GLEN CANYON ENVIRONMENTAL IMPACT STUDIES (GCEIS) PHASE II WORK PLAN FOR MONITORING SELECTED ARCHAEOLOGICAL SITES FOR EROSIONAL IMPACTS CAUSED BY REGULATED FLOWS FROM GLEN CANYON DAM TO THE PARIA RIFFLE 1993

Prepared by

Tim W. Burchett
Seasonal Archaeologist

Prepared for

Chris Kincaid
Chief, Cultural Resources
Glen Canyon National Recreation Area
Resource Management Division
P.O. Box 1507
Page, Arizona 86040

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I. INTRODUCTION

As part of the ongoing Glen Canyon Environmental Impact Statement (GCEIS) archaeological monitoring program at Glen Canyon National Recreation Area (GLCA), this document presents a work plan for monitoring erosional and human impacts to archaeological sites caused by regulated flows from Glen Canyon Dam to Lee's Ferry for the FY93 field season. The document is divided into several sections. This introduction is followed by Section II, an overview of the environmental impact statement, including the need for and purpose of the action, the implications for Glen Canyon, archaeological perspectives, and objectives of the monitoring program. Section III presents monitoring issues and goals including background information concerning Glen Canyon Environmental Impact Statement (GCEIS) monitoring, sediment and geomorphic studies. Section IV summarizes the FY92 monitoring activities, including the monitoring of archaeological sites, and stationary camera locations, testing and sampling of sites AZ C:2:32 and C:2:100, level of work conducted at each site, the Spencer Steamboat reconnaissance dive, and the Paiute familiarization trip. Section IV concludes with recommendations for future monitoring activities. Section V presents the proposed methods and scope of work for the FY93 field season, including the selection of sites to be field monitored, continued terrestrial photogrammetry of specific locations selected during FY92, scheduling of these field activities, analyses, and reporting procedures. Section VI presents references cited in this document.

II. ENVIRONMENTAL IMPACT STATEMENT OVERVIEW

A. Need for and purpose of action.

The Glen Canyon Dam was completed by the Bureau of Reclamation in 1963; however, no environmental impact statement (EIS) was filed regarding its construction or operation. Therefore, in January, 1992, the U.S. Department of the Interior, Bureau of Reclamation presented a draft that analyzed the impacts of current and alternative operations of Glen Canyon Dam on downstream environmental resources of Glen Canyon National Recreational Area and Grand Canyon National Park (GRCA). The purpose of this EIS is to determine alternative ways of operating the dam to meet the statutory purposes as defined by Section 1 of the Colorado River Storage Project Act (43 U.S.C. 617) and the *Criteria for Coordinated Long-Range Operation of Colorado River Reservoirs*, mandated by the Colorado River Basin Project Act of 1968.

B. Glen Canyon work regarding the EIS.

The GCEIS archaeological monitoring project concerns GLCA from the dam to Paria Canyon, and its goal is to determine the impacts of current and alternative dam operations on downstream cultural and environmental resources on that stretch of the Colorado River.

The 1992 Bureau of Reclamation Draft Environmental Impact Statement: Operation of Glen Canyon Dam Colorado River Storage Project, Arizona (DEIS) reported on Phase I, the Glen Canyon Environmental Studies from 1982-88, which concentrated on two major questions:

1. Are current operations of the dam, through control of the flows in the Colorado River, adversely affecting the existing river-related environmental and recreational resources of Glen Canyon and Grand Canyon?

2. Are there ways to operate the dam, consistent with Colorado River Storage Project water delivery requirements, that would protect or enhance the environmental and recreational resources (U. S. Department of the Interior, Bureau of Reclamation 1992:7)?

The final analysis in the DEIS (U. S. Department of the Interior, Bureau of Reclamation 1992:8), which integrated biology, recreation, sediment and hydrology studies, indicated that:

1. Glen Canyon Dam has had an impact on the downstream environment. Changes have occurred and continue to occur to many sensitive ecosystem resources. Some changes are considered positive and some negative.

2. Operations and management can be modified to minimize losses of some resources in the canyon and to protect and enhance others.

3. The ecosystem of Glen and Grand Canyons is dynamic and, with careful management, gradually may be able to reestablish more harmonious environmental relationships.

C. EIS and the archaeological perspective.

In recent years several archaeological sites were recorded below the historic high-water zone of the river that exhibited evidence of direct and indirect river effects (Balsom 1989). Based on these findings, a pilot research project to evaluate erosion at one site along the Colorado River was conducted in October, 1989 by the Grand Canyon (GRCA) and the U.S. Geological Survey (USGS) (Balsom et al. 1989). Analysis of the data gathered suggested that the operation of Glen Canyon Dam might be contributing to ongoing site erosion, not only at the study site but at numerous other sites in the canyon. Because of the possible connection between site erosion and the operation of the dam, further evaluation of impacts to cultural resources located along the river was recommended to the Bureau of Reclamation as part of the EIS process, which began in 1989.

An accumulation of studies revealed that river flows need to be moderated so that clear-water floods do not occur and that sediment loss is lessened or eliminated. Flows that cause continued erosion of the margin deposits have the potential to destabilize banks containing cultural deposits. As the lower beaches and sediment deposits are eroded away, the likelihood of impacts into the older deposits increases. As sand deposits in the current fluctuating flow zone are removed, the old flood zone becomes increasingly susceptible to erosion. Continued erosion will impact cultural deposits, causing irreparable damage.

D. Objectives of erosional monitoring at archaeological sites.

The objectives of the monitoring program are to identify and quantify erosional change and determine its cause. Observable variables of interest include the stratigraphic and geographic position of alluvial, aeolian, and colluvial deposits, variable rates of water flow released from Glen Canyon Dam, the existing condition of the terraces and margin deposits, and the direct and indirect erosional impacts upon the alluvial terraces containing archaeological deposits. Daily observations over several years can provide information concerning daily, monthly, seasonal, and annual changes in the terrace deposits. These observations will aid in determining flow rates that will preserve and enhance the river corridor resources.

Other objectives include the development of mitigation programs for archaeological remains that are currently being impacted and for those that will be affected in the future. Data recovery methods may include site mapping, collection of artifacts for functional and typological analyses, collection of samples from threatened feature contexts for chronological and ethnobotanical analyses, photographic recording, testing, and excavation of archaeological deposits.

Low-altitude aerial photographs were taken at quarterly intervals beginning in October 1992. These aerials assist the ongoing monitoring efforts of GRCA, GLCA, Cluer (GCEIS) and Hereford (USGS) to document overall erosional impacts to river resources caused by perturbation hydrology linked to dam operations.

Any recommendations for changes in the flow regime should be supported by effective monitoring programs evaluating erosional changes of the sites. Further, they must be linked to actions developed as part of the compliance required by the National Historic Preservation Act. A monitoring program such as the one described here is adaptive, creative and linked to actions that are crucial to the preservation of the cultural resources of the river corridor.

