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Colorado River Management

Resource Monitoring Program:
Recreational Impacts: Camp and Attraction Site Quality
River Rehabilitation
Visitor Experience

Program Summary

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Forward

The revised Colorado River Management Plan mandates an integrated long-term monitoring program to assess changes in natural, cultural and experiential resources. The Resource Monitoring Program specifies monitoring camp and attraction site quality, the visitor experience, and cultural resources. This program summary gives an overview of three programs and the results since the implementation of the 1989 Plan. The first draft was presented to the Colorado River Constituents Panel in Fall 1992. The updated version includes the 1992 results of the Natural Resources monitoring program, November 1992 Rehabilitation work, the 1992 Secondary Season river contact survey, and notes on the influence of research trips on number of river contacts.

Contents

I. Monitoring Camp and Attraction Site Quality

Trailing, refuse accumulation and the destruction of vegetation and cultural resources is a perennial problem in the river corridor. Sites that are prone to high levels of use require an active program of photo documentation, baseline data accumulation and monitoring. The Limits of Acceptable Change (LAC) strategy utilized in the CRMP prescribes monitoring and site rehabilitation as a means of attaining management objectives.

Methods

The primary methodology used in the camp and attraction site quality monitoring program is photographic documentation or "photo-monitoring". This is coupled with recordation of impacts to vegetation, soil conditions, and cultural sites.

The purpose for utilizing a photo-monitoring technique is to establish visual evidence of existing conditions, and to compare conditions over time and throughout rehabilitation actions. The advantage of using photos in observing change is that the photos can be studied at any time after the field examinations are made. They can also be a convincing factor to management evaluators not familiar with the study site or problem. This type of documentation also provides information to interested publics.

Initial sites were identified that had a history of problems and/or rehabilitation or trail work done over the past ten years. These sites were jointly identified by the River Subdistrict and Resources Management staffs. Additional sites were developed as either control areas, or new areas recognized to receive rehabilitation work in the future. Currently, there are over 50 individual monitoring locations. A site may contain up to 15 individual photo points and more than 20 photo directions.

The following table is a list of sites along the Colorado River corridor currently being monitored. The monitoring locations were assigned a classification; and most sites have more than one classification. Many of the monitoring sites listed below are also locations with recorded archeological sites. These however, will not be identified due to the sensitive nature of these resources.

Key: C = Campsite
A = Attraction site
R = Rehabilitation site
B = Backpacker camp
T = control site

Table 1: Recreational Impact Monitoring Locations

Location	River Mile	# of Sites	Classification
4 Mile	4.0 L	3	C,A,R
6 Mile	6.0 R	2	C,T
Badger (Jackass)	8.0 L	5	C,A,B
Soap Creek	10.0 R	3	C,B
19 Mile Canyon	19.5 R	6	C,R,B
20 Mile*	20.0 L	2	C,T
North Canyon	20.5 R	4	C
23 Mile	23.1 L	5	C,T
South Canyon	31.5 R	15	C,A,R,B
Tatahatso	37.4 L	2	C,R
Martha's Camp	38.0 L	4	C,R
Buck Farm	41.0 L	8	C,A
Royal Arches	41.5 R	3	A,R
Anasazi Bridge**	43.0 L,R	5	C,R
Saddle Canyon	47.0 R	25	C,A,R
Little Nankoweap	51.7 R	5	C,A,R,B
Nankoweap	52.2 R	20	C,A,R,B
Kwagunt	56.0 R	6	C,T
LCR - Beamer's	61.5 L	12	C,A,R,B
LCR - Hiker's Camp	61.8 L	5	R,B
Lava Canyon Camp	65.5 R	3	C,A
Carbon-Chuar Trail	65.5 R	5	A
Palisades	65.8 L	5	C,B
Tanner River Right	68.6 R	6	C,R,B
Tanner Delta	68.7 L	15	R,B
Cardenas	71.0 L	16	C,R,B
Furnace Flats@	71.3 R	4	C
Unkar Delta	72.7 R	20	A,R

