Basin reservoirs. Although the flow of the Colorado River through Grand Canyon is thus assured, the daily, seasonal and yearly flow will fluctuate greatly as reservoir and energy commitments are met.

Ten major dams are now in the Colorado River system. Glen Canyon Dam and Hoover Dam have the most noticeable effect on the river in Grand Canyon National Park.

Hoover Dam, forming Lake Mead has backed water to Mile 240 or for 37 miles into the park. This portion of the river has changed from a stream to a lake aquatic system.

Before Glen Canyon Dam, the volume of flow at Lee's Ferry, Arizona varied from 700 cubic feet per second (cfs) to 200,000 cfs. The average silt load was 500,000 tons per day at Phantom Ranch. The pre-dam river temperature varied from approximately freezing to 80° F. Its tributaries, the Paria River and the Little Colorado River are the principal contributors of silt. Present flows from the dam vary between 1,000 cfs to 35,000 cfs at Lee's Ferry. The current silt load is about 80,000 tons per day, less than one-sixth the pre-dam load.

Under the dam-controlled river regime, the Colorado River flows at an average rate of 4.5 miles per hour. The velocity of the flow increases up to 30 mph in the abrupt drops (rapids) in the drainage profile. The total descent of the river from Lee's Ferry to the Grand Wash

Cliffs is approximately 2200 verticle feet, or about 7 feet per mile.

2. Water Quality

In addition to the Colorado River, other substantial sources of water in the Inner Canyon originate from the following springs or tributaries: Paria River (Mile 0); Vasey's Paradise (Mile 32); Little Colorado River (Mile 61.8); Bright Angel Creek (Mile 87); Shinumo Creek (Mile 108); Royal Arch Creek (Mile 116); Tapeats Creek (Mile 134); Deer Creek (Mile 136); Kanab Creek (Mile 143); Havasu Creek (Mile 157); Diamond Creek (Mile 225); and Spencer Creek (Mile 246). All of these water sources are easily available to and some frequently used for drinking water by river recreationists and backcountry users.

The water quality of the Colorado River, its tributaries and associated springs and seeps can be evaluated on the basis of five major criteria: (a) levels of contamination by fecal coliforms; (b) concentration of specific elements, e.g., zinc, mercury, lead, etc.; (c) total salt concentrations; (d) concentrations of biotic and abiotic parameters that could lead to hypereutrophication (nutrient enrichment and rapid growth of undesirable organisms); and (e) known levels of pollutants added by direct or indirect human contact.

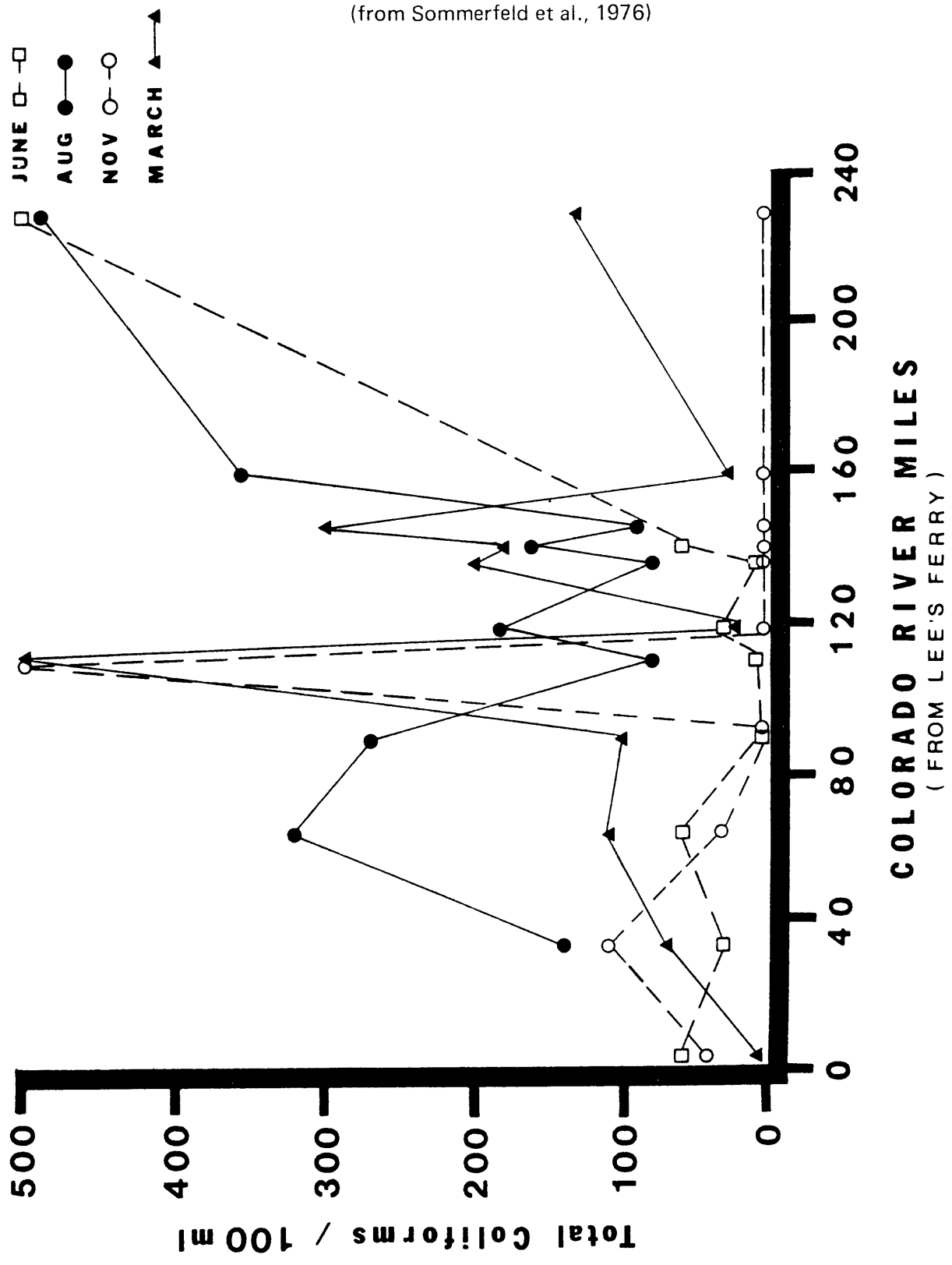
Recent investigations on the water quality in Grand Canyon National Park indicate that, in general, unpolluted conditions exist (Cole and Kubly, 1976; Czarnecki et al, 1976; Decon and Baker, 1976; and Sommerfeld et al., 1976). However, during certain periods of the year, during peak flood flows or at specific tributary sites, contaminants in excess of U.S. Public Health Service (USPHS) standards for human drinking water are locally present. These potential problem areas and situations are discussed below under each of the major criteria used for evaluating the water quality of the system.

a. Levels of Contamination by Total Coliform

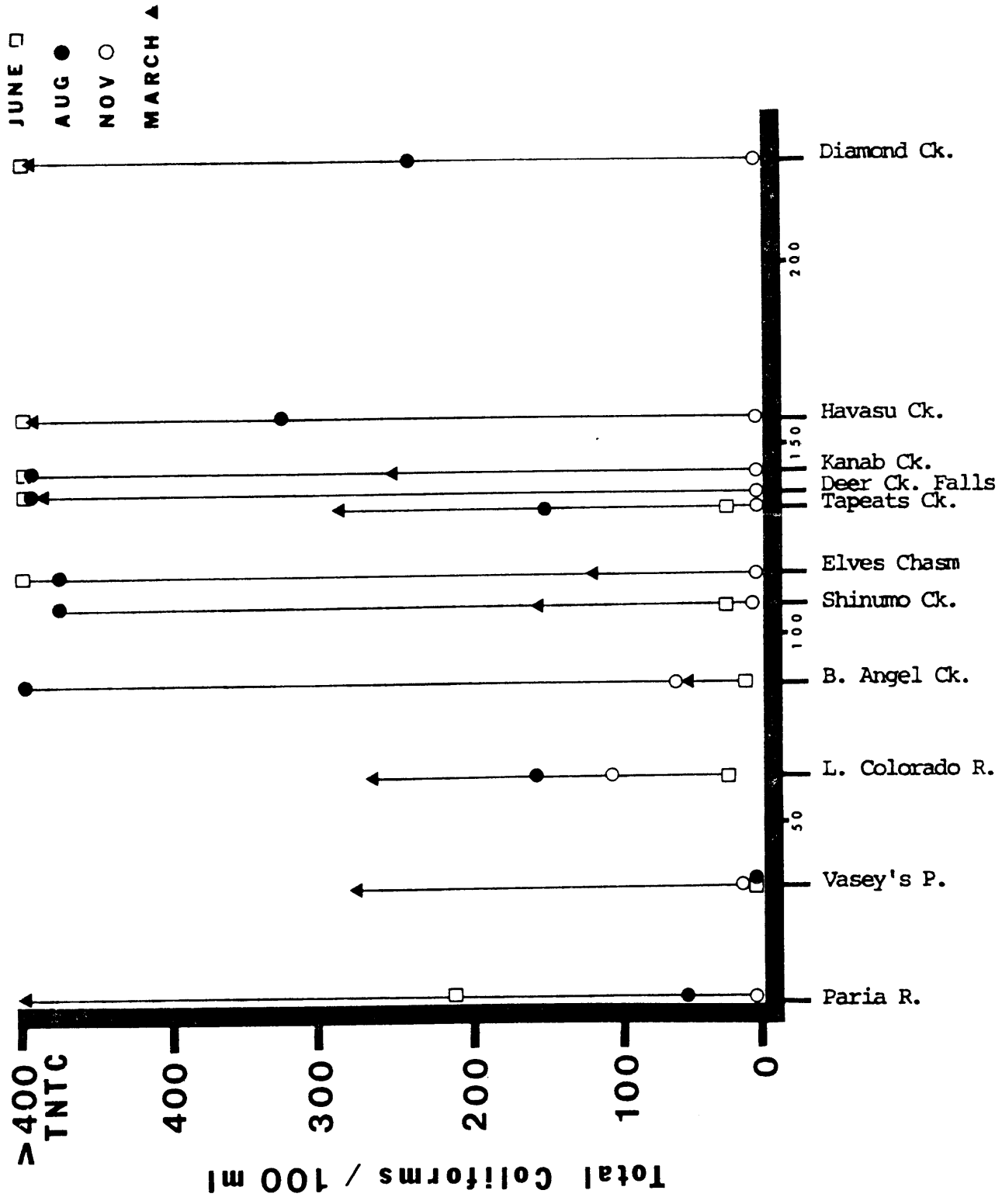
Public Health Service standards for water used for human consumption recommend that coliform levels are not to exceed 1 coliform/100ml. The desirable criteria set by the Federal Water Pollution Control Administration (U.S.D.I., 1968) for raw surface waters is less than 100 coliforms/100ml., and the permissible limit is 10,000 coliforms/100ml. Both "desirable" and "permissible" waters can be used for human consumption if treated.

The total coliform concentration levels of the Colorado River and the 11 most popular tributaries and springs are presented on pages II-15 and 16.

TOTAL COLIFORM COUNTS IN THE COLORADO RIVER
(from Sommerfeld et al., 1976)



TOTAL COLIFORM COUNT IN THE TRIBUTARIES OF THE COLORADO RIVER
(from Sommerfeld et al., 1976)



four sampling periods, June, August, November, and March of 1975 (Sommerfeld et al., 1976).

The total coliforms found in the Colorado River and the tributaries and springs were extremely variable, ranging from none detectable to more than 400 coliforms/100ml.

Indications of pollution occasionally occur under special conditions.

- Paria River, Bright Angel, Shinumo, Havasu, and Diamond Creeks show occasional presence of pollution indicator algal associations (Blinn et al., 1976).

- Potential health hazards may exist at some river campsites in the form of adjacent high total coliform counts, possibly due to seepage from porta-potty disposal (Deacon and Baker, 1976).

- Total viable coliform bacterial numbers exceeded desirable water quality standards at several river sampling sites and in most of the tribuarties throughout the year (Sommerfeld et al., 1976).

- Heavily used tributaries generally had total coliform numbers that exceeded desirable water quality criteria (Sommerfeld et al., 1976).

b. Concentrations of Specific Elements

Natural surface waters contain dissolved minerals that reflect the type of substrata the waters have contacted and the duration of that contact. Natural streams may reflect the chemical characteristics of surface runoff, as well as ground water that enters the spring or seep.

Of fifteen elements surveyed, (boron, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, molybdenum, potassium, sodium, and zinc), only two, iron and manganese were ever found to exceed recommended drinking water standards (EPS Water Quality Criteria, 1972). These elements were only found in excess of the standards in the Little Colorado River drainage during high and sustained floods. Neither iron nor manganese are known to be health hazards, particularly at these concentrations.

c. Total Salt Concentration

The salinity of the Colorado River is in excess of present

health standards (500 mg/liter) for sustained human consumption (U.S. Public Health Service, 1962). The USPHS allows, however, a two-fold increase in salinity for occasional consumption. The salinity levels found in the Colorado River waters range from 623 to 644 mg/liter, and thus falls within the criteria for periodic consumption. For the tributaries and springs, complete data are not available, however, it is known that the Little Colorado River is essentially a sodium chloride water. However, the normal, clear water flow of the Little Colorado River is insufficient to change the total salt concentration of the Colorado River.

d. Concentration of Biotic and Abiotic Parameters that Could Lead to Hypereutrophication

The Colorado River is rich in essential plant nutrients and has the potential to be a productive system (Cole and Kubly, 1976). Yet all the aquatic studies done to date indicate that the entire system is relatively unproductive with low population densities of the primary producers (phyto plankton, etc., Sommerfeld et al., 1976). Reasons hypothesized for the low productivity are the low water temperatures and the high and variable degree of turbidity (Cole and Kubly, 1976; and Deacon and Baker, 1976).

e. Known Levels of Pollutants Added by Direct or Indirect Human Contact

Some sources of pollutants which are considered to cause short- or long-term degradation of the water quality include wastes resulting from motorized watercraft on the Colorado River.

Oil and gasoline can be spilled into the Colorado River at Lee's Ferry from boat servicing facilities. Ruptured gasoline tanks can also leak during motorized trips through the canyon. On the average, an estimated 20 to 35 percent of the fuel used in outboard motors is wasted in the exhaust. Laboratory studies of pollutants from outboard motor exhaust indicate that approximately 0.23 pounds of oil, as measured by non-volatile suspended solids, are wasted per gallon of fuel consumed. The turbulence caused by the propeller creates conditions ideal for dispersion of the waste material into the water. The rest enters the air as an air pollutant in the canyon.

It has been estimated that approximately 25,000 gallons of gasoline are used annually on the motorized trips. Therefore, approximately 5,750 pounds of oil residue are dumped in the Colorado River annually.

E. CLIMATE

The Grand Canyon has many climates depending mainly on the elevation. Average annual precipitation varies from more than 25 inches along the forested North Rim (9,000 feet) to less than 9 inches on the desert of the Inner Canyon (2,400 feet). Intermediate amounts of about 16 inches per year fall on the South Rim (7,000 feet). The North Rim receives more precipitation in winter than in summer, the South Rim and the Inner Canyon receive about equal amounts during the two seasons. The spring and fall are relatively dry in all three areas. Summer precipitation is usually received from thunderstorms that form over the heated canyon walls almost every afternoon from early July until the end of August. Although these storms are capable of producing locally heavy downpours, they rarely last more than 30 minutes and usually cease completely shortly after sundown.

Winter precipitation is not as consistent as that of summer, varying greatly from year to year in both amount and frequency of occurrence. It is associated with middle latitude storms moving eastward from the Pacific Ocean and normally falls in gentle to moderate showers which may persist for several days. However, severe storms with heavy snow and strong winds can strike. Practically all of the winter precipitation on the North and South Rims occurs as snow. Snowfall is a rarity in the Inner Canyon and averages less than 1 inch per year.

As a general rule, the temperature increases as one descends into the canyon. However, during the winter months there are short periods of temperature inversion when clouds fill the canyon and cold air drains into and is trapped within the canyon while the rims are being warmed by sunshine. Based on an elevation gradient of 4,800 feet and a dry adiabatic lapse rate of 5.4° F/1,000 feet, the average adiabatic temperature change between the rim and the river is approximately 26° F. The air in the canyon is considered to be conditionally stable in August and September; statically unstable in June and July; and statically stable for the rest of the year. The hourly temperatures at the rim and the river approach each other to within a few degrees in the hour just preceeding sunrise.

The data in table 3 summarize the annual temperature for the Grand Canyon area. In addition to the river canyon data, temperatures are also presented for the North and South Rim and the Desert View weather stations. Comparison of these data dramatically demonstrate the marked differences in temperature from rim to river.

F. AIR QUALITY

Natural dust particles, water vapor, chemicals given off by growing plants, and the refraction of light all combine to form a haze which

TABLE 3

MEAN PRECIPITATION AND TEMPERATURE

GRAND CANYON NATIONAL PARK

MONTHS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MEAN MAXIMUM TEMPERATURES (^{O}F)												
Inner Canyon	56	62	71	82	92	101	106	103	97	84	68	57
Tuweep	49	50	61	68	79	89	95	92	85	74	61	49
Desert View	40	43	49	57	69	79	84	81	73	61	49	39
South Rim	41	45	51	60	70	81	84	82	76	65	52	43
North Rim	37	39	44	52	62	73	77	75	69	58	45	40
MEAN MONTHLY TEMPERATURES (^{O}F)												
Inner Canyon	46	52	59	69	77	86	92	89	83	72	57	47
Tuweep	38	40	47	54	64	73	80	78	71	60	48	39
Desert View	30	33	38	44	56	65	71	69	61	50	39	30
South Rim	30	33	38	46	54	64	69	67	61	50	39	31
North Rim	26	28	34	40	48	56	62	60	54	45	35	30
MEAN MINIMUM TEMPERATURES (^{O}F)												
Inner Canyon	36	42	48	56	63	72	78	75	69	58	46	37
Tuweep	26	30	34	40	49	58	65	63	56	46	35	29
Desert View	21	23	27	31	42	51	59	56	59	39	30	21
South Rim	18	21	25	32	39	47	54	53	47	36	27	20
North Rim	15	18	24	28	34	40	46	45	39	31	24	20
MEAN PRECIPITATION (Inches)												
Inner Canyon	.72	.73	.79	.48	.31	.28	.79	1.31	.88	.69	.51	.82
Tuweep	1.10	.90	1.25	.73	.40	.40	1.28	1.97	.79	.80	.77	1.31
Desert View	1.00	.94	1.52	.75	.50	.32	1.29	1.34	.99	1.39	.80	1.72
South Rim	1.32	1.53	1.37	.92	.65	.46	1.87	2.28	1.50	1.21	.95	1.61
North Rim	3.28	3.17	3.12	1.67	.97	.76	1.86	2.53	1.81	1.50	1.44	2.62

is a natural part of the Grand Canyon environment. The predominant wind direction in the Grand Canyon area above the rims is from the southwest. Below the rims of the canyon there is little large-scale horizontal air movement. The deep, narrow configuration of the canyon forms a relatively closed air system of over 5,000 verticle feet.

Available information indicates that dustfall and sulfation rates, as well as the levels of sulphur dioxide, nitrogen oxides, lead, benzene organics, and total oxidants are all low to very low. (These data are summarized in table 4.)

Because of its almost pristine purity, the air in Grand Canyon can be degraded by introducing pollutant levels which would be considered negligible in metropolitan areas. Visible ranges often exceed 190 kilometers (118 miles) in the exceptionally clean atmosphere above the canyon. Very small increases in atmospheric pollutants can significantly decrease visibility through air of this clarity and thus degrade the esthetic values of the park.

The air movements are primarily up and down canyon at very low velocities, making the potential for removal of air pollutants very low. Most of the higher wind velocities encountered in the canyon are not due to the exchange of canyon air with air above the rims, but rather a sloshing of a limited volume of local air back and forth within the canyon. The slow circulation of air and low dispersive capabilities increase toward the level of the Colorado River. Inversion layers or stable environmental lapse rates develop each night within the canyon and increase the stagnation of air circulation.

G. NOISE

A preliminary sound survey was made on Labor Day in 1971 by Dr. Black of Northern Arizona University. He reported that the drone of aircraft engines could be heard almost continuously on that day of survey. The aircraft are a mixture of fixed-wing and helicopter tour planes, private planes, military aircraft, and high altitude commercial craft. Automobile noises were the most pervasive at overlooks and within Grand Canyon Village.

Black found that in general the ambient noise levels ranged from about 45-50 decibels in remote backcountry areas to around 70 decibels in late afternoon on the front steps of the El Tovar Hotel.

While the sounds from motor vehicles and aircraft are the most disruptive along roadways, at overlooks and in the developed areas of the park, the sounds from aircraft and outboard motors are the most disruptive in backcountry and river areas. The noise problem associated with the use of outboard motors on raft trips through the Grand Canyon

TABLE 4 -- AIR QUALITY DATA AVAILABLE
GRAND CANYON VILLAGE AND VICINITY
1969 -- 1972

Pollutant	Grand Canyon EPA Mean	Annual Phoenix Mean	Grand Canyon Walther's Data	EPA Standard-1[1]	EPA Standard-2[2]	Arizona Standard
Total particulates (aerosol) ug/m^3	34 (n = 56)	108-265	18	75[3]	60[3]	60[3]
Dustfall ug/cm^2/day	-	11.5	5.3	-	-	-
Sulphur Dioxide ug/m^3	10	calo	calo	80[4]	-	50[4]
Sulfation rate ug/cm^2/day	-	1.75	0.38	-	-	-
Nitrogen Dioxide ug/m^3	21 (n =58)	168	22	100[4]	100[4]	100[4]
Total oxidants ug/m^3	-	17.5	10.4	160[5]	160[5]	80[5]
*Lead ug/m^3	0.15	3.12	-	-	-	-
Benzene soluble organics ug/m^3	1.0	-	-	-	-	-
Benzopyrene ug/m^3	0.11	-	-	-	-	-

*1969 data. n = number of data points
1. Level of pollutant which, if exceeded, endangers "public health"
2. Level of pollutant which, if exceeded, endangers "public welfare"
3. Annual geometric mean
4. Annual arithmetic mean
5. Maximum 1-hour concentration

was studied in the summer of 1973 by Drs. D. N. Thompson, A. J. Rogers, Jr. and F. Y. Borden of the University of Pennsylvania. They found that sound-pressure and levels of the motors, measured at head level in the boatman's station, ranged from 83 to 89 dBA, compared with background levels of 35 to 45 dBA. This borders on, but does not clearly exceed, present health standards, although it can cause significant shifts in the hearing threshold. In the presence of motor noise, natural environmental sounds or the almost unnatural lack of sound in the canyon can never be sensed by party members. The study concluded that outboard motor noise was a deterrent to normal, relaxed conversations that one should expect in such an environment, a safety hazard in raft operation, and a potential health hazard to the boatman.

H. VEGETATION

Along both sides of the Colorado River, from Lee's Ferry to Lake Mead exists a dynamic riparian (streamside) community. The riparian habitat includes all the vegetation, from the river's edge, inward, toward the canyon walls. Riparian vegetation may be defined as "those species of plants which are there only because of the presence of the river." The most striking aspect of the streamside community of the Colorado River is the amount of influence Glen Canyon and Hoover Dams have on the structure and integrity of the Colorado River and its riparian habitat.

Prior to the construction of Glen Canyon Dam, the Colorado River was a silt-laden river, warm in summer and cold in winter; the river's flow could fluctuate anywhere from almost no flow during dry summers to an excess of 200,000 cubic feet per second during spring floods (Fenneman, 1931). Now the river, as it originates from the bottom of Lake Powell, is clear and perpetually cold (45 - 50^{o} F), diurnally tidal as water releases are based on power demands; and rarely does the flow fluctuate outside a range from 1,000 cfs to 35,000 cfs. As a result of these changes, the natural biotic system of portions of the riparian zone has been destroyed and subsequently replaced by a new "exotic" system.

Prior to and during the construction of Glen Canyon Dam, numerous studies were undertaken to provide a data base and to determine what resources would be lost by the inundation of Glen Canyon (Woodbury et al., 1959). Unfortunately, there were no studies undertaken on what change would occur below the Glen Canyon Dam site in the Grand Canyon.

A graphic reconstruction of the pre-dam vegetation conditions has recently been undertaken (Karpiscak, 1976) By using data gathered during a brief pre-dam botanical study of the river environs (Clover and Jotter, 1944) and through analysis of pre-dam habitat photographs,

Karpiscak (1976) has been able to present a convincing picture of what was present along the banks of the Colorado River prior to the influence of the dam (Carothers et al., 1977).

1. Pre-Dam Riparian Vegetation

Prior to the construction of Hoover and Glen Canyon Dams, there existed three distinct zones of vegetation which paralleled the river from Lee's Ferry to the Grand Wash Cliffs (see illustration, page II-25). The zone closest to the river (Zone 3) and hence subjected to annual flooding, was composed partially of many ephemeral herbaceous species that were adapted to habitats subjected to periodic disturbance, and partially of some mesophytic woody plants such as seep willow and desert broom, Baccharis sp., and the true willows, Salix sp., that would make a futile attempt to become established before the next scouring flood. Above the ephemeral zone was a belt of vegetation whose lower boundaries were delineated by the high water line of major floods which would periodically scour away all vegetation growing below the zone. Typical plant species of this high water line zone (Zone 2) were Apache plume (Fallugia paradoxa), redbud (Cercis occidentalis), hackberry (Celtis reticulata), honey mesquite (Prosopis juliflora) and acacia (Acacia greggii). On the talus slopes (Zone 1) above this zone lived desert species that were not influenced by the river environment below (e.g., brittle bush, Encelia farinosa; various cacti; creosote bush, Larrea tridentata; Mormon tea, Ephedra Trifurca spp., etc.)

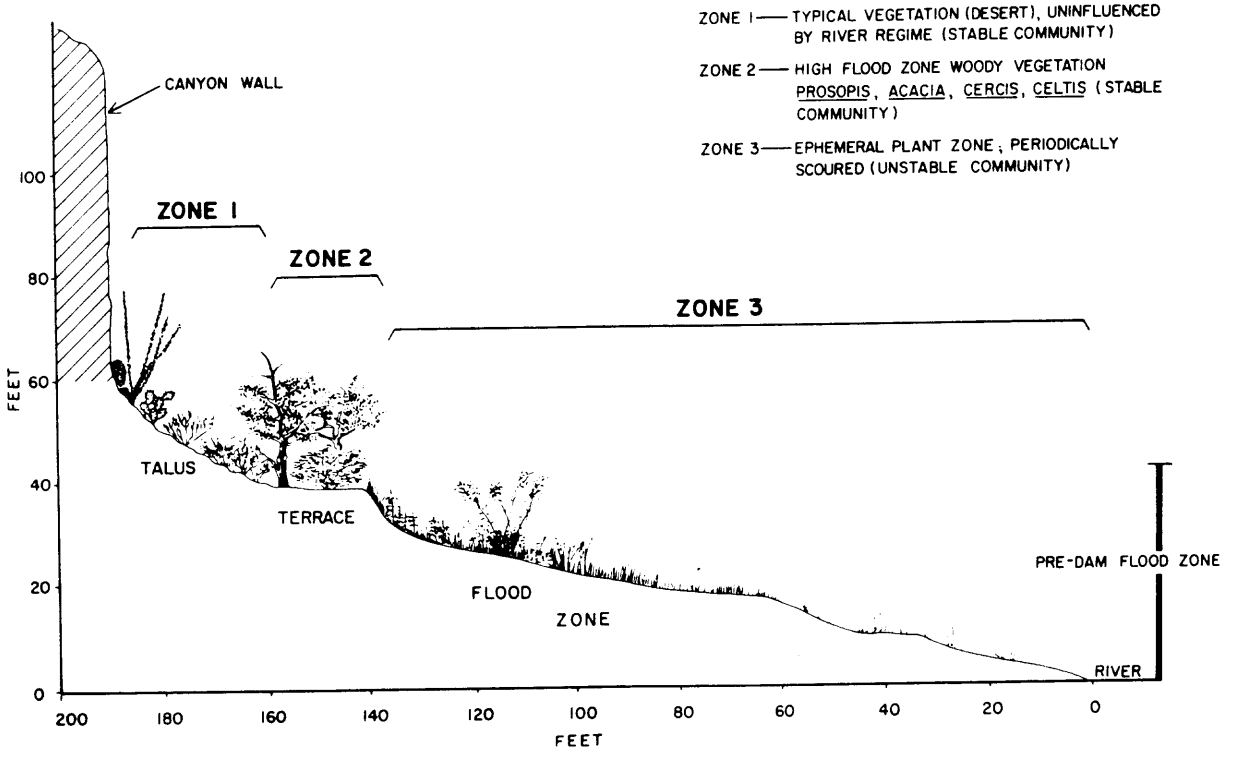
The construction of Hoover Dam inundated the two lower vegetational zones and much of the desert vegetation of the upper zone upstream from the dam to Mile 240. Within a matter of a few years, however, a new zone consisting almost exclusively of salt cedar (Tamarix sp.) appeared at the water's edge.

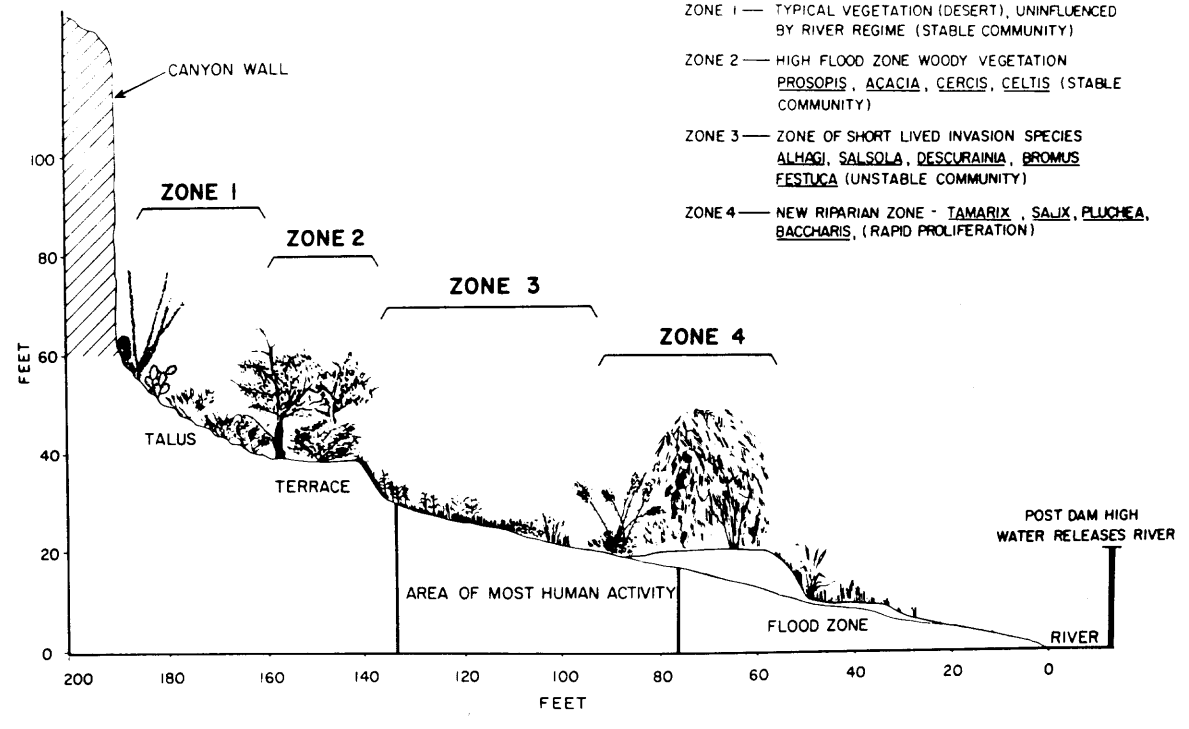
2. Post-Dam Vegetation

The significant reduction in high flood waters in the Colorado River below Glen Canyon Dam has permitted the development of a new riparian community that extends from Lee's Ferry (Mile 0) to the backwaters of Lake Mead (Mile 240. This rapidly proliferating community (Zone 4) is composed of salt cedar (Tamarix), arrowweed (Pluchea sericca), coyote willow (Salix exiqua), four species of Baccharis, and hundreds of species of herbaceous plants. In most areas, this new community occupies all of the former ephemeral zone (Pre-dam Zone 3), while in other locations, particularly where the bedrock has always been close to the river, there are no discernible changes between the pre- and post-dam vegetational patterns. Above the new riparian community and below the high water line community we now find another distinct zone (Zone 3) of ephemeral plants, e.g., red brome (Bromus rubens), tansy mustard (Descurainia pinnata), fescue (Festuca) and the composite Chaenactis fremontii, to mention only a few. Two very noxious exotic species, Russian thistle (Salsola kali) and camelthorn (Alhagi camelorum)

PRE-DAM AND POST-DAM RIPARIAN VEGETATION

(from Carothers et al., 1976)





also proliferate in this zone. Interestingly, it is this zone wherein the majority of campable beaches are contained and many of the species typical of this zone are indicators of disturbed areas.