III. MONITORING ISSUES AND GOALS

A. Background of GCEIS monitoring.

The Secretary of Interior authorized implementation of a program of reduced maximum flows and modified ramping rates from Glen Canyon Dam beginning in August, 1991. The interim flows were designed to mitigate impacts of dam operations on downstream riverine resources until a Record of Decision is reached for the Glen Canyon Dam Environmental Impact Statement. The interim flow regime calls for low-, medium-, and high-volume months. Low flows will occur during the spring and late fall, medium flows in May and September, and high flows during mid-summer and mid-winter. Interim flows have a maximum discharge of 20,000 cfs, a reduced range of daily fluctuation, and reduced up- and down-ramping rates.

B. Sediment studies.

A proposal by Dexter and Cluer (1992) describes a method termed terrestrial photogrammetry for monitoring sand bars on a daily basis during the interim flow period. This proposal is an expansion of earlier work by Cluer in 1991, which involved monitoring sand bar dynamics at seven fixed camera stations. These monitoring activities were conducted during a test flow period from August 1990 to July 1991 within Grand Canyon National Park along the Colorado River.

During the test flow period an effective technique was developed to obtain area measurements of sand bars from inexpensive fixed camera photographs. That technique has recently been enhanced by incorporating computer digitizing equipment (AUTOCAD) for image rectification. It was shown during the test flow program and the early part of the interim flow period that deposits change size and morphology sometimes daily in response to hydraulic interactions between the river and bank-stored water. Rapid degradation and aggradation were both documented.

With the ability to capture daily photography on a large number of deposits, some containing archaeological sites, during the interim flow period, comprehensive evaluation of interim flow effects can be produced. They will be compared to effects documented during the test flow and pre-test flow periods by various investigators.

As part of the 1992 monitoring activities, additional fixed automatic cameras were installed overlooking deposits in the Glen and Grand Canyons. In the Glen Canyon river section, from the Dam to the riffle of the Paria River just below Lee's Ferry, three cameras were installed. The cameras used are Pentax 105s, housed in environmental containers. The view of each camera was adjusted to include the area of most interest. The camera containers are semi-permanently fixed to rock outcrops using clear silicone glue. The cameras are hidden, but no attempt was made to anchor them.

Following the retrieval of the first photographs, after 35 days, a survey expedition was conducted to define the field of view and provide photo scaling information so that deposit areas could be scaled to real-world/mappable values.

Color transparency film is recording a wide variety of daily information, including local river stage, area of deposit exposed at low stage, manifestation of dominant erosional processes, zones of inundation, relative moisture content of surface materials, seasonal vegetation trends, relative turbidity of river, local weather conditions, and recreational use patterns. Databacks stamp the date on each image, and log books are used to record the time each roll of film is replaced and when the exposure interval is started. The film is commercially processed. Only the measured images are mounted in slide mounts by the analyst. Original images are not released to the public; however, duplicating services and printing may be arranged.

Measurements are taken from images using one of two methods developed during the test flow period. First, a scaled magnifying loupe can be used to measure cross sections beginning each at a prominent point evident in each daily photograph. Second, a method has been recently developed that uses a computer system to digitally trace deposit area and rectify oblique images projected onto a digitizing tablet. This technique promises to produce deposit area values scaled to real-world geographic units that are directly comparable to values obtained by other investigations using more expensive vertical photography or land surveying.

The deposit areas are measured during each evaluation period at a constant flow rate. Daily area is estimated based on the bracketing measurements. Periodic flows at or near 5,000 cfs are desired for maintaining continuity of the measurement of deposit area and for comparing interim flow measurements with test flow measurements. The interim flow measurements are plotted monthly to determine the effects of adjustments to releases on that time scale.

C. Geomorphic studies.

A variety of evidence suggests that a number of archaeological sites have been extensively damaged or destroyed by erosion. Others have been recently exposed. Moreover, Hereford et al. (1991) hypothesize that this erosion has probably accelerated since the advent of regulated flows, which has resulted in the reduction of sediment load. Their report documents a project addressing the effects of the operation of Glen Canyon Dam on the erosion of archaeological sites through the undertaking of geomorphic and surficial geologic studies at four areas in eastern Grand Canyon National Park. Repeated photographs by National Park Service archaeologists show that many features associated with the sites have been exposed by erosion over a period of up to 26 years. A number of sites are near or within the zone of regulated flows, suggesting the operation of

Glen Canyon Dam might have either directly or indirectly caused increased erosion.

The objective of Hereford's study was to determine how or if the operation of Glen Canyon Dam affects erosion of archaeological sites along the river corridor in eastern Grand Canyon. Results of the field study indicate that archaeological materials susceptible to erosion are typically on or beneath the surface of soft, relatively non-resistant silt and sand deposits. Removal of these deposits and exposure of associated archaeological materials occurs principally as a result of the flow of the Colorado River, the short streams that drain into the river corridor, and wind erosion.

The geologic studies of Hereford et al. (1991) include classification and dating of the unconsolidated sedimentary deposits within the river corridor. The classification of a deposit is based on the sedimentary process that formed it. Relative and absolute dating techniques are used to place the deposits in chronological sequence. The absolute ages of the older deposits are determined from radiocarbon dates of organic material associated with the deposits. Wherever present, temporally diagnostic ceramic material is also used for dating. Diagnostic ceramic artifacts often provide tightly constrained dates compared with radiocarbon dating. Younger sediments, those deposited since about 1930, were dated by dendrochronology using salt cedar.

Relative age was determined stratigraphically following the Law of Superposition. The major stratigraphic units portrayed on maps consist of deposits representing distinct periods of erosion and subsequent deposition. These events and their corresponding stratigraphic relations are reflected in the terrace-like topography of the river corridor, a series of progressively higher terraces that become increasingly older as height above the river increases. This geomorphic expression of physical stratigraphy results from fluctuations of the river baselevel, which lowers over time.

Effective interpretations of the geologic and geomorphic data are enhanced when that data is compiled on maps of appropriate scale. To assure spatial accuracy, large-scale topographic maps were produced ranging from 1:1,000 to 1:2,000 in scale with contour intervals from 1 to 2 meters. These maps depict the topography of the river corridor at scales adequate to show drainage patterns and the topography of the deposits. The maps were produced photogrammetrically using a stereo analytical plotter mounted with existing low-altitude GCEIS aerial photographs. Surveys were conducted in 1989 and 1990 to rectify the aerial photographs and to establish vertical control.

The prehistoric archaeological sites identified in Hereford's study are associated with two alluvial deposits that are largely of Colorado River origin. These deposits occupy a distinct topographic position in the river corridor as illustrated by Hereford's surficial geologic mapping. Specifically, the deposits form the highest and most extensive terrace adjacent to the river. They are referred to as the Striped unit and PII alluvium, respectively. These field terms reflect the typical red gravel stripes of the former and the abundance of Pueblo II archaeological remains of the latter. The Striped unit is radiocarbon dated to between 400 B.C. and A.D. 600, and the PII alluvium is dated mainly by diagnostic ceramic artifacts associated with the deposit to about A.D. 700-1300. In addition, the remainder of late Holocene deposits located within the river corridor were generally classified and dated, as well as mapped in cross section to show the geomorphic and geologic relations of the alluvial deposits.