Escalante	75.0 L	3	R,B
Hance	76.8 L	15	C,A,R,B
Grapevine	81.3 L	2	C
Clear Creek	84.0 R	9	C,A,R,B
87 Mile Camp	87.2 L	6	C,R
Granite	93.5 L	6	C,R,B
Boucher	96.8 L	10	R,B
Crystal	98.0 R	6	C,T
Bass Camp	108.2 L	8	C,A,R,B
Royal Arch	115.6 L	5	R,B
Elves Chasm	116.5 L	7	A,R
120 Mile	120.0 L	5	C,R
128 Mile	127.7 L	1	T
Galloway Camp	131.8 R	8	C,R
Tapeats Creek	133.7 R	10	C,A,R,B
Thunder River	133.7 R	5	A,R
135 Mile	135.0 R	4	R,B
Deer Creek	136.2 R	25	C,A,R,B
Poncho's Kitchen	136.8 L	5	C,A,R
143 Mile Camp	143.5 L	3	C,T
Havasu Creek	156.8 L	10	A,R
Mohawk Beach	171.5 L	1	T
Whitmore Helipad	186.5 L	5	C,A
Whitmore Wash	187.5 R	10	A
Indian Canyon	206.6 R	4	C,A
Granite Park	208.7 L	5	C,R
Pumpkin Springs	212.8 R	1	T,(R)
Three Springs	215.6 L	5	A,R
57 Locations		**410 sites**	

** Anasazi Bridge: 43 Mile camp on river left, Prehistoric site on river right closed to visitation.
@ Furnace Flats closed to visitation.

When the program was implemented in 1986, photos were taken during the early spring months (before seasonal use), in the late fall (after seasonal use), and again in the early spring (between use periods). Photos were also taken before any rehabilitation work was done, and then directly after the work was completed. Given the constraints of budget (personnel, funding for trips, etc.), the photo-monitoring is currently done during the fall months in conjunction with the Cultural Resources monitoring trip and in conjunction with a spring rehabilitation trip. Once the baseline was established, a routine monitoring program settled into place that dictated evaluation in the fall and work projects for winter and spring.

The reason for so much recordation in the early stages is based on the need for consistency. The consistency of documentation is critical for the establishment of a baseline comparison where trends can help control unknown intervening variables such as natural change/growth, exceptional water years and catastrophic events. This type of control can aid the evaluator in the determination of what factors caused the condition to occur.

Once a uniform baseline of data is developed, general trends in the site's condition can be assessed, rehabilitation actions can be assigned, and an overall schedule for future documentation at specific sites can be established.

Results

Because the photo monitoring work is a continual process of tracking the success and failure of our management efforts, it is difficult to give an overall description of the results. Inferences must also be made when questions, such as those relating visitor use and site deterioration over a given use season, are posed.

The inferences are developed through the use (over time) of site monitoring information. For example, in 1986, visitor use levels exceeded the total allotted commercial level. It was questioned if this excess level had an impact on the riverine environment, and if so, what type. It is also speculated that the research activities associated with the Glen Canyon Environmental Studies between 1989 and 1991 have caused additional impacts especially trailing at sites.

It is known that the project work done at various locations has improved site condition and has directed use patterns. For example, the trail delineation, rehabilitation, and revegetation work done at several sites has provided a mechanism by which the perimeter vegetation can rejuvenate and the site to stabilize.

Monitoring Condition Matrix

To help facilitate the analysis of results for the photo monitoring information, a matrix has been developed. The purpose of the matrix is to present a general rating of the site condition and success of the work implemented. Specific questions as to impact analysis must be presented before a specific analysis can be done.

The matrix covers all the sites monitored between 1986 - 1992. It is difficult to speak of positive and negative change without a point of reference. The pluses and minuses given in the matrix are based on the comparison of conditions from the previous year or season to the present condition, or from the before work to the after work. Any change observed showing improvement to the existing condition is considered positive. Any change showing a deterioration to the existing condition is considered negative. An overall rating of change is calculated from the original baseline photo and compared to the existing condition. A sample section of the matrix is shown below.

Figure 1: Monitoring Condition Matrix (sample section)

RIVER MILE and SITE #	SPRING 1989 1-PHOTO BEFORE	SPRING 1989 AFTER	FALL 1989 1-PHOTO BEFORE	FALL 1989 AFTER	SPRING 1990 1-PHOTO BEFORE	SPRING 1990 AFTER	FALL 1990 1-PHOTO BEFORE	FALL 1990 AFTER
133.7 R;SITE #24	0							
133.70;SITE #24					0			
133.7 R;SITE #25	+							
133.70;SITE #25					0			
135 MILE								
135.0 R;SITE #1		B WD						
135.0RR;SITE #1			0					
135.0 R;SITE #1							0	
135.0 R;SITE #2	B		0				0	
135.0 R;SITE #3		B WD	+				+	
135.0 R;SITE #4		B WD	+				0	
DEER CREEK								
136.2 R;SITE #1		0	0					0 WD
136.2 R;SITE #1a		0	0					0 WD
136.2 R;SITE #2	0		+					0 WD
136.2 R;SITE #3	0		-					0 WD
136.2 R;SITE #4	WD		-					0 WD

II. River Rehabilitation Program

The rehabilitation program is directed by the Division of Resources Management. Projects are accomplished in cooperation with the River Subdistrict, Maintenance Trail Crew and volunteers.