Preliminary investigations indicate that the woody vegetation of Zone 2 is beginning to die back. Although the high water floods of pre-dam days only rarely reached the lower limit of this vegetation zone, it may have been of sufficient frequency to provide some required nourishment for this vegetative community. The high water flows now never approach the lower limits of this community, and each year more and more of the plants in this zone appear to be dying.

3. Vegetational Habitats and Topographic Habitats

Within the inner gorge, six topographical and eight vegetational habitat types have been identifed. The topographical habitat types and a brief description of each follows:

Rocky Outcroppings, Cliff Faces, and Upper Talus Slopes: These areas generally provide the minimum of the essentials to the survival of many animals as nesting areas.

Lower Talus Slopes and Bench: Erosion of upper areas provides sufficient soil for sparse plant growth, which is limited by the lack of enduring moisture within the root zone. This zone exists above the historic floodline, and can be divided into talus and bench as separate entities.

Upper Terraces: Commonly called "benches," these pre-dam fluvial deposits just below the old high water line are no longer eroding due to the absence of flooding. They provide one of the most fertile habitat types within the canyon. These areas show high incidence of invasion by native and exotic plant species.

Lower Terraces: Fluvial deposits formed prior to the construction of Glen Canyon Dam are now eroding away because of the reduced sediment load of the river. This may cause a stabilized condition where marsh species will increase in numbers. These post-dam areas increase the size of the cat-tail marsh habitat and are the sole nesting sites for some riparian animals of the canyon.

Side Canyons and Seeps: With permanent to seasonal water regimes separate from the main flow and with protection from wind and sun not offered by the open river banks, the tributaries, seeps, and alcoves provide an additional unique habitat type within the canyon.

Sand and Gravel Bars: These areas receive enough disturbance presently to keep them free of vascular plant vegetation of sizable amount. Frequently submerged, this is an interfall between the river and the lower terraces.

The vegetational habitats which may be found in association with the topographical habitat types are as follows:

Sparse Vegetation: This zone is characteristic of rock outcroppings, cliff faces, upper talus, and sand and gravel bars.

Decidious Forest: Found in side canyons, seeps and upper and lower terraces. Characterized by mature cottonwood (Populus), box-elder (Acer), willow (Salix), and Cercis), dense to sparse ground cover as herbaceous understory.

Evergreen Scrub: Found in side canyons, seeps, lower terraces, and upper terraces characterized by arrowweed (Pluchea), seep willow (Baccharis), brickel-bush (Brickellia), immature willow (Salix), and saltcedar (Tamarix), stands often dense.

Deciduous Scrubs: Found in upper terraces and lower talus slopes and bench with acacia (Acacia), mesquite (Prosopis), Apache plume (Fallugia), with closed ground cover.

Deciduous Dwarf Scrubs: Found in upper talus, lower talus, and bench brittle-bush (Encelia), Mormon tea (Ephedra), cheat-grass (Bromus), and the composite (Chaenactis).

Seasonal Marsh: Often found in a transition between the river and lower terrace includes plant species of scarlet monkeyflower (Mimulus), cat-tail (Typha), and horse-tail bush (Equisetum).

Evergreen Savanna: Found in upper talus slopes, lower talus slopes, and benches characterized by yucca (Yucca), agave (Agave), cholla (Opuntia), barrel cactus (Ferocactus), has a sparse to moderate ground cover.

Desert Scrub: Found in upper talus slopes, lower talus slopes, and benches, are creosote bush (Larrea), sage (Franseria), blackbush (Coleogyne), and ocotillo (Fouuieria) are found here with a sparse ground cover (Carothers et al., 1976).

A complete catalogue of the plant species known to occur within the inner gorge includes 807 species representing 92 families. A number of species, such as tamarix, camelthorn and Russian thistle have been introduced from the eastern hemisphere and are known as exotics. Others are endemic, (known only from the area) such as Schribner's needle grass (Stipa scribneri) and bittercress (Cardamine parviflora). Most representative species are of wide geographic distribution and are plants common to the upper and lower Sonoran life zones and their related riparian communities (Carothers and Aitchison, 1976)

4. Ecologically Sensitive Areas

Ecologically sensitive areas within the river corridor can be defined as "areas with high density and/or densities of plant and animal life and/or areas that provide a unique element required for the reproduction and survival of indigenous plant and/or animal populations." Ecologically sensitive areas that have been identified to date are presented in table 5. These areas should be afforded special management consideration as they represent biotic resources that are unique to the Grand Canyon riparian system. (Also, refer to map, page I-15.)

I. WILDLIFE

1. Amphibians and Reptiles

Amphibian species are not well represented in the Inner Canyon area. The arid surface conditions that almost exclusively pervade the entire area, preclude a high abundance and distribution of these species. The amphibians that are present, demonstrate a high degree of specialization for desert environments.

Reptilian species, especially lizards, appear to flourish in the riparian habitats of the Grand Canyon. The expansion of saltcedar seems to be beneficial to the populations of such species as spiny lizard (Sceloporu magister), western shiptail (Cnemidophorus tigris), and western prairie rattlesnake (Crotalus viridis).

List of common reptiles and amphibians known from the immediate river environs are as follows:

Red-spotted toad	Bufo punctatus
Woodhouse's toad	Bufo woodhousei
Chuckwalla	Sauromalus obesus
Desert spiny lizard	Sceloporus magister
Side blotched lizard	Uta stansburiana
Western whiptail	Cnemidophorus tigris
Gopher snake	Pituophis melanoleucus
Common kingsnake	Lampropeltis getulus
(Grand Canyon) Western Rattlesnake	Crotalus viridis (abyssus)

(after Carothers and Aitchison, 1976, and Suttkus et al., 1976)

Table 5

Ecologically Sensitive Areas Along the Colorado River

Name	Mile	Side of River or Location
House Rock Marsh	17.5	South
Stantons Cave	31.8	North
Vasey's Paradise	31.9	North
Buck Farm Canyon	40.8	North
Spring Canyon	41.2	North
43-Mile	43.2	South
Saddle Canyon	47.5	North
Nankoweap	52.0 - 53.0	North
Kwagunt Canyon	56.0	North
Little Colorado River	61.5	South
Hopi Salt Mines	62 - 64	South
Furnace Flats	65.6	South
Cardenas Marsh	71.0	South
Red Canyon	76.6	South
Clear Creek	84.0	North
Phantom Ranch	87.5	North
Garden Creek	89.0	South
Monument Creek	93.5	South
Hermit Creek	95.0	South
Boucher Creek	96.5	South
Shinumo Creek	108.8	North
Elves Chasm-Royal Arch Creek	116.5	South
Blacktail 122 Mile Creek	122.0	North
Stone Creek	132.0	North
Tapeats Creek Thunder River (Mi. Tapeats and Thunder River Caves)	133.7	North
Deer Creek	136.2	North
Kanab Creek	143.5	North
Matkatamiba	147.9	South
Havasu Canyon	156.8	South
National Canyon	166.5	South
Fern Glenn	168.0	North
Mohawk Canyon	171.5	South
Lava Falls	179.5	South
185-Mile	185.5	North
Granite Park	208.6	South
Juniper Seep	215.0	North
Three Springs Canyon	216.0	South
Suprise Canyon	248.4	South
Maxson Canyon	252.4	South
Burnt Canyon	259.3	North
Spencer Canyon	246.0	South
Emery Falls	274.4	South
Grapevine Wash	279.0	South

(Taken from Carothers and Aitchison, 1976)

2. Birds

Approximately 240 species of birds have been recorded in the Grand Canyon region (Johnson, et al., 1976), an area encompassing not only the Colorado River and its riparian habitat, but also the wide variety of habitat types found throughout the Grand Canyon area. The riparian habitat of the inner gorge contains its distinct assemblage of breeding birds, yet during the non-breeding season, or migratory season, the riparian areas are frequented by birds that breed in all Grand Canyon habitats and some that breed elsewhere throughout the United States and Canada. The riparian habitat of the inner gorge provides a natural corridor for migratory movements of birds on their way to or from breeding grounds.

The very depth and size of the entire Grand Canyon system provide for striking climatic differences between canyon bottom and canyon rim. Generally, the spring and fall weather along the Colorado River is much more hospitable than that of either rim. The deciduous riparian vegetation enjoys a longer growing season within the canyon, providing insects with a longer period of food, which in turn provides a predictable food source for some migrating birds.

A total of 41 species are known to breed within the river corridor. Of these, 27 species utilize the riparian vegetation as nesting habitat while the remaining 14 nest in association with the surrounding desert scrub, the verticle cliffs or the loose talus slopes of the Inner Canyon.

The riparian vegetation is preferred by 74 percent of the total population of breeding birds in the Inner Canyon. Of the 74 percent, only two species are permanent residents. Thus, it may be generalized, that the summer resident species of the inner gorge are almost exclusively restricted to the narrow belt of riparian vegetation along the river, while the permanent residents are restricted to, or prefer, the desert scrub, talus or verticle steep cliffs adjacent to the riparian habitat.

The species most dramatically affected by the new stabilized vegetative community are as follows: Willow flycatcher (Empidenax traillii), Bell's vireo (Vireo bellii), Yellow warbler (Dendroica petechia), common yellowthroat (Geothlypic trichas), yellow-breasted chat, (Icteria virens), northern oriole (Icterus galbula), brown-headed cowbird (Molothrus ater), and blue grosbeak (Guiraca caerulea). These species account for about 14 percent of the total breeding bird population along the Colorado River. These are the animals that will continue to increase in density as long as the vegetation below the old high waterline continues to proliferate. Also these are probably species that did not occur with significant frequencies along the river during the pre-dam era. Other species that are equally dependent upon this green vegetation such as the Lazuli bunting (Passerina amoena) and indigo bunting (Passerina cyanea) might be expected to begin utilizing this vegetation along the banks of the river as well as the heavily vegetated tributaries they are now in.

The most common breeding bird of the river corridor is the Lucy's warbler (Vermivora luciae) accounting for almost 20 percent of the total population of breeding birds. The house finch (Carpodacus mexicanus) is the second most common species (15 percent) followed by the canyon wren (Catherpes mexicanus) (11 percent). See Appendix E for a summary of breeding bird species known to occur in the river corridor, their preferred habitat and relative densities.

The house sparrow (Passer domesticus) and the starling (Sturnus vulgaris) are exotics found breeding in the Inner Canyon area, but almost always in association with human habitation, e.g., Phantom Ranch, Indian Gardens and Havasu Village. Recent exceptions to this restricted distribution was the occurrence of a breeding pair of house sparrows at Deer Creek Falls Campground, Colorado River Mile 136. It is interesting to note that this campsite is one of the most heavily used areas by river runners (Carothers et al., 1976).

3. Mammals

Within the riparian zone of the Colorado River approximately 22 species of terrestrial mammals and 18 species of bats are known to occur. The most common mammals are the rodents, with 13 species inhabiting the riparian, semi-riparian or desert habitats. On the beach and terrace habitats, the rodent species are the most common mammals, comprising an average density of about 20 individuals per acre (Carothers and Aitchison, 1976). The bats have been little studied, however, they are present in very high density, utilizing the available rock cliffs for roosting sites, the river for drinking and the insects associated with the riparian habitat for food. Carnivorous mammals, i.e., bobcats, coyotes, foxes, and mountain lions are uniform in distribution, but extremely rare. Spotted skunks, ringtail cats, and rock squirrels are common scavengers throughout the canyon area, but especially concentrated in popular camping areas. The rock squirrels have reached such high population densities in some camping areas (e.g., Indian Gardens) that they have become pests, robbing food from backpackers and destroying visitors' camping gear. The larger mammals are represented by the mule deer and the bighorn sheep.

The most conspicuous exotic animal within the Inner Canyon area is the feral ass or wild burro (Equus asinus). This animal was initially introduced into the canyon area during the late 1800's by early explorers and prospectors. When the mineral exploration subsided and/or national park status precluded any further mineral exploitation in the canyon, the animals were released to the wild. Since 1923, resource managers have attempted to reduce or eliminate the feral burro from the Grand Canyon. The damage inflicted on the native

ecosystem by this feral equine has been determined to be extensive (Carothers et al., 1976). Feral horses, escapees from the Havasupai Indians in Havasu Canyon, are known to occur in western Grand Canyon. They have not invaded the Colorado River corridor.

See Appendix F for a summary of the mammals known to occur in the river corridor, their preferred habitat and their relative abundance.

4. Fishes

The Colorado River has only a few species native to its waters. Because of the change in the river environment due to the dam at Glen Canyon, such fish as the Colorado River squawfish (Ptychocheilus lusius) and the humpback chub (Gila cypha) may possibly be nearing extinction. The native fish depended on the seasonal fluctuation of temperatures to breed. The cold, stabilized temperature of the waters now limit breeding to warm, side streams.

Carp and various chubs, shiners, minnows, bullheads, bass, and other fish have been introduced to the Colorado in varying quantities. Rainbow, brook, and brown trout have been introduced into Bright Angel, Clear Creek, Shinumo, Garden Creek, and Tapeats Creek. Plantings have been made as recently as 1967 in cooperations with the Arizona Fish and Game Department. Earlier efforts to establish trout in Havasu Creek were not successful.

Stocking still occurs at Lee's Ferry, Arizona. Five- to seven-inch rainbow trout are planted from one to two times a year. Lee's Ferry is 1/2 mile from the park boundary on the Colorado River. Trout when planted are known to migrate along the length of the Colorado in the park. Being carnivorous, they place pressure on the young of the endangered native species, but the impact of this factor is not known at this time.

Stocking has also occurred and will continue at Lake Mead. Coho salmon, rainbow trout, striped bass, and walleye have been stocked since 1968. Coho salmon, rainbow trout, smallmouth bass, walleye, and striped bass all move from the lake into the lower park and as the river continues to alter from the pre-dam system, they will probably or possibly increase in abundance. There are no quantitative data on fish densities in the river.

Known fish species of Colorado River in Grand Canyon and tributaries:

Native Species

Flannel Mouth Sucker	Catostomus latipinnis
Bluehead Sucker	Pantosteus discobolus

Bonytail Chub	Gila elegans
Humpback Chub	Gila cypha
Colorado Squawfish	Physhocheilus lucius
Speckled Dace	Rhinichthys osculus
Humpback or Razorback Sucker	Xyrauchen texanus

Exotic Species

Threadfin Shad	Dorosoma petenense
Rainbow Trout	Salmo gairdneri
Brown Trout	Salmo trutta
Coho Salmon	Oncorhynchus kisutch
Carp	Cyprinus carpio
Fathead Minnow	Pimephales promelas
Red Shiner	Notropis lutrensis
Channel Catfish	Ictalurus punctatus
Black Bullhead	Ictalurus melas
Plains Killifish	Fundulus zebrinus
Green Sunfish	Lepomis cyanellus
Large Mouth Bass	Micropeterus salmoides
Bluegill	Lepomis machrochirus

(after Suttkus et al., 1976)

J. RARE, ENDANGERED AND THREATENED SPECIES

1. Animals

Along the river corridor, five species, the Southern bald eagle (Haliaeetus leucocephalus leucocephalus), the American peregrine falcon (Falco peregrinus anaturn), brown pelican (Pelecanus occidentalis), the humpback chub (Gila cypha) and the Colorado River squawfish (Ptychocheilus lucius), are on the list of endangered fauna, maintained by the Secretary of the Interior. The status of the three endangered bird species in the national park has recently been reviewed (Carothers and Johnson, 1975). The peregrine falcon is a permanent resident of the canyon, although few in numbers. The falcon utilizes the river corridor for hunting activities, primarily preying on waterfowl and swifts. The other bird species are either transient (bald eagle) or accidental (pelican). The endangered fish species are "endangered" because of the drastic changes in their habitat that has taken place since the impoundment of Lake Powell by Glen Canyon Dam. These changes include the increases in non-native fish populations which are believed to be competing with the native fishes for necessary resources (Minckley and Blinn, 1976). The Colorado River squawfish may, in fact, be already extinct in Grand Canyon, as none were encountered during exhaustive searches during 1974, 1975, and 1976. The humpback chub is now restricted in distribution to

the mouth of the Little Colorado River and unless measures are taken to restrict visitor activities in this area (bathing, angeling, etc.) this species is also doomed to extinction (Suttkus, 1976).

The spotted owl (Strix occidentalis), the prairie falcon (Falco mexicanus) and the Little Colorado River spinedace (Lepidomeda uittata), known occupants or visitors to the river corrider, were considered "threatened" species by the U.S. Fish and Wildlife Service in the 1973 edition of "Threatened Wildlife of the United States." They have not, however, been recorded as threatened species in the official Fish and Wildlife Service list of "Endangered and Threatened Wildlife and Plants," Federal Register, July 14, 1977.

There is only one record for the spotted owl as having occurred in the Grand Canyon area, and this sighting considered to be of an animal out of its normal range. The prairie falcon is an occasional resident of the Grand Canyon area and its numbers in the park seem to be declining with the national trend (Carothers and Johnson, 1975). Fish sampling of the river and its tributaries during 1974, 1975, and 1976 did not produce a single specimen of the spinedace, thus it may already be extinct in the Grand Canyon area.

Several other species exist along the Colorado River in Grand Canyon whose status in Arizona may be in jeopardy in the near future (AGFD, 1976). These include the following:

River otter (Lutra canadensis sonora)

Desert Bighorn Sheep (Ovis canadensis mexicana)

Snowy Egret (Egretta thula brewsteri)

Black-crowned Night Heron (Nycticorax nycticorax hoactli)

Osprey (Pandion haliaetus carolinensis)

Bonytail Chub (Gila elegans)

Desert Tortoise (Gopherus agassizi)

Gila Monster (Heloderma suspectum)

The fish and reptile species listed above, encountered during the research projects, are susceptible to disturbances initiated by increased human use of the riparian zone. The National Park Service and the U.S. Fish and Wildlife Service have jointly recommended the bonytail chub, Gila elegans for endangered status and the razorback or humpback sucker, Xyrauchen texanus for threatened status under the Endangered Species Act of 1973.

2. Plants

A number of endangered or threatened species of plants are known from Grand Canyon National Park. Species endemic to the area or species much diminished in range or habitat and listed as Endangered in House Document 94-51, "Report on Endangered and Threatened Plant Species of the United States," are as follows:

Palmer Amsonia	Amsonia palmeri
Goldenweed	Haplopappus salicinus
Draba	Draba asprella var. kaibensis
Plains Cactus	Pediocactus bradyi
Scouler Catchfly	Silene rectiramea
Milkvetch	Astragalus cremnophylax
Phacelia	Phacelia filiformis
Wild Buckwheat	Eriogonum darrovii
Wild Buckwheat	Eriogonum thompsonae var. atwoodi
Wild Buckwheat	Eriogonum zionis var. coccineum
Primrose	Primula hunnewellii
Clute penstemon	Penstemon clutei

The following plants in Grand Canyon National Park are recommended for consideration as a threatened species in House Document 94-51:

Crossosoma	Crossosoma parviflorum
Beavertail Cactus	Opuntia basilaris var. longeareolata
Fleabane	Erigeron lobatus
Goldenweed	Haplopappus scopulorum
Actinea	Hymenoxys subintegra
Draba	Draba asprella var. stelligera
Phacelia	Phacelia serrata
Agave	Agave utahensis var. kaibabensis
Flowering Ash	Fraxinus cuspidata var. macropetala
Milkvetch	Astralagus troglodytus
Primrose	Primula specuicola
Wild Buckwheat	Eriogonum densum
Wild Buckwheat	Eriogonum ovalifolium var. vineum
Columbine	Aquilegia desertorum
Wild Rose	Rosa stellata

Very little is known regarding the distribution and abundance of the endangered and threatened species of plants in Grand Canyon National Park. The bulk of the available information has come from recent ecological studies performed throughout the river corridor (Carothers and Aitchison, eds., 1976). Although more complete information on these species and their critical habitat is not available, it is believed that human interference in the form of river recreation is not inimical to the survival of the plants in question.

K. THE CULTURAL RESOURCES

1. Archeology

Archeological resources in Grand Canyon constitute a primary scientific and historic value of the park. The more than 1,200 known Indian ruins within the national park indicate and represent the adaptation of man to his environment over the past 4,000 years in the Grand Canyon region. The initial occupation of the canyon began about 4,000 years ago, and is represented by the Grand Canyon Split-Twig Figurine Complex occupation of dry caves. These deposits contain split-twig figurines which are found only in a few other locations in the southwest. An apparent lull in human occupation followed, with primary occupation in the canyon occurring between A.D. 700 and 1200. During this time, Anasazi to the north and east, and Cohonina to the south and west, used the plateaus for their agriculturally based way of life. The Anasazi occupied the depths of the canyon as well. In the historic period, Hualapai, Havasupai and Paiute evidenced the only use of the canyon by the surrounding Indian tribes. These various cultures all left evidence of their life styles upon the land, but only the Havasupai and Hualapai still remain within the boundaries of Grand Canyon National Park.

At the present time, over 50 prehistoric archeological sites have been discovered immediately adjacent to the Colorado River from Lee's Ferry to the Grand Wash Cliffs and Lake Mead.

Archeological surveys of the river corridor are far from complete. Present knowledge of the existence and location of the known sites have resulted from only a few organized, but brief, archeological surveys of the Colorado River environs. In addition to the presence of sites immediately adjacent to the river, other important cultural resources have been located in tributary canyons. Dozens of ruins have been identified in virtually every major drainage of the Colorado River system. Many of these sites are undergoing rapid and irreversible damage, some due to natural erosive forces but considerable damage due to visitor activities, particularly river runners, and to a lesser extent back-country users.

Nineteen commonly visited archeological sites include a number of pueblo ruins, rock shelters, pictographs, masonry granaries, caves, and sacred Indian sites.

Sites in danger of disturbance by natural forces (erosion through flash flooding) or by the trampling activities of the feral ass (Equus asinus) are located throughout the lower Grand Canyon. These sites are as follows:

Type of Site	Source of Damage
Pueblo Ruin	Feral Asses
Midden	Flash Floods
Rock Shelter, mescal pit	Feral Asses
Campsite, mescal pit	Feral Asses

Although ten archeological sites are eligible for nomination to the National Register, no sites within the river corridor are presently listed on the National Register of Historic Places. Site evaluation and preparation of nomination forms are now underway. Compliance with Executive Order 11593 is expected by 1978.

2. History

Although the archeological record indicates a very early human interaction with the Grand Canyon, it has been only during the past 75 years that extensive organized activity has occurred. The historic resources of Grand Canyon relate primarily to the establishment and development of the Grand Canyon as a national park.

Recorded history of the Grand Canyon began with its discovery in 1540 by Don Lopez de Cardenas, one of Coronado's captains, and 12 followers who were seeking the fabled wealth of the Seven Cities of Cibola. Fathers Dominguez and Escalante crossed the Colorado River in Glen Canyon in 1776 and in that same year Francisco Tomas Garces visited the Havasupai Indians during a traverse south of Grand Canyon. American fur traders made forays into the Grand Canyon region during the early 19th century. After the war with Mexico, the United States became owner of the region in 1848 by the Treaty of Guadalupe Hidalgo. The first comprehensive report on Grand Canyon country resulted from the work of a War Department expedition of 1857 - 58 headed by Lieutenant Joseph C. Ives. His mission was to ascend the Colorado River and report on its navigability.

Major John Wesley Powell and nine companions won lasting fame as a result of their daring descent by boat of the Colorado River in 1869. Their trip began at Green River, Wyoming, and transitted the river from there through the Grand Canyon. Powell repeated the trip again in 1871 - 72. His were scientific explorations, and worthwhile information was gathered in spite of the hardships involved. A U.S. Army expedition led by Captain George Wheeler passed immediately south of the canyon in 1871 as they were mapping potential railway routes.

Along the river corridor, there are no historic sites that presently qualify for listing on the National Register of Historic Places. The following, however, is a list of currently known sites within the river corridor which require historic evaluation. Some of these sites may meet the national register criteria when they are fully understood.

Name of Site

Brown Inscription
Cave Springs Rapid Historic Site
Bert Loper's Boat
Graves of Peter Hansbrough (1889) and Boy Scout (1946)

Grave of Willie Taylor
Beamer's Cabin
Tanner Mining Camp
Hance Cabin
Asbestos Canyon Mining Camp
Bass' Winter Camp and Cable Crossing
Hakatai Canyon Mining Camp

Other sites, not immediately adjacent to the Colorado River, but easily accessible to river runners and backcountry users that are in need of investigation include Hermit Camp, Boucher Camp, and Bat Cave Guano Mine.

L. RIVER RECREATION

The Colorado River through Grand Canyon is one of eight stretches of recreation rivers on the Colorado-Green River system. It is one of more than 44 stretches of recreation river in the western United States.

The Colorado River through Grand Canyon National Park, however, has characteristics which set it apart from other rivers. It is the longest stretch of recreation river in use, some 277 miles, all of which are contained within a national park. It is also surrounded by more than one million acres of land with little human development. The river contains some of the world's most difficult and exciting white water. The Colorado's isolation by the mile-deep gorge of Grand Canyon also gives it desirable wilderness qualities which enhance off-river hiking, climbing, and sightseeing.

Prior to the early 1960's, resource managers at Grand Canyon National Park were virtually unaware of, or unconcerned with, resource management problems along the Colorado River. Most of the park visitors were concentrated on the South Rim of the canyon, and to a lesser extent, the North Rim. Relatively few visitors entered the canyon, and when they did it was usually on the well-maintained trails of the Inner Canyon corridor. Backcountry hiking and river running were rare and management attention to these activities was minimal.

In 1963, the gates of Glen Canyon Dam were closed, forming Lake Powell, and river management problems began for the resource managers of Grand Canyon National Park. In addition to changing the biotic regimen of the Colorado River and its associated habitats, Glen Canyon Dam also resulted in drastically altering the maximum and minimum flow levels of the river and the silt concentrations. The predictable flows and clear water have resulted in the Colorado River below Glen Canyon Dam becoming one of the most sought-after white water recreation rivers in the Western Hemisphere. Other factors operating at the same time to encourage growth in river running were: emerging interest in wilderness experience, increased mobility and leisure time, expanding numbers of people with river running expertise, and an increased amount and variety of equipment.

By late 1969, the park managers were astonished at the annual increase in river running enthusiasts. Before 1963, fewer than 100 people had run the Colorado River through the Grand Canyon (Johnson and Martin, 1976). By 1967, the annual number of river runners had reached 2100, and river running was becoming a thriving business on the Colorado Plateau. Incredibly by 1973, over 21 commercial boating companies and private outfitters carried over 15,000 people down the river, an increase of almost 700 percent in six years (See table 6). Colorado River use in 1972 alone exceeded the 100 years from 1870 through 1969.

1. User Days and Allotments

The alarming visitor increase forced the National Park Service to initiate a ceiling on the number of available user days (one user day equals one passenger on the river for one day). To allow time to determine what the effect increased use was having on the resource and on the visitor's experience, the decision was made to hold 1973 use to the level experienced in 1972.

As an interim measure, the commercial allotment for 1972 was set at 105,000 user days. Of these, only 88,135 were used, so for 1973 the allotment was adjusted downward to 89,000, an overall reduction of 16 percent. This level has been maintained to the present. The private and noncommercial river runners used 7,600 user days in 1972 and that level has constituted the ceiling on the noncommercial allotments to the present time.

The number of user days allocated to individual concessioners was based on their actual levels of use in 1972. For most concessioners, their use was reduced by 16 percent in 1973 from the 1972 figure (see table 7).

The 7,600 user days allocated to the noncommercial sector has been dispensed by a variety of methods. In 1972 and 1973, use was assigned on a first-come, first-served basis. Then in 1974 - 75, an early post-mark and a no-repeat rule was tried. In 1976, the no-repeat rule was dropped and a general lottery system was established. Considerable controversy has pervaded the decision on both commercial and non-commercial disbursements since 1972, becoming more intense and widespread in 1976 and 1977.

The following tables show the allocation of use between commercial (92 percent) and noncommercial river running interests (8 percent). Table 8 presents the number of noncommercial permits and table 9 the allocated and actually used user days for all 21 commercial outfitters from 1972 to 1976.

Table 6

Travel on the Colorado River Through the Grand Canyon
From 1867 to the Present (after Nash, 1976)

Travel on the Colorado River Through the Grand Canyon of Arizona

Year	Number of People	Year	Number of People
1867	1[1]	1957	135
1869-1940	73	1958	80
1941	4	1959	120
1942	8	1960	205
1943	0	1961	255
1944	0	1962	372
1945	0	1963-1964	44[2]
1946	0	1965	547
1947	4	1966	1,067
1948	6	1967	2,099
1949	12	1968	3,609
1950	7	1969	6,019
1951	29	1970	9,935
1952	19	1971	10,385
1953	31	1972	16,432
1954	21	1973	15,219[3]
1955	70	1974	14,253
1956	55		

1. Some contend that James White, a trapper fleeing the Indians, floated the Grand Canyon on a makeshift log raft two years before the famous expedition of John Wesley Powell.

2. Travel on the Colorado River in these years was curtailed by the completion of Glen Canyon Dam upstream and the resultant disruption of flow.

3. The downturn in visitation was the result of the institution by management of a quota system. The numbers applying for the available private permits continued to rise annually.

Table 7. Current Allocation of Available Passenger Days (PD) to Each of the 21 Concessioners

Company	1972 P/D Allot	1972 P/D Use	1973 P/D Allot	1973 P/D Use	1974 Use	1975 Use	1976 Use	1975 # Trips
WEST	12000	*13125	10080	10052	10013	10049	10153	75
HATCH	12000	11689	10080	10034	9532	9944	8297	64
SAND	12000	10636	10080	10039	10007	10003	10011	50
AMER	11000	9775	9240	9096	9233	8148	9241	40
GRCE	10000	*11000	8400	8347	8481	8941	8470*	48
CROS	8000	3560	6720	5297	4566	4372	4349	27
WHIT	4500	* 4589	3780	3765	3542	3832	3476	20
TOUR	4500	* 4515	3780	3734	3522	3610	3755	25
CANY	4000	2893	3360	3344	3336	3190	3409	26
GRCD	3600	2329	3025	2979	3016	3017	2944	12
ARIZ	3000	3050	2600	2609	2771	2694	3078	20
WILD	3000	721	2520	2526	2246	2668	2478	11
FORT	2600	1391	2200	2213	2267	2020	2054	24
MOKI	2400	1241	2050	1466	986	1112	2190	8
GEOR	2300	1414	2000	1988	1978	1988	2015	11
COLO	2000	1879	1800	1819	1806	1821	1951*	17
HARR	2000	975	1680	1570	1561	1628	1580	20
WOND	2000	600	1680	1449	1440	1569	1629	10
OARS	1600	1218	1600	1589	1591	1677	1603	10
OUTD	1200	738	1200	1215	1197	1207	1206	8
GRCY	1300	784	1125	1134	1104	1219	1117	7
	105000	88135	89000	86264	84195	84709	85006	533

(*PD allotment 1973-76 same)

Table 8. Number of Noncommercial Permit Applications and Permits Granted From 1972 to 1976

	1972	1973	1974	1975	1976
Number of Applications	47	74	84	173	425
Number of U.D. Requested	7,611	14,193	17,115	33,569	89,084
Number of Permits Granted	47	49	41	42	36
Number of U.D. Granted	7,611	7,833	7,638	7,679	7,636

Total requested U.D. denied 1972 to 1976 = 123,175

Table 9. Total User Days Allotted vs. Total User Days Used by Commercial River Runners From 1972 to 1976

	1972	1973	1974	1975	1976
Number of Days Allotted	105,000	89,000	89,000	89,000	89,000
Number of Days Used	88,135	86,264	84,159	84,709	85,006
Number of Days Not Used	16,865	2,736	4,841	4,291	3,994

Total user days not used from 1972 to 1976 = 32,737

Commercial use has not reached the total allotment level. However, the data indicate clearly that some concessioners could use more user days than they are currently allotted while others do not use their total allotment. These data suggest that no citizen would have been denied a commercial trip if all 21 concessioners were contacted. At the same time, 81,448 user days were denied the noncommercial sector in 1976. National Park Service files are replete with complaining letters from the noncommercial interests whereas there are no complaints from citizens indicating that they could find no open berth on a commercial trip. While there are specific data as to number of applications received and permits issued to noncommercial river runners, it is evident that these figures are not accurate. For example, there were over 1200 blank applications sent out for 1977, with 507 actual applications received and 37 permits issued. The National Park Service has evidence that some of the people who requested applications did desire a trip, but did not submit an application due to the limited chance of drawing a permit, and other related reasons. At the same time, there were duplicate applications among the 507 received. The demand for commercial trips appears to be greater than exhibited, but the data is inadequate to determine the extent of demand.