Active erosion of archaeological sites is documented photographically in parts of the study area. These photographs show that several archaeological features were destroyed between 1965-1983 and between 1965-1991. Initially, the high water of 1983-1984 was thought to be responsible for this apparent increase of erosion. Hereford et al. (1991) emphasize, however, that the eastern Grand Canyon is probably not typical of the entire river corridor. Yet, 33 of the 475 recorded sites along the entire river corridor are within the 1983 flood zone and were directly affected by the 1983 flood and subsequent high flows (Fairley et al. 1991).

The majority of eroding archaeological sites are exposed in the arroyos of the short tributary streams that cross the terrace of the Striped unit and PII alluviums. Field evidence suggests that many of these drainages are undergoing active arroyo cutting, which is a deepening and a widening of the stream channel. Moreover, Hereford et al. (1991) believe that this arroyo cutting in some cases results indirectly from the operation of the Glen Canyon Dam.

Large-scale topographic maps show that these streams have different effective baselevels. Type I streams drain to the Colorado River and have the lowest effective baselevel. Type II streams do not reach the River, rather their effective baselevel is usually well above the river emptying onto a higher terrace. Erosion of Type I arroyos is indirectly linked to regulated flows, and therefore, the operation of the Glen Canyon Dam, whereas erosion of Type II arroyos has no relation to regulated flows. But both types of arroyos impact archaeological sites, and therefore, are of interest for any monitoring program.

Before the advent of regulated flows, the present Type I streams probably drained to a lower level terrace. Effective baselevel was maintained at this higher level by sand deposited at the mouth of the streams during the spring runoff. The regulated flows lowered the elevation of this deposition and reduced it substantially. This in turn lowered the effective baselevel of the streams, eventually causing the channels to regrade and rejuvenate through deepening and widening.

The effect of regulated flows on arroyo cutting evidently stems from the low-sediment concentrations and low-peak flow rates compared with pre-dam conditions. The arroyo cutting could possibly be reversed through the release of high stage, sediment-laden floods comparable to those of the pre-dam era. Such flows would deposit sand high in the mouths of Type I streams, thereby raising the effective baselevel and inducing the stream profiles to regrade through deposition.

In the study areas in the eastern portion of the Grand Canyon, Hereford et al. (1991) concentrated on the impacts of regulated flows on arroyo cutting rather than direct impacts to river cutbanks because they lacked archaeological sites associated with such deposits. Along the Glen Canyon portion of the river corridor, from the Dam to the riffle of the Paria River, several cutbank deposits do contain archaeological remains. These cutbanks, therefore, have the potential to demonstrate the direct effects of regulated flows on cutbank deposits and the archaeological remains they contain. The results of investigations of direct impacts to cutbank deposits and other monitoring activities from the Glen Canyon Dam to the riffle of the Paria River during the FY92 field season are presented in the next section.

IV. PREVIOUS MONITORING ACTIVITIES -- FY92 FIELD SEASON

A. Introduction

This section presents the field activities, results, and recommendations of the FY92 monitoring program.

B. Field Activities

Table 1 is a list of 50 sites recorded by GCRCS in Reach 0 from Glen Canyon Dam to the Paria Riffle. In the 1991 Monitor and 1992 Monitor columns, an alphanumeric code indicates the site was monitored and its erosion status. A '0' indicates the site was not monitored. The 1991 Monitor column presents the erosion status codes for all 50 sites. This is the baseline data recorded during the GCRCS survey from which 1992, 1993, and future erosion information will be compared.

Table 2 specifies the tasks completed during FY92 at 16 monitored sites. Completed tasks included terrestrial and underwater photography, updating of the Intermountain Antiquities Computer System (IMACS) site forms and site maps, GCEIS monitoring and form completion, trip reporting, archaeological testing and reporting, and completion of GLCA monitoring and maintenance forms.

1. During the FY92 field season, 15 archaeological sites and four features at site AZ C:2:11 were monitored for erosional and human impacts between Glen Canyon Dam and the Paria Riffle. Twelve of the monitored sites were selected from a stratified random sample generated by GCRCS personnel. The random sample was stratified on the kinds of impacts present at the sites -- Direct, Indirect, and Potential Impact 1 categories. The sites are C:2:12, C:2:41, C:2:53, C:2:57, C:2:72, C:2:74, C:2:75, C:2:80, C:2:82, C:2:95, C:2:100 and C:2:106. On Table 1, the 1992 Monitor column presents the kinds of impacts present at each site.

2. Two other sites were monitored for specific reasons. Site C:3:10 (Table 1) was selected due to its highly eroded condition and the necessity to obtain as much data as possible before it is potentially lost. It was recommended that the charcoal lens at this site be tested in the near future. Site C:2:38 (Table 1) was chosen for monitor because of the high level of visitation it receives from rafters.

3. Three stationary cameras were installed to monitor erosion at sites C:2:11, C:2:12, C:2:32, and C:2:100. These four sites were also recorded under the GCEIS archaeological monitoring format (Table 1). Tasks included the installation of the cameras, the generation of on-site photo scales, and film retrieval and development on a less-than-34 day cycle. Brian Cluer, Grand Canyon National Park/GCEIS geologist, directed

Table 1. List of 50 sites recorded by GCRCS in Reach 0 from Glen Canyon Dam to the mouth of the Paria Riffle. In the 1991 Monitor and 1992 Monitor, an alphanumeric code indicates the site was monitored and its erosion status. A '0' indicates the site was not monitored.

AZ Site Number, Feature	Site Type	River Mile and Bank	1991 Monitor*	1992 Monitor*	Previous (1991 - 1992) Condition	1993 Proposed to Monitor
C:2:11, F. 5	Hist. rock art	-00.5LB	DI	CO, DI, LFHD	Incipient/Stable	
C:2:11, F. 6	Walls	-00.5LB	DI	CO, DI, LFHD	Incipient/Stable	
C:2:11, F. 10	Spencer Steamboat	-00.5LB	DI	CO, DI, LFHD	Active Erosion	XX
C:2:11, F. 14	USGS Cableway	-00.5LB	DI	CO, DI, LFHD	Stable/Incipient	XX
C:2:12	Dugway	+00.1LB	DI	CO, DI, SRS	Active Erosion	XX
C:2:13	Rockshelter	-02.3LB	II1	0		XX
C:2:32	Charcoal Lens	-09.8LB	DI	CO, DI	Active Erosion	XX
C:2:35	Blind, artifact scatter	-09.6LB	II1	0		XX
C:2:36	Historic mining camp, lithic component	-12.3RB	PI1	0		XX
C:2:37	Rock art	-10.5RB	PI2	0		
C:2:38	Rock art	-09.9LB	II3	II3	Incipient Erosion	XX
C:2:39	Lithic procurement	-08.8RB	NI	0		
C:2:40	Lithic scatter	-03.4RB	PI2	0		
C:2:41	Prehistoric structure, artifacts	-01.3LB	PI2	PI2, SRS	Stable	
C:2:48	Historic road	000.0LB	PI1	0		XX
C:2:53	Artifact scatter	+00.2RB	PI1	PI1, SRS	Stable	
C:2:56	Rock art	-00.1RB	PI2	0		
C:2:57	Historic homestead	-00.1LB	PI1	PI1, SRS	Incipient Erosion	XX
C:2:58	Historic Bureau of Reclamation Cableway	-00.8RB	D1	0		XX
C:2:59	Guaging station	+00.1LB	D1	0		XX
C:2:60	Stanton's Road	-03.0LB	II1	0		XX
C:2:71	Rock art, artifact scatter	-11.3LB	PI1	0		XX
C:2:72	Prehistoric, historic artifact scatter	-00.1LB	II1	II1, SRS	Active Erosion	XX
C:2:73	Rock art	-11.7LB	PI1	0		XX
C:2:74	Shelter, lithics	-08.5RB?	II2	II2, SRS	Incipient/Stable	
C:2:75	Lithic scatter	-11.1LB	II1	II1, SRS	Active Erosion	XX
C:2:76	Hearth, flakes	-03.8LB	II1	0		XX
C:2:77	FCR, lithic scatter	-11.3LB	II1	0		XX
C:2:78	Rockshelter, artifact scatter	-05.5LB	PI2	0		
C:2:79	Rockshelter, artifact scatter	-11.0LB	NI	0		