Since the Spring of 1989, six full rehabilitation trips and one site evaluation/monitoring trips have been conducted. Rehabilitation efforts have been conducted at 49 projects locations resulting in:

- approximately 14,015 linear feet of multiple trail eradication,
- relocation of approximately 7,128 linear feet of trail,
- delineation of approximately 21,120 linear feet of poorly defined trail,
- and routine maintenance of approximately 65,000 additional feet of trail.
- Approximately 461 log or rock checks were emplaced,
- and 50 feet of gully that was eroding archeological sites was stabilized.
- Approximately 96 square meters and 73 linear feet of rock riprap was emplaced,
- and approximately 30 linear feet of retaining wall was constructed.
- Conducted restoration and revegetation on approximately 3,750 square feet of impacted beach and attraction sites.

The following table lists the sites and types of work projects conducted.

Key: A = Multiple Trail Eradication (may include revegetation)
B = Trail Relocation
C = Trail Delineation (of poorly defined trail)
D = Routine Trail Maintenance (includes emplacement of checks, clearing, and cleaning water bars)
E = Campsite Stabilization
F = Archeological Site Stabilization
G = Routine Trash Pick-Up
H = Revegetation - Restoration of Impacted sites

Table 2: River Rehabilitation Project Locations

Location	Type of Impact[1]	Level of Impact[2]	Type of Rehabilitation work done
4 Mile	H,F	H	G,A,D
Jackass Canyon	C,H,F	H	G
Soap Creek	C,H,F	M-H	A,D,F
19 Mile Canyon	C,H,F	M	E
South Canyon	C,A,H,F	H	A,B,C,D,F,G
Tatahatso	C	M	A
Martha's Camp	C	M	A
Royal Arches	A	L	A
Anasazi Bridge**	A	H	A (Closure)
Saddle Canyon	C,A	H	A,B,C,D,E
Little Nankoweap	C,A	M	A,B,C,D
Nankoweap	C,A,H,F	H	A,B,C,D,E,F,H
LCR - Beamer's	A	H	A,C,D,F
LCR - Hiker's Camp	C(Hikers)	M	A,C
Carbon-Chuar Loop	H	M	B
Lava-Chuar Camp	C,A	M	A,E,H
Palisades Delta	C,A,H	M	A,B,C
Tanner Delta	C(Hikers)	H	A,B,C,D,E,F,G
Cardenas	C,A	H	A,C,D,E,F,H
Unkar Delta	A	M-H	A,C,D
Escalante	C	M	A,C,D
Hance	C,R,H	M-H	A,C,D,F
Clear Creek	A	M	A,C,D
87 Mile Camp	C	H	A,C,D,E
Granite (Monument)	C,H	H	A,C,E
Bass Camp	C,A	H	A,C,D,E
Royal Arch Creek	H	M	A,B,C,D

Elves Chasm	A	H	A,C,D
120 Mile	C	M	A,D
Galloway Camp	C	M-H	C,D,E
Stone Creek	C,A	H	A,B,C
Tapeats Creek	C,A,H,F	H	A,C,D
Thunder River	A,H	H	A,C,H
135 Mile	H	L	A,C
Deer Creek	C,A,H	H	A,C,D
Poncho's Kitchen	C,A	H	A,C,E
143 Mile Camp	C	L-M	E
Havasu Creek	A,H	H	A,B,C,D
183 Mile	C	M	C,E
Granite Park	C	H	A,D
Three Springs	A	M	A,C
216 Mile Camp	C	M	A

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1. Colorado River Management Plan. 1989. Appendix A: Resource Monitoring Program. Types of Impact identified for camps and attraction sites along the Colorado River corridor with high levels of estimated use-related impacts:

A = Attraction site with trailing
C = Campsite
D = Departure site
F = Fishing related impacts (waste and trailing)
H = Hiking related impacts
R = Rapid scouting and trailing

2. Colorado River Management Plan. 1989. Appendix A: Resource Monitoring Program. Estimated Level of Impact:

L = Low
M = Medium
H = High

III. Monitoring the Visitor Experience: River Contact Survey and Attraction Site Observations

The River Contact Survey and Attraction Site Monitoring programs were implemented in 1989 to monitor the visitor experience using crowding and contacts as indicators. The program evaluates the actual use levels at attraction sites during each use period and the number of daily contacts made by river trips.