It is also important to note that commercial use was growing at a rapid rate prior to 1973 when the ceiling was imposed. There is no question that this use would be at a much higher level today had it been allowed to operate in a free market situation, where concessioners were allowed to increase number of trips freely in response to demand. How much higher use might have been is entirely speculative.

In summary, it appears that noncommercial permit interest is most intense at this time, but comparative demand, noncommercial to commercial, cannot be accurately assessed.

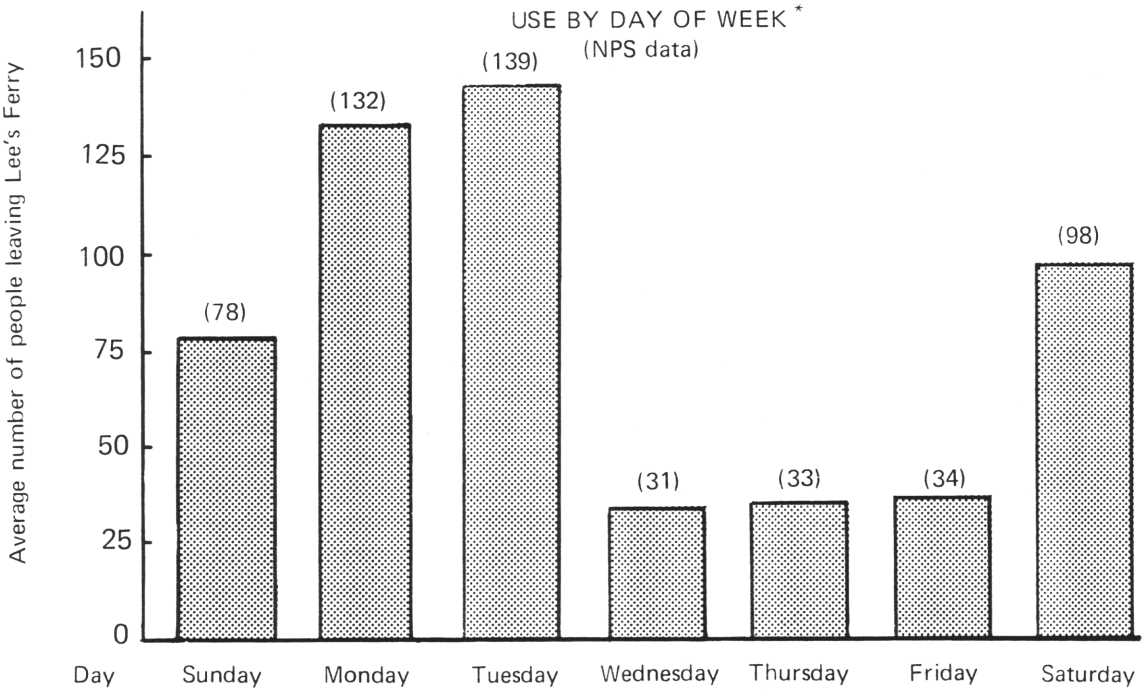
2. Levels and Distribution of Use

Beginning with the 1973 season, stricter standards of safety, sanitation, licensing, and interpretation were demanded of all commercial river operators. The maximum commercial passenger days allotted each month is no greater than 25 percent of the operator's annual allotment. A maximum of 150 commercial passengers, and one party of up to 15 private users, is permitted to depart from Lee's Ferry on any single day. The maximum number of commercial passengers per type of boat is 6 to 20, and the maximum number of passengers per commercial trip is 40 (averages 25). Commercial trips are not permitted to average more than 40 miles per day.

TABLE 10

USE BY DAY OF WEEK *

(NPS data)



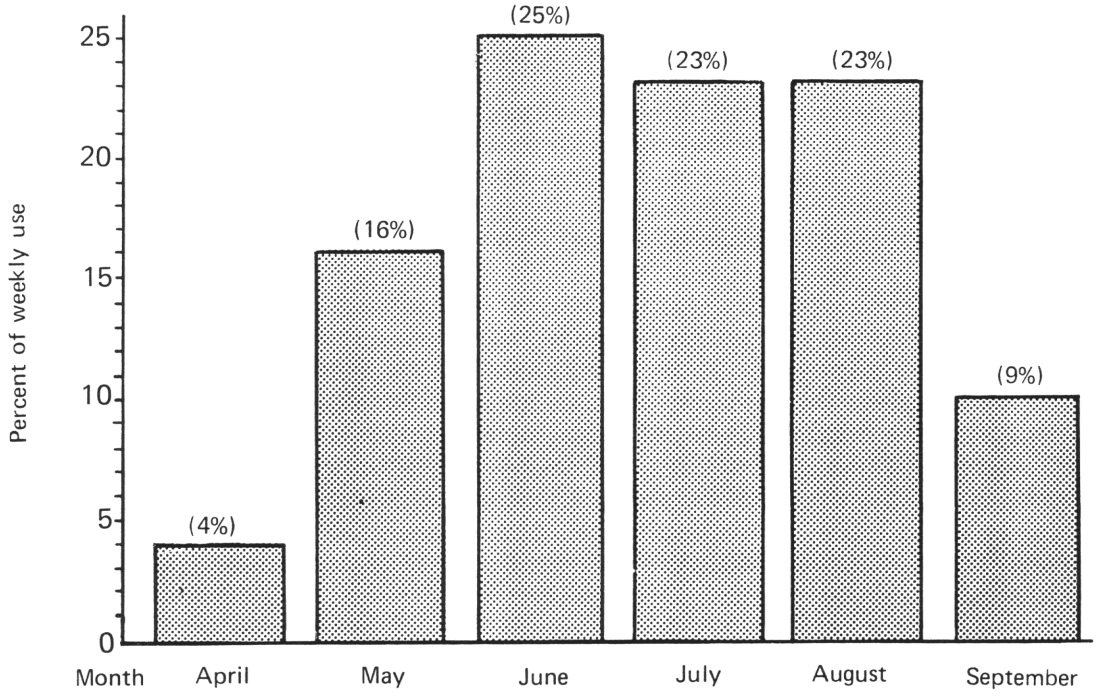
Percent of weekly use	14	24	26	6	6	6	18

*April through September only

TABLE 11

USE BY MONTH OF SEASON*

(NPS data)



Average Number of people leaving Lee's Ferry	(487)	(2,193)	(3,398)	(3,104)	(3,127)	(1,277)	13,586

*April through September only

Current use levels range from 80 to 940 people leaving Lee's Ferry per week with up to 200 people leaving Lee's Ferry on a single day (including crew, research, and administrative personnel). This use, however, is not dispersed evenly through time. The majority of the weekly use occurs on Monday and Tuesday and the monthly use occurs almost exclusively June through August (see tables 10 and 11). Little or no use occurs between October and March.

3. Lower Gorge

The use levels and allotments discussed above apply only to the first 225.6 miles of river. The portion of river from Diamond Creek to Grand Wash Cliffs is currently not under use allotment.

Below Diamond Creek, boating by private and commercial outfitters is unlimited. This section of the river has only recently been added to the park (Grand Canyon National Park Enlargement Act, P.L. 93-620) and it has a history of use and management that is substantially different than the river above Diamond Creek. In 1975, commercial trips, originating at Diamond Creek (under permit from NPS and auspices of the Hualapai Tribe) took an estimated 700 passengers from Diamond Creek to the debarkation points on Lake Mead (Pierce Ferry, Temple Bar). In addition, approximately 6,000 commercial passengers continuing their trip from Lee's Ferry used this portion of the Colorado River. There are no data available on the numbers of noncommercial passengers that float from Diamond Creek to the lake each year. Conservative estimates indicate that approximately 100 trips per year leave Diamond Creek.

Boaters in motor boats also run up the 15 miles of rapids to Diamond Creek but are not allowed to travel upstream beyond this point. Fishing and water skiing also occur below Separation Rapids (Mile 240). This area is considered to be a portion of the lake and approximately 12,000 persons, other than river runners, engage in lake recreation.

M. THE NATURE AND EFFECT OF EXISTING USE PATTERNS

Rapid irreversible physical and ecological changes are being inflicted on the riparian resources of the Colorado River as a result of the present visitor use levels and patterns. It has been demonstrated that the irreversible changes are not necessarily a simple function of the total number of annual visitors, but more importantly, of visitor use patterns and activities (Carothers and Aitchison, 1976).

1. Beaches

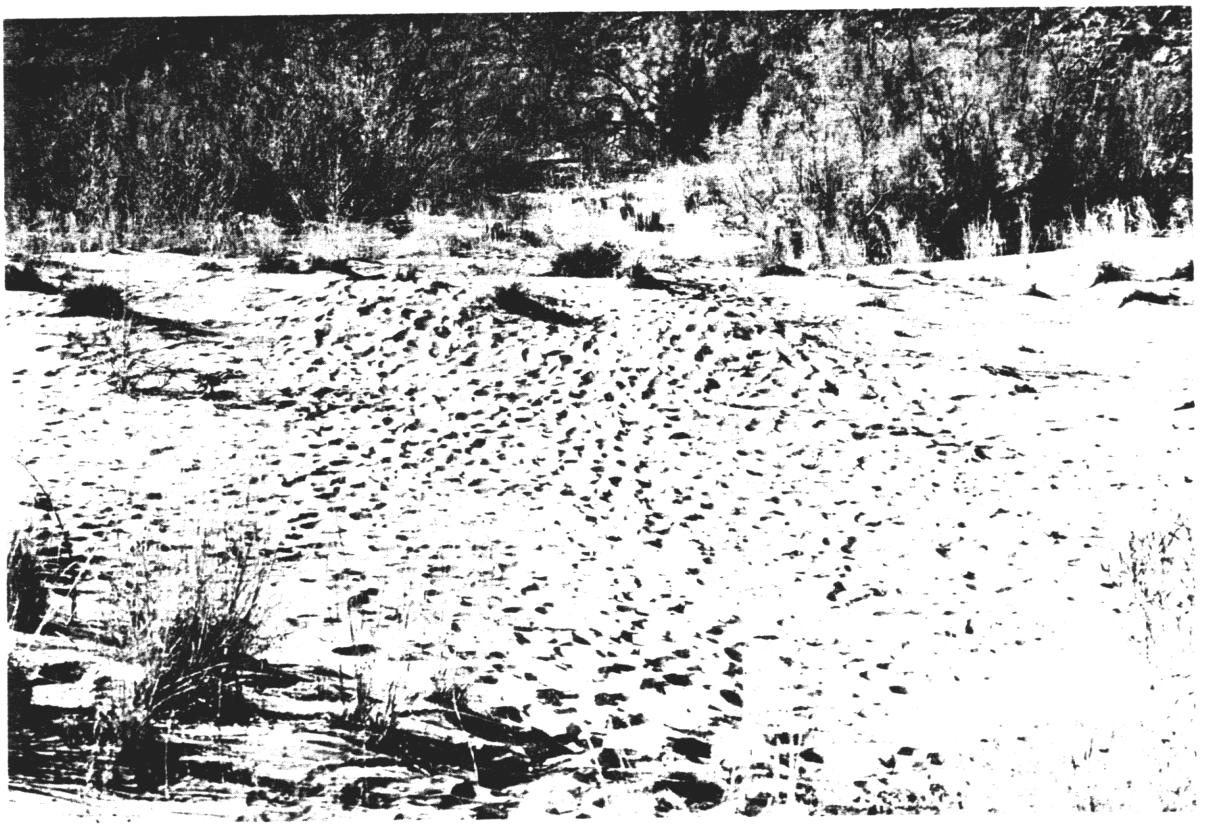
From Lee's Ferry to Separation Canyon (240 miles) 354 campsites are available for an average of 1.5 per mile. However, most beaches occur in clusters; portions of the river have abundant camps and

others have few or no camping areas where the sheer canyon walls meet the river. The critical sections are upper Marble Canyon, Granite Gorge, mile 142 to mile 175 (Great Thumb Section), and Lower Gorge (See River Corridor sections, pages I-15 to I-17. Although the uneven occurrence of river beaches presents a limiting factor in camping space, fewer than 100 beaches receive 75 percent of all camping activity during one season (Carothers et al., 1976). At the more desirable sites 30 to 40 persons camp on the beaches each night during a 3- to 4-month season. Most of the campable beaches are less than 5 acres, and some campsites with capacities of 20 or more persons show damage from overuse (20 to 30 sites). It is estimated that approximately 250 acres or 25 percent of the beaches receive moderate to heavy visitor impact.

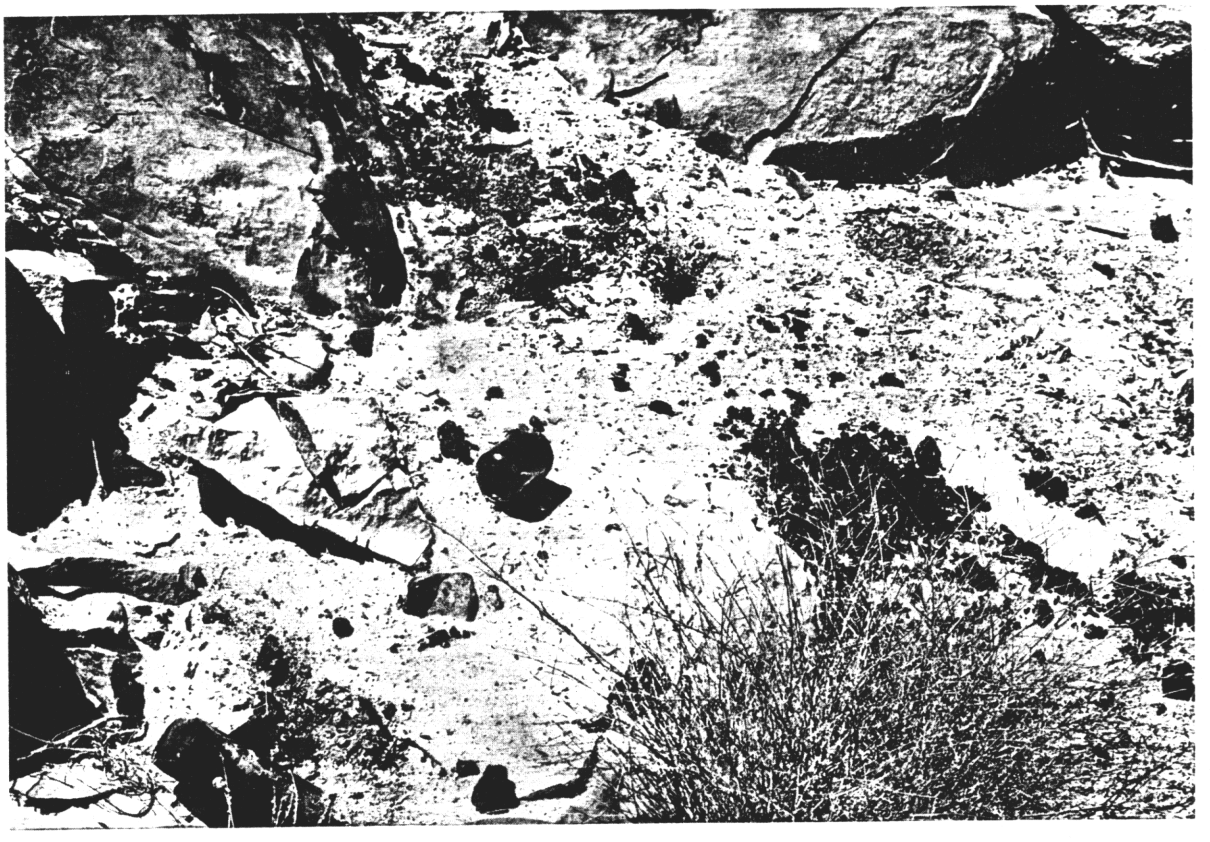
At existing use levels and densities, there is evidence of considerable damage to the riparian vegetation and soils within and adjacent to popular beach areas. The most heavily used beaches have areas of 2,500 to 10,000 square feet largely to completely devoid of vegetation. This is a result of direct stress associated with people walking on the unstable sedimentary deposits and vegetation. The vegetation is sometimes so affected by visitor activities that the further spread of either invasive exotics or native species is reduced or eliminated. This may be either through destruction of the plants themselves or by uprooting of seedlings through disturbance of soil structure (foot traffic). However, without some visitor activity, many campable areas would become overgrown and not suitable for camping (Howard and Dolan, 1976; Carothers and Aitchison, 1976).

Most of the foot traffic on the prime camping beaches is concentrated within 100 meters of the mooring sites and decreases outward exponentially with distance. Use is concentrated along pathways that radiate outward from the main campsite. These pathways are commonly eroded .75 to 1.25 meters in depth. The foot traffic to and from boats and camps dislodges beach material downslope and roughens beach material which increases turbulence at bed surface. Both of these factors accelerate erosion of beach material (Howard and Dolan, 1976). Human debris (food particles, plastic, pop-tops, etc.) is being incorporated into the sand/silt deposits at rates that exceed the purging capacities by natural processes, causing beaches to look and smell like sandboxes found in heavily used public parks.

Also significant is the rate of incorporation of charcoal and ash into beach deposits despite current regulations for fire pans. The charcoal leaks out of the pan or is thrown into the river and redeposited on downstream beaches or transported via wind up and onto campsites (Howard and Dolan, 1976).



Foot Traffic on Beaches



Charcoal and Debris on Beach

2. Off-River Use and Attraction Sites

Off-river use activities are important factors in the visitor's experience. Many spectacular side canyons, river overlooks, and historical and archeological sites are easily available from the river. This interest has resulted in impacts on the resource and to some extent, restrictions on use patterns of the visitor.

The following factors are directly related to congestion and crowding at attraction sites; uneven rate of travel, trip length, number of people leaving Lee's Ferry, and type and amount of off-river use such as hiking and camping.

On commercial motorized trips of 7 days or less in length, little time is spent off-river. On longer commercial motorized trips or on non-motorized trips an average of 1/3 of the day is spent hiking to interest sites. Also, some groups participate in overnight hikes to off-river attraction sites.

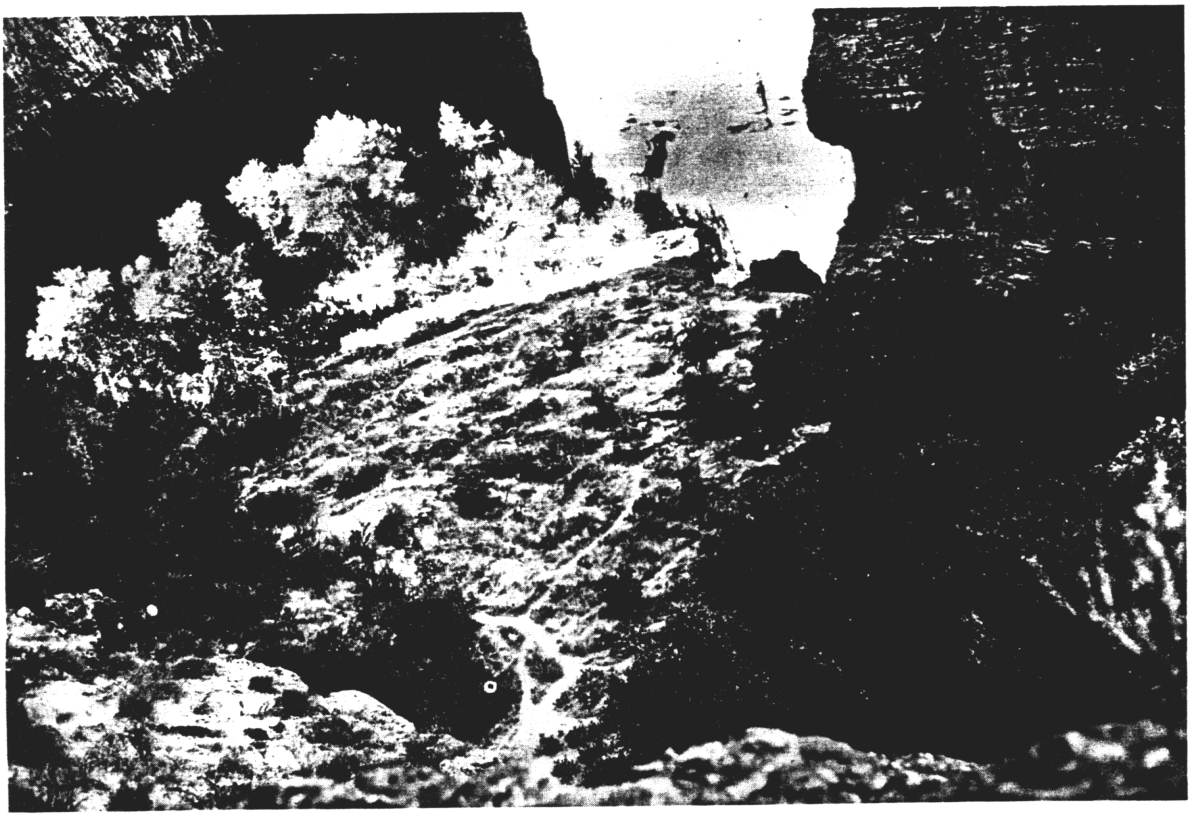
Private trips average 17.5 days and sometimes up to 30 in length. Up to 15 days are spent hiking to off-river attraction sites. Currently there is no limit for length of off-river use or maximum length of river trip. The only limitation is that no more than two nights may be spent in any one location.

Noncommercial users visit more off-river attraction sites than commercial users, but commercial oar users spend more time at sites. Table 12 presents data on the relative differences in attraction site visitation for commercial (oar and motor) and noncommercial (virtually all oar) river groups.

Table 12. Attraction Site Visitation by Commercial and Noncommercial River Travelers

	Commercial		Noncommercial
	Motor	Oar	All Trips
Total number of sites visited	12.1	17.0	21.3
Average length of visit (hrs)	1.3	6.0	3.9

(after Shelby and Nielsen, 1976)



Examples of Multiple Trailing

High visitor densities at prime attraction sites have been found to be detrimental to both the physical and biological preservation of the resource as well as user satisfaction. For example, 2 or 3 river parties (40 to 60 persons) may meet and congregate at such popular sites as the Little Colorado River, Elves' Chasm, Deer Creek Falls, or Havasu Creek. Encounters with other parties occur at about half of all other sites visited. The present chaotic patterns of foot traffic to side canyons, attraction sites, and beach terraces have resulted in severe vegetation damage and soil disturbance. Multiple trails, trampled vegetation and aeolian erosion are evident at the 13 prime attraction sites listed in the proposed plan (I. F. 5).

3. Fire

The use of wood fires for cooking, recreation (campfire talks, etc.) and warmth is presently a common practice of river runners during all seasons of the year. Research findings indicate that there are major resource management problems associated with this use of fire.

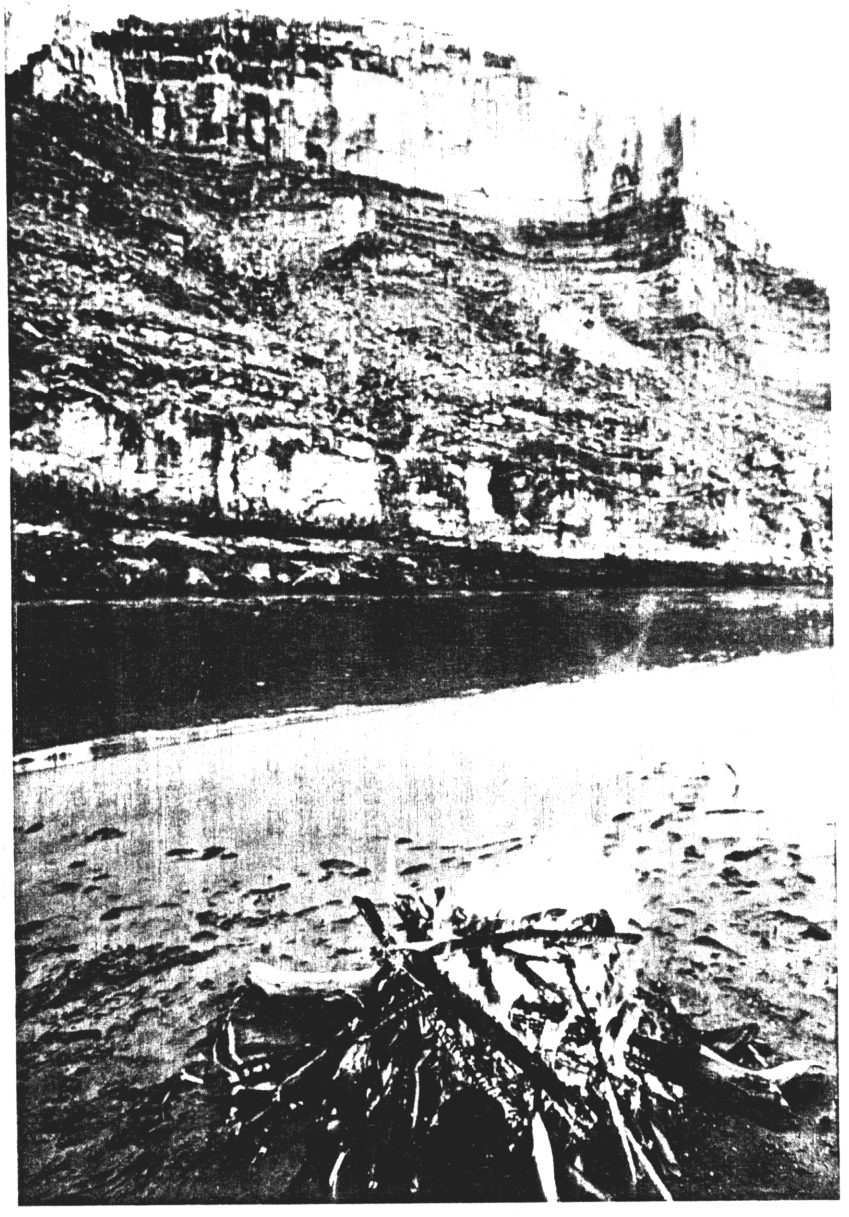
- Depletion of the firewood supply (driftwood) is occurring at a rate exceeding the natural replenishment rates of the system.
- Removal of driftwood piles affect certain wildlife resources (particularly reptiles).
- The ash and charcoal resulting from combustion of the firewood is being incorporated into the beaches at a rate that is currently far in excess of the natural purging processes that act to clean the beach sands.
- Standing and fallen dead trees native to the canyon are being used for firewood.
- Brush fires within the Colorado River Corridor have been caused by the careless incineration of toilet tissue.

Although the current regulations regarding the use of fire are designed to prevent resource impacts, these regulations are (1) not always followed, (2) extremely difficult to enforce and, (3) not adequate for the variety of situations that develop during river trips.

4. Sanitation

The only apparent sanitation problems that exist as a result of the river recreation practices involve the disposal of human waste products. The current regulations require that all organic and inorganic garbage be carried out of the canyon, but provisions allow for the burial of the waste products generated by human metabolism. Under existing visitor use levels, approximately 20 tons of fecal materials are buried annually in the beach soils of the Colorado River.

Results of wildfire started by River Runner



Illegal Fire - No Firepan

National Park Service river regulations require that all river trips carry a portable toilet or other means of containerization of human waste and that these wastes be buried according to the following criteria: The burial site must be at least 200 feet from any area normally used for camping, 6 feet above the normal high water fluctuation, at least 50 feet from the riverbank, and the hole itself must be at least 2 feet deep.

There are many popular camping areas where it is physically impossible to bury the wastes according to the regulation, in fact 18 sites are now off limits to sewage burial because they are not 200 feet long or wide, and no areas other than the immediate camping area where a burial site could be located. When this situation arises, river parties are instructed to carry their waste products to another site downstream where burial according to regulations is possible. These regulations are often not observed, resulting in a waste burial site being located in the center of a camp.

The practice of burying the waste products has resulted in potential health problems and actual esthetic problems. Because of colloidal interactions with feces, beach sand and water, some burial sites do not drain adequately, resulting in feces being buried only a few inches below the soil surface rather than 2 feet down in the burial hole. Wind then uncovers the feces, resulting in noxious olfactory and visual stimulation for the canyon visitor. The actual pathogenic potential of the burial sites is relatively short-lived. Sartor-Lynch and Phillips (1976) determined that 99.98 percent of the viable fecal coliforms perished within the first month of burial and that it is unlikely that contamination from this source could result from one season to another. Nevertheless, with some of the more popular camping areas being in use almost every night during the height of the river running season, health problems exist. Recent research (K. Johnson, 1976 and Knudsen, 1976) indicates the following:

- The health of river runners is potentially endangered due to the numbers of fecal coliform bacteria and associated pathogens which have been found capable of surviving up to 11 months of burial in porta-potty dump sites located on or near camping beaches.

- Fecal contaminants are not restricted to the actual porta-potty dumpsite, but have been found to migrate up to 8 inches away from the dumpsite.

- Random sand samples taken from sleeping, eating, and cooking areas at some campsites contain viable fecal coliform bacteria.

  The disinfectant chemicals presently used in porta-potties do not provide for total disinfection of pathogens associated with fecal wastes.

  Viable fecal coliform bacteria have been isolated from the top 3-6 inches (8-15 cm) of porta-potty dumpsites.

Under current use levels and use patterns, over 5,000 human waste burial sites are annually dug in the beaches of the Colorado River. At the more heavily used campsites, it is not uncommon for a boatman to unearth the remains of the previous group's fecal dumpsite when attempting to bury the wastes from his group. Many of these campsites, for example the Deer Creek Camp (Mile 136, left), are receiving up to 150 separate dumps per river season in an area that does not exceed 5 acres.

Associated with improper disposal of the fecal materials is improper disposal of toilet tissue, kotex and tampons. These items and raw feces can be found in surface beach deposits at most of the heavily used sites and, in some cases, are not associated with portable toilet dumps at all.

There is also currently a serious esthetic and possible infectious contamination problem associated with human waste disposal in all back-country areas of the Grand Canyon where visitors congregate. This problem is accentuated by allowing indiscriminate disposal of fecal materials when the parties are away from the river.

5. Fishing

Fishing is not a major attraction within the river corridor. It does occur along the river and in some of the major tributaries (e.g., Bright Angel and Tapeats Creeks), the common fish caught are channel cat, carp, striped bass, walleye, trout, and occasionally Coho salmon. All these fish have been introduced to the river through stocking or transplant at Lake Mead, Lee's Ferry, Diamond Creek, and the major tributaries within the park. Gila cypha (Humpback Chub) is an endangered species occasionally caught on hook and line. By contrast, fishing in the backwaters of Lake Mead is a popular activity in the Lower Gorge area. For approximately half of the 12,000 lake recreationists, fishing is either the main or an incidental pursuit.

N. SOCIAL FACTORS

1. Commercial Passengers

The 11,500 commercial passengers that annually make passage of the Colorado River through Grand Canyon are a select socioeconomic group. They are not representative of the American public.