Table 1 continued. List of 50 sites recorded by GCRCS in Reach 0 from Glen Canyon Dam to the Paria Riffle. In the 1991 Monitor and 1992 Monitor columns, an alphanumeric code indicates the site was monitored and its erosion status. A '0' indicates the site was not monitored.

Site Number, Feature	Site Type	River Mile and Bank	1991 Monitor*	1992 Monitor*	Previous (1991 - 1992) Condition	1993 Proposed to Monitor
C:2:80	Lithic scatter	-03.1RB	PI2	PI2, SRS	Stable	
C:2:81	Lithic scatter, one sherd	-10.0LB	II3	0		XX
C:2:82	Shelter, artifact scatter	-02.6LB	PI1	PI1, SRS	Incipient Erosion	XX
C:2:83	Sherds, lithics	+00.1LB	II1	0		XX
C:2:84	Wall, artifacts in overhang	-02.7RB	II1	0		XX
C:2:86	Cist, wall, FCR, artifact scatter	-02.4LB	II1	0		XX
C:2:87	Tower, historic, modern trash	-05.0LB	PI1	0		XX
C:2:88	Rockshelter, artifacts	-01.1RB	NI	0		
C:2:90	Rock art, structure	-01.6LB	II1	0		XX
C:2:91	Hearths, artifacts	-03.9LB	II2	0		XX
C:2:95	Shelter, artifact scatter	+00.1RB	NI	IR, SRS	Incipient Erosion	XX
C:2:99	Prehistoric, historic artifacts	-00.3LB	PI1	0		XX
C:2:100	Charcoal lens, artifact scatter	-00.4LB	II1	CO, II1, SRS	Active Erosion	XX
C:2:102	Hist. rock art	-09.3RB	PI2	0		
C:2:103	Hist. rock art	-10.2LB	PI2	0		
C:2:104	Rock art	-00.1RB	NI	0		
C:2:105	Alcove, Hist. rock art	-02.4LB	NI	0		
C:2:106	Roasting feature, artifact scatter	-02.2LB	DI	DI, SRS	Incipient Erosion	XX
C:2:108	Rock art	-01.5LB	NI	0		
C:3:3	Modern Trail	-15.1RB	DI	0		XX
C:3:4	Rock art	-14.4RB	NI	0		
C:3:6	Rock art	-14.2RB	NI	0		
C:3:10	Charcoal lens	-14.6LB	II1	II1	Active Erosion	XX

Table 1 continued.

* Monitor Codes

CO: Camera Overlook
DI: Direct Impact -- there has been inundation or bank cutting within the site area in recent years.
II1: Indirect Impact 1 -- there is bank slumpage or slope steepening adjacent to the site.
II2: Indirect Impact 2 -- there is evidence of arroyo cutting or other erosion exacerbated by base level lowering or proximity to river-eroded sediments within the site.
II3: Indirect Impact 3 -- there is evidence that changes in recreational use patterns have affected visitor impacts at the site (i.e., walking passengers around sites to aviod dangerous rapids, the creation of new camps to replace camps that eroded away).
PI1: Potential Impact 1 -- the site is buried in or is located on old river alluvium and is below the 300,000 cfs river flow zone.
PI2: Potential Impact 2 -- the site is located below the 300,000 cfs rever flow zone and is not situated in or on river alluvium.
NI: No Impact
IR: Incipient Erosion.
LFHD: Lee's Ferry Historic District
SRS: Stratified random sample used for selection of FY92 monitoring sites by impact. Sites were selected in the following manner: All sites in the Direct impact category; sites in the Indirect Impact categories (1, 2, 3) at the 20% level; Potential Impact 1 sites at a 20% level; no sites in the Potential Impact 2 and No Impact categories. All sites within sampled groups were selected randomly with no attempt to address additional factors (NPS 1992:5).

Table 2. Tasks completed at 16 monitored sites, FY92.

AZ Site Number, Feature	1992 Tasks Completed
C:2:11, F. 5	Photos
C:2:11, F. 6	Photos, updated IMACS
C:2:11, F. 10	GCES monitoring form, terrestrial & underwater photos, camera location, trip report
C:2:11, F. 14	GCES monitoring form, photos, camera location
C:2:12	GCES monitoring form, photos, camera location
C:2:32	GCES monitoring form, photos, camera location, tested and sampled, testing report
C:2:38	GCES monitoring form, GLCA monitoring & maintenance forms 9 & 11, photos, edited IMACS
C:2:41	GCES monitoring form, photos
C:2:53	GCES monitoring form, photos
C:2:57	GCES monitoring form, photos
C:2:72	GCES monitoring form, photos, updated map
C:2:74	GCES monitoring form, photos, updated IMACS
C:2:75	GCES monitoring form, photos, updated IMACS
C:2:80	GCES monitoring form, photos, edited map
C:2:82	GCES monitoring form, photos
C:2:95	GCES monitoring form, photos
C:2:100	GCES monitoring form, photos, camera location, sampled, testing report, edited IMACS, updated map
C:2:106	GCES monitoring form, photos, updated IMACS, edited map
C:3:10	GCES monitoring form, photos, edited IMACS

the installation and photo scale processes. The film was changed on the following days: August 24, September 24, October 27, November 25, December 21, 1992; January 22, February 23, March 29, April 23, 1993. Rolls were sent to Kodak with specific processing instructions. Upon development, the uncut, unmounted processed film is sent to Brian Cluer for photo data analysis. Additional data recovery activities were conducted at sites C:2:32 and C:2:100 (see below).

4. In addition to the stationary camera work at site C:2:32, a small-scale testing program was conducted to determine the nature and extent of Lens B, a directly impacted charcoal lens exposed in the cutbank above the Colorado River (Figure 1). No artifacts were recovered from the surface, the test unit, the cutbank, or the flood deposit of C:2:32, suggesting that the charcoal lens was probably natural. Based on depth and stratigraphy, the charcoal lens exposed in the cutbank appears to be the same one present at the bottom of the test unit.