Previous sociological studies done at Grand Canyon National Park indicate that density (frequency and number) of trips have an effect on the character of the visitor experience (Shelby, et.al, 1976). These were measured in terms of river and attraction site contacts.

The objectives of the monitoring program are: 1) to identify the current trends and conditions of present use levels by collection of river contact data and attraction site observations, 2) to measure the results against the objective limits outlined in the CRMP, and 3) to make recommendations to management for mitigation of the impacts of crowding and congestion in the river corridor.

The management objectives were developed from the baseline research while utilizing current use levels. The "Recreation Opportunity Spectrum" objectives and process for management actions are described by the Limits of Acceptable Change (LAC) in Appendix B of the Plan.

Methods

The methodology use follows that of Shelby, et.al, 1976). During the 1989 and 1990 Primary Seasons, River Contact survey forms were distributed to guides, outfitters and noncommercial boaters. They were distributed by mail and at the Lees Ferry put-in. During 1991, data was collected for the GCES by volunteer researchers. National Park Service employees conducted on site observations for attraction site data collection at four locations.

Results

The following tables describe the management objectives for River and Attraction Site contacts and the results for the 1989, 1990, and 1991 Primary Seasons, and the 1992 Secondary Season.

Table 3: Summary of River Contact Survey Results

Management Objective	Year 1 (89)	Year 2 (90)	Year 3 (91)
Primary Shoulder Season: 80% probability that a party will contact 4 or less parties per day on the river	Objective not met: On 73% of days, groups had contacts w/ 4 or less 4 parties	Objective not met: On 44% of days, groups had contacts w/ 4 or less parties	Objective not met: On 45% of days, groups had contacts w/ 4 or less parties
Primary High Density Season: 80% probability that a party will contact 7 or less parties per day on the river	Objective met: On 88% of days, groups had contacts w/ 7 or less parties	Objective not met: On 67% of days, groups had contacts w/ 7 or less parties	Objective not met: On 75% of days, groups had contacts w/ 7 or less parties

Table 4: Summary of Results for Attraction Site Contacts

Management Objective	Year 1 (89)	Year 2 (90)	Year 3 (91)
Primary Shoulder Season:	Little Colorado River		
65% probability of contacts w/ 70 people or less at LCR, Elves Chasm, and Deer Creek	Objective met: 74% of trips contacted 70 people or less	Objective met: 82% of trips contacted 70 people or less	Objective met: 100% of trips contacted 70 people or less
	Elves Chasm		
	No Sampling	No Sampling	Objective met: 100% of trips contact 70 people or less
	Deer Creek		
	Objective met: 64% of trips contacted 70 people or less	Objective not met: 42% of trips contacted 70 or less; 58% of trips contacted more than 70	Objective met: 71% of trips contacted 70 people or less
90% probability of contacts w/ 100 people at Havasu	Havasu Objective not met: 52% of trips contacted 100 or less; 48% of trips contacted more than 100	Objective not met: 86% of trips contacted 100 or less; 14% of trips contacted more than 100	Objective not met: 79% of trips contacted 100 or less; 21% of trips contacted more than 100

Primary High Density Season: **100%** probability of contacts with 150 people or less at LCR, Elves Chasm, Deer Creek and Havasu	Little Colorado River: **Objective not met: 82%** of trips contacted 150 or less; **18%** of trips contacted more than 150 Elves Chasm **Objective met: 100%** of trips contacted 150 or less Deer Creek **Objective met: 100%** of trips contacted 150 or less Havasu **Objective not met: 70%** of trips contacted 150 or less; **30%** of trips contacted more than 150	**Objective met: 100%** of trips contacted 150 people or less **Objective met: 100%** of trips contacted 150 or less **Objective not met: 94%** of trips contacted 150 or less; **6%** of trips contacted more than 150 **Objective not met: 51%** of trips contacted 150 or less; **49%** of trips contacted more than 150	**Objective not met: 93%** of trips contacted 150 or less; **7%** of trips contacted more than 150 **Objective met: 100%** of trips contacted 150 or less **Objective not met: 93%** of trips contacted 150 or less; **7%** of trips contacted more than 150 **Objective not met: 86%** of trips contacted 150 or less; **14%** contacted more than 150

Discussion of Results

River Contacts: Overall, the results of the monitoring program indicate that the management objectives are not being met in terms of contacts while travelling on the river, especially during the Shoulder Season.