Commercial river runners in Grand Canyon have above average income levels, with over half the people reporting family incomes over $24,000. Education level is also high, with 78 percent having at least some college and 53 percent possessing a bachelor's or more advanced degree.

Average age of river runners is 33, 43 percent are married, and half are women. The majority (64 percent) currently live in large cities or suburban areas. Only 22 percent belong to an outdoor club or conservation organization, and for a sizable portion (31 percent), the Colorado River trip represents their first wilderness expedition and for the overwhelming majority (91 percent) the river trip represents their first float down the Colorado (Shelby and Nielsen, 1976).

It has been reported in the "Congressional Record" that restricting river travel to non-motorized craft only, would eliminate a particular socioeconomic/demographic group of park visitors traveling the Colorado River. Studies show, however, that this appears unlikely (Shelby and Nielsen, 1976). Although the demographic characteristics indicate that the commercial passenger is from a fairly select group, there are only minor pretrip background differences between passengers that select motorized trips and non-motorized trips. That is, the social demographic factors which act to "select" river travelers in general are the same for passengers on all commercial trips, regardless of mode of river craft locomotion.

2. Private or noncommercial passengers

There are differences in the socioeconomic/demographic characteristics of noncommercial and commercial river trip passengers (Shelby and Nielsen, 1976). Noncommercial river runners in Grand Canyon have slightly lower incomes (half report incomes over $16,000), are more predominately male (77 percent), are generally younger in age, and are less likely to live in cities. Noncommercial users are more likely to belong to outdoor groups, and they have more wilderness experiences and began having them at an earlier age. The noncommercial user also has more experience running rivers and is more likely to have had experience on the Colorado River before; about 70 percent of 1977 applicants have been on at least one and some have been on as many as 100 Colorado River trips (Grand Canyon NP data).

3. Lower Gorge Users

Visitor characteristics in this zone are of two types. Those continuing their trip from Lee's Ferry would have the characteristics described for that area. The remainder can be described by the Arizona Statewide Comprehensive Outdoor Recreation Plan. They have incomes between $10,000 and 15,000, and the median size family was 2.21 members. Most of the visitors come for active water-based recreation such as water skiing and motor boating.

4. Visitor Perceptions and Preferences

a. Mode of Travel

There are a number of structural differences between the usual motor and oar trips. Motor trips are larger, have more people per boat, have a higher passenger/guide ratio, have more contact with other parties each day, spend less time in the canyon, make fewer and shorter side stops, and make more adjustments for crowding* (Shelby and Nielsen, 1976).

Table 13. Comparison of Motor and Oar Trips

Average	Group Size	Boat Size	Number of Boats	Persons Per Boat	Trip Length	Number of Boatmen
Motor Trip	30	30 - 40 ft.	2	15	7	2
Oar Trip	24	15 - 20 ft.	5	5	14	5
Noncommercial Groups (mostly oar)	12	small/varied	6	2	17	0

Research indicates that 61 percent of those on motor trips and 1 percent of those on oar trips prefer motorized travel. Experimental trips were conducted in the summer of 1975 to further define the effects of motor-oar differences. The procedure involved a combination trip in which one group of passengers spent the first half of their trip in oar-powered boats, while another group traveled in motorboats. The oar-powered boats left two days ahead, and were met by the motorboats about halfway through the canyon; passengers then switched boats. This provided data from a group of people with both motor and oar experience. This procedure was carried out twice, once in July and once in August. Passengers on combination trips, who had experience with both motor and oar travel in the canyon, preferred the oar trip. In response to four different items, 79 to 91 percent chose oar and 4 to 6 percent chose motor (Shelby and Nielsen, 1976).

The most frequently expressed explanations for preferring the non-motorized trip involved the slower, more relaxed pace; the

*Adjustments for crowding are defined as occurring whenever trips went farther or faster than planned, slowed down, changed the location of a planned campsite, or passed up attraction sites because of the presence of others.

opportunity to become aware of the natural sounds and water movements without the drive of the engine; the smaller, more comfortable social groupings; and the feeling of a more sensitive, esthetic experience. People described the motorized trip as speedy, hurried, rushed, noisy, loud, crowded, big, and wet, but also as fun and exciting. By contrast, non-motorized travel was described as leisurely, slow, lazy, relaxing, peaceful, quiet, silent, natural, friendly, individualized, intimate, and again fun and exciting.

Additionally, it has been determined that passengers on non-motorized trips know more about the canyon, i.e., natural history, geography, special attraction sites, etc., than do passengers on motorized trips. This may be due to increased learning opportunities related to mode of travel (motor noise is detrimental to normal relaxed communication between the guide and passengers), length or speed of the trip, or a difference in knowledge before the trip.

b. Crowding

The vast majority (91 percent) of river travelers define their river trip as a wilderness experience and most do not perceive the canyon as crowded.

> "Thirty percent of the visitors see the canyon as crowded, but this is unrelated to the number of people they saw during their trip. The lack of relationship between contacts, perceived crowding, and satisfaction is attributed to the lack of agreement about how crowded the canyon 'should' be. Most river runners are making the trip for the first time; over half didn't know what to expect in terms of contacts with other groups, and there was little consensus among those who had some expectations."

Most people (65 percent) prefer 2 or less contacts per day and 90 percent prefer to camp away from others. Small travel groups are considered most appropriate, with 57 percent preferring groups of 20 or less and another 29 percent favoring groups of 20 to 30 persons (Shelby and Nielsen, 1976).

The noncommercial river runners differed from the commercial river runners in their preference for meeting other parties. They preferred fewer contacts each day and they were more likely to perceive the canyon as crowded and more impacted by the presence of man. They were also more likely to complain that they met too many people during their river experience (Shelby and Nielsen, 1976).

The combination of unregulated upstream and downstream use in the Lower Gorge area often creates congestion. This area is immediately adjacent to a national recreation area and many river travelers do not know they are in a national park. Thus the atmosphere of a recreation area is accepted and complaints of crowding are not frequent. The nature of the use of high speed motorboats, makes contacts with other groups nonsignificant because it is an accepted part of this type of recreation.

c. Visitor Safety

The rapids of the Colorado River create a potential safety hazard to the park visitor. The establishment of safety regulations and boat operator qualification standards by the National Park Service has kept accidents to a minimum. In 1974, 20 accidents occurred; in 1975, 12 accidents occurred. Of this total of 41, 15 occurred from accidents on the boats, the remaining 26 occurred on hiking trips or during camp activities. The injury rate on boats is, then, one in every 2,000 passengers. The injury rate was not significantly different on oar, motor, commercial or noncommercial river trips.

The following table reflects the comparative differences for on river injury rates for both motor and non-motorized trips from 1971 to 1976.

Table 14. On River Injuries Which Resulted in Helicopter Evacuation

Type of Craft*	Year						Total Injuries
	1971	1972	1973	1974	1975	1976	
Motorized	6	6	5	6	4	8	35
Non-Motorized	1	0	1	1	3	1	7

*The number of passengers carried on motorized and non-motorized craft during this period has been about 80 and 20 percent respectively. Thus, motor trips, with 80 percent of the passengers having 83 percent of the injuries whereas the non-motorized trips with 20 perent of the passengers have 17 percent of the injuries. Although these data tend to indicate that non-motorized trips are safer, the difference is not statistically significant.

The motor and oar trips were perceived as equally safe by combination trip passengers (those who experienced the river trip by both motor and oar). Twenty-five precent considered the oar trip safer, 25 percent the motor, and 46 percent felt there was no difference (Shelby and Nielsen, 1976).

Safety problems do occur as uniformed users attempt to run the rapids in the Lower Gorge. Though accident rates are not exceptionally high, a potential for serious problems exist if use increases and visitors are not informed of the potential hazards of the river trips.

O. ECONOMIC FACTORS

1. Local and Regional Economy

The float trip concessions in Grand Canyon National Park represent a multimillion dollar industry. In 1974, 1975, and 1976, the estimated gross income for the industry in Grand Canyon was 4.4 million dollars. Twenty-one concessioners shared in this gross revenue.

The effect that the river running industry has on the local and regional economies of the Grand Canyon area has been summarized by Parent and Robeson (1976). The 21 concessioners represent 16 different base locations in four states. The total taxes paid by the concessioners in their respective states represent a relatively insignificant portion of the total economies of those states.

Table 15. Taxes Paid by Type and Concessioner Location (Parent, 1976)

	Location by State			
Taxes	Arizona	California	Nevada	Utah
Real:				
State	0	423	0	0
Local	0	16	0	422
Sales:				
State	8,772	1,306	4,389	12,627
Local	0	1,275	0	0
Personal Property:				
State	1,263	119	45	0
County	368	1,363	0	7,839
Amusement Tax	0	0	0	0
License Fees	603	4,410	53	1,730
No. of Concessions Reporting	5	6	1	9

Kane County, Utah is the base for 40 percent of the concessioners, and in Kane County, the float trip concessions account for 7.4 percent of the retail sales. Although the total float trip contribution to the economy of this county is less than one percent of the receipts in the county, the monetary benefits could be important to a small community.

In 1975, the Hualapai Tribal river runners received revenues from transporting paying passengers from Diamond Creek to Pierce Ferry.

Visitors originating from Diamond Creek may exit at one of the marinas on Lake Mead and contribute to the incomes of these small businesses. It is assumed that persons who stay on Lake Mead make up the majority of the business for these firms, thus up-river travel does not significantly affect regional or local economy.

The river running industry employes a limited number of people on a full-time basis (other than officers and managers). The majority of the employees are seasonal guides, hired to escort the paying passengers down the river. The normal river running season is five months long (May to September), and the majority of guides are either students or employed in other occupations during the off-season. An average river guide does not earn a total wage equal to or greater than the equivalent of a minimum yearly poverty level wage as suggested by the Department of Economic Security.

There are approximately 200 regular seasonal guides. Most of them live in other locations during the winter season. During the summer when they are on the river, they do not live predominately on the local economy. (Parent, 1976)

As a hypothetical situation, the economic impact of eliminating all commercial river trips in Grand Canyon was explored. The research results indicate that the elimination of all commercial river trips would not have a major economic impact on most communities in which these companies are based.

2. Concessioner Services, Visitor Satisfaction

Concessioners offer a wide range of trips by type, duration and price. For the 1976 season, float trips were available for a range of prices from $125 per person to $650 per person. On trips of the same duration there is little difference between the average cost of a non-motorized trip vs. a motorized trip. The range of prices available for an 8-day oar trip range from $345 to $395, while motorized trips of the same duration range from $345 to $440 (Parent and Robeson, 1976).

The overwhelming majority of commercial passengers on Grand Canyon float trips believe they are getting their monies worth (Shelby and Nielsen, 1976 and Parent and Robeson, 1976). This is further substantiated when the average daily rate of Grand Canyon float trip concessions is compared with that charged for other recreation oriented activities at destination recreation resort areas. The average per day rate for Grand Canyon float trips is generally less than that of other activities elsewhere.

There is, however, evidence of some dissatisfaction in that 32 percent of the respondents surveyed by Shelby and Nielsen said they were willing to pay $100 more for a trip which made fewer contacts with other trips. There is also an indication that the demand for higher priced trips appears to be greater than for lower priced trips. The company offering the highest priced trip used nearly 96 percent of its allotment. In general, float trip passengers are able to choose from among several different products and prices, and since "values" are individually and personally evaluated, there is a greater likelihood that they are being met than dictated when there is such diversity.

P. PROBABLE FUTURE OF THE ENVIRONMENT WITHOUT THE PROPOSAL

Without the proposed plan, management of the river would continue under the present allotment and scheduling system. River recreationists would continue to float the river and experience the canyon. Negative impacts would also continue to occur on the natural, cultural, and sociological aspects of the river environment.

Further deterioration of the riparian resources can be expected due to present use activities. Based on research and previous examples of misuse or unguided use of the river corridor, many adverse changes could eventually alter the character of the Inner Canyon. Some of these changes are summarized below.

Destruction of fragile soil profiles and vegetation due to foot traffic on prime camping beaches and the multiple trailing at attraction sites will accelerate until the natural or historic character of the affected areas is severely degraded.

Foreign materials, such as human wastes, kitchen wastes, ash, and charcoal incorporated into beach sands, could accumulate to the point that few camping sites would be considered suitable for human use. The river cannot purge itself of the litter and wastes of 14,000

persons per year. Unsanitary conditions could force closure of camping beaches and a severe reduction in numbers of visitors may be inevitable. On the other hand, the remaining suitable camping beaches may receive higher use, causing congestion and crowding.

River users expecting a high quality natural experience tend to become frustrated by evidence of overuse and unesthetic conditions. In general, visitors to the National Park System are becoming more aware of environmental quality. As a consumer, the visiting public is capable of judging deteriorating recreational or environmental conditions. Whether river runner or backcountry user, visitor dissatisfaction could develop.

Use of wilderness areas, the search for solitude, and the popularity of river running will increase. All potential users cannot be accommodated within the river corridor, and restrictions on user allocation and numbers of visitors will continue. However, disappointment on the part of the noncommercial segment of the river running public would intensity due to the present allotment ratios.

Impacts related to operation of Glen Canyon Dam will continue and human use will accelerate some of those impacts. According to Dolan (1976) rapids are becoming more severe, beaches are eroding and human activity accelerates that erosion. Beaches are eroding more rapidly in the upper reaches of the canyon than in the lower portion, and while tributaries below the dam slow this erosional process by replacing lost sediments, the long-term trend is toward loss of camping beaches.

III. ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

A. IMPACT ON SOILS AND VEGETATION

Several elements of the plan will directly reduce existing impacts on the soils and vegetation of the river corridor. The portion of the riparian community most affected by camping and mooring are the dam-dependent zones 3 and 4. Zone 3 contains short-lived invasion species such as red brome, tansy mustard, fescue, Russian thistle, and camel-thorn. Zone 4 is composed mainly of salt cedar, arrowweed, coyote willow, and many herbaceous plants. Zones 1 and 2 are affected by off-river use (hiking, attraction sites) and represent the original pre-dam communities (desert and woody vegetation). Refer to Section II. C and H for the description of soils and vegetation and to Section II. M for visitor use activities.

Under existing use patterns, both beach soils and vegetation have been severely damaged by the practice of digging waste disposal holes. Twenty tons of human fecal material are buried in the beach sands annually, requiring 5,000 disposal holes on less than 100 beaches. Each dumpsite contributes to further destruction of the soil profile and the microbiology of the beaches. Vegetation is trampled or uprooted and disturbance of the soil profile inhabits natural germination processes. The practice of burning toilet paper has resulted in brush fires and accelerated erosion on unstable slopes.

The proposal to remove all solid human wastes from the canyon will eliminate the digging activities and the subsequent soil and vegetation disturbance within 250 acres of beach environment. Natural decomposition and cleansing processes of the river ecosystem will require several years to restore beach areas to their original condition.

The use of wood fires for warmth, cooking, and recreation and the practice of collecting driftwood have contributed to soil and vegetation disturbance. Charcoal and ash have been incorporated into beaches at rates that exceed the purging capacities of the river systems. The disposal of waste charcoal and ash in the main current of the Colorado River causes further deterioration of beach soils. The charcoal residue is carried in suspension downstream to the next beach area, where it is re-deposited on the beach face and transported by wind onto campsites.

The gathering of wood for fires has in some parts of the canyon led to the denudation of standing trees both alive and dead. Driftwood is a by-product of vegetative growth that originates primarily outside of the canyon proper. Nevertheless, driftwood supplies form a portion of the natural environment in the Grand Canyon. During the past five years there has been a sharp decline in the available driftwood supply. The present use of driftwood exceeds the capacity of the system to replenish itself.

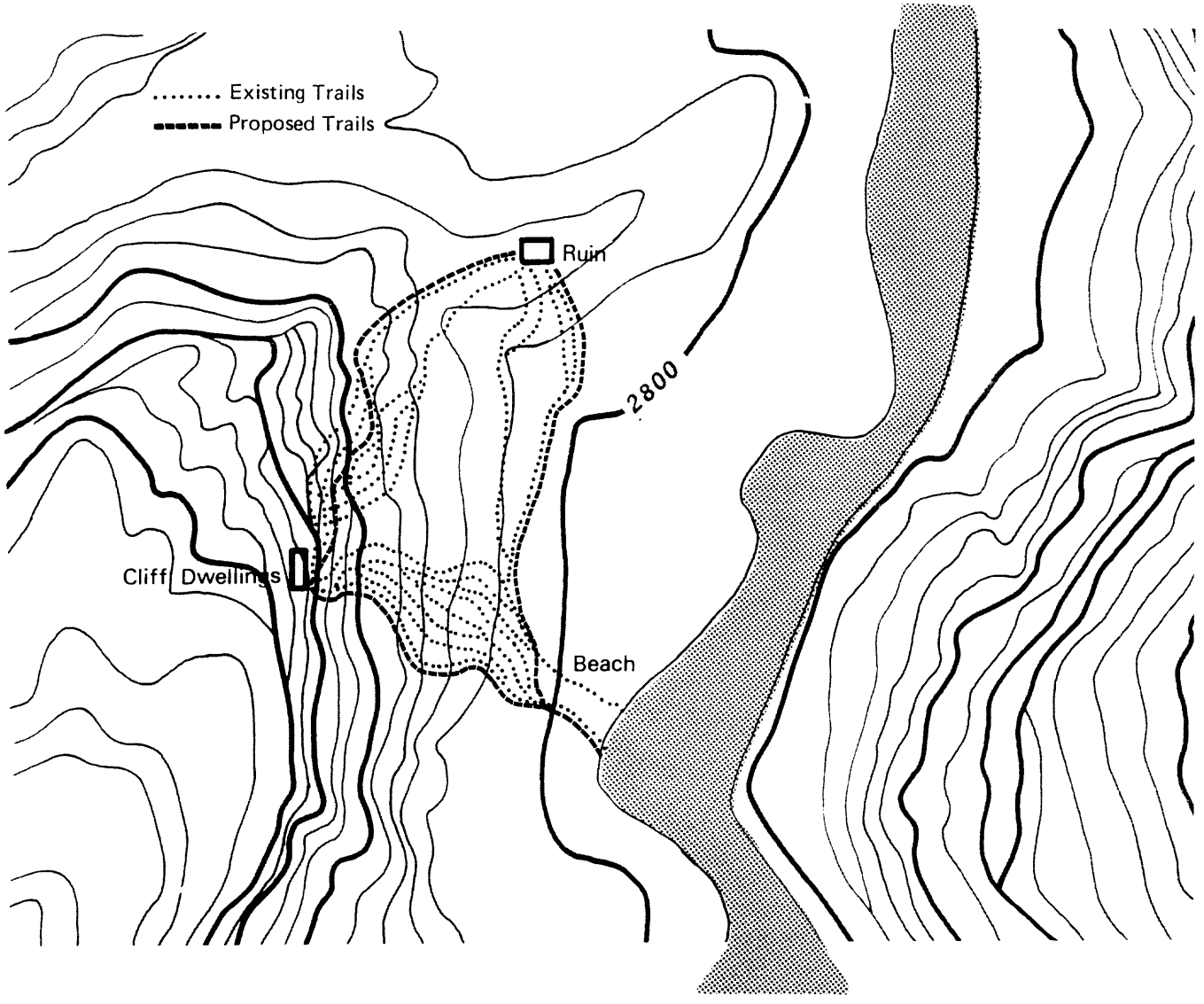
The proposal to eliminate wood fires and driftwood collecting during the summer season (April 1 to September 30) will considerably reduce the amount of charcoal in beach soils and the loss of driftwood along the river corridor. Approximately 2600 fires would be eliminated during the summer season. However, wood fires will be allowed from October 1 to March 31. It is unknown whether or not the reduced rate of incorporation of ash and charcoal into beach deposits would be within the natural purging capacity of the system during the winter season. Reducing the use of fire will allow natural replenishment of driftwood which should meet the demand for firewood during the winter river running season. Minor soil and vegetation impacts will continue due to some spillage of charcoal and ash from fire pans and failure to properly deposit and carry out all cooking fire residues. Minor trampling of soils and vegetation will occur due to driftwood collection during the winter season.

Other activities and patterns of use that result in natural resource impacts are overuse of popular beaches and crowding and congestion at attraction sites. Soils and vegetation have been severely impacted at both beach and attraction sites, due largely to foot traffic and subsequent trailing and trampling of vegetation. Soil disturbance, accelerated erosion, and changes in vegetation are apparent in heavily used areas where multiple trails, all with the same beginning and same end, are maintained by large numbers of people. For example, at Nankoweap (see following illustration), more than 15 trails have developed between 3 points. Much of the native streambank growth in the larger tributaries such as Clear Creek, Hermit Creek, Tapeats Creek, and Havasu Canyon, also shows heavy damage because of foot traffic.

The proposal to construct 12.1 miles of trail at 13 attraction sites will serve to delineate an appropriate walkway to each site and discourage uncontrolled access to areas of interest. The number of areas with multiple trails will be reduced and approximately 4,700 acres of disturbed soil and vegetation will be allowed to recover (see table 16). Trail construction itself will result in short-term adverse effects. Some minor cut and fill will be required and ground disturbance can be expected within 4 feet of the trail alignments. Due to construction in sedimentary deposits and on unstable slopes, minor erosion will occur. However, the rate of erosion from wind and water is expected to be far less after trail development than at present.

Actions that will indirectly serve to prevent further visitor impact at beach and attraction sites involve daily, weekly and seasonal scheduling, as well as the more uniform rate of travel through the canyon due to the elimination of motors. At present, more than 150 persons per day and as many as 940 per week leave Lee's Ferry. Trip length through the canyon

varies from 5 to 11 days by motor and from 12 to 18 days by oar power. The uneven dispersal of use and varying rates of travel, especially during the months of June, July, and August, cause overuse of certain beaches and crowding and high density at attraction sites.



Nankoweap - Multiple Trailing

Proposed scheduling of oar-powered trips will reduce the total number of persons leaving Lee's Ferry per day by 50 percent and allow a maximum of 525 persons to launch per week. Use will be uniformly dispersed throughout the summer season and extended into the winter season. With fewer people on the river at any given time, the probability of congestion and crowding at attraction sites will be reduced, thereby, alleviating potential resource impact.

Table 16. Multiple Trail Impact and Restoration

Existing* Disturbance	Approximate Acreage	Estimated Acreage Improved** Through Trail Designation or Construction
South Canyon	160	75
Saddle Canyon	1200	300
Nankoweap	1000	600
Little Colorado	200	50
Cardenas Creek	320	160
Unkar	1200	700
Hermit Creek	1200	600
Shinumo Creek	1200	300
Elves Chasm	640	160
Stone Creek	640	160
Tapeats Creek	1000	550
Deer Creek	640	350
Havasu	1200	700
Total	10,600	4,705

* Existing disturbance encompasses both direct impact and radiating effects within a given area. Direct impact (multiple trails, gullying, erosion, compaction) affects approximately 25 to 40 percent of each area. Marginal impact entails occasional trailing, soil disturbance, and vegetation damage. Some areas, such as Nankoweap, contain beaches, ridge overlooks, cultural sites and tributary streams, which are included in total acreage of disturbance.

** It is estimated that 25 to 60 percent of each site will be improved through trail construction. Until trail designs are developed and recovery rates monitored, exact acreages for restored areas cannot be given.

Beach use will also be more evenly dispersed throughout the season which will eliminate the heavy 3-month impact.

It is probable that the most heavily used beaches will continue to be the most popular throughout the year, and soils and vegetation will continue to receive impact. Furthermore, the longer trips require each person to camp more nights in the canyon. This, coupled with the proposed increase in user days (from 122,600 to 225,695), will increase beach use. However, oar trips generally carry fewer persons per party than do motor trips, 24 persons as opposed to 30 persons. With fewer people camping per night at each beach and total use spread more evenly throughout the canyon, overall resource impacts per beach are expected to be less than at present. Rotation, restriction, or scheduling of campable beach areas will not be attempted unless future monitoring indicates an impact level that is unacceptable.

The increased allocation to noncommercial users (from 7,600 to 58,770 user days) may result in greater impact on beach and off-river resources. Although there is no concrete evidence, it has been suggested that noncommercial river runners may be more damaging to the natural resources than commercial parties despite the fact that the noncommercial people were more knowledgeable about natural features and geography in the canyon at the end of a trip. This observation is generally shared by researchers (Carothers and Aitchison, 1976) and National Park Service patrol trips. This is not to say that noncommercial river runners cause all the damage, but that they may be less inclined to follow the requirements or less knowledgeable of the special techniques for protection of the natural resources. Adverse impacts could include soil and vegetation disturbance caused by using or creating multiple trails, burial of garbage or human waste, and improper use of fires.

The above probable effects, however, can be reduced under the proposed plan. All noncommercial river trip leaders will be required to have adequate knowledge of the regulations and to attend an education/orientation program before running the river. All noncommercial visitors will be afforded the opportunity to gain the knowledge necessary to prevent resource damage. The possibility that commercial or noncommercial river runners may inadvertently or purposely disregard resource protection measures will continue to exist.

The allocation of commercial use by fact sheet offering would allow park managers to consider all responses from any company desiring to operate river running services through Grand Canyon. Companies with the proper background and knowledge in resource protection could be chosen. This will serve to aid in control of visitor patterns of use, lessening impact on natural resources.

At present, the Lower Gorge area is relatively unmanaged, lacking restrictions and adequate regulations for visitor use. Also, lack of patrol and interpretation in this zone has resulted in deterioration of esthetic qualities, sanitation, and safety.

There are clear and definable differences in attitudes, equipment, experience, and resource conservation consciousness between the commercial and noncommercial river runners and lake recreationists. Clearly, the commercial river running interests are more prepared to take proper care of the natural resources in that they are continually exposed to National Park Service resource protection indoctrination. The lake recreationists are at the opposite end of the scale. This is evidenced by the fact that below the Diamond Creek area, accumulated litter on beach areas dramatically increases. Strictly enforced and publicized regulations geared to the needs of the lake recreationists will reduce resource impacts along the lakeshore.

Because the requirement to carry out all solid human wastes will not apply to lake recreationists using powerboats, unavoidable adverse impacts resulting from human waste disposal in beach areas and attraction sites would continue.

Although, off-river hiking and camping is not a significant use of the lake and river in the Lower Gorge, several sites show high use. These areas include: Travertine Grotto, Spencer Canyon, Quartermaster Canyon, Bat Cave, Rampart Cave, and Emory Falls. Use impacts, such as uncontrolled foot traffic, erosion, and vandalism would continue. Misuse of these and other areas can be correlated to two main factors: lack of patrol and lack of education. Increased interpretation and education, as well as added patrols would probably reduce overall resource impacts to an acceptable level.

The known threatened or endangered plant species, for the most part, are found above the current high water line in Zones 1 and 2, and to some degree in Zone 3. Primary impacts on these species would occur through trampling related to camp activities and hiking to attraction sites. Although the plants are fairly well distributed throughout the canyon, no critical habitat areas have been determined at this time. Impact will occur to individual plants, but will not significantly affect the overall population of any species.

In summary, the overall effects of the plan will significantly reduce disturbance to soils and vegetation in the riparian zones of the river corridor, and to some extent in the lake area below Separation Canyon. Direct actions, such as elimination of human waste dumpsites, the reduction in wood fires, and trail construction will have a positive effect on 250 acres of beach area and approximately 4,700 acres of soils and vegetation at the 13 major attraction sites. Moderate visitor use impacts will continue at popular beaches and in areas of off-river camping, hiking, and special interest sites. Visitor related impacts on the resource are caused largely by existing practices, patterns, and activities rather than by the total

number of persons allowed on the river (Carothers and Aitchison, 1976). Therefore, with certain practices changed or eliminated and patterns and activities modified, the riparian ecosystems are expected to receive less impact and remain relatively unimpaired.

B. IMPACT ON WILDLIFE

In general, no serious adverse effects on terrestrial fauna are evident under present use levels. Visitor use activities can, however, cause shifts in animal behavior patterns and populations. Actions that presently disrupt animal or fish species include intentional or unintentional feeding, improper human waste and garbage disposal, habitat destruction through trampling, pruning, or collection of vegetation, and use of soap in side streams or tributaries.

At heavily used campsites intentional feeding or improper garbage disposal encourage high concentrations of campsite scavengers such as the ringtail, spotted skunk, and common raven. The harvester ant has become a problem, and increases in the densities of flesh flies and blow flies has been associated with the improper disposal of fecal waste materials. The digging of waste disposal holes may also interfere with the normal activities of ground dwelling and burrowing animals. A reduction in lizard populations has been noted due largely to the decrease of driftwood on which lizards rely for shelter, displaying, and foraging.

Plan actions that will alleviate wildlife disruptions include proper disposal of human wastes and garbage outside the canyon, reduction of driftwood collection, increased education of all river travelers regarding wildlife, and the continued regulation against use of soap in the tributaries. The amount of scavengers and campsite pest insects will be reduced, and the adverse effect of digging on ground burrowing animals would be eliminated. Impacts on wildlife, especially lizards, that are associated with removal of driftwood piles will be reduced.

Three species of endangered birds, the bald eagle, the peregrine falcon, and the brown pelican (accidental) are known to utilize the Grand Canyon environs. The present use levels have no apparent effect on these animals, and no adverse impacts are foreseen due to proposed use levels and allocations.

The endangered humpback chub largely restricted in distribution and breeding population to the mouth of the Little Colorado River, is occasionally caught by visitors on hook and line. To protect this species, the restricted area on the Little Colorado will remain in effect. No camping or fishing will be allowed within ½ mile of the stream's confluence with the Colorado River. Although there will be increased use during the spring and fall months, no significant disturbance of wildlife populations is anticipated.

C. IMPACT ON WATER QUALITY

The present use levels and patterns have minimal effect on the quality of water in the Colorado River and its associated tributaries in Grand Canyon. The existing impacts come from the production of hydrocarbons from outboard motors, seepage from human waste dumpsites, the incorporation of camp waste water, and the use of detergents.

The current use of outboard motors results in the consumption of approximately 25,000 gallons of gasoline per year during float trips on the Colorado River. Pollutants added to the river as a result of motorized travel include approximately 5,750 pounds of oil annually, as well as gasoline from leaking tanks and oil spills. The elimination of motor use on the river will prevent incorporation of oil and gasoline products and generally enhance water quality of the river.

The potential for localized pollution adjacent to campsites or along tributaries will be eliminated when all human fecal material is removed from the canyon.

Waste water from cooking and washing activities in camping situations will continue to be disposed of in the river. The use of soaps and other detergents in the river will continue to be permitted; however, using soaps in the tributaries is and will not be permitted. The amount of phosphates released to the main stream are probably insignificant.

The amount of all pollutants added to the river by visitor activities will probably be insignificant due primarily to the high dilution factor related to the volume of water in the river.

Therefore, the above actions will slightly improve, but not significantly change the overall water quality of the river and its tributaries.

D. IMPACT ON AIR QUALITY

The present use patterns have a minimal effect on the quality of the air in the Inner Canyon area. The existing impacts result from the production of outboard motor exhaust pollutants and the particulates generated from cooking and recreation fires.

The current use of outboard motors results in the consumption of approximately 25,000 gallons of gasoline per year during the float trips on the Colorado River. The hydrocarbons generated by gasoline combustion will no longer enter the atmosphere when motorized travel is eliminated.

The combustion of wood at present levels has only a slight local and temporary effect on overall air quality along the Colorado River. Reducing the number of fires would only improve on this situation.

Local impacts due to odors caused by motor exhaust and gasoline while on the river or at mooring sites will be eliminated. Also the noxious odors associated with improperly buried fecal material will no longer impair air quality in beach camping areas.

Pollutants added to the air through river running activities are local and temporary. Actions of the proposed plan will have a positive effect on air quality of these localized areas, but no measureable effect on overall quality of the air within the Inner Canyon.

E. IMPACT ON CULTURAL RESOURCES

The gathering of firewood and the disposal of human waste along the river corridor are two activities that can cause direct destruction of cultural resources. Firewood collecting has become particularly damaging to some of the archeological and historical resources in the canyon. The present use patterns have resulted in such a shortage of firewood that the river runners are frequently forced to halt other activities in the early afternoon and specifically gather firewood wherever it is available. None of the heavily used campsites have a supply of firewood now. During their firewood foraging activities, the river runners occasionally come in contact with the remains of some previous occupation (e.g., Hance Cabin, Bert Loper's boat, etc.). The result has been that these structural resources are disappearing. In addition, the gathering of firewood on some of the beach terraces may cause the disturbance of surface archeological remains. The digging of waste disposal holes can also cause serious disturbances to the irreplaceable archeological resources in areas of the canyon where sites are known to be abundant, such as Nankoweap and Unkar.