Charcoal samples were obtained from two areas to date the different burned and depositional episodes. The sample recovered from the charcoal lens 90 cm below the top of the cutbank returned an uncalibrated radiocarbon age of 3150 +/- 55 years B.P. (Beta 57294). The sample recovered from the stain in the excavation unit, 1.24 m below present surface, returned an uncalibrated radiocarbon age of 1715 +/- 55 years B.P. (Beta 57295).

One flood deposit duff zone sample was collected from about 30 cm below the top of the cutbank on the southeast portion of site C:2:32 (Figures 1 and 3). Pollen and macrofloral analyses were conducted, revealing a plant assemblage similar to that noted for the modern vegetation community (Cummings and Puseman 1993:3).

Based on the work at site C:2:32: 1) the lens is restricted in north-south dimensions to a few meters north of the cutbank, the east-west dimensions are unknown; 2) the charcoal lens at C:2:32 most likely is not of cultural origin and was probably caused by more than one natural burn; 3) the lens is buried in an alluvial terrace that is similar to others referred to as the "striped alluvium" (Hereford et al. 1991). Radiocarbon dates for the "striped alluvium" range from 400 B.C. to A.D. 600 (Figure 2); 4) the radiocarbon sample from the cutbank, dating to 3150 +/- 55 years B.P., is older than anything thus far sampled in the eastern Grand Canyon (Richard Hereford 1993:Personal Communication), including the Upper Unkar, Lower Tanner Wash, Tanner Wash, and Palisades Creek study areas (Hereford et al. 1991); 5) the radiocarbon sample from the excavation unit, dating to 1715 +/- 55 years B.P., is comparable to the Basketmaker II dates from the "striped

Figure 1. Planview of site C:2:32.

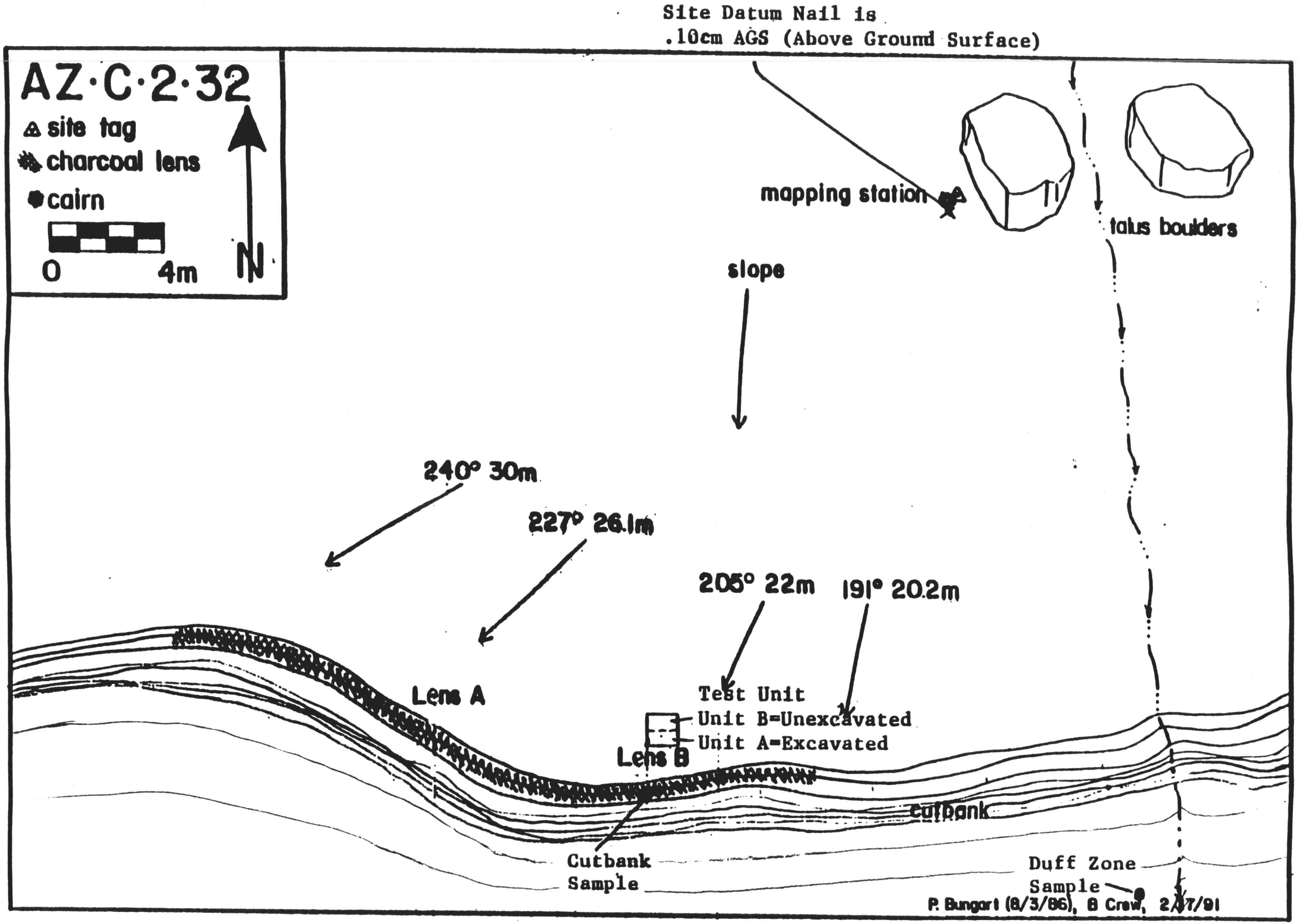
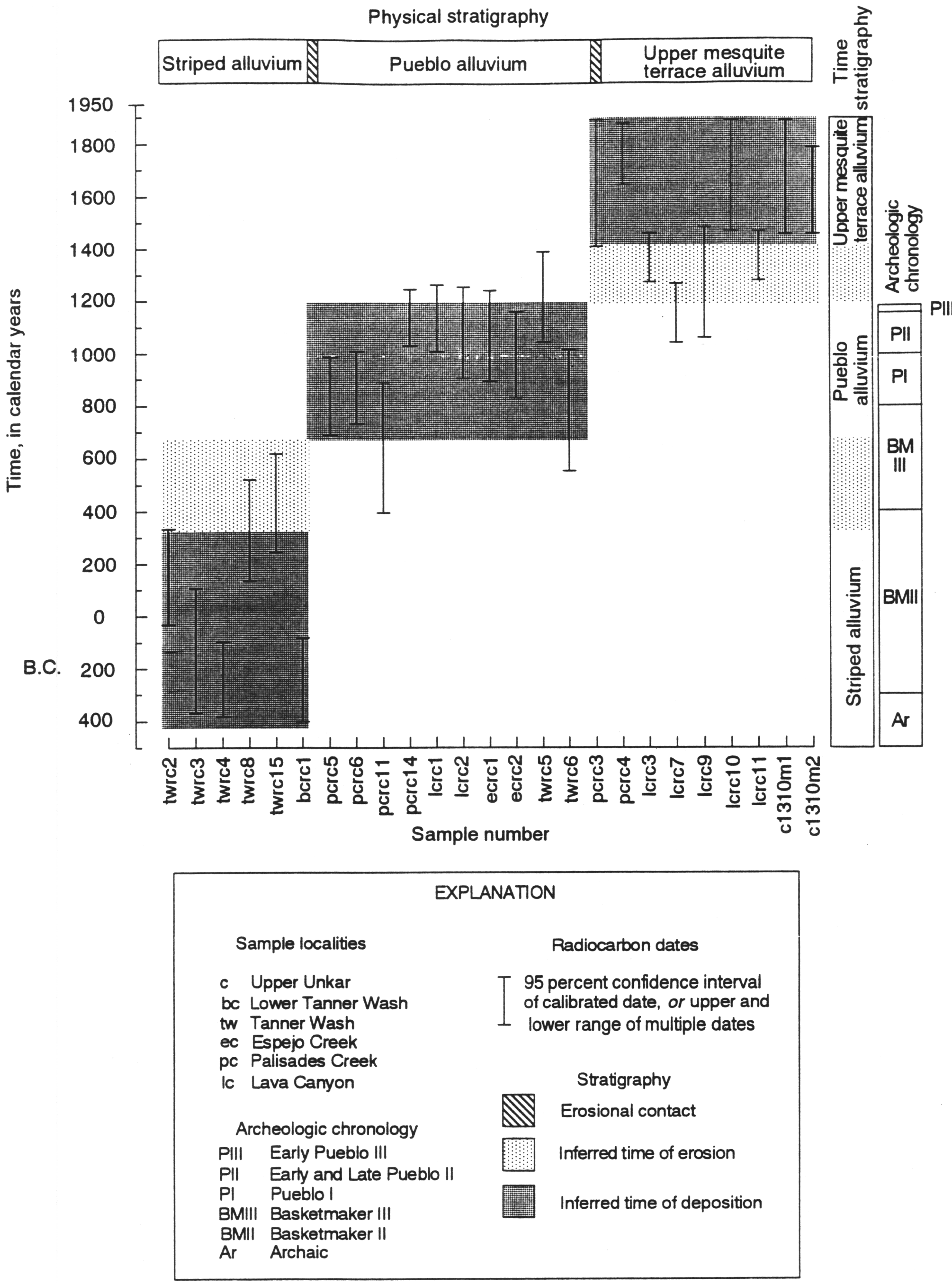