During the Shoulder Season (May, and August 16 - September 30), trips are contacting more than 4 trips per day, over 50% of the time. Therefore, it may be inferred that on the average, contact levels are being exceeded every other day. Based on the objectives (80% probability), the level of exceedance would occur 20% of the time. Thus, we may infer that contact levels during the Shoulder Season are 30% greater than those prescribed by management. It should be noted that most of the Shoulder Season sampling occurred in May, and this level of exceedance is more likely to occur in May than in September, because of the decrease in use after September 15, the nonmotor season.

During the High Density Season (June 1 - August 15), trips are contacting more than 7 trips per day 23% of the time. Based on the objectives (80% probability), the level of exceedance would occur 20% of the time. Thus we may infer that contact levels are 3% greater than those prescribed by management. Given the

parameters of the sampling, this would suggest that river contact objective levels are being met for a very high proportion of trips during the High Density Season.

During both the shoulder and high density periods, commercial motor contacts are highest with other commercial motor trips; and similarly for contacts with commercial oar, noncommercial and NPS or research trips. Overall, commercial motor trips have the highest contact levels; that is due to travel rate which is dictated by trip length. The high level of commercial motor contacts with other commercial motor trips may also be attributed to the current management of launch scheduling. The occurrence of trips with similar schedules launching on the same day is highest with commercial motor trips.

It seems to reason that if the objective contact limits during the Shoulder Season are nearly half (4) of those prescribed for the High Density Season (7), and that the use limits during May, (especially mid to late May) are similar to those in June and July, that the contact levels would also be similar. Thus, it is reasonable to expect a higher rate of exceedance for the shoulder season. If use levels were lower for May, one would expect a lower contact rate, and a greater probability of management objective compliance.

Research trips: The results of the 1990 and 1991 River Contact Surveys suggest that the number of research trips may have slightly contributed to an increase of river contacts as compared to the 1989 results.

When looking at the total population of trips sampled, contacts with research trips were significantly less than contacts with other trip types. The 1990 results show that for both seasons, contacts with NPS or research trips amount to roughly one contact every three days. Comparatively, average contacts with commercial motor trips are between two and five per day, while commercial oar and noncommercial trips are slightly less than two per day.

During the 1991, the River Contact Survey was conducted for the Glen Canyon Environmental Studies. The survey sample was smaller than the previous years, but showed similar results in terms of use and contact patterns. Compared to contacts with all trip types, the contact rate was lowest with research trips, however there was a slight increase from the previous year. For all trips, contacts with research trips occurred roughly once every two to three days. This may be attributed to the intensity of research activities along the river corridor. The rate for contacts with commercial motor, commercial oar and noncommercial was comparative to previous years.

Table 5: 1992 River Contact Monitoring: Secondary Season

Management Objective	October 1992	November 1992
Secondary Season (10/1 - 4/30) 80% probability that a group will contact 2 or less trips per day on the river	**Objective not met:** On 78% of the days, groups had contacts w/ 2 trips or less.	**Objective met:** On 98% of the days, groups had contacts w/ 2 trips or less.

The results of the 1992 secondary season are reported by month. A greater number of use occurs in early October compared to November. Between October 1 and 15, there was (usually) one commercial and one noncommercial trip launching. Beginning October 16, only noncommercial trips were launching. In addition motorized research trips continued to launch during this month.

For October, the limits were exceeded particularly in the early part of the month. Some trips were making as many as five contacts per day, however the average number of contacts for those trips was over 2 but less than 3 per day. Compared to commercial trips, the noncommercial trips had a greater proportion of contacts with research trips, which contributed to about half of the total contacts for each trip type. It is obvious that the presence of research trips contributed to the slight exceedance of contact levels.

Attraction Site Observations: The results of this program are based on data collected by NPS at the Little Colorado River (LCR), Elves Chasm, Deer Creek Falls, and Havasu Creek. These sites were identified as those receiving the highest visitation. The findings of the attraction site monitoring program indicate that the level of management objective compliance varies by site.

Overall, the results show that the management objectives are being met, or nearly met for number of people contacted at the LCR, Elves Chasm and Deer Creek during the Shoulder and High Density seasons. The contact levels were exceeded at Havasu Creek for all monitoring periods.

The findings of the river contact and attraction monitoring programs have also shown that distribution of launches contribute to higher contact rates at attraction sites. Contact rates tend to be higher, and are often exceeded for motor trips that launch on weekend days. It is known that the weekend days (and Monday and Tuesday) are the busiest launch days, and trips with similar schedules tend to make several contacts with each other while travelling on river and at attraction sites.

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