The reduction and limitation of wood fires and the removal of all human waste from the canyon will serve to protect the remaining cultural resources. The deterioration of historic structures due to firewood gathering practices and the potential for digging into an archeological site for a waste dump hole will be eliminated.

Although vandalism results in a certain amount of destruction under existing use patterns, the principal impacts result simply from visitation to the historic and archeological sites. The proposed plan will lengthen the visitor's stay on the river and, therefore, increase day-use visitation of the cultural sites. However, the high-density use

patterns at attraction sites will be modified, serving to lessen the deterioration of sites where crowding and uncontrolled use occur. Increased annual visitation could accelerate the rate of deterioration of these areas and, without mitigation, could result in the loss of valuable non-renewable resources.

To ensure preservation of cultural resources at the proposed use level, all archeological sites within the river corridor will be evaluated and receive protective treatment, if needed (stabilization, testing, or excavation). There will be a minor loss of scientific data due to stabilization, testing, or excavation in that any removal of material from its cultural context reduces the amount of information available for future archeological research (see I. F. 5 for specific sites).

All historic remains will be evaluated for historic significance, and those meeting the criteria for the National Register of Historic Places will be nominated. Eleven historic sites will be preserved through protective devices or stabilization.

Other sites, not immediately adjacent to the Colorado River but easily accessible to river runners and backcountry users, that will be investigated include: Hermit Camp. Boucher Camp, and Bat Cave Guano Mine.

Another action that will serve to offset visitor use impacts and reduce deterioration of cultural resources includes the implementation of educational/orientation programs for boatmen, commercial trip leaders, and guides and noncommercial river runners.

In summary, both direct and indirect adverse impacts on cultural resources will be reduced through the reduction of firewood collecting, the removal of human waste from the canyon, and the modification of high density user levels. Inadvertent harm and deterioration due to greater visitation will be reduced through direct preservation or protection, interpretation and education. No serious impacts on cultural resources are expected to occur as a result of the proposed actions.

F. IMPACT ON VISITOR GROUP CHARACTERISTICS

Under the present use levels, the river running public represents a select socioeconomic/demographic group. A change in total use levels would not be expected to have any effect on this overall pattern. Similarly, the removal of motorized craft would not affect any socioeconomic/demographic group utilizing the river between Lee's Ferry and Separation Canyon (see Section II. N. for discussion). Since both oar and motor trip passengers possess essentially the same education, economic and urban backgrounds including such characteristics as age, marital status and number of children, the shift from motors to oars will not alter the overall composition of the commercial river running group.

Motorized traffic and up-river travel will be eliminated from Diamond Creek (Mile 225.6) to Separation Canyon (Mile 239.5), but will be allowed to continue on downstream from Separation Canyon to Grand Wash Cliffs (Mile 277). This will adversely impact those boaters who now make up-river runs in the rapids above Separation Canyon.

No change is expected in characteristics of the visitor who participates in a recreational activity in the Lower Gorge section of the canyon below Separation Canyon. The people in this part of the canyon come for different experiences than the participants in the upper 240-mile river trip. Present visitors are primarily interested in water-based recreation, the use of powerboats, and the scenery for short weekends or one-day experiences. It can be assumed that these people will continue to visit the backwaters of Lake Mead and will not be affected by proposed management actions above Separation Canyon.

The proposed allocation of use between commercial and noncommercial parties could change the socioeconomic/demographic characteristics of the total river running population. The research results, summarized below, indicate the potential shift under present use conditions.

The private and commercial groups differ in demographic characteristics, so alterations in the precentage of use allocated to each group would affect the demographic composition of the river running population. If the percentage ofprivate use were increased, more people who are young, male, of slightly lower income, and from less urbanized areas would be running the river. If total use remained constant, an increase in private use would, of course, mean a decrease in commercial use, and consequently a decrease in the number of persons with "commercial" characteristics (e.g., older persons, women, etc.). The magnitude of these shifts would probably not be large, since correlations of trip type with demographic variables are fairly low. For example, a change to 50 percent private, 50 percent commercial would be expected to change the average age of river runners from 32.4 to 30.3. Private users also have more outdoor and river running experience, so an increase in private use would probably cause an increase in the number of river runners with such experience (Shelby and Nielsen, 1976).

Under the proposed plan one of every four river runners will be a noncommercial user as compared to one of every 20 under status quo or one of every two as indicated in the above example. Although commercial use will decrease by approximately 1000 persons (excluding those taking half trips from Phantom Ranch) and noncommercial use will increase by 2,600 persons, overall visitor characteristics are expected to shift slightly, but not to a significant degree.

In summary, the proposed elimination of motors above Separation Canyon and the allocation of use will not alter the overall composition of the river running groups to any great degree.

G. IMPACT ON VISITOR OPTIONS

The removal of motors, the allocation of use, increased use throughout the year, and scheduling will have an effect on the range of options available to the river recreationists.

With the elimination of motorized float trips, park visitors who prefer only motorized travel may forego the river running experience through the Grand Canyon. Research data obtained during the sociological studies indicate that 98 percent of those on commercial oar trips and 15 percent of those on commercial motor trips prefer to run the river on an oar trip. Of those who had the opportunity to experience both types of travel, approximately 5 precent preferred motorized craft. Assuming this group represents the river running population, only 550 of the 11,094 people who ran the river in 1975 would be adversely affected by the change from motors to oars.

The elimination of motors in the Lower Gorge from Diamond Creek to Separation Canyon (15 miles) will reduce visitor options, in that motor boat trips down river with the Hualapai will be eliminated, and visitors will have to make that distance in rowing craft. Also visitors will lose the option of up-river runs in the rapids of the Colorado River in Grand Canyon.

However, those canyon visitors who come by boat from Lake Mead National Recreation Area will be relatively unaffected by this action. Most of the lake boating occurs well below Separation Canyon. Some boaters do go up the canyon as far as the first rapids (Mile 237), and their option to do so will be eliminated by this action.

Those users continuing a trip from Lee's Ferry past Diamond Creek, or beginning a trip from Diamond Creek, would still have the option of motoring across the lake slackwater below Separation Canyon.

Options involving length of trip and off-river use will differ to some extent from the opportunities available under existing conditions.

The exclusion of motorized craft would lengthen the minimum amount of time required to traverse the Grand Canyon by river from 5 to 11 or 12 days. Motorized trips average 8 days in length, non-motorized trips average 12.5 days in length. The option of a short 5- to 10-day trip through the entire canyon will no longer be available. However, the option of half-canyon trips would still be available, either beginning or ending at Phantom Ranch. In addition, trips ranging

from 1 day to 12 or more days will be possible, but will involve hiking into or out of the canyon or both. Examples are provided below:

Trail In	On River	Trail Out
Hance	1 day	Bright Angel
Bright Angel	1 day	Hermit
Bright Angel	2-3 days	Tapeats-Thunder River
Tanner	3-4 days	Havasu
Little Colorado	8-9 days	Whitmore Wash

The maximum length of trip will be limited to 18 days in the summer season and 30 days in the winter season. Visitor options in terms of maximum length of stay will remain about the same. Noncommercial parties will forego the opportunity to spend an unlimited amount of time in the canyon during both summer and winter seasons.

Noncommercial passengers will have greatly increased options due to both the increase in user days (from 8 to 30 percent), and the more even dispersal of commercial use during the peak summer months. Some commercial users, on the other hand, will be inconvenienced due to reduced numbers of float trips during the peak months of June, July, and August.

Oar-powered trips allow more time for the visitor to experience the various points of interest within the canyon. Trips of 18 days in the summer season and 30 days in the winter season will provide a variety of options for off-river use, including the opportunity to visit more attraction sites or unique canyon features, to hike, and to camp. Average trips of 12 to 14 days would provide 5 to 6 additional days for off-river hiking or scenic viewing in the summer. In the winter, up to 19 additional days would be available for off-river use.

Within the portion of the public desirous of a river trip a variety of user interests exist. These segments exist in unequal sizes, and their satisfaction is a function of the type of trip and options offered. Not all people want a long trip, or want to do extensive hiking. Amount and length of stays off river and on river would be factors delineated in a fact sheet used for selection of concessioners. By choosing companies offering a variety of trips, a wider range of visitor options would be made available, thus satisfying an even larger portion of the public than is satisfied under status quo.

In summary, the proposed changes will not significantly alter the range of options presently available to the river running public. Commercial passengers may choose from trip lengths ranging from 1 to 18 days, and opportunities for off-river use will be greater. Options for the noncommercial passenger will increase, providing a wider variety of choice. Those river recreationists preferring motorized travel will be adversely affected. The option of a short, speedy trip through the canyon will be denied a small percentage of the river running public.

H. IMPACT ON THE VISITOR EXPERIENCE

Providing a high quality river running experience is a concern of both commercial outfitters and National Park Service managers. Although the quality of an experience is hard to define, there is some general agreement that two major factors have an important effect on the visitor's river trip experience: the amount of use encountered on the river and the kind of trip taken (whether motor or oar). Other important aspects include esthetics, interpretation, and education.

1. Contact and Crowding

Elements of the plan that serve to reduce the resource impacts that result from crowding and congestion at attraction sites will also operate to reduce contacts while on the river, and contact and congestion at off-river areas of interest. These include less variable rates of speed due to the removal of motors, the smaller trip size, and scheduling.

At present, commercial trips leaving Lee's Ferry travel at different speeds and take 5 to 18 days to traverse the canyon. Fast trips, then, may encounter people who left several days before them, while slower trips are passed by those leaving later. A typical river trip during the 1975 or 1976 season met between three to four other trips on the river each day and spent about 40 minutes per day in sight of other parties. By eliminating the use of motors, the speed variable is reduced considerably. This coupled with the daily and weekly launch restrictions will probably reduce on-river encounters below present contact levels. Trips would also be scheduled in such a manner as to allow an average of approximately 6.25 miles between groups. Overall, contacts on the river and at attraction sites would be within the range preferred by the majority of the river running public, which is lower than at present (See Section II. N. 4 for visitor preferences). The variables of trip length, time spent at attraction sites, and length of off-river hiking will continue to influence the probability of contact.

Two elements of the proposed plan could increase the probability of higher contact levels--the allocation of noncommercial use and the short trip to or from Phantom Ranch.

Noncommercial river trips spend more time off river and in the canyon than do the commercial trips. The average length for noncommercial trips is approximately 17.5 days. The greater number of noncommercial users, staying longer within the canyon could influence contact levels. This potential effect is not, however, considered significant. Noncommercial users prefer even less contact than do commercial users and will tend to avoid crowded areas.

The more even dispersal of use will also offset contact or crowding potential of increased noncommercial use.

Because non-motorized craft take longer to traverse a given section of the river, the demand for partial trips of 6 days in length to or from Phantom Ranch may increase. Partial trips would increase the overall number of people who are to take river trips. The amount of increased numbers would be difficult to predict at this time. It might seem at first glance that this activity would increase disproportionately, causing river congestion and greater use of hiking and camping facilities in this major passenger transfer area. However, there are certain built-in and natural limiting factors. Those factors are:

- There is a campground limit of 75 people at the Bright Angel Camp at Phantom Ranch. This will limit the number of people who would hike down to the river or out with an overnight stay.

- The commercial accommodations at Phantom Ranch have a limited capacity of about 75 people per night which also limits the number of people who could hike in and stay overnight or stay overnight and then hike out.

- There is a limit on the number of mules allowed on the Bright Angel Trail which limits the number of people who could ride a mule in or out. There is no limit at the present time that addresses itself to how many of those in mule-ride parties can be going on or coming from river trips, but if the number becomes disproportionate, a limit would have to be imposed to ensure that other park visitors wanting a mule ride would not be turned away due to excessive river ingress or engress mule riders.

Under present management, about 1000 persons take half-canyon trips. Even if this use were to double, the potential increase is not expected

to adversely affect contact levels nor create undue congestion or crowding in the Phantom Ranch area. This conclusion is partially based on the assumption that not all less than full-length trips would ingress or egress at Phantom Ranch.

Finally, the reduced party size and the smaller number of persons per boat on the oar-powered river trip will decrease off-river congestion and more nearly approximate visitor preferences. The majority of commercial users favored a small party size of 20 persons or less, and 80 percent preferred to run the river with a party of 30 or less. Most visitors also preferred to meet smaller parties on the river and at attraction sites.

In summary, with the more even dispersal of use during a longer season, daily and weekly launch schedules and small party size, the number of contacts per day and the number of persons encountered off river should be reduced. The visitors' river running experience, in terms of the amount of use encountered on the river, is expected to increase in quality.

The combination of upstream and downstream use in the remaining 37 miles of river corridor would continue, as would the probabilities of contact and congestion. Because the Lower Gorge is adjacent to a recreation area, the use of high speed motorboats and greater contact levels are accepted as part of the lake experience. However, the transition from the quiet oar trip to the motorized crossing of the lake could adversely affect the quality of the visitors experience, in that the feeling of wilderness will abruptly end at Separation Canyon.

2. Trip Character

The proposal to convert from motorized to oar-powered river craft will significantly affect the type and character of the river trip available to the visitor. Each of the following changes will, to a lesser or greater degree, affect the overall quality of the visitor's experience.

- Large motorized craft will be replaced by smaller craft
- There will be more craft per party and fewer people per boat
- River guides per party will increase
- River parties will spend more time in the canyon

. River parties will visit more sites and stay longer off-river

. Motor noise will be eliminated

. The fast, short trip will be eliminated

Research has indicated that non-motorized trips are more pleasing to the visitor (See Section II. N. 4 for discussion). Reasons given suggest that oar travel is seen as more consistent with a natural or wilderness experience. Passengers who had experience with both motor and oar trips preferred the oar trip. They enjoyed the slower pace, could relax; they became more aware of natural sounds in the canyon; and they were able to observe more closely the unique features along the river and more easily ask questions of their guide.

Smaller social groupings appear to influence feelings of comfort, friendliness, and comradery. On oar trips, the passengers could communicate freely at normal voice levels among themselves and with the boatman. The strain of trying to hear or to be heard over the noise of the motor was eliminated and made the oar trip more enjoyable.

The slower oar trip allowed more time at a site, visits to a greater number of attractions and provided passengers an opportunity to see and explore features of interest at their own pace. Oar passengers showed greater knowledge of the canyon and gained a fuller appreciation of canyon resources.

Clearly, the mode of travel, smaller parties, length of time spent in the canyon and lack of noise contribute to the character of the river trip. This type of trip, in turn, influences the overall human experience which includes social interaction, the learning process, satisfaction, and awareness.

In summary, because the oar trip appears to contribute substantially to the quality of the river running experience, no significant adverse effects on the visitor experience are anticipated due to the proposed change in trip character. However, disappointment and minor inconveniences may be felt by a small percentage of people due to their preference for a faster more active motorized experience. Also, those visitors who cannot spend the amount of time required to travel the entire river by oar, may choose the half canyon or other less than full length trip, but experience disappointment in not seeing the whole canyon. Although the quality of the river trip to or from Phantom Ranch would remain the same, the time restraint felt by the individual could adversely affect his or her river running experience.

Other factors that may alter trip character and thereby affect the visitor's experience to a minor degree are season of use and new regulations.

Climate and temperature impose varying constraints on river runners throughout the year. For instance, cooler temperatures during the winter months require additional clothing for warmth, and summer thunderstorms on many afternoons during July and August can either bring relief from high temperatures or discomfort if caught in the rain.

The extended river running season will have both advantages and disadvantages depending upon the month of year and the expectations of individual visitors. The spring and fall months, now underutilized, potentially provide the better trip experience; the temperatures are not extreme, rainfall is rare, and natural elements are of more interest. Spring and fall are the times of natural change: bird migrations, nesting activities, desert floral displays, and bighorn lambing. Adverse effects on the visitor experience can occur when the individual prefers the character of a summer trip, but must choose either late spring or early fall to run the river, due to proposed regulation of trip launches affecting the peak summer months.

The winter river trip may require a "hardier outlook" on the part of river travelers choosing this season; it offers more solitude but colder temperatures. River running in the winter presents additional preparation requirements. Where marginal clothing for summer includes cut-off trousers, bathing suits, and light weight shirts, winter travel will require warm waterproof clothing and possibly wet suits. Additional preparations for warmer sleeping gear are also needed. Constant awareness and remedial action to prevent or correct hypothermia is necessary. However, if preparations are made and proper precautions taken, winter trips can be very rewarding and are no more difficult or dangerous than other winter sport activities. Night temperatures are usually below freezing during only December and January and the daytime temperature is pleasant.

The total river running experience for most visitors will not be adversely affected by the character of the trip during any particular season. In general, those preferring the summer season trip would be accommodated as would those favoring the winter trip. The overwhelming experience of the canyon itself usually far outweighs the minor inconveniences brought about by climate or temperature.

Similarly, new regulations and restrictions could cause minor inconvenience but not to the degree that the visitor's experience would be adversely affected. As implied in the previous discussion, the regulation of daily and weekly trip launches reduces the number of persons allowed on the river during the months of highest demand. Some adjustment in terms of selecting a day of the week or month in

the season for trip departure will be unavoidable (see section II, tables 10 and 11). At present, approximately 3000 persons per month leave Lee's Ferry during June, July, and August. The proposed trip scheduling will permit only 2000 per month; therefore, 3000 persons or 24 percent of the total number of visitors leaving Lee's Ferry (11,900) during the summer season must choose other months for their trip departures.

Restrictions on the use of fire could affect the character of the river trip during the summer season. Fires are unnecessary for warmth during this period (April 1 through September 30), and only stoves or charcoal fires will be allowed for cooking purposes. For the majority of the river running public, the luxury of a campfire would be lost. Fires will be allowed during the winter for warmth. Because the elimination of fires and the use of stoves has become a norm in other backcountry or wilderness areas, the regulation should have little effect on the visitor.

The regulation that all human solid waste material be taken from the canyon will affect noncommercial users more than commercial passengers since waste disposal is already part of the commercial operation. Private river parties must make their own arrangements for proper waste disposal equipment. Although technically simple, carrying and hauling out wastes could be considered a hindrance by some noncommercial users.

3. Interpretation and Education

As indicated previously the length of trip, party size, and motor noise influence the type and amount of knowledge gained by the vistitor. The interpretive value of the river trip was increased significantly for the people who preferred the oar trip over the motorized trip. Communication between 1 boatman and 5 people in the relative quiet of the canyon appears to be significantly greater than communication between 1 boatman and 15 people masked by motor noise.

The average trip length of 12 days and reduced speed, as well as reduced party size and an average passenger to guide ratio of 1 to 5 will serve to increase interpretive potential. The removal of motor noise should increase the information available to visitors, and will foster boatman/passenger relations and communications, an important factor in their perception of the canyon.

The interpretive value of the river trip has a direct bearing on the quality of the visitor's experience. Interpretation not only fulfills the need to know about various geological, natural, or historical features, but serves to educate an individual unfamiliar with river running conditions within the canyon. The reason for safety regulations or visitor restrictions must be understood before they can be readily accepted. Visitors who feel they have learned a great deal about the canyon and have gained an understanding of river running procedures in relation to safety, sanitation, and resource protection tend to give their trip experience a high rating.

Pre-trip education of commercial trip leaders and guides and noncommercial trip leaders may be the most important factor influencing the interpretive values of the river trip for both commercial and noncommercial passengers. The proposal to expand the orientation/information/interpretive training program for commercial guides and to develop a pre-trip program of a similar nature for all noncommercial trip leaders is viewed as a positive measure that can only increase the value of the river running experience. Some noncommercial trip leaders may, at first, feel inconvenienced having to attend a program before floating the river, but the requirement should enhance rather than impair the quality of their trip.

4. Esthetics

The plan contains elements that will improve the esthetic aspects of the canyon. Disposal of human wastes outside the canyon would improve the quality of the visitor's experience by removing a current source of esthetic displeasure, the noxious visual and olfactory impacts associated with improper waste burial sites. In addition, potential health hazards would be removed by discontinuing the burial of wastes in the beaches.

Restrictions on the use of fire and proper disposal of charcoal residues will prevent the "bathtub" effect on beach areas. Darkened patches of beach sand or rings of charcoal created by wave action will no longer impair the visual quality of the beaches.

Elimination of motorized watercraft will reduce noise throughout the river corridor. Motor noise is disturbing not only to the river running visitors, but to other backcountry users hiking or camping in areas adjacent to the river. A large portion of river users (44 percent) felt their wilderness experience would improve if motors were banned.

The only development proposed by the plan that could impair the esthetic quality of the canyon or that of lands adjacent to the river for the visitor is trail construction. New trail alignments that require minor cut and fill, erosion control measures, and other devices to direct run-off could be considered intrusions in natural areas. The proposed single trails to attraction sites will replace 12 to 15 multiple trails in some areas. After obliteration of old trail scars and restoration, the appearance of such areas will be considerably improved.

5. Safety

There are no actions in the plan that would adversely affect the health and safety of the river running public. The removal of motorized craft will not affect the real or perceived safety of the river trip. Table 14, page II-57 indicates that non-motorized craft have fewer accidents requiring NPS evacuation, but this difference is not satistically significant.

Research indicates that noise levels of motors near boat pilots (83 to 89 dbA) approach the national health standard's maximum allowable limits (90 dbA). There exists the potential for permanent hearing loss for boatmen on motorized craft. Motor noise levels may also adversely affect the operator's performance, resulting in potential safety hazards. The removal of motorized craft will eliminate the possibility of hearing injuries and provide a potentially safer trip for the visitor.

The elimination of wood fires during the summer season will reduce the number of injuries (burns) associated with improper use or supervision of fire.

Existing regulations concerning sanitation, food preparation, water use, and boating safety will continue in effect, with increased enforcement.

Other than cold weather from mid-November to mid-February, there are no added safety problems during the winter months. Water flow during winter is lower than summer but is adequate for rowing craft trips.

Power boating accidents will continue in the Lower Gorge area due to the retention of powerboating and up-river travel from Lake Mead.

I. ECONOMIC IMPACT

1. Visitors

Overall trip costs are not expected to increase significantly due to the implementation of river management plan. The range of prices offered the visitor will probably remain the same, although some increases depending upon the commercial company, may be expected due to changes in the type of trip offered and status of the economy at any given time.

At present, there is little difference between the average cost of an oar-powered trip and a motorized trip. The range of prices available for an eight-day oar trip range from $345 to $395 while motorized trips of the same duration range from $345 to $440. Elimination of motorized trips may economically benefit the park visitor to a slight degree.

Not all visitors want the same experience, nor do all people want to pay the same for their canyon experience. The allocation of user days among concessioners will provide for a variety of prices from which the visitor may choose. Based upon the average socioeconomic background of the commercial user and the demand for higher priced trips, increased trip costs would not significantly affect this segment of the river running population.

The noncommercial river runner will be affected by the new regulations. The cost of the private trip will increase due to equipment required for sanitation and cooking. These costs are not expected to incur undue financial hardship on this river running group.

2. River Guides

Most of the current concessioners could accommodate an increase in use by simply extending their river running season. This would affect the guides by providing approximately 6 to 7 months work rather than 4 to 5. River guides operating and prefering motorized float trips may forego job opportunities when concessioners convert to oar-powered craft. The extended season and longer oar trips may increase income for some river guides. Opportunities for employment should be greater due to the increased passenger/guide ratio.

3. Other Interests

The Hualapai Tribe presently benefits from the operation of motorized float trips. Conversion from motor to oar will adversely affect their concessioner operation launching at Diamond Creek. They will have to modify equipment so that oar power is used as far as Separation Canyon. They then would have the option to continue rowing across Lake Mead or carry a motor to be put on and used from Separation Canyon to Pierce Ferry. There will be added costs to modify equipment accordingly. However, the cost is not expected to create significant economic problems for this operation.

A positive economic effect, on the other hand, may probably occur at Diamond Creek. Removal of motors could potentially increase the revenues being paid to the Hualapai Tribe for the use of their road from Diamond Creek to Peach Springs because more companies may choose to take their boats out at that point.

4. Regional Economy

The river running industry makes up such a small portion of the local and regional economies that increasing the total visitor use levels and allowing increased commercial allotments would not have any appreciable effect. The one exception to this would be Kane County, Utah (Kanab) where the river running industry contributes measurably to the local economy, but even in this case it is not a significant factor. (Refer to Appendix G for a summary of economic effect on Grand Canyon river running concessioners.)

5. Park Management

Management costs will increase considerably due to personnel needed for additional patrols, monitoring, and orientation/education/training

programs. If additional personnel, equipment, and funding are not provided to properly execute the management plan, negative effects can be expected due to lack of effective orientation provided by the Glen Canyon personnel at Lee's Ferry and lack of resource protection, regulation, and training to be provided by the Grand Canyon staff.

J. OUTSIDE INFLUENCES

1. Noise

Unnatural sounds will continue to intrude upon the quiet of the canyon and create a disturbance for many users. Noises from low-flying aircraft, helicopters, and subsonic and supersonic airplanes are superimposed upon and mask the natural sounds. Existing noise intrusions from aircraft which adversely affect the visitor experience will continue until research is completed and a control plan implemented. The problem is complex and parkwide. Further study and intensive coordination with commercial and noncommercial aircraft operators will be necessary before noise impact can be reduced.

2. Water Flow

The release of water from Glen Canyon Dam will continue to affect river running activities in the canyon. Water flow fluctuates daily depending upon power demands in the region. When power demands are low, minimum flows are released to conserve as much water as possible; when power is needed, high volumes of water are released into the canyon (refer to Section II. A. 2 for previous discussions). Low flows are a serious problem. For example, in April 1977, approximately 90 boaters on eight float trips were stranded in the Marble Canyon section due to low water flows of about 1000 cubic feet per second. The National Park Service and the Bureau of Reclamation worked together for additional water releases (approximately 6,000) to allow the stranded boaters to move down river to Phantom Ranch. Food had to be flown to passengers of one trip that had been stranded for 4 days. One boat, a 22-foot row boat, was not able to travel the low water and was flown from the canyon at Phantom Ranch. Extremely low water flows make river running virtually impossible, except for trips with the small rowing boats. The April incident caused 31 commercial trips to be cancelled and approximately 135 additional trips to be cancelled on the basis of low water flow for May and early June 1977.

During times of low perciptation and expecially during periods of drought, the following effects can be anticipated:

- River passengers may become stranded depending upon their location in the canyon and the amount of water released during the week, and size of water craft.

- Oar-powered boats will encounter less problems during low water releases than do larger motor trips at present.

- During minimal flows, only the small oar craft can be expected to negoatiate the canyon, but even then with delay.

- Trip cancellations and subsequent economic loss to the concessioners can be expected, but will be less when large motor trips are eliminated.

- Potential visitors will be disappointed if their trips are cancelled.

During periods of high percipitation or peak power demand, excess water may be released, resulting in the following effects:

- High flows will not adversely affect the river running industry

- High flows allow the large boats to negotiate the canyon.

- Rapids can become hazardous, especially for inexperienced river runners, and accidents can increase

- High flows coupled with daily fluctuation will continue to erode beach sands more rapidly than more stable or consistent flows.

Adjustments in scheduling and management of river trips will probably continue for both the National Park Service and river runners due to the regulation of Glen Canyon Dam. Efforts will be made to coordinate water releases for the benefit of the river running public, but it is understood that the purpose of Glen Canyon Dam is to satisfy water and power demands of the region's growing population.

IV. MITIGATING MEASURES INCLUDED IN THE PROPOSED ACTION

A. MITIGATION OF IMPACTS ON NATURAL AND CULTURAL RESOURCES

Under the existing use levels of 122,600 user days, irreversible impacts are being inflicted on the natural and cultural resources of the Inner Canyon area. The proposed action calls for a maximum increase of 225,320 user days annually.

Although the research findings demonstrate no clear correlation with absolute numbers of visitors and the rate and magnitude of resource damage, it is evident that unless the resource impacts are mitigated, an increase in the total user days would lead to an acceleration of the adverse impacts (Carothers and Aitchison, 1976). The proposed plan will significantly reduce primary impacts, but continuing human use of the river corridor will cause resource damage.

The direct measures included in the proposed action to alleviate the human impact on the natural and cultural resources are presented below.

Restriction of Visitation at Attraction Sites: Congestion of visitors at attraction sites has been found to be a principal cause of resource destruction. Too many people in an area at the same time result in foot traffic patterns that lead to unnecessary destruction of vegetation through the formation of new and redundant trails.

The action limiting the total number of persons that can launch each day from Lee's Ferry to 75 should do much to alleviate the status quo congestion problems.

Additional mitigation necessary to insure against crowding is to prohibit more than two separate groups from stopping simultaneously at an attraction site.

Construction of Trail Systems Adequate to Accommodate Foot Traffic at Attraction Sites: There are several areas along the Colorado River, particularly selected attraction sites and side canyons, where multiple trail systems have developed. Impacts that result from this situation include vegetation trampling, destruction of cultural resources and increased rates of erosion. These impacts will be minimized by the construction of trails in specific areas.

To avoid unsightly cut and fill, excessive erosion, and damage to cultural resources, each trail alignment will be designed with environmental and esthetic constraints taken into consideration. Topography, slope, and unstable soils as well as appropriate access for the visitor will be analyzed before trails are developed. Special care will be taken to avoid visually obtrusive alignments. All alignments will

be surveyed by the National Park Service archeologist prior to construction, and should cultural materials be encountered, trail alignments will be altered to avoid damage.

Use of Unique Resource and/or Ecologically and Culturally Sensitive Areas: Because of their unique features and/or sensitivity, the restricted areas, previously listed in Section I and shown on the maps on pages I-15 to 17, will be closed to visitation and/or camping. Other areas or sites including those proposed for archeological or historical evaluation and the ecologically sensitive areas will be subject to closure or restriction should monitoring show unacceptable damage due to visitor use. Camping beaches may be closed on a rotational basis if resource damage is not significantly reduced under the proposed actions.

Disposal of Solid Human Waste: All waste will be containerized and carried out of the canyon.

Disposal of Debris: Cans, rubbish, and other refuse of any kind may not be discarded in the water along the shore. All refuse must be carried out of the canyon and placed in an acceptable disposal area. Deposits will not be made at Phantom Ranch, Diamond Creek (unless arrangements are made with the Hualapai Tribe), Pierce Ferry, or South Cove. Any solids such as coffee grounds or food particles from dishwater must be strained and put in garbage containers before such liquid wastes are drained into the main river current. No waste liquids may be dumped on beaches or in eddy currents. Wet garbage such as egg shells, leftover food, bones, grapefruit or orange peels, melon rinds, etc., must be placed in garbage containers and carried out of the canyon. Particular attention must be given to pop tops from cans and cigarette butts. Cooking greases must be carried out.

Use of Detergents: The use of detergents, soaps or any other form of cleansing agent is specifically prohibited in any side stream or spring or within 100 meters upstream or downstream of any live side stream. The use of soaps is restricted to the Colorado River only.

Education of the Guides/Trip Leaders and Visitors in Proper Resource Protection Behavior: It is the responsibility of the commercial guide or the noncommercial trip leader to insure that members of his or her group follow the National Park Service guidelines on resource protection. It is the responsibility of the National Park Service that these guidelines are clearly and precisely stated and that each guide/trip leader is well versed in these regulations. These guidelines will have no protective import if they are not adequately communicated to the user. Programs necessary to provide this communication include the following:

- Provide copies of the operating requirements to every guide/trip leader prior to launching.

- Provide an audio/visual education program on resource protection: this should be designed for viewing by all commercial and noncommercial passengers and presented prior to departure at an NPS facility located at Lee's Ferry.

- Provide guide/trip leader training programs in resource protection/safety/sanitation/interpretation at a National Park Service facility. The importance and necessity of a program of this design has been stressed by various research investigators (Johnson, 1977). This program will be the framework for a future guide/trip leader licensing program. Training sessions held twice yearly, spring and fall, for five days each, will include instruction on resource protection, review of operating requirements, safety and sanitation procedures, first aid and rescue, and natural history interpretation.