Figure 1. Planview of site C:2:32 with the tested areas.

Figure 2. Preliminary results of radiocarbon dating in the eastern Grand Canyon. (After Hereford 1993).



Physical stratigraphy
Striped alluvium
Pueblo alluvium
Upper mesquite terrace alluvium
Time stratigraphy
Upper mesquite terrace alluvium
Pueblo alluvium
Striped alluvium
Archeologic chronology
PIII
PII
PI
BM III
BMII
Ar
Time, in calendar years
1950
1800
1600
1400
1200
1000
800
600
400
200
0
B.C. 200
400
twrc2 twrc3 twrc4 twrc8 twrc15 bcrc1 pcrc5 pcrc6 pcrc11 pcrc14 lcrc1 lcrc2 ecrc1 ecrc2 twrc5 twrc6 pcrc3 pcrc4 lcrc3 lcrc7 lcrc9 lcrc10 lcrc11 c1310m1 c1310m2
Sample number
EXPLANATION
Sample localities
c Upper Unkar
bc Lower Tanner Wash
tw Tanner Wash
ec Espejo Creek
pc Palisades Creek
lc Lava Canyon
Archeologic chronology
PIII Early Pueblo III
PII Early and Late Pueblo II
PI Pueblo I
BMIII Basketmaker III
BMII Basketmaker II
Ar Archaic
Radiocarbon dates
95 percent confidence interval of calibrated date, or upper and lower range of multiple dates
Stratigraphy
Erosional contact
Inferred time of erosion
Inferred time of deposition

C14DATE.DRW

Figure 3. Flood deposit/duff zone sample area and profile, site C:2:32.

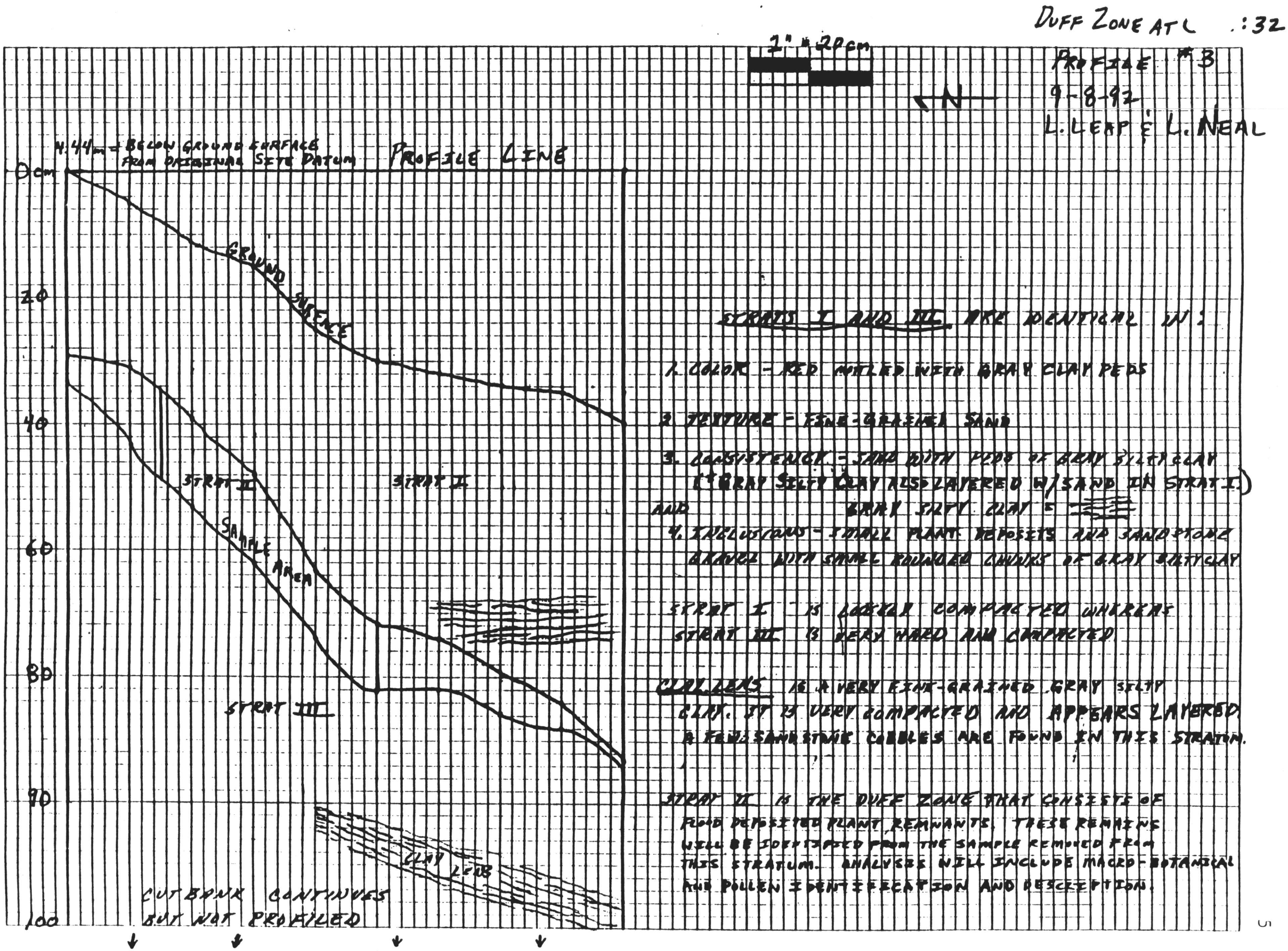


Figure 3. Flood deposit/duff zone sample area and profile.

alluvium" (Hereford et al. 1991); 6) results of macrobotanical and pollen analysis from samples collected from a duff zone 30 cm below the top of the cutbank suggest a plant community similar to that noted for the modern vegetation community.

It was initially suggested that the charcoal lenses exposed in the cutbank and in the excavation unit are the same. However, the results of the radiocarbon analysis of samples from these two locales suggest two burns. The dates are anomalous with respect to the single burn idea. Analysis of additional charcoal samples from the lens(es) would shed light on this dating problem. In any case, the radiocarbon analysis suggests that this alluvial terrace is coeval with terraces further to the west identified as the "striped alluvium" (Hereford et al. 1991). In addition, this analysis suggests that similar extensive terraces in Reach 0 may also date to this general time period. No cultural remains were associated with the radiocarbon dates from C:2:32. Does this suggest that during that period there was an occupation hiatus in this portion of the Grand Canyon? More dating control of not only cultural deposits but of naturally deposited sediments is needed from these terraces in Reach 0.

5. One radiocarbon sample was recovered from site C:2:100 (Figure 4), a hearth located in an arroyo cut 1 m below ground surface. The sample returned an uncalibrated radiocarbon age of 2430 +/- 55 years B.P. (Beta 57297). This date also corresponds to determinations thus far obtained for the "striped alluvium" (Hereford et al. 1991) further to the west in Grand Canyon.

6. A reconnaissance underwater dive and camera monitoring on the Spencer Steamboat were conducted. The submerged steamboat was recorded by Carrell (1987) as Feature 12 on site C:2:11. In addition to the completion of GCEIS archaeological monitoring documentation for the steamboat, the dive was performed to assess integrity of the submerged portions of the boat. An extensive photographic record was obtained under good diving conditions.

   The boat looks in relatively good condition when compared with the last underwater photographs taken in 1986 (Carrell 1987). Overall, the Spencer appears in better condition underwater, but the portions exposed above the surface are being heavily impacted by wet/dry cycling and wave action. Recommendations for best preserving the steamboat include extending the no wake zone around the Lee's Ferry boat launch area to incorporate the Spencer. This will reduce the damaging effects of the wave action against the boat. In addition, impacts from wet/dry cycles can be mitigated by keeping the vessel underwater at all times.
   One goal of the FY93 field season is to determine an 'ideal cfs flow' that will accomplish the latter recommendation.

Figure 4. Planview of site C:2:100.

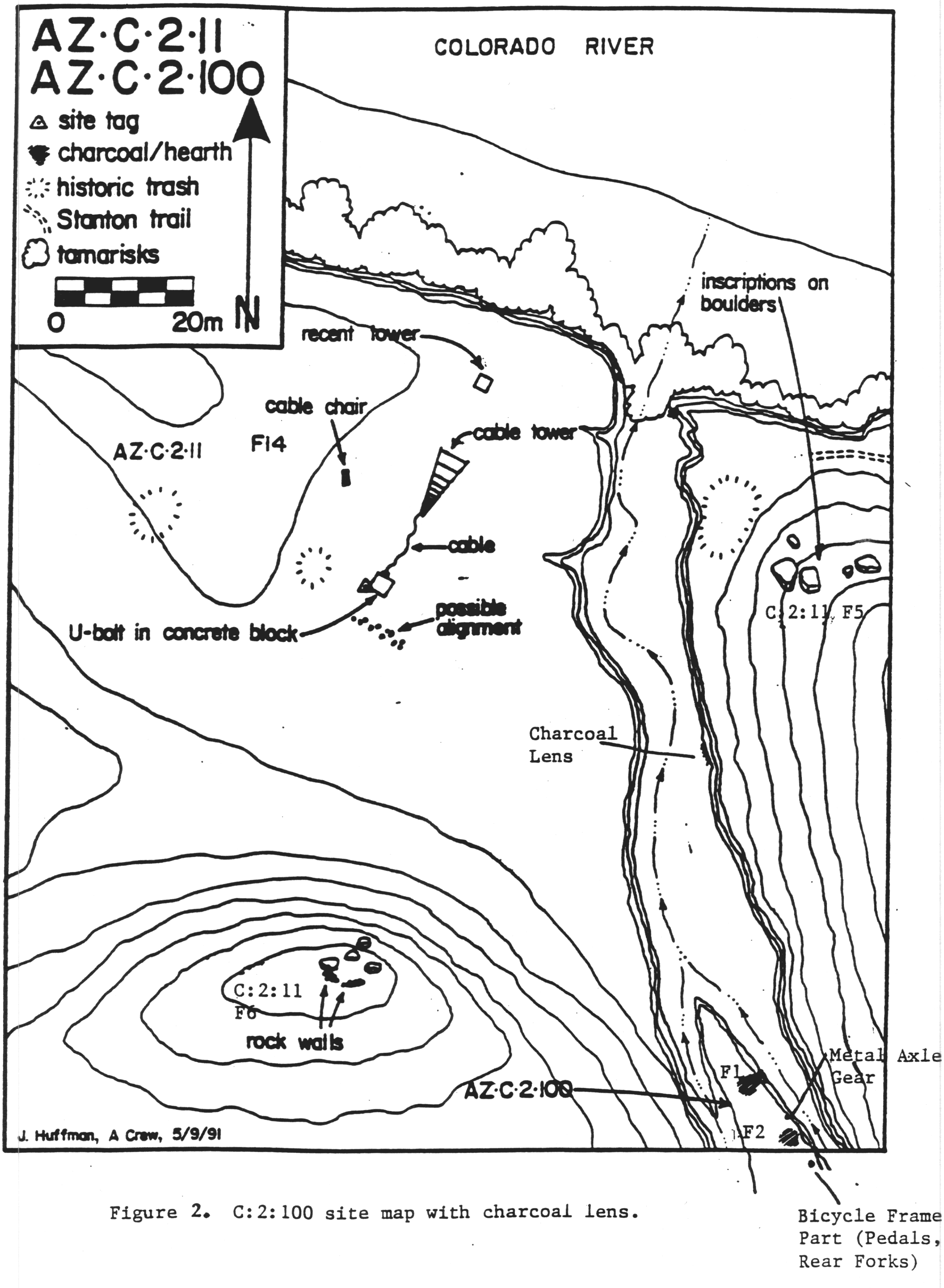


Figure 2. C:2:100 site map with charcoal lens.