Increased National Park Service Patrol of the River Corridor for Interpretation and Enforcement: National Park Service patrol of the river corridor will be imperative to insure proper resource protection. Patrol duties will include interpretation, first aid, rescue, trail patrol, and maintenance and enforcement of regulations.

To adequately patrol the river corridor during the heavy use period (April 1-September 30), one patrol trip per week will be necessary. During the winter season, one patrol every two weeks will be provided.

B. MITIGATION OF IMPACTS ON SOCIOECONOMIC FACTORS

The National Park Service must require certain standards that will provide for the maximum safety of the visitor. These standards are indirect mitigating measures that are designed to reduce accidents and injury while floating the Colorado River.

The current operation and equipment standards (See Appendix C) have proven to be adequate in achieving National Park Service management goals for providing for maximum visitor safety while simultaneously not deterring from the visitor's experience.

All commercial concessioners will be required to comply with the Arizona Department of Health Services "Guidelines for Communicable Disease Control on Colorado River Expeditions". Therefore, for purposes of use of the Colorado River in Grand Canyon by commercial concessioners, these are no longer guidelines but will be requirements.

The Colorado River plan will be assessed annually to evaluate the adequacy of launching schedules in relation to contact, crowding, and resource protection; to determine whether or not an equitable distribution of user days between the commercial and noncommercial sectors has been achieved; whether total numbers of people are within the resource capabilities of the river system; and to determine future adjustments, if needed, within the commercial sector regarding user days, types of trips, and service to the public.

The only economic impact resulting from the proposed action which would require mitigation, is the impact on some of the concessioners in changing from motorized to non-motorized equipment.

To mitigate the impact of conversion from motorized to non-motorized river craft a three year phase-out of motors is proposed. By 1979, 30 percent of a concessioners passenger day allotment must be on non-motorized trips, by 1980, 60 percent of the allotment must be non-motorized and by 1981, 100 percent of the use must be converted to non-motorized craft.

C. MONITORING AND RESEARCH REQUIRED TO ENHANCE ENVIRONMENTAL QUALITY AND GUIDE THE DEVELOPMENT OF ANY FUTURE CAPACITY CHANGE

Present research projects on the Colorado River have delineated the status of the present system, as well as inferring possible future biological and sociological trends. The physical and biotic inventories have aided in pointing out areas in which future research and monitoring is desirable. Future research and monitoring will be instrumental in indicating the ecological responses brought about by changing management procedures or environmental conditions, as well as needs to monitor visitor satisfaction and shifting demands of interest groups, and economic changes.

The monitoring of sociological trends regarding contacts, crowding, and particularly relative demand for commercial and noncommercial river trips is essential. The proposed action significantly modifies use patterns. Contact and crowding data provided from recent research was based on current use levels and patterns. This data cannot be used to accurately predict the future level and nature of contacts and crowding. Therefore, as this plan is implemented, there will be a critical need to monitor use patterns under changed conditions.

Also, there is very intense concern about the relative demand for commercial trips verses noncommercial trips. This is evidenced by two law suits that have been filed within the past year (Wilderness Public Rights Fund vs. Kleppe et al, 1976 and Eiseman et al. vs. Andrus et al, 1977). Additional research is needed to aid in determining what the relative demand is and monitoring of demand fluctuations is needed as well.

The various research projects have determined that irreparable damage is being inflicted on the natural system of the Colorado River corridor. These impacts will be alleviated for the most part, by the mitigating measures that are included in the proposed action. However, of necessity, a resource monitoring program must be designed in such a way as to detect deterioration in the resource quality. The resource alterations that will or could take place over a period of sustained use (15 to 20 years) are unknown and can only be determined by careful monitoring of the system.

Of highest priority is a monitoring program that is designed to provide an annual assessment of the environmental health of the campsites. This program will consist largely of study areas consolidated in a single series of research sites along the river. These study sites will allow a single visit at sites which have a high biotic resource rating, thus lending themselves to multidisciplinary investigations of fishes, terrestrail vertebrates, water quality, algae, vascular plants, beach erosion, etc. This would have the added advantage of providing reasonably complete biological information on several areas as they undergo changes, enabling analysis of the complete system rather than individual aspects.

A great need exists for additional baseline data concerning the physical substrate. This would be provided by high resolution verticle color aerial photography taken at a scale of between 1:500 and 1:1,100 at metric, or near-metric standard with stereo coverage. Photography covering 20 to 50 beaches selected to provide a cross section of geomorphic setting, vegetational characteristics, and human use density could resolve changes in species composition and distribution, changes in human impact, movement of surface materials, and erosion. Aerial photography provides the lowest cost per unit of information when extensive areas are under consideration, however, field surveying in geomorphological, macrofloral, and human impact studies is essential to establish detailed calibration data to correlate with photographic data. Aerial photography should be reflown at least once between 1980 and 1985 to provide a documentation of all major changes taking place along the river. Several heavily impacted beaches would be placed off-limits, or on a rest-rotation system, to study recovery rates. Also, a resurvey of all beach profiles on the benchmark beaches should be undertaken sometime in the period of 1978 to 1981 to allow an accurate assessment of erosion and deposition rates. Campsite monitoring should continue in order to show changes in size of impacted areas.

Water quality monitoring will continue to assess any future changes in water quality parameters in both the river and tributaries. This would provide human impact data and habitat data regarding aquatic life, especially endangered fish species affected by water quality alterations brought about by Glen Canyon Dam.

Further studies will be initiated to better define the relationships, both intra- and interspecific, of fish occurring in the region. This would include surveys of the river in addition to systematic surveys of selected tributaries and the collection of fish for analysis of food habits, general health and reproductive conditions.

Benthic samples should be taken at each tributary to aid in identification of fish stomach contents, to help define key tributaries and to determine why they are utilized by certain fish. This would provide information concerning endangered fish species, particularly the genus Gila. Restoration of habitat is essential to the survival of Gila in the Grand Canyon area. Monitoring studies of both chub species should be carried on to determine population trends and spawning success. The management of endangered fish species is programmed for 1977 and 1978 in the natural resources management plan now being prepared for Grand Canyon. Specific monitoring projects described above will also be included in the management program when the final Colorado River plan is approved.

D. MEASURES NEEDED TO COMPLETE COMPLIANCE WITH THE NATIONAL HISTORIC PRESERVATION ACT AND THE ENDANGERED SPECIES ACT

1. National Historic Preservation Act

All actions in the proposed plan will comply with the Procedures of the Advisory Council on Historic Preservation (36 CFR 800) and the National Park Service historic preservation policies.

In compliance with Executive Order 11593, a complete cultural resources inventory will be undertaken. Both archeological and historic sites will be evaluated for historic significance and those meeting the criteria will be nominated to the National Register of Historic Places in consultation with the Arizona State Historic Preservation Officer.

Cultural sites in need of repair or stabilization will be accomplished in accordance with Historic Structures Handbook, Part II, Ruins Stabilization, the Administrative Policies for the historical areas of the National Park System Preservation Policy; the Act to provide for the Preservation of Historic American Sites (49 Stat. 666) and the Act for Preservation of American Antiquities (34 Stat. 225).

The Advisory Council on Historic Preservation and the State Historic Preservation Officer will be afforded an opportunity to comment on the plan actions. Their comments will be incorporated in the final environmental statement for the Colorado River Management Plan.

2. The Endangered Species Act

In compliance with the Endangered Species Act, measures must be taken to protect the endemic, endangered Humpback Chub (Gila cypha). The Humpback Chub is known to be endemic to the Colorado River, and more specifically, that portion of the Colorado River flowing through the Grand Canyon. Recent investigations have indicated that as a result of construction and operation of Glen Canyon Dam, this species has now been further restricted in distribution (Blinn et al., 1976; Miller, 1976 and Suttkus et al., 1976). As a result of the dam-controlled river regime, the only area left suitable for this species' spawning is the mouth of the Little Colorado River. The mitigating measures necessary to protect this species include continued enforcement of the existing regulations regarding the use of detergents in side streams, and more specifically closing this area to angling and seining. To effect maximum protection of this species, it will be necessary to prohibit angling and seining for 0.5 miles above and below the confluence of the Little Colorado River and the Colorado and 1.0 miles of the Little Colorado River above the confluence.

No other rare, endangered or threatened species are known to be affected by the proposed action.

V. ANY ADVERSE IMPACTS THAT CANNOT BE AVOIDED SHOULD THE PROPOSAL BE IMPLEMENTED

The total number of river runners that annually traverse the canyon will increase by approximately 1,000 persons (from 14,000 to 15,000), and the plan will result in about 102,720 additional user days (from 122,600 to 225,320). Although mitigation of the resource impacts resulting from visitor use patterns is provided for in the proposed action, certain impacts will be unavoidable. Foot traffic on beach areas, side canyons, and attraction sites will continue to result in erosion and destruction of vegetation. This loss of resources will be carefully controlled through adjustments of use based on continued research/monitoring, but the very fact that visitors will be accommodated in the system results in a certain amount of resource loss which is unavoidable.

Minor soil and vegetation damage will occur during the winter season due to driftwood collection and wood fires. Trail construction will result in short-term minor erosion until the affected areas are naturally stabilized.

The increase in user days can potentially result in a greater disturbance of wildlife species.

Normal visitation to cultural sites will result in minor, but unavoidable deterioration. Vandalism or carelessness will also remain as potential impacts.

Under the current river running system, motorboats dominate the river. A considerable controversy has developed among boatmen and outfitters concerning the relative values of motorized vs. non-motorized river craft. An unavoidable adverse impact resulting from the proposed action will be that those persons favoring the use of motorboats will be disappointed. The loss of a fast, motorized trip from Lee's Ferry to Diamond Creek cannot be mitigated. It will adversely affect approximately 550 to 600 persons (5 percent of 12,000 users) who may prefer only motorized travel.

There will be a slight shift in the overall visitor characteristics of the river running population due to the greater allocation proposed for noncommercial river runners.

The elimination of all wood fires during the high use period will result in impacts that cannot be avoided. One, there will be a certain disappointment factor in those visitors and guides who find campfires an integral aspect of the outdoor experience; and two, the use of charcoal briquets for cooking and use of wood fires during winter will

continue to be a small source of beach pollution in that ashes will be occasionally incorporated into the beach soils due to spillage from fire pans.

Vacation trip adjustments due to launch restrictions during the popular summer months, and new regulations may cause inconvenience for some visitors. Approximately 3,000 persons will be adversely affected during the peak months of June, July, and August due to launch schedules. Some may choose alternate months; others may have to forego the river trip entirely.

Potentially, 3,135 noncommercial river runners will be affected by the new regulations for cooking and sanitation equipment, as well as by the requirement for training/orientation. Costs of equipment will not be an adverse factor. Rather, inconvenience due to time spent meeting specific regulations or attending an orientation program may prove adverse for some. Trip leaders (209 persons) will have to commit an extra day for boatman's training before running the river.

VI. THE RELATIONSHIP BETWEEN LOCAL, SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The unique combination of scenic, biotic, geological, archeological, and historic values within the river corridor of Grand Canyon will be perpetuated over the long term. However, use by 15,000 people each year will unavoidably alter or disrupt some elements of the riverine environment. Even though the process of natural biotic response to unnatural change has occurred within the riverine environment due to the Glen Canyon Dam, human use should not adversely accelerate the process nor impair the new systems to the point of decreased productivity. Erosional forces of the river and other natural processes are intensified by human activities, such as camping and hiking. Short-term visitor enjoyment must be weighed against the relatively long-term adverse effects of use on the river environment.

Increased use proposed by the plan will continue to cause erosion and vegetative disturbance in some beach areas (250 acres). The removal of human wastes, kitchen debris, and ash and charcoal from the canyon will enhance the beach environment over the long-term.

Multiple trailing at prime attraction and side canyon sites will be reduced. Existing disturbance encompasses approximately 10,000 acres. The proposal to construct or designate trails to prime sites will reduce high impacts such as compaction, gullying, and erosion. Approximately 5,000 acres will be maintained and enhanced over the long-term. However, short-term visitor use and activities will continue to cause soil disturbance and some inadvertent loss of cultural materials, but the overall health of the ecosystems and the integrity of cultural resources are expected to be maintained.

Short-term adverse effects will be experienced by both the river-running public and the commercial operators. Restrictions, rules, regulations, and requirements are the adjustments that must be accepted if use is to be increased and a quality wilderness experience maintained. Rules, restrictions, and regulations may also be considered adverse over the long-term. An added burden will be placed on managers, operators, and visitors alike. Some visitors resent regulations and feel they should not be restricted in any way.

However, the required training, orientation and resource regulations will provide immediate and long-term benefits. The elimination of human waste burial in beach sands will remove both esthetic and environmental disturbance. The elimination of wood fires during the summer season will disappoint many river travelers, but the restriction mitigates the dwindling supplies of driftwood in the river corridor. The natural and cultural resource impacts associated with this overuse (reptile habitat destruction, cultural and historical resource

destruction in firewood gathering activities) will be significantly reduced. Both short-term and long-term resource protection gains are realized. Ensuring that all river runners have access to and understand resource protection measures can only benefit the natural environment in the long-term.

Visitors may not always be able to run the river at times they prefer. Scheduling may become a short-term inconvenience. Regulation of river trips to achieve less contact and prevent congestion within the corridor will allow more users to experience the canyon under conditions approaching wilderness solitude. Short-term visitor inconveniences were weighed against the short- and long-term benefits of maintaining a high quality river trip experience.

The elimination of motorized craft will disappoint and inconvenience a relatively small percentage of visitors (5 percent) and operators who prefer short, fast, convenient river trips through the canyon. This loss was balanced against the higher quality oar trip experience that could be provided for the majority of present river users and perpetuated for future generations. The preservation of this quality experience seems imperative as the availability of "wilderness areas" dwindles before the demands of an expanding population.

The long-term productivity of the canyon in terms of maintaining environmental quality, social appreciation and enjoyment of the visitor will be enhanced by the plan actions.

VII. ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

The proposals in the Colorado River Management Plan result in few irrevocable uses of the canyon's resources. The plan actions and the proposed mitigating measures are designed to lessen current detrimental trends and keep resource impacts at an acceptable level.

Any use of the resource will result in some loss of soils and vegetation in beach areas and at attraction sites. The proposed actions include the building of trails to minimize this impact; ironically, the trails themselves are commitments of the landscape over the long-term. However, the area committed to unregulated use will be reduced by approximately 5,000 acres.

Some loss of archeological and historical materials will occur due to visitor use, but if ruins are monitored, protected and stabilized this impact should be minimal.

There are no natural or cultural resources irreversibly or irretrievably committed to destruction or consumptive use by this proposal. There are no actions in the plan that would cause direct loss of historic or archeological sites, the elimination of wildlife habitat, or impair the viability of any threatened or endangered species.

VIII. ALTERNATIVES TO THE PROPOSED ACTION

A. NO ACTION (STATUS QUO)

Under the no action alternative, total use would be approximately 13,000 to 14,000 persons per year or 122,600 user days. This would include 89,000 commercial, 7,600 noncommercial, 21,000 crew and 5,000 administrative user days. Length of trip would range from 7 to an unlimited number of days. Persons launched per day from Lee's Ferry would continue to be 150 and above, with 15 private passengers per day.

Use of motors would continue to be the decision of each commercial or noncommercial operator.

Allocation of use between commercial and noncommercial parties would remain 92 and 8 percent, respectively, and allocations among commercial concessioners would remain the same.

Use of portable toilets and burial of wastes on beaches would continue. Driftwood and charcoal fires would be allowed. Use of fire pans would continue. Current regulations would continue in effect, except that patrols would be increased to protect natural and cultural resource areas.

1. Impacts on Natural Resources

Irreversible physical and ecological changes would continue to occur in the riparian zones of the river corridor as a result of present visitor use patterns and activities. Soils and vegetation at beach and attraction sites would receive heavy impact due to burial of human wastes, uncontrolled foot traffic, trampling and clearing of vegetation, removal of materials for wood fires, and incorporation of human debris into beach sands. Twenty-five precent of the campable beach areas (250 acres) will continue to receive heavy impact from waste disposal and camping, and an estimated 4000 acres will be adversely affected by multiple trailing and foot traffic.

Existing resource impacts are discussed in Section II. M. The following recapitulation of research findings indicates the kinds of resource damage that can be expected to continue under this alternative:

> The present policy of the National Park Service is to allow the river parties to bury their consolidated solid human waste in the canyon. Assuming an average of 8.7 days per trip and 150 grams (5 ounces) of feces per day per person and approximately 15,000 person/year, this represents 20 tons of solid human body wastes which require disposal during a normal river running season.

Approximately 5000 porta-potty burials per year take place within the river corridor. Each dump site contributes to further destruction of the soil profile and the microbiology of the beaches (Knudsen, 1976).

The major impact of human waste disposal in the beach soils is associated with the digging activities, and the initial disturbance of the soil profile, necessary to bury the wastes (Howard and Dolan, 1976).

Destruction of vegetation from the digging of waste disposal holes is evident (Carothers and Aitchison, 1976).

The destruction of the soil profile that is associated with waste burial holes is inimical to natural germination processes (Carothers and Aitchison, 1976).

In addition to improper burial of the waste products, even properly dug holes sometimes result in problems. Because solids float to the top when dumped in a hole and colloidal interactions between sand and protable toilet effluents, the holes do not drain adequately, resulting in solid fecal material being buried very close to the surface or not buried at all (Aitchison et al., 1974; Knudsen, 1976).

The disinfectant chemicals presently used in the portable toilets do not provide for total disinfection of pathogens associated with the fecal wastes (Knudsen, 1976).

Viable fecal coliform bacteria have been isolated from the top 3-6 inches of human waste dump sites (Knudsen, 1976).

Human waste burial sites are so numerous on some of the more heavily used beaches that repeated use of the same dump site is a common occurrence (Carothers and Aitchison, 1976).

Under the present use patterns, river guides report that they occasionally unearth recent fecal materials buried by groups that had prior use of the camping area. These recent deposits are infectious and initially contain high levels of enteric organisms (800,000/g dry wt. of sand) (Sartor-Lynch and Phillips, 1976).

The fragile desert ecosystem (physical and biological) cannot withstand the current uncontrolled patterns of off-river use. Therefore, the present chaotic patterns of foot traffic to side canyons, attraction sites, and beach terraces must be controlled (Carothers and Aitchison, 1976).

The interrelationship between trampling, impacted vegetation and aeolian erosion is evident at attraction sites and some heavily used camps (Carothers and Aitchison, 1976; Howard and Dolan, 1976).

The impact associated with multiple trails changes the plant community structure in the immediate vicinity of the trail (Carothers and Aitchison, 1976).

The practice of burning toilet paper has resulted in brush fires which produce a long-term effect on some vegetative elements (Carothers and Aitchison, 1976).

2. Impact on Cultural Resources

Cultural resources would continue to be damaged or destroyed due to the practice of digging waste holes and collecting materials for wood fires. Visitor congestion at archeological or historical attraction sites would continue to cause deterioration due to uncontrolled foot traffic, dislocation of cultural materials, and heavy use. Increased patrols, protective devices, or prohibiting visitation to most of these areas could prevent further resource deterioration in compliance with Executive Order 11593.

3. Socioeconomic Factors

The impact on the visitor under the no action alternative would be moderately beneficial for most commercial passengers, but adverse for noncommercial visitors in that allocations between the two groups would remain at the present ratio.

Generally, most visitors are satisfied with their Grand Canyon float trips. Opportunities for the majority would remain the same under status quo. However, the character of the river trip and the quality of the experience would continue to be impaired for some and certainly not improved for the majority under the no action alternative. Motor noise, high contact levels, crowding at attraction sites, inadequate interpretation and education, and unsatisfactory esthetic conditions would persist. The following research conclusions are indicative of continuing and future effects:

The present use patterns of the river result in visitor satisfaction with 85 percent of the visitors' rating their experience as "excellent" or "perfect" (Shelby and Nielsen, 1976).

The research findings show that the highest quality wilderness river experience is attained on mon-motorized craft (Shelby and Nielsen, 1976; Thompson et al, 1975).

Most river travelers (80 percent) accompany large groups on motorized trips. Boatmen on these trips are less accessible either generally or for specific information (Shelby and Nielsen, 1976).

On motorized craft, pilot to passenger communication is possible but the reverse is difficult or impossible when the motor is operating (Thompson et al., 1974).

Motor noise is detrimental to normal relaxed conversation and frequently affects interpretation of park resources (Thompson et al., 1974; Shelby and Nielsen, 1976; NPS).

Passengers on motorized trips are denied the aural dimension of a wilderness almost entirely during their on-river exposure to the resource (Borden, 1976).

Significant temporary hearing losses occur for pilots and some passengers on motorized craft (Thompson et al., 1974).

Oar trip passengers knew more names of places and features in the canyon than did motor trip passengers. There were no differences between the motor and oar passengers, however, in the percent who carried guide books or the number of books and articles they read about the canyon (Shelby and Nielsen, 1976).

A typical trip during the 1975 or 1976 season met between 3 and 4 other trips on the river each day and spent about 40 minutes per day in sight of them. The number of people on the trips seen each day amounted to about 70 people (Shelby and Nielsen, 1976).

A majority of users, 57 percent, said they would rather run the river with a small (20 persons or less) party (Shelby and Nielsen, 1976).

It can be assumed from the above that motor noise, large party sizes, and high contact levels will continue to affect a majority of the visitors. Eighty percent of those running the river would have a significantly reduced opportunity for interpretive and educational experiences due to motor noise and the size of the group. On the other hand, oar passengers (20 percent) seeking the wilderness-type trip would continue to be affected by noise intrusions, crowding, and high on- and off- river contacts. Education/interpretation programs would be unavailable to noncommercial river guides and passengers under this alternative.

Under the status quo management of the river, no significant adverse economic impact is anticipated.

The float trip concessions in Grand Canyon National Park represent a multimillion dollar industry. Most float trip concessions are earning healthy profits. This situation is expected to continue. Although the profitability of a concession is not significantly related to size (in sale of user days) of float trip concessions, the larger companies have a greater potential to maintain an economic stability than do the smaller companies. The concessioner allocations would remain the same; therefore, some small companies that might benefit from additional user days to remain economically viable would be adversely affected under the no action alternative.

B. INCREASE THE VISITOR USE LEVEL

This alternative would increase the visitor use level to the absolute physical carrying capacity of the system. It is important to emphasize however, that the quality of the visitor experience provided by this alternative is not as high as that anticipated under the proposed action.

The physical capacity of the river system is limited mainly by the availability of camp space within reasonable traveling distance per day. Reasonable spacing between groups is also a limiting factor. Within the above constraints and allowing for five groups per day to be launched (one group of 8, one of 20, and three groups of 40), the daily launch capacity would be 148. Assuming a 182-day season and 12 days to complete the trip, the annual capacity is arrived at as follows: 148 people/day x 182 days = 26,936 visitors per year x 11 user days per trip = 296,296 user days (Borden et al., 1976). Borden's study of carrying capacity uses 12 days as the basic trip length. However, since only 11 nights are spent in the canyon, he considers that 11 user days are utilized on a standard trip, to arrive at total annual capacity of 296,296 user days. This is contrary to NPS standards where a passenger day is counted for any passenger for any part of one day in the system and therefore capacity by NPS standards is 323,232 user days. This use capacity is almost 2½ times the present use level. Present use levels, however, appear to be moderate to high for a wilderness experience (Shelby and Nielsen, 1976).

Under a very tight scheduling system of launch days and times, campsite space assignments, structured river travel restrictions, time and area limitations at attraction sites, and a standardized trip length of 12 days, this alternative could increase the total visitor use level to approximately 27,000 visitors and the total number of user days to 323,232. This is an 85 percent increase in total visitors and a 242 percent increase in total number of user days over the status quo.

1. Impact on Natural and Cultural Resources

Section II. M. and the no action alternative address impacts on natural resources that are and will continue to result under current use levels

and patterns. A pervading fact throughout the discussion on visitor related impacts is that the total number of visitors does not effect impacts as much as the activities and patterns of use of the visitors.

By increasing the total use level by 85 percent, there will be no change in the kinds of impacts; however, the rate these impacts are inflicted on the resource is expected to increase, leading to an overall rapid deterioration of the natural resources.

This alternative would also increase day-use visitation of the cultural sites in the canyon, unless limitations were placed on site visitation. Increased visitation would accelerate the rate of deterioration of these areas and, without mitigation, could result in the loss of valuable nonrenewable resources.

Without intensive mitigation of the existing problems associated with disposal of wastes, this alternative would increase the deterioration of the environmental and esthetic quality of the riparian corridor, as well as creating a potential for serious health hazards.

2. Impact on the Visitor

The visitor would be affected by trip length, strict regimentation, and amount of time allowed off river.

The length of both the private and commercial trips would be affected. Only 12-day trips would be possible. Currently, commercial trips average 8.7 days in length, private trips average 17.5 days in length. This would affect both the private and commercial sectors' maximum and minimum trip length and significantly reduce options for trip variety and experiences. The option of taking 6-day trips to or from Phantom Ranch would continue and offer the visitor a river running experience in a short period.

Under this alternative strict scheduling would be employed to reduce on- and off-river contacts. At this level of use with outlined travel constraints, contacts would be at or above current patterns. Trips would be staggered to allow an average of 1.5 to 3 miles between them. However, trips would overlap resulting in contacts, as they stopped at different places along the river. Selection of this alternative would also require regimentation and scheduling of all aspects of the visitor experience in order to provide for resource protection.

Due to the scheduling necessary to accommodate the increased number of visitors, off-river use would be limited to no more than 3 to 4 hours at a time. This alternative would eliminate virtually all overnight off-river camping for the river running groups. Ultimately, more off-river use would be concentrated at the attraction sites that are

easily and quickly available from the river. Regimentation, scheduling and lack of options would detract from the quality of the visitor's experience.

This alternative would increase the need for interpretation and education of the visitor in regard to resource preservation. Since visitor use patterns and activities are directly related to preservation of the canyon, some of the resource damage caused by increased use could be mitigated by teaching the visitor how to avoid adverse impacts. In addition, the standard trip length of 11 days would increase the desirable factor of trip length and speed of travel which have been shown to increase the interpretive value of a river trip.

3. Economic Factors

Economic effects, under this alternative, would be moderate but beneficial. The river running industry makes up such a small part of the local and regional economies that increasing the total use levels by 85 percent would not have a significant impact on these economies. The only exception to this would be Kane County, Utah, where the industry makes up a sufficiently important part of the local economy that such an increase would have a positive effect.

The river running industry employs a limited number of full-time people. The majority of guides are seasonal due to the seasonal nature of the business. Most of the current concessioners could accommodate an increase in use by simply extending their running season with existing equipment and personnel. Significant additional employment, however, is possible under this alternative.

The increase in visitor use levels to the extent as defined in this alternative would have a considerable effect on park management. A detailed schedule of launch dates and times would have to be developed. An intricate scheduling of campsite assignments and times at camps and attraction sites would be necessary. All river runners, commercial, noncommercial and administrative trips would have to be intensively scheduled in such a system. This would require additional manpower and time both pre-season and during the season for education and training. Additional patrol efforts would be necessary to insure that assigned campsites are being used at the right location by the correct party, and this would require additional personnel and time as well as river-running equipment.

In summary, impacts on natural and cultural resources would increase. A greater number of visitors would be accommodated in the river corridor, but options would be severely limited and the river running wilderness experience degraded due to regimentation and strict scheduling. Economic benefits would accrue to the commercial sector, but costs would increase considerably for park operations.

C. REDUCE VISITOR USE LEVEL BY APPROXIMATELY 50 PERCENT

Reducing the visitor use levels by 50 percent would result in a total number of annual user days of approximately 55,000 and, under patterns of current use, a total number of visitors of approximately 7,000. The 55,000 user-day level is the original use level as proposed in the final environmental statement of the 1973 wilderness recommendation for the Grand Canyon Complex. This proposal was not adopted due to the Grand Canyon Enlargement Act and restudy of the proposed wilderness areas.

1. Impacts on Natural and Cultural Resources

With a 50-percent reduction in user days and total visitors, the rate of irreversible impacts may slow down, but the simple reduction in visitor use levels will not affect the magnitude of change nor stop impacts on the natural resources.

Under existing visitor use levels, approximately 20 tons of fecal materials are buried annually in the beach soils of the Colorado River. By reducing the visitor use level 50 percent, the amount of fecal material would also be reduced by one half, thus, partially alleviating some of the health, sanitation, and esthetic problems now associated with human waste disposal.

Off-river use to side canyons and other areas of historical/archeological/scenic interest in an integral part of the Grand Canyon experience. A reduction in visitor use levels would not necessarily change the existing patterns of off-river use for the visitors. Again, patterns of use are more impacting than use levels.

The present impact on the cultural resources results from vandalism and direct visitation to the historical and archeological resources of the Inner Canyon that are neither stabilized nor protected. Reducing the visitor use levels by 50 percent will possibly slow down the rate of deterioration, but will not affect the magnitude of change nor solve or stop the problems of visitor related impacts.

If, however, the reduction of visitor levels under this alternative were combined with the protective, regulatory and scheduling actions described in the proposal, natural and cultural resource impacts would be reduced far below those anticipated under the proposed plan. The natural purging capacity of the river system would not be exceeded and the potential for natural restoration would be greatest under this action.

2. Impacts on the Visitor

The major adverse impact of this alternative is the reduction in the number of persons who could experience a river trip through the canyon. Approximately 7000 persons per year would be denied the opportunity to visit a unique aspect of the National Park System; and, the non-commercial visitor, under present allotments, would be severely restricted.

The issue of crowding as used in this document, partially reflects the ability of the visitor to perceive his or her experience along the Colorodo River as a wilderness or recreation experience. The parameters that will effect the visitor's perception of the experience are as follows: (1) frequency of on-river encounters with other groups; (2) frequency of encounters at attraction sites; and (3) frequency of encounters at camping areas, mode of travel and length of stay. At present use levels, 91 percent of the river runners define their river trip as a wilderness experience (Shelby and Nielsen, 1976). Reducing the visitor use level by 50 percent would simply serve to improve upon a situation that is generally satisfying. Also, simple reduction of user-day levels will not, by itself, necessarily improve the character of the river trip or the quality of the wilderness river-running experience.

At present use levels, interpretation of the natural resources has been evaluated as less than desirable (Thompson, et al., 1975; Shelby and Nielsen, 1976). Reasons given for the "less than desirable" rating for current interpretive practices are (1) motor noise, (2) length of trip and (3) size of group. Reducing the current visitor use level by 50 percent would have no effect on the above items and thus have no effect on changing the interpretive experience of the visitor.

Substandard quality experiences that now result from visitor use patterns and activities can be mitigated by a combination of revised river running regulations and/or education programs and scheduling, as well as conversion to oar-powered travel. The 7000 persons whc would be afforded the opportunity to run the river under this modified alternative would then have the fewest contacts, little or no esthetic intrusions, and a purer wilderness experience.

3. Economic Factors

Reducing the visitor use levels by 50 percent will have no average negative effect on the total economy of the river running industry under existing managerial practices. However, factors other than available numbers of user days affect a concessioner's ability to earn profits.

Depending upon how allocation of this reduced use was made, especially among commercial concessioners, it could conceivably eliminate up to half or more of the existing 21 companies. Obviously this would cause financial hardship to those companies that are eliminated.

Half the existing companies may be eliminated as currently constituted; however, mergers or combinations could enable them to survive in a new form. The priority issue with 50 percent reduction is whether prices would increase. The cost of a trip would probably go up by as much as 30 to 40 percent, even 100 percent to clear the market. This may cause equity kinds of problems.

From data presented by Parent, 1976, it is hypothesized that the reduced level of use and a shift to higher priced trips (reduced commodity) would, therefore, narrow the availability of trips to higher income people.

Employment would be affected to a moderate degree since there are currently about 200 regular full-time guides (full-time = 5-month river running season), the reduction of visitor use levels by 50 percent would result in fewer than 100 part-time jobs being lost.

Management of the river corridor, under this alternative would be less costly than under the proposed action. Staffing needs would be reduced due to reduced river patrols and educational services. The potential for thoroughly informing all passengers and guides of river running procedures and regulations would be greater due to the reduced number of persons in need of training and/or education.

In summary, a simple reduction in visitor numbers will not necessarily improve existing environmental conditions, nor improve the quality of the visitor's experience. Combining reduced visitor levels with trip scheduling, sanitary regulations, and the elimination of motors would benefit both the visitor and the resources of the river corridor. However, a significant number of persons would be denied the river running experience and approximately half of the commercial operators would suffer economic hardships.

D. PROVIDE EXCLUSIVE PERIODS (JANUARY 1 THROUGH JUNE 30) FOR NON-MOTORIZED USE

This alternative may be considered a compromise between maintaining the status quo and the elimination of motors. This alternative would provide periods of time where the highest quality river running experience would be available to all persons traversing the

canyon. During the periods wherein motorized use was allowed, the status quo would be maintained. The period of use split from January 1 to June 30, with a 10-day transition period from motors to non-motors, would result in a 50-50 user day split at present use levels.

1. Impacts on Natural and Cultural Resources

Natural or cultural resources would not be affected to any significant degree by this alternative. Non-motorized oar trips, due to less variable speeds and fewer people could, however, serve to lessen contact and congestion at attraction sites, and thereby reduce resource impacts during the first half of the year. Scheduling of daily and weekly trip launches, similar to that of the proposal, as well as waste disposal regulations would have to be implemented to ensure adequate resource protection.

2. Socioeconomic Factors

The effects on the visitor would vary depending upon the season of choice. During the motorized periods, this alternative would maintain the status quo in terms of a variety of trip lengths (5 days to 18 days). During the non-motorized periods, the short 5- to 10-day trip through the entire river corridor would not be available.

Interpretation is greater and more effective on non-motorized craft (Shelby and Nielsen, 1976; Borden, 1976; Thompson et al., 1975). Thus, during the portion of the year that motorized use is permitted, a lesser quality river running experience would be available to the visitor, while during the non-motorized periods, the highest quality experience would be available.

It has been demonstrated that non-motorized trips are esthetically more pleasing to the park visitor. This alternative would provide half the year with maximized esthetic satisfaction. During the period in which motorized craft were allowed, the lower quality esthetic potential (status quo) would be maintained.

This alternative would probably have the greatest effect upon the commercial operator and the consumer. The January 1 season to June 30 season could cause firms to invest in two types of equipment--oar and motor. The added investment would adversely affect profitability and increase the price to the consumer.

The impact of this alternative on the park management would be to require additional on-river monitoring to insure that the motorized/ non-motorized periods of use were being maintained.

E. ELIMINATE MOTORIZED USE IN THE LOWER GORGE FROM DIAMOND CREEK (MILE 225.6) TO GRAND WASH CLIFFS (MILE 277)

This alternative would remove all motorized traffic from Diamond Creek to Grand Wash Cliffs. Powerboating, including up-river runs in the Lower Gorge, would not be allowed.

1. Impacts on Natural and Cultural Resources

The elimination of motorized craft and subsequent reduction in the numbers of persons engaging in lake recreation will significantly reduce overall resource impacts. The vegetation in the riparian zone below Diamond Creek is primarily dense stands of exotic salt cedar which grows on silt deposits which were laid down during the periods when the level of Lake Mead was substantially higher. Certain beach areas show extremely heavy impacts from visitor use and, generally, the problems of litter and waste disposal increase between Diamond Creek and Lake Mead. With a reduction in recreational activities and the relatively heavy visitor use, impacts on beach soils (erosion) and exotic vegetation (removal and trampling) will be minimal. A reduction in wood gathering, boat mooring, foot traffic, and deposition of fecal material and food scraps into the soils would occur. However, due to the fact that a completely unnatural habitat has replaced the native and ephemeral riparian vegetation in the lake zones, the elimination of use impacts may not be considered as important as improvement of the riparian zones above Diamond Creek.

The reduction in lake recreation activities will also serve to diminish disturbance to archeological and historic sites. Off-river use and camping are not major activities in the Lower Gorge at present. These activities would be further reduced, thereby, lessening impact on sites such as Bat Cave and Rampart Cave, as well as important archeological sites adjacent to the river and the lake.

2. Socioeconomic Factors

The elimination of motors would significantly reduce visitor options in the Lower Gorge area. A minimum of 12,000 visitors, other than river runners, would be affected. An estimated ½ of these visitors use powerboats to fish, either incidentally or primarily, in the Lower Gorge-Lake Mead area. Very few, if any, would continue to do so if motor boats were eliminated. The option of motorboat travel from Grand Wash Cliffs upstream into the park would be foregone. There is no indication that any of the visitors currently traveling upstream would still make the trip if motors were eliminated. An additional portion of the users who are continuing their river trip from Lee's Ferry or who launched at Diamond Creek would not choose to travel by oar the 40 miles of lake backwater to Pierce Ferry. Total use could be reduced by as much as 75 percent in this zone under these restrictions.

The elimination of motors will change the characteristics of the visitor who participated in a recreational activity in the Lower Gorge section of the canyon. The people in this part of the canyon come for different experiences than the participants in the upper 225.6-mile river trip. Present visitors are primarily interested in water-based recreation, through the use of powerboats, and the scenery for short weekends or one-day experiences. It can be assumed that these people would be replaced by a different socioeconomic group interested in a more natural, non-motorized experience and willing to spend the extra time necessary to travel the lake. It can also be assumed that use levels would drop if power boats are eliminated.

The elimination of motors would increase the time necessary to float the river from Diamond Creek to Grand Wash Cliffs by a minimum of 1 day. It would increase the time necessary to travel from Grand Wash Cliffs upriver to Separation Canyon from 2 to 3 hours to 2 to 3 days. The option of traveling the 40 miles of slackwater in a short period of time will be foregone for both river runners and lake recreationists.

Those visitors wishing to travel beyond Diamond Creek to Lake Mead can expect increased trip fees due to removal of motors from the Lower Gorge area. The cost of a commercial river trip taking out on Lake Mead could be increased as much as $35 to $70 to meet the increased cost of the extra day necessary to make the trip across the backwaters of Lake Mead.

Elimination of motors would also affect about 50 percent of the trips now launching from Lee's Ferry that end their trip on Lake Mead. This includes several companies who at this time travel the upper 240 miles by oar or paddle boat and use motor to propel them after Separation Canyon to Pierce Ferry (Mile 280). These companies would have to end their trip at Diamond Creek or spend at least 1 day longer traveling the lake. This would mean an added expense to the company for additional boatmen wages to travel to Pierce Ferry or for the use of the Diamond Creek Road, which is currently under a toll basis.

The Hualapai Tribe presently benefits from the operation of motorized float trips. Conversion from motor to oar will adversely affect their trips, all of which launch at Diamond Creek. The economy of the operation could be affected since at least one extra day would be needed to travel the backwater to Lake Mead by oar. The extra cost may discourage commercial passengers. The income of this commercial operation could be significantly reduced.

A positive economic effect, on the other hand, will probably occur at Diamond Creek. Removal of motors could potentially increase the revenues being paid to the Hualapai Tribe for the use of their road from Diamond Creek to Peach Springs because few companies would choose to spend the extra day on the lake and would take their boats out at Diamond Creek.

Some minor impact on the economy of the marinas on the east side of Lake Mead might occur. This would be due to the reduction in the purchasing of gasoline and other supplies for trips upriver.

F. ALLOCATION OPTIONS

None of the following options would result in environmental or cultural impacts significantly different from those discussed under the proposal in Section III. The management options will, however, affect the river running public to varying degrees.

1. Individual Application

This would provide that all persons or groups interested in a river trip would apply to the National Park Service for a permit. Successful permittees would be selected by the National Park Service through a procedure such as a lottery or on a first-come-first-served basis. The successful applicant would then determine whether to hire a commercial guide to take him/her down the river or purchase equipment and run the river as a private party.

At first glance, this appears to be a very fair method of allocation. This alternative is strongly proposed by many who are interested in noncommercial permits. The basic premise is that allocation would be set by the relative number of applications that come in from non-commercial applicants compared to those for commercial trips, thereby eliminating the need for the National Park Service to impose pre-set allocations.

This proposal while appearing to be more fair than current allocation methods may in fact result in being less equitable.

Commercial companies desire to maintain a sufficient amount of use to remain economically viable. Case studies have shown under very comparable situations that commercial companies artifically increase the number of applicants desiring concessioner guided trips through heavy advertising. Noncommercial applicants could not realistically compete with this sort of advertising, and therefore, would have less opportunity for a trip than persons applying for commercially guided trips.

A person or group desiring a commercially guided trip would not be assured of such a trip even if they were successful in obtaining a permit. The reasons are that a permit must be assigned for a given day and group size. There is no way to assure that a commercial trip would be available on the specific day and for the specific group size authorized by permit. Also, the specific type of trip, in terms of length, cost, type of boat, and other amenities may or may not be available.

Management of this system by the National Park Service would be very difficult. This is particularly so in reference to matching commercial trip permit holders with a trip.

The park visitor will be adversely impacted in that noncommercial applicants will have less opportunity for a river trip than commercial applicants and even less opportunity than under the present system. Commercial passengers who have obtained a permit will not be assured of a trip.

2. Equal Commercial Allocations

This option would provide an equal disbursement of the available trips among the approved concessioners. If the number of concessioners were to remain at 21, this alternative would result in each concessioner receiving 4.76 percent of the total available user days, 5,526 user days or 18 trips per company. Therefore, some companies would have less use than at present and others would receive an increased amount of use.

Not all companies would necessarily want as much use as would be available under this proposal. It is doubtful that the larger companies want to be reduced.

The variety of trip experiences available to the public would be reduced under this proposal as sameness of allocation is likely to result in stereotyped trips. This could result in narrowing the availability of trips to only a certain segment of the public.

3. Educational and Organized Group Allocation

This option would provide a special allocation of use to education and other organized groups. Some of these groups feel they should have special standing due to their educational or social service attributes.

An exact definition of "educational trips" has never been established and, in fact, Shelby and Nielsen (1976) showed that all trips result in meaningful educational experiences.

The flow of money to trip organizations and leaders must be assessed, as many such organizations are commercial. By law and regulation any commercial operation must obtain a commercial permit.

Educational and underprivileged youth groups have pressed for special allocations. They do not want to be considered as commercial even though some must be viewed as such due to their financial arrangements.

If educational and underprivileged youth groups are entitled to a special allocation then any other organized group would have to be given equal opportunity. This could include religious, civic, boy scouts, civil rights, conservation, and other organizations. In each instance of awarding special allocations for such groups, a determination of commercial/noncommercial status would have to be made and permits authorized accordingly.

Such an allocation would have a positive impact on those groups involved who would gain direct access to river trips. There appears to be more groups interested than could logically be permitted; therefore, selection of groups to gain permits would adversely affect those not selected.

Use allocation for the educational or organized groups would have to be taken from commercial and/or noncommercial allocations, thereby, adversely impacting those groups.

IX. CONSULTATION AND COORDINATION WITH OTHERS

A. CONSULTATION AND COORDINATION IN THE DEVELOPMENT OF THE PROPOSAL AND IN THE PREPARATION OF THE DRAFT ENVIRONMENTAL STATEMENT

1. Public Input

Public hearings on the preliminary wilderness proposal for lands within Grand Canyon began in May 1971. The most recent public review of a revised wilderness classification for the expanded park entailed both pre-planning public meetings in September and October 1975, and the distribution of the draft environmental statement (DES 76-28) in July 1976. The river corridor was an important issue during the 1971 hearings and the 1975 workshops, as well as in letters of comment responding to the draft statement. Over this 5-year period, there was not a significant fluctuation in public sentiment. Their input strongly favored the inclusion of the river and the surrounding land into a wilderness system, and included the elimination of motorized river craft, control of aircraft noise and preservation of the canyon's natural ecosystems.

Six river management workshops were held in March 1976 in the following cities; Phoenix, Arizona; Grand Canyon, Arizona; Los Angeles, California; San Francisco, California; Salt Lake City, Utah; and Denver, Colorado. The workshops were attended by 365 participants. Over 100 clubs and organizations were represented as well as many concerned individuals. About 27 percent each came from Arizona, California, and Colorado; 14 percent from Utah; and 5 percent from eight other states. Ages of the participants ranged from 12 to 69, of which 43 percent were between 20 and 29, and another 23 percent were between 30 and 34.

Participants were divided into small groups and asked to place on large easel pads those river-running issues of concern to them, and then to select the five issues which concerned them most. Six hundred fourteen issues were listed and 286 of the 365 participants handed in cards with the 5 issues thought to be the most significant.

Some 1,325 items plus 614 additional individualized issues were listed on the easel sheets. The most important item on the minds of the participants was how and to whom uses are to be allocated. Other concerns included the environment, motor vs. oars, methods of establishing permits, and wilderness designation.

The following is a list of issues raised and primary points of view taken in order of mentioning:

Allocation of Use. Most people were concerned with establishing a fair ratio or balance between private, commercial, and educational groups, basing it on demand figures. Most people recommended increasing private allocations. Other suggestions presented were giving priority use to the private sector, allowing an allocation for educational use, and staying with the status quo.

Environment. Protection and conservation were the key words here. Issues included the necessity of fires, the impact of people on the environment, stopping aircraft flights over the canyon, sanitation, and maintaining the water quality in the canyon.

Motors vs. Oars. This concerned many people, but views were mixed both for and against motors. A suggestion was presented to have motorless periods of the year, thus allowing for both experiences.

Permit Systems. Exactly how permits were to be issued brought varying responses. Some ideas were: issue all permits to individuals, then the permittee could decide whether to go privately or commercially, this was termed "hunting system"; keep the lottery system for private permittees as it is; do away with the lottery system and give priority to experienced private people.

Wilderness Designation. The majority were for designation of the river and surrounding areas into the wilderness system. The use of motors on boats in this designated wilderness was controversial. Some were for and some were against this use.

Disposal of Human Waste. The real answer here was left for research to determine. If disposal of human waste is determined to be a health hazard, dumping stations and carrying waste out of the canyon was suggested.

Total Use. The ceiling on use was again controversial. Most agreed to limit use to protect the canyon and "wilderness experience." It was suggested that by encouraging off-season use, less overall feeling of crowding might occur, with even a possibility of increasing the overall use ceilings.

Commercial Use. Concern was expressed about the amount of commercial advertising. Many people were concerned that this advertising is creating an unnecessary demand. The desire was also voiced to increase boatman standards and interpretive programs.

Limitations. Smaller maximum limits on group size for commercial parties and longer minimum lengths for commercial parties were suggested. Equality of limits for private and commercial use was also discussed.

Regulations. More enforcement of existing regulations and education of all users, rather than establishing more regulations, seemed to be a consensus.

Dams. Some would like to get rid of the dams now on the river. Almost all were against additional dams.

Private Trips. This was a major concern. Increased group size, the definition of private user, equipment criteria, criteria for private guides, the necessity of support boats for kayaks, policy on equipment rental, and posting monetary bonds to insure compliance with rules were all discussed.

Education. A need for better and more interpretation and training programs was discussed.

Wildlife. Control of burros was a dominant concern. The protection of all other wildlife was also stressed.

Research. The establishment of an ongoing monitoring program was considered important to evaluate changes or problems as they occur.

2. Coordination With Other Organizations

Hualapai representatives meet regularly with park officials at river running meetings held each year at Grand Canyon National Park. Close cooperation with the tribe is necessary since they maintain the only road access to the river between Lees Ferry and Pierce Ferry, that of Diamond Creek Mile 225.6. Park officials will continue to maintain close relations with the Hualapai to insure mutual understanding of the canyon and river running procedures.

During the fall of 1975, park personnel met with chairman, members of the Havasupai Planning Committee and the Bureau of Indian Affairs Planning Group. A workshop was also conducted by the Havasupai Tribal Council to discuss preliminary planning proposals for the Havasupai Land Use Plan. Discussions concerned backcountry use in the traditional use lands, trails crossing the reservation lands which may be needed by hikers to gain access to various portions of the national park, and a cooperative system for management of backcountry use in areas that border the Havasupai Reservation.

3. Consultation During Development of the Plan

Individuals who were contacted in person or by telephone during the fall of 1976:

Biology and Ecology - Dr. Stephen Carothers, Museum of Northern Arizona, provided direct input into the draft environmental statement

Beach Erosion and Pollution - Dr. Robert Dolan, University of Virginia

Economic Data - Dr. Michael Parent, Utah State University

Sociological Data - Dr. Joyce Nielsen and Dr. Bo Shelby, Human Ecology Research Services, Inc.

River Running Management - Middle Fork District Ranger, Challis National Forest, Forest Service, USDA

River Management Specialist, Utah State Office, Bureau of Land Management, USDI

Members of the Western River Guides Association, Salt Lake City, Utah

Members of the Sierra Club, Tucson, Arizona

B. COORDINATION IN THE REVIEW OF THE DRAFT ENVIRONMENTAL STATEMENT

Comments will be requested of the following:

Advisory Council on Historic Preservation
Department of Agriculture
- Forest Service

Department of the Interior
- Bureau of Indian Affairs
- Bureau of Land Management
- Bureau of Outdoor Recreation
- Bureau of Reclamation
- Fish and Wildlife Service
- Geological Survey

Department of Transportation
- Coast Guard
- Federal Aviation Administration

Environmental Protection Agency

Arizona State Clearinghouse
- Arizona State Historic Preservation Officer
- Northern Arizona Council of Governments

Havasupai Tribal Council
Hopi Tribal Council
Hualapai Tribal Council
Navajo Tribal Council

Informational copies will be sent to the following:

Coconino County Board of Supervisors
Coconino County Planner and Director
Mohave County Planning and Zoning Commission

Cocopai Resource Conservation Development Project

City Manager, Kingman, Arizona
City Manager, Williams, Arizona
Mayor, Flagstaff, Arizona
Mayor, Kanab, Utah
Mayor, St. George, Utah

Arizona Academy of Science
Advisory Commission of Arizona Environment
Aircraft Owners and Pilots Association
Arizona Conservation Council
Arizona Desert Bighorn Sheep Society, Inc.
Arizona Friends of the Earth
Arizona Mountaineering Club
Arizona Parks and Recreation Association
Arizona Wildlife Federation
Arizona Wildlife Society
Arizona-New Mexico Wildlife Society
Arizonans for Quality Environment
Citizens for a Best Environment
Colorado Plateau Environmental Advisory Board
Colorado River Wildlife Council
Conservation Foundation
Desert Protection Council
DNA-People's Legal Services
Environmental Conscience Corporation
Federation of Western Outdoor Clubs
Lord's Earth Committee
Maricopa Audubon Society
Museum of Northern Arizona
National Audubon Society
National Parks and Conservation Association
National Wildlife Federation
Nature Conservancy
Navajo Tribal Museum
Nevada Open Spaces Council
Saguaro Conservation and Ecology Club
S.A.V.E.
Save the Grand Canyon Committee
School of American Research
Sierra Club, Palo Verde Chapter

Southern Arizona Hiking Club
Southern Nevada Resources Action Council
Tucson Environment Center
Wilderness Society

American River Touring Association
Arizona Cattle Growers Association
Arizona Daily Star
Arizona Daily Sun
Arizona Public Service Co.
Arizona River Runners, Inc.
Babbitt Brothers Trading Co.
Canyon Food Mart
Canyon Squire Motel
Canyoneers, Inc.
Colorado River and Trail Expeditions, Inc.
Cross Tours and Explorations, Inc.
Flagstaff Chamber of Commerce
Fort Lee Company
Four Corners Regional Commission
Fred Harvey Company
Georgie's Royal River Rats
Grand Canyon Airlines
Grand Canyon Dories
Grand Canyon Expeditions
Grand Canyon Gas Company
Grand Canyon Scenic Rides
Grand Canyon Schools
Grand Canyon-Tusayan Chamber of Commerce
Grand Canyon Youth Expeditions, Inc.
Harris Boat Trips
Hatch River Expeditions
Hughes Air West
Kane County Record
Moki Mac River Expeditions
Moqui Lodge
O.A.R.S., Inc.
Outdoors Unlimited
Recreation Equipment, Inc.
Red Feather Lodge
Sanderson River Expeditions
Scenic Airlines, Inc.
Tour West, Inc.
Tri-State Flight Operations
Verkamps
Western River Expeditions, Inc.

White Water River Expeditions
Wilderness World
Williams Chamber of Commerce
Williams News
Wonderland Expeditions

X. REFERENCES

Aitchison, S. W. and S. W. Carothers, 1974. An ecological survey of the Colorado River and its tributaries between Lee's Ferry and the Grand Wash Cliffs. Colorado River Research Technical Report #10, Grand Canyon National Park.

Blinn et al., 1976 (See Czarneki et al., 1976).

Borden et al., 1976 (See Weeden et al., 1976).

Borden, F. Y., 1976. Carrying capacity for river running the Colorado River in the Grand Canyon region. Colorado River Research Technical Report #9, National Park Service, Washington, D. C.

Bowman, E. G., 1975 and 1976. Survey of noise levels in Grand Canyon National Park. Unpublished Research Report, Grand Canyon National Park, Arizona.

Carothers, S. W. and S. W. Aitchison, 1976. An ecological survey of the riparian zone of the Colorado River between Lee's Ferry and the Grand Wash Cliffs, Arizona. (Reports by S. W. Aitchison, S. W. Carothers, M. M. Karpisak, G. A. Ruffner, N. J. Sharber, P. L. Shoemaker, L. E. Stevens, M. E. Theroux, and D. S. Tomko.) Colorado River Research Technical Report #10, Grand Canyon National Park

Carothers S. W. and R. R. Johnson, 1975. Recent observations on the status and distribution of some birds of the Grand Canyon region. Plateau 47(4):140-153.

Carothers, S. W., J. H. Overturf D. S. Tomko, D. B. Wertheimer, W. Wilson, and R. R. Johnson, 1974. History and bibliography of biological research in the Grand Canyon Region and emphasis on the riparian zone. Unpublished Colorado River Research Report, Grand Canyon National Park, Arizona.

Cole, G. A. and D. M. Kubly, 1976. Recommendations following a limnology study of the Colorado River and its major tributaries in the Grand Canyon. Unpublished Colorado River Research Report, Grand Canyon National Park, Arizona.

Czarneki, D. B., D. W. Blinn, and T. Tompkins, 1976. A periphyton microflora analysis of the Colorado River and major tributaries in Grand Canyon National Park and vicinity. Colorado River Research Technical Report #6, Grand Canyon National Park, Arizona.

Deacon, J. E. and J. R. Baker, 1976. Aquatic investigations on the Colorado River from Separation Canyon to the Grand Wash Cliffs, Grand Canyon National Park. Colorado River Research Technical Report #15, Grand Canyon, Arizona.

Dolan, R., B. Hayden, A. D. Howard, and R. R. Johnson, 1976. Man's impact on the Colorado River fluvial deposits within the Grand Canyon. Paper for the First Conference on Scientific Research in the National Parks, New Orleans, Louisiana.

Dolan, R., A. Howard, and A. Galleson, 1974. Man's impact on the Colorado River in the Grand Canyon. Amer. Sci. 62(4):392-401.

Howard, A. D. and R. Dolan, 1976. Alterations of terrace deposits and beaches of the Colorado River in the Grand Canyon caused by Glen Canyon Dam and by camping activities during river float trips. Colorado River Research Technical Report #7, Grand Canyon, Arizona

Johnson, R. R., 1976. The Colorado River Research Project, a multi-disciplinary research project for management alternatives. Proceedings of visitor capacity symposium, NPS, Santa Fe, New Mexico.

Kilgore, B. M., 1973. A call for proposals: the river contact study. National Park Service, San Francisco.

Knudsen, A. B., 1976. A bacteriological analysis of portable toilet effluent at selected beaches along the Colorado River, Grand Canyon National Park, Arizona. Unpublished Colorado River Research Report, Grand Canyon National Park, Arizona.

Minckley, C. O. and D. W. Blinn, 1976. Summer distribution and reproductive status of fishes of the Colorado River and its tributaries in Grand Canyon National Park and vicinity during 1975. Colorado River Research Technical Report #14, Grand Canyon National Park, Arizona.

Shelby, B. and J. M. Nielsen, 1976. River contact study. Colorado River Research Technical Reports #1-4, Grand Canyon National Park, Arizona.

Sommerfeld, M. R., W. N. Crayton, and N. L. Crane, 1976. Bacteria, phytoplankton and trace chemistry of the Colorado River and tributaries in the Grand Canyon National Park. Colorado River Research Technical Report #12, Grand Canyon National Park, Arizona.

Suttkus, R. D., G. H. Clemmer, C. Jones, and C. R. Shoop, 1976. Survey of fishes, mammals, and herpetofauna of the Colorado River and adjacent riparian areas of the Grand Canyon National Park. Colorado River Research Technical Report #15, Grand Canyon National Park, Arizona.

Thompson, D., F. Y. Borden, and J. Rogers, 1974. Sound level evaluations of motor noise from pontoon rafts in the Grand Canyon. Unpublished Research Report, National Park Service.

U.S. Fish and Wildlife Service, 1973. Threatened Wildlife of the United States. Resource Publ. 114, U.S. Government Printing Office, Washington, D. C.

Weeden, H. A., F. Y. Borden, B. J. Turner, O. N. Thompson, C. H. Strauss, and R. R. Johnson, 1975. Grand Canyon National Park campsite inventory. Unpublished Research Report, National Park Service, Washington, D. C.

APPENDIXES

A. Colorado River Research Program

B. Concessioner Fact Sheet

C. Boating Safety Standards

D. Noncommercial and Commercial Guide Requirements

E. Breeding Birds of the Colorado River

F. Mammals of the Colorado River

G. Summary of Economic Analysis

APPENDIX A

COLORADO RIVER RESEARCH PROGRAM

Grand Canyon National Park

A series of research investigations relating to the natural resources of the Colorado River within Grand Canyon National Park and visitor recreation uses was initiated in 1973. These studies were conducted under contract with educational institutions and a professional research firm to provide scientific information to serve as the basis for realistic management decisions and for the development of a resources management plan for the Colorado River from Lee's Ferry to Grand Wash Cliffs.

Final reports on all of these projects have been received by the National Park Service and have been professionally reviewed and analyzed. Basic findings and recommendations from each report will be consolidated into a synoptic report which the National Park Service managers responsible for the Colorado River will use in the implementation of the river management plan.

Each project is listed below with: the title of the project, the contract or purchase order number; the organization to which the contract was issued; the principal investigator, and the period covered by the study.

1. Ecology of the riparian zone of the Colorado River including (1) vegetation mapping, (2) interrelationships of visitors with plants and animals, (3) successional changes in plants as a result of Glen Canyon Dam, (4) population densities, home ranges and demography of important vertebrates, (5) impact of wild burros on beaches, (6) impact of burros on vegetation, (7) an inventory of insect species; CX821550007; Museum of Northern Arizona; Dr. Steve Carothers; FY 75 and 76.

2a. Sociological carrying capacity of the Grand Canyon-Colorado River area (commercial use); CX821040104; Human Ecology Research Services, Inc.; Drs. Eugene Haas, Joyce Nielsen, and Bo Shelby; FY 74 through FY 76.

2b. Sociological carrying capacity of the Grand Canyon-Colorado River area (private use); change order; Human Ecology Research Services, Inc.; Drs. Eugene Haas, Joyce Nielsen, and Bo Shelby; results incorporated into the final report of the commercial use; FY 75 - 76.

3. Grand Canyon National Park campsites inventory; CX000-3-0061; Penn. State University; Dr. F. Yates Borden; FY-75; Dr. Borden has completed a physical carrying capacity model.

4. Human waste disposal analysis (porta-potty) along the Colorado River; CX821060029; University of Arizona; Dr. Robert Phillips; FY-76

5. Analysis of human waste disposal with special reference to public health and bacteriology; Dr. Bruce Knudsen and Grand Canyon National Park science staff; FY-75

6. Sound level evaluations of motor noise from pontoon rafts in the Grand Canyon; CX0001-3-0061; Penn. State University; Don Thompson; FY-75.

7. History with bibliography of biological research in the Grand Canyon region with emphasis on the riparian zone; PX821040040; Museum of Northern Arizona; Dr. Steve Carothers; FY-74.

8. Riparian feasibility study; CX821050079; Museum of Northern Arizona; Dr. Steve Carothers; FY-74.

9. Number and distribution of burros in the Grand Canyon; PX821050830; Museum of Northern Arizona; Dr. Steve Carothers; FY-76.

10. Burro follow-up study; damage and recommendations for protection of the Grand Canyon ecosystem; PX821060722; Museum of Northern Arizona; Dr. Steve Carothers; FY-76.

11. Status survey of vertebrates and associated plants of the riparian area and Inner Gorge of the Grand Canyon, with emphasis on fishes; CX821060006; Tulane University; Dr. Royal Suttkus; FY-76.

12. Aquatic investigations on the Colorado River from Separation Canyon to the Grand Wash Cliffs; PX821060350; University of Nevada at Las Vegas; Dr. James Deacon; FY-76.

13. Survey of fish and their breeding status in the Colorado River; PX821060298; Dr. Royal Suttkus; FY-76

14. Study of the status of fish in the Colorado River; collaborator; University of Michigan; Dr. Robert Miller; FY-76

15. A preliminary survey of fishes of the Colorado River in the Grand Canyon (feasibility study); PX821050965; Dr. Royal D. Suttkus; FY-75.

16. Limnologic studies on the Colorado River in the gorge of the Grand Canyon, Grand Canyon National Park (feasibility study); PX821050862; Arizona State University, Dr. Gerald Cole; FY-75.

17. Continued studies on the limnology of the Colorado River in Grand Canyon National Park; PX821060263; Arizona State University; Dr. Gerald Cole; FY-76

18. Periphyton microfloral analysis of the Colorado River-Lake Powell to Lake Mead; CX821060008; Northern Arizona University; Dr. Dean Blinn; FY-76.

19. Analyses of periphyton and certain physico-chemical parameters from the Colorado River system between Lakes Powell and Mead (feasibility study); PX821050861; Northern Arizona University; Dr. Dean Blinn; FY-75

20. Survey of phytoplankton, bacteria and trace chemistry of the lower Colorado River and tributaries in the Grand Canyon (feasibility study); PX821050863; Arizona State University; Dr. Milton Sommerfeld; FY-75

21. Survey of bacteria, phytoplankton, and trace chemistry of the lower Colorado River and tributaries in the Grand Canyon; CX821060007; Arizona State University; Dr. Milton Sommerfeld; FY-76

22. An annotated bibliography of limnologically related research on the Colorado River and its major tributaries in the region of Marble and Grand Canyons; PX821041350; Arizona State University; Dr. Gerald Cole; FY-74.

23. An inventory of large and small bird bones from Stanton's Cave PX821050967; University of Arizona; Dr. Amadeo Rea; FY-75 - FY-76.

24. Camelthorn control; no contract; NPS-GRCA; Dr. Roy Johnson.

25. The establishment of bench marks and GCNP techniques for measuring erosion along the Colorado River; PX821060262; University of Virginia; Dr. Alan Howard; FY-76.

26. Changes in fluvial deposits of the Colorado River in the Grand Canyon; continuation of Washington-funded project CX821060009; University of Virginia; Drs. Alan Howard and Robert Dolan; FY-76

27. Hydrology and sedimentology of the Colorado River; CX821060030; University of Arizona; Dr. Emmett Larsen; FY-76

28. Analysis of backcountry trail use in Grand Canyon National Park; CX821060027; Museum of Northern Arizona; Dr. Steve Carothers; FY-76

29. Economic analysis of river companies running the Colorado River in Grand Canyon National Park; CX821060028; Utah State University; Dr. Michael Parent; FY-76

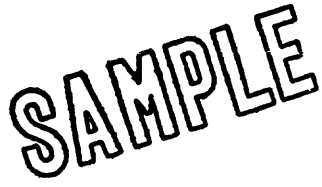
APPENDIX B

Fact Sheet

Colorado River Float Trips

Grand Canyon

National Park



United States

Department of the Interior

National Park Service

FACT SHEET

1. The Department of Interior, National Park Service, Grand Canyon National Park proposes to issue concession permits to no more than 20 persons and/or companies to provide guided river trips on the Colorado River through Grand Canyon National Park. Any offer submitted within 30 days of publication date of public notice will be considered and evaluated as to experience, financial capabilities and other criteria. Offers from the existing concessioners listed below will be given preference in renewal as required by Section 5 of the Act of October 9, 1965, (79 Stat. 969; 16 U.S.C. 20).