This can be done by using survey equipment to calculate the top elevation of the exposed keel of the overturned boat. Other information needed includes the elevation of the river at the boat location during specific cfs flows.

7. Finally, five members of the Paiute tribe, three Kaibab and two Shivwits, were given a tour of the various resources on the Colorado River from Glen Canyon Dam to Lee's Ferry. Two affiliates with the Bureau of Applied Research in Anthropology at the University of Arizona, Richard Stoffle and Michael Evans, conducted ethnographic interviews with the Paiute tribal members.

   In preparation for this trip, five sites that were previously documented as having possible Paiute affiliation were revisited. Two of these, C:2:57 and C:2:106, are located on the Colorado River corridor. A third, C:2:56, is located within the boundaries of the Lee's Ferry Historic District, C:2:11. The fourth and fifth sites are located off the Colorado River. Site C:2:2 is on the right bank of the Paria River, and C:2:43 is just north of Cathedral Wash on the left hand side of the Lee's Ferry access road. Sites C:2:57 and C:2:106 were monitored for erosion in 1992. Site C:2:56 could not be found; however, additional prehistoric petroglyphs not previously recorded were found and plotted on the site map.

   Presentation of a summary of the ethnographic interviews, including the sites visited, is another goal of the FY93 monitoring season.

C. Results and Recommendations

1. Table 1 lists the previous (1991-1992) condition of the sites monitored. The table suggests that, compared to the 1991 GCEIS monitoring results, changes in site conditions are minimal. Of the 19 locations monitored in FY92, four of these are from C:2:11, seven are actively eroding, six are eroding incipiently, and six are stable.

2. The eroding condition of charcoal lenses in the alluvial cutbanks at sites C:2:32 and C:2:100 prompted investigations of them. It was important to record them in a timely and efficient manner before they eroded to the point where no useful information could be gathered. The testing results aid in the management and evaluation of the cultural significance of these and other sites in similar erosional situations. When monitoring efforts reveal other cultural remains whose information is about to be lost through erosion and/or other impacts, proactive measures such as testing, sampling, and excavation should be considered to mitigate the impacts.

3. Site C:3:10 was selected for monitoring activities during FY92

due to its highly eroded condition and the necessity to obtain as much data as possible before it is potentially lost. The charcoal lens at this site should be tested and radiocarbon and paleoethnobotanical samples collected for analysis.

4. Sites C:2:57 and C:2:106 are located directly on the Colorado River corridor, providing relatively easy access for tribal visitors. It is recommended that at least these sites be visited by the next group of Paiutes to take a raft trip from the Dam to Lee's Ferry.

5. The monitoring of all sites within the Colorado River corridor should continue. In addition to monitoring the randomly selected sites, cyclic monitoring should be conducted for the stationary camera sites, all sites described as actively eroding, sites under direct impact by the interim flows of the Colorado River, and sites with eroding charcoal features. If charcoal features are severely eroding, they should be excavated to obtain samples for radiocarbon and paleoethnobotanical analyses. Sites C:2:32, C:2:91, C:2:100, and C:3:10 contain severely eroding thermal features with datable charcoal.

V. PROPOSED SCOPE OF WORK AND METHODS -- FY93 FIELD SEASON

A. Introduction

The following scope of work is based on the results and recommendations of the 1991 GCRCS and FY92 monitoring activities. Five major tasks are proposed for FY93, including 1) continuation of on-site monitoring of erosion and human impacts; 2) continuation of the terrestrial photogrammetry; 3) collection and analysis of radiocarbon and paleoethnobotanical samples from site C:3:10, ; 4) determine the cfs flow required to keep the keel of the overturned Spencer Steamboat completely submerged, and conduct photographic recording of known cfs flow rates there; and 5) establish and update GCEIS monitoring data base for the 50 sites in Reach 0, from the Glen Canyon Dam to the Paria Riffle.

B. On-site Monitoring Activities

1. Selection of sites to be monitored.

   a. Criteria for site selection. The 1992 program of random selection of sites to be monitored will not be used in FY93. In general, all sites described as actively eroding, sites impacted directly by the river's interim flows, and sites with eroding charcoal features will be monitored. If charcoal features are severely eroding, they will be sampled for radiocarbon and ethnobotanical remains. These features may also be selected for limited data recovery programs. Specific criteria are provided below.

      1. Continue monitoring of all sites overviewed by cameras (code CO on Table 1).

      2. Monitor sites with Direct Impacts, inundation or bank cutting within the site area in recent years from water releases from Glen Canyon Dam (code DI on Table 1).

      3. Monitor sites with Indirect Impact 1, bank slumpage or slope steepening adjacent to the site, based on the presence of Type I and Type II drainage problems (code II1 on Table 1).

      4. Monitor sites with Indirect Impact 2, where erosion is accelerated by the proximity to river eroded sediments, based on the presence of Type I and Type II drainage patterns (code II2 on Table 1).

5. Monitor sites with Indirect Impact 3, erosion caused by recent changes in recreational use patterns (i.e. walking passengers around sites to avoid dangerous rapids, the creation of new camps to replace camps that eroded away) (code II3 on Table 1).

6. Monitor sites with Potential Impact 1, the site is buried in or is located on old river alluvium and is below the 300,000 cfs river flow zone (code PI1 on Table 1).

7. Sites excluded from the FY93 monitoring program are characterized by the following:

   a. Potential Impact 2, the site is located below the 300,000 cfs river flow zone and is not situated in or on river alluvium (code PI2 on Table 1).

   b. No Impact, there is no apparent impact occurring on site (code NI on Table 1).

   c. Sites determined during the FY92 monitoring program to have 'Stable' current conditions (Table 1).

b. Table 1 lists the 33 locations at 32 sites, including two at site C:2:11, proposed for monitoring activities during FY93.

2. Methods

a. Monitoring forms developed and used by GCRCS in 1992 to produce comparable and replicable data will continue to be used in the FY93 field season (see Attachment 1).

b. GLCA monitoring and maintenance forms 9 and 11 will be completed (see Attachments 2 and 3).

c. Photographic recording using GLCA archival procedures will continue.

d. Photograph sites C:2:11, 12, 32, 58, 59, 106, and C:3:3, having direct impacts and active river cutbank erosion, over Memorial Day weekend when dam release will be held to 8000 cfs from May 29 through May 31, 1993.

3. Level of Effort

It is estimated that an average of four sites can be monitored per two-person day. For 33 monitor locations, this equals 16-17 person days.

C. Terrestrial Photogrammetry with Cluer.

1. Actions at the sites.

a. Table 3 presents proposed tasks for the FY93 sites. Cyclic monitoring will continue for Stationary Camera Site 1 overlooking C:2:32 and Stationary Camera Site 2 overlooking C:2:100 and C:2:11. Stationary Camera Site 