> "SECT. 5. The Secretary shall encourage continuity of operation and facilities and services by giving preference in the renewal of contracts or permits and in the negotiation of new contracts or permits to the concessioners who have performed their obligations under prior contracts or permits to the satisfaction of the Secretary. To this end, the Secretary, at any time in his discretion, may extend or renew a contract or permit, or may grant a new contract or permit to the same concessioner upon the termination or surrender before expiration of a prior contract or permit. Before doing so, however, and before granting extensions, renewals or new contracts***, the Secretary shall give reasonable public notice of his intention so to do and shall consider and evaluate all proposals received as a result thereof."

2. A. Names and addresses of current concessioners are:

ARTA (Southwest)-Bob & Jessica Elliott
c/o American River Touring Ass'n.
1016 Jackson St., Oakland, CA 94607
(415) 465-9355

ARIZONA RIVER RUNNERS, INC.
Fred and Carol Burke
Box 2021
Marble Canyon, Arizona 86036
(602) 355-2223 or 2224

CANYONEERS, INC.
Grace Ralston
P. O. Box 2997
Flagstaff, AZ 86003
(602) 626-0924

GRAND CANYON DORIES, INC.
Martin Litton
P. O. Box 3029
Stanford, California
(415) 851-0411

GRAND CANYON EXPEDITIONS, INC.
Ron and Sheila Smith
P. O. Box O, Dept. NPS
Kanab, Utah 84741
(801) 644-2691

GRAND CANYON YOUTH EXPEDITIONS
Dick and Susan McCallum
Rural Route 4, Box 755
Flagstaff, AZ 86001
(602) 774-8176

COLORADO RIVER EXPEDITIONS, INC.
David J. Mackay
5058 S. 300 W
Salt Lake City, Utah 84107
(801) 261-1789, 485-8572

CROSS TOURS & EXPLORATIONS, INC.
John L. Gross
274 W. 1400 S.
Orem, Utah 84057
(801) 225-0849

GEORGIE'S ROYAL RIVER RATS
Georgia Clark
P. O. Box 12489
Las Vegas, Nevada 89112
(702) 451-5588

OUTDOORS, UNLIMITED
John Vail
2500 Fifth Avenue
Sacramento, CA 95818
(916) 452-1081

SANDERSON RIVER EXPEDITIONS
Jerry Sanderson-Bill Diamond
P. O. Box 1535
Page, Arizona 86040
(602) 645-2587

TOUR WEST, INC.
Russell H. Hansen
P. O. Box 333
Orem, Utah 84057
(801) 225-7600 (800) 453-9107

WESTERN RIVER EXPEDITIONS, INC.
Jack Currey
P. O. Box 6339
Salt Lake City, Utah 84106
(801) 486-2323

HARRIS BOAT TRIPS
David Kloepfer
Box 521
Kanab, Utah 84741
(801) 644-5635

HATCH RIVER EXPEDITIONS, INC.
Don & Ted Hatch
411 E. 2nd N.
Vernal, Utah 84078
(801) 789-3813

MOKI MAC RIVER EXPEDITIONS
Richard Quist
6829 Bella Vista Drive
Salt Lake City, Utah 84121
(801) 943-6707, 564-3361

O.A.R.S., INCORPORATED
George Wendt
Box 67,
Angels Camp, CA 95222
(209) 736-2924

WHITE WATER RIVER EXPEDITIONS
Henry Falany
P. O. Box 1249
Turlock, CA 95380
(209) 634-1133

WILDERNESS WORLD
Vladimir Kovalik
1342 Jewell Avenue
Pacific Grove, CA 93950
(408) 373-5882

WONDERLAND EXPEDITIONS
Ken Sleight
P. O. Box 338
Green River, Utah 84525
(801) 564-3656

B. Address and telephone number of Superintendent is:

Superintendent
P. O. Box 129
Grand Canyon, Arizona 86023
(602) 638-2411

3. Term of the proposed permit is not to exceed 5 years. Current permits as extended expire December 31, 1979.

4. The only National Park Service government owned facilities to be used by the concessioners are the launch ramp at Lee's Ferry in Glen Canyon National Recreation Area and the take-out at Pierce Ferry in Lake Mead National Recreation Area. The only other take-out at Diamond Creek is governed by the Hualapai Indian Tribe.

5. A description of managerial background and experience of the owner and/or manager should be included. Offers will be evaluated as to previous experience and background in river guiding service comparable to that proposed here. Experience on the Colorado River in Grand Canyon or other comparable rivers is essential. Business references must be included.

The offer should include a statement to show that the offerer is financially capable of entering into such a business and can successfully provide a satisfactory service to the public.

If the applicants are, or are to be, newly formed corporations, the financial statement relating thereto should accompany the offer showing the amount of capital pledged or paid in by the principals, together with personal financial statements and business and personal references of the individual principals. Any changes in the stockholders and in the ratio of stockholdings, after such submission, must be submitted and will be considered as part of the original proposals. In addition, all applicants proposing to finance the concession through borrowed capital must submit a financial plan showing its ability to secure such additional funds.

The concessioner will be required to adhere to the System of Account Classification prescribed by the National Park Service. A copy of the system and instructions for its use are available for review in the Superintendent's Office. The permit will require the concessioner to submit annually a financial report as prescribed by the National Park Service covering all operations conducted pursuant to the permit. The permit will provide that the reports and records of the concessioner will be subject to audit by the Secretary. In addition, pursuant to the Act of October 9, 1965 (79 Stat. 969; 16 U.S.C. 20), the Comptroller General of the United States or his duly authorized representatives shall have access to and the right to examine any pertinent records of the concessioner related to operations under the permit.

6. The franchise fee will be determined at a rate per/user day. The rate will be based upon an amount equal to approximately 3 percent of the estimated gross receipts. Franchise fees will be subject to periodic renegotiation. The offerer must state the amount of franchise fee he is willing to pay.

7. The offerer must agree to comply with all state and Federal laws pertaining to equal employment opportunity and nondiscrimination.

Salaries and hours of work of employees must conform with all Federal and local laws, rules, and regulations now in force or which may hereafter be promulgated. The concessioner shall comply with the requirements of all Federal and state laws and regulations relating to minimum wage, social security, unemployment insurance, and workmen's compensation.

The concessioner will be required to adhere to the equal employment opportunity requirements of Title VII of the Civil Rights Act of 1964 and Executive Order No. 11246 of September 24, 1965, as amended by Executive Order No. 11375 of October 13, 1967. The offer must be accompanied by the attached Equal Opportunity Questionnaire.

The concessioner and its employees will also be required to practice nondiscrimination in the furnishing of accommodations and services to the public. He shall require employees to observe all applicable rules and regulations and to exercise courtesy and consideration in their relations with the public. If required by the Secretary, the concessioner shall require its employees, who come in contact with the public, to wear a uniform or badge to show they are its employees. Any person in the employ of the concessioner found objectionable to the Secretary shall be subject to immediate dismissal.

8. Public notice will be made of the intent to renew permits giving the opportunity for anyone interested in providing this service an opportunity to submit a proposal, within 30 days of publication date.

9. Selection Criteria

A. Financial, Managerial and Insurance

1. All offerers must submit evidence of the financial capability to provide the services indicated. Consideration will be given to previous financial management background of existing concessioners and to financial abilities, background, and experience of new offerers in river running or other similar business. Current concessioners will be evaluated on the basis of current financial conditions and on financial statements submitted during the term of the present permit. New offerers will be evaluated from a statement of current financial conditions.

   A ratio of one to two equity capital to borrowed capital will be considered as a minimum standard for ability to operate the required services.

2. Managerial ability of existing concessioners will be evaluated on the basis of the records and experience during the term of current permits.

   New offerers should submit a statement of managerial background in this or similar business and include references from which they can be evaluated.

3. Offerers must show current insurance status. Current insurance policies or statements of insurability will be necessary. Amount of insurance is not specified but must be sufficient to cover any normal potential liability to the concessioner and must show the United States Department of Interior, National Park Service as co-insured.

   Evaluation of insurability will consist of consideration of previous insurance experience and future potential to be insured.

B. Services to be Offered

1. Trip length: While it is recognized that most full length trips will be from 12 to 14 days in length, a variety of trip lengths are encouraged through offering less than full length trips. Use of trails such as Tanner, Kaibab, Bright Angel, Hermit, Bass, Tapeats, Havasu, Whitmore, etc., can provide a variety of trip lengths involving a hike in or out or both in and out. Overnight hikes on any of these trails must be approved through the backcountry reservation system, however, day hikes into or out of the canyon do not.

   A variety of trip length is desired for the public who wish to take concessioner guided river trips. The river management plan proposes that approximately half of the commercially guided trips be 12 days long, one fourth average, 14 days in length, and the remaining one fourth average 16 days in length. In order to achieve this balance in trip lengths offered, selection of concessioners will be considered as a group.

   Offers may be for all 12-day trips, all 14-day trips, all 16-day trips, or a combination thereof. The service will select concessioners so that the above overall approximate percentages are reached. Negotiations with offerers is likely so that this may be achieved. The offer should specify the number of trips requested. Maximum group size will be 25 passengers plus five crew not to exceed 30 total.

2. Menu: A description of the menu to be offered should be included in the offer.

3. Personal Gear: Items of personal gear to be provided such as sleeping bags, mattress pads, small ammo cans, duffel bags, rain coats, etc., should be described.

4. Rates: The offer should show rates to be charged for trips and services offered. A breakdown of trip charges should be included as to food charges, extra gear provided, shuttle service, on river transportation, before or after trip services such as lodging or meals, etc.

   Services offered will be evaluated as to length of trip, menu, extra gear, etc., compared to rates proposed for the specific trip described.

C. Equipment

1. The offer should include a list and description of boats and related equipment such as oars, frames, coolers, food boxes, river bags, etc. The description should include the age and previous usage of such equipment. Photos of equipment could be included.

2. Safety equipment should be listed and described including number, type, and age of life jackets, number and general contents of first aid equipment, and emergency signaling equipment.

3. Type of stores for cooking should be listed along with other general cooking gear.

4. Human waste haul-out equipment and procedures should be described.

   A brief description of previous experience and use of equipment to be used should be included, since evaluations will be made on the basis of apparant quality, care, and experience of the offerer in the use of such equipment. Standards outlined in the river management plan will be the criteria used in selecting successful applicants as to equipment.

D. Experience and Expertise

A statement of the experience and expertise of the offerer and personnel to be involved should be included. This should

include experience and background of boatmen and trip leaders who are now working for existing permittees. Also proposed training programs for new boatmen, plus a statement of willingness to participate in NPS training programs should be given.

All personnel must meet the standards outlined in the river management plan as to boatmen and trip leaders.

E. Interpretation

Proposed interpretive programs should be described. This should include any special areas that the offerer plans to emphasize, the experience and qualifications of boatmen and trip leaders relative to knowledge of the natural features of the Grand Canyon, and background in interpretation programs.

Evaluation of interpretative programs will be based on previous experience and qualifications of the offerer and its personnel as described above.

10. The National Park Service is interested in providing the public a variety of service as to trip length, price, menu, interpretation, style of boats, etc. In order to meet this objective, offers will be evaluated both individually and as a group.

11. The river management plan is attached to this fact sheet and should be reviewed in detail by all offerers. All proposals must be within the framework of the plan and this fact sheet.

12. The National Park Service reserves the right to seek supplemental information at any time prior to the award of a permit, in clarification or amplication of information furnished by the applicants with its offer. The National Park Service will determine whether the applicants are sufficiently financed to provide the necessary facilities and to operate the concession in a satisfactory manner.

APPENDIX C

BOATING SAFETY STANDARDS

I. Types of Craft

A. Inflatable boats are well suited for the trip down the Colorado River. Certain recommendations for raft size have been established to insure a safe river trip.

1. Single boat trips must be approved by the Superintendent

2. For a two-boat trip, rafts must be of the "7-man" size or larger minimum length of 12 feet, minimum width 5½ feet, minimum tube diameter 15 inches.

3. Trips with more than three boats may travel in any size craft providing they meet all other equipment standards, e.g., toilets, holding tanks, and fire pans, and have a knowledge of the Colorado River through Grand Canyon National Park.

B. Hard hulled boats, such as dories, may be used if two or more are traveling together or if accompanied by approved rafts or pontoons.

C. Fiberglass or sturdy plastic whitewater canoes and kayaks are approved craft provided that, the paddler has adequate prior experience in heavy whitewater (6' to 15' waves are common). He or she must have a strong brace on both sides and a reliable roll on at least one side.

II. Capacities

Because of the nature of the Colorado River rapids, manuverability and stability are important factors in safety. Recommended maximum capacities for boat sizes are listed below:

A. Dories, five persons. 17-18 feet in length.

B. Inflatable rafts and pontoons (persons and gear):

1. Pontoons between 22' and 27' in length - 9 persons.

2. "Snouts" (22) - 6 persons.

3. "Green River" (17') - 6 persons.
   Triple operation - 15 persons.

4. "Yampa" and "10-man size" - 5 persons.
   Triple operation - 15 persons.

5. "7 man" and "Selway size" - 3 persons.

III. Life Preservers and Regulations

Each participant MUST have a U.S. Coast Guard approved life preserver. One extra life preserver for every 10 persons must be carried. They must be maintained in good and serviceable condition in compliance with U.S. Coast Guard Standards, AND MUST BE WORN AT ALL TIMES WHILE ON THE RIVER. The permittee will be held accountable. A court appearance is mandatory for failure to comply with this regulation. (36 CFR 7.4(h)(2). Life jackets are subject to testing prior to departure at Lee's Ferry, and those found to be nonserviceable will be marked and discarded. (All webbing, straps, buckles, clips, kapok envelopes or foam and outer fabric or material will be checked for serviceability.) A throwable device (Type IV) is also required for each watercraft over 16 feet in length. (It is recommended that all trips carry throwable devices).

The use of Type I or V is encouraged, but Type II and III are acceptable for use on noncommercial river trips.

Commercial trip passengers are required to use Type I or V.

IV. First Aid

A major first-aid kit is required and shall be carried on each trip. A smaller kit should be carried on each boat. A list of recommended first-aid items will be provided to each successful permittee.

V. Communications and Signalling

A. Emergency signalling equipment will include a signal mirror of the U.S.A.F. type and a set of signal panels, 3' x 10', one international orange and one white. In the event of an emergency, the symbol "X" marked or placed on the ground by any means will signify that help or emergency aid is necessary. Upon notification by observers, a helicopter will be dispatched by the National Park Service.

B. Recommended (though not required) equipment is a ground-to air radio transceiver on frequency 122.9 and a personnel distress flare kit.

VI. Other Emergency Items

A. A minumum of one extra set of oars must be carried on each oar-powered boat or raft (four per boat). An extra set of paddles are acceptable for approved rafts that are paddle-powered.

B. When inflatable rafts or pontoons are used, each river trip will carry at least one air pump.

C. Every river trip will carry a boat-patching and repair kit.

D. A supply of ropes and canteens should be carried.

E. One or more of the following maps or guides should be carried on each boat: The Les Jones scroll map of the Colorado River; Colorado River Guide, by Buzz Belknap; "Pictoral Color Map of Grand Canyon," Jack Currey; appropriate U.S.G.S. quadrangles; B.Y.U. guidebooks to the Colorado River; "Colorado River Guidebook," Troy L. Pewe.

APPENDIX D

Noncommercial and Commercial Guide Requirements

I. Noncommercial

Experience on one or more of the other western whitewater rivers or equivalent is mandatory. The trip leader, or another member of the party should be familiar with the Grand Canyon portion of the Colorado River. This is necessary due to the unique nature of this stretch of river. Controlled releases from Glen Canyon Dam result in daily water flow fluctuations averaging between 1,500 and 30,000 cubic feet per second, considerably more than most of the commonly run western rivers.

Heavy hydraulics, the shocking contrast between 50^{o} water and 100^{o} air temperatures and the unusual degree of isolation require that the trip leader and boatmen have a working knowledge of whitewater safety, general first aid and river equipment repair in addition to techniques of whitewater navigation (ability to skillfully interpret or read rapids) and map reading skills.

II. Commercial Trip Leader and Guide Requirements

A. Registration

All guides and trip leaders must be registered with the Superintendent, Grand Canyon National Park, and companies must provide the following information on each guide/leader.

1. Name, birthdate, mailing address.
2. Experience (motor and/or oar-powered), where, and dates (inclusive).
3. Company(s) with whom previously employed
4. Current status (leader, guide, trainee, etc.)

B. Certification

A certification program will be established in cooperation with outfitters and guides, which will include qualification standards, training requirements, etc. Until this program is finalized, the following requirements will remain in effect:

1. Guide: An individual who meets the following qualifications:

   a. Must be age 18 or older.

   b. Have made at least three river trips through the portion of the Colorado River to be traversed as a trainee or apprentice under a qualified guide, having run every rapid on the river at least twice.

   c. Be able to read the river and operate a boat accordingly.

   d. Be able to operate the emergency communications equipment carried by the outfitter.

   e. Have a knowledge of State, U.S. Coast Guard, and National Park Service regulations applicable to boats carrying passengers for hire.

   f. Have a knowledge of Grand Canyon natural and human history and the points of interest, and the ability and willingness to impart this knowledge to passengers.

   g. Have a working knowledge of safety, sanitation, and equipment repair.

   h. A standard first-aid certificate equivalent to the Red Cross course is required.

2. Trip Leader: A person whose character, personality, and capabilities qualify him as a responsible leader shall be in charge of each river party. In addition to meeting the guide qualifications, the individual must:

   a. Have made at least three additional river trips through the portion of the Colorado River to be traversed, all as a guide running the entire trip.

   b. Hold a current first-aid certificate, indicating the holder has satisfactorily completed the equivalent of an American Red Cross Advanced First Aid or Emergency Medical Technician course.

   c. Be knowledgeable and capable of giving a suitable orientation talk to all passengers throughout the trip. This required orientation will cover life preservers, boating safety, swimming and hiking safety, drinking water, sanitation, and human and natural history of the Grand Canyon.

APPENDIX E

The Breeding Birds of the Colorado River From

Lee's Ferry (Mile 0) to Diamond Creek (Mile 225)

Species 4/	Preferred Habitat 1/	Status 2/	Relative Density	Average Absolute Density Pairs/ 225 mi. 3/
Turkey Vulture	B	SR	0.76	6.8
Cooper's Hawk	A	SR	0.11	1.0
Red-Tailed Hawk	B	PR	0.50	4.5
Golden Eagle	B	PR	0.25	2.3
Prarie Falcon	B	PR	0.15	1.4
Peregrine Falcon	B	PR	0.15	1.4
American Kestrel	A	PR	0.84	7.5
Spotted Sandpiper	A	SR	6.44	57.0
Morning Dove	A	SR	9.92	87.8
Greater Roadrunner	B	PR	0.11	1.0
Great-Horned Owl	B	PR	0.11	1.0
Black-Chinned Hummingbird	A	SR	1.32	11.7
Ladder-Backed Woodpecker	A	SR	0.11	1.0
Ash-Throated Flycatcher	A	SR	1.09	9.7
Black Phoebe	A	SR	0.92	8.2
Say's Phoebe	A	SR	2.71	24.0
Willow Flycatcher	A	SR	0.11	1.0
Common Raven	B	PR	3.31	29.3
Dipper	A	PR	(not on river, in flowing tributaries)	
Canyon Wren	B	PR	11.45	101.3
Rock Wren	B	PR	8.98	79.5
Blue-gray Gnatcatcher	A	SR	1.27	11.3
Phainopeola	A	SR	0.22	2.0
Starling	A	SR	(only in heavily populated areas)	
Lucy's Warbler	A	SR	19.67	172.5
Yellow Warbler	A	SR	1.86	16.5
Common Yellowthroat	A	SR	0.92	8.2
Yellow-Breasted Chat	A	SR	2.03	18.0
House Sparrow	A	PR	0.11	1.0
Northern Oriole	A	SR	0.22	2.0

APPENDIX E (continued)

Species 4/	Preferred Habitat 1/	Status 2/	Relative Density	Average Absolute Density Pairs 225 mi. 3/
Brown-Headed Cowbird	A	SR	1.01	9.0
Blue Grosbeak	A	SR	2.88	25.5
Indigo Bunting	A	SR	(only in Tapeats, Deer and Havasu Creeks)	
Lazuli Bunting	A	SR	(only in Tapeats, Deer and Havasu Creeks)	
House Finch	A	SR	15.25	135.0
Lesser Goldfinch	A	SR	0.41	3.7
Black-Throated Sparrow	B	PR	0.11	1.0
TOTAL			100.00	884.7

1/ A = riparian vegetation
B = desert scrub, talus slopes and verticle cliffs

2/ SR = summer resident; PR = permanent resident

3/ Average absolute density determined from field data gathered in April May and June

4/ Three species which prefer the verticle cliff areas for nesting, the white-throated swift, the violet-green swallow and the cliff swallow are locally colonial and their densities have not been determined. (after Carothers and Aitchison, 1976)

APPENDIX F

The Mammals of the Colorado River Area
(Lee's Ferry to the Grand Wash Cliffs)

Species	Preferred Habitat	Rel. Abundance
BATS		
California Myotis *Myotis californicus*	A	R
Long-eared Myotis *Myotis evotis*	A	R
Small-Footed Myotis *Myotis subulatus*	A	R
Long-Legged Myotis *Myotis volans*	A	R
Western Pipistrelle *Pipistrellus hesperus*	A	C
Big Brown Bat *Eptesicus fuscus*	A	FC
Red Bat *Lasiurus borealis*	A	R
Lump-Nosed Bat *Plecotus townsendii*	A	UC
Pallid Bat *Antrozous pallidus*	A	UC
RACCOON RINGTAIL AND SKUNKS		
Spotted Skunk *Spilogale graulis*	A	FC
Raccoon *Procyon lotor*	A	R
Ringtail *Bassariscus astutus*	A	C
COYOTES AND FOXES		
Coyote *Canis latrans*	A & B	UC
Gray Fox *Urocyon cinereoargenteus*	A & B	UC

Species	Preferred Habitat	Rel. Abundance
CATS		
Bobcat *Lynx rufus*	A & B	UC
Mountain Lion *Felis concolor*	A & B	UC
SQUIRRELS, GROUND SQUIRRELS, CHIPMUNKS, PRAIRIE DOGS		
Cliff Chipmunk *Eutamias dorsalis*	B	UC
White-Tailed Antelope Ground Squirrel *Citellus leucurus*	B	UC
Rock Squirrel *Citellus variegatus*	B	UC (except popular campgrounds)
MICE AND RATS		
Western Harvest Mouse *Reithrodontomys megalotis*	A	UC
Brush Mouse *Peromyscus boylii*	A	UC
Canyon Mouse *Peromyscus crinitus*	B	A
Cactus Mouse *Peromyscus eremicus*	A & B	A
Deer Mouse *Peromyscus maniculatus*	A	FC
Pinyon Mouse *Peromyscus truei*	A	R
White-Throated Wood Rat *Neotoma albigula*	A	FC
Desert Wood Rat *Neotoma lepida*	A & B	FC
Long-Tailed Pocket Mouse *Perognathus formosus*	A & B	UC
Rock Pocket Mouse *Perognathus intermedius*	A & B	FC

Species	Preferred Habitat	Rel. Abundance
UNGULATES		
Bighorn Sheep *Ovis canadensis*	B	FC
Mule Deer *Odocoileus hemionus*	B	FC
BEAVER		
American Beaver *Castn canadensis*	A	C

A = Riparian Habitat; B = Desert Scrub, Talus Slopes; R = Rare;

UC = Uncommon; FC = Fairly Common; C = Common; A = Abundant

APPENDIX G

SUMMARY OF ECONOMIC ANALYSIS

Grand Canyon River Trip Concessioners

1. The Economic Equitability of River Trip Concessions

Most of the concessioners are financially viable; however, there are wide variations in profit structure, asset structure, working capital position and overall financial structure. Most firms are profitable, some earning a 15 to 20 percent profit and paying high officer salaries (up to $64,000). The average industry profitability is not excessive, considering the size of the average firm. The smaller firms show a greater variability in economic stability; however, there is no indication that measurable economies of scale exist. That is, there is no substantial indication that the size of the firm (in user day allotments) has anything to do with the quality of the river trip experience provided to the park visitor. Management expertise, rather than size of the firm influences absolute profitability by influencing the profit rate. For example, if a large firm and a small firm earned 15 percent and the 15 percent were fixed by the National Park Service regulations, then obviously the size would influence absolute profits. However, in the case of Grand Canyon National Park, the two largest firms had the highest and lowest absolute profits, and a low allocation firm had among the highest absolute profits. Profit rates differ probably due to management expertise (not just experience) rather than size of the firm (Parent, 1976).

Float trip companies are more labor intensive than capital intensive. That is, the major outlay is for current operating expenses, food, transportation and labor, not interest expense on money borrowed for long-term investment in fixed assets.

Because investment is not sizable and cash flows are excellent, most concessions have been able to self-finance investment in new equipment in current (less than one year) time periods. Also, most concessions have already depreciated over half their total fixed investment.

In terms of rates charged, the float trip concessions offer park visitors a wide range of choice. Average revenue per user day ranges between $34.88 and $78.64 with an average cost of $52.60 per person per day. For the profit earning firms, profit per user day ranges from $3.01 to $13.59, with an average profit per user day of $5. This excludes those firms reporting a loss on operations.

2. The Economic Performance of Non-Motorized vs. Motorized Concessions

It was reported in the "Congressional Record" (Vol. 119, Nools) that the price of a non-motorized trip is twice the cost (to the concessioner) of a motorized trip. Existing evidence, however, indicates that the average cost to the commercial operator per user day for a non-motorized trip averages $1.50 less than the motorized trip. There is such a wide variation in costs for both motorized and non-motorized trips, that differences in costs cannot be accounted for simply on the basis of mode of travel. The overall profitability of firms has been demonstrated to be much more a function of managerial expertise rather than whether or not the firm used motors on their river craft.

3. Noncommercial River Trips

The noncommercial river runners expended approximately $71,000 on trip costs in 1975. With only 8 percent (7600 user days) of the total visitor use allocation, noncommercial interests floated the Colorado River for approximately $8.75 per day or 80 percent less than the average commercial rate. This figure does not include the private individual's investment for equipment--from $100 to $5,000 per boat.

4. Economic Impact

The increase in commercial allotments from 89,000 to 134,550 user days and the allocation of user days between the 21± commercial firms will have positive economic effects. The increase in allocations to the noncommercial sector will have little or no effect on commercial operations.

Within the different kinds and sizes of concessions, there are no particular economies of scale, that is, larger firms do not necessarily enjoy higher profits. However, under sound economic management, profits should increase with additional increases in allotments, especially for smaller concessioners. Conversely, if a company's allocation of use were decreased, it would not necessarily reduce it's profitability, since other factors such as managerial ability and outside interest have a considerable bearing. Reduced allocations, nevertheless, have the potential for reduced profits.

In general, some small concessions may not have the management skill to budget, borrow to finance, control quality and employees, and hence would suffer personal and economic hardship if they were allowed or forced to grow. Also, some concessions, it can be argued, will become more manageable if their size is reduced.

The offer in response to the fact sheet would allow concessioners to request the number of launch days or user days which they felt could be

operated to their profit. The potential for variety of concession size would insure that all user days would be effectively used and would approximate the company size their owners desired to manage. Fact sheet offering would inevitably provide a variety of sizes which ensures all firms now operating an opportunity to compete for a permit.

Elimination of motorized watercraft will affect 80 percent of the commercial use. The phase-out of motor-powered equipment will affect companies offering only motorized trips more than those who now provide both oar and motor float trips.

Economic data indicates that there is little difference in the capability of motor or non-motorized concessioner to make an economic profit; that non-motorized trips are less expensive to operate; and that changing from motorized to non-motorized craft would have a slight economic impact on the concessioners concerned, although not sufficient to cause liquidation of assets. "Profitability (as measured by percent of sales) is not significantly related to type of trip (i.e., non-motors or motors." (Parent, 1976)

Commercial firms would be financially capable of making the shift from motor to oar operation. If motors were eliminated, some of the fixed investment could be used by an oar operation while a substantial amount of the remainder (motors, trailers, etc.) could be sold at book value or perhaps more. Many concessions have depreciated over half of their fixed investment.

There is more diversity among the profits of motor concessioners and among the profits of non-motorized concessioners than there is variance between the two groups. The only companies in the last two years to operate at a loss were motorized operators.

However, a change or reduction in allocation combined with the phase-out of motors could economically harm a few unstable firms, (primarily firms whose investments outside Grand Canyon had resulted in significant business loss). For several firms now operating in Grand Canyon, an increased allocation of use and the shift from motorized to oar-powered float trips would have little adverse economic impact on their operations. On the other hand, the larger motorized companies providing short 5-day trips through the canyon will be adversely affected due to the trip-length minimum of 12 days. For example, a company may now run from 60 to 70 trips per season. Under the proposed plan, the number of trips could be reduced by more than half. The longer trips may not compensate for loss of trip numbers, thereby reducing economic benefits. Also, as trips get longer and boat size (capacity) is reduced due to the proposed oars-only policy, concessions may show more unused capacity due to physical constraints.

Other elements of the plan will cause an incremental increase in costs mainly for those firms now operating only motor trips. These include new regulations concerning sanitation and use of fire and the higher guide/passenger ratio required of oar trips.

Removal of all human waste material from the canyon will require modification of the existing waste disposal facilities currently owned by the commercial river running interests. The major modification will be the purchase or construction of adequate holding facilities or tanks for each trip. The cost of these holding facilities is estimated to be from a minimum of $75 to $175 for a 30-person river trip for 14 days.

Actual costs have proved to be less for those who have already modified their holding facilities. For example, for initial use the following expenditures must be made for a 10-day river trip with 10 to 30 persons:

(1) 4 rocket boxes @ $8.00 each	$32.00
(2) 2 plastic toilet seats w/ring @ $5.00 each (two may be needed - being plastic they are subject to breakage after sustained use)	10.00
(3) rubber gloves @ $1.00 each	1.00
(4) 1 gallon 40 percent formaldehyde solution @ $3.00/gallon	3.00
(5) plastic bags	
30 "tall kitchen" 2' x 2½' @ 10¢ each	3.00
10 large heavy duty garbage bags @ 20¢ each	2.00
Total Cost First Trip	51.00
Total Cost Each Subsequent Trip (items 4 & 5)	8.00

Reducing the use of fire would require a minimal amount of expenditure on the part of the concessioners. Under the present regulations, all outfitters are required to carry operable cooking stoves on their river craft. The only additional expense resulting from the implementation of the regulation would be the purchase of fuel to operate the stoves. These expenses would be under $10 for the average trip.

Due to the structural characteristics of an oar-powered river trip, more smaller boats with fewer people per boat are required. An average of 2 guides per party will increase to an average of 5.

If a company runs 3 trips of 25 persons every two weeks, the personnel needed will increase from 6 to 15 persons for that period. Because river guides do not generally receive high salaries, and personnel for oar trips receive on an average less ($15 per day) than personnel on motor trips, total costs are not considered significant. Furthermore, as the river running season will be extended, generally the number of trips per week of any one company will be reduced and spread over the longer season. The number of personnel needed would be less than in the example above, but employed for a longer time. In either case, some increased labor costs can be expected for some of the companies.

Increased expenditures due to regulations and staffing are insignificant in terms of the overall economy of the commercial sector.

In summary, the plan will allow for increased commercial user days to be reapportioned among the concessioners who chose to make an offering in response to the proposed fact sheet. The greatest adjustment for the river running industry involves the conversion from motorized to oar-powered craft. Motorized firms will experience short-term cost increases during the 3-year period allowed for the change to oar-powered equipment. The change is not expected to force motorized firms out of business. Minor economic adjustments, such as increased costs for new sanitary equipment and labor, can be absorbed by most companies at present, without affecting profitability. Smaller firms may realize a greater economic potential if allotments are increased. Although high profits may decrease for some firms, the opportunity to realize a reasonable profit for all commercial companies operating in Grand Canyon will not be diminished. No significant adverse economic impact on the river running industry is expected to result from the proposed plan.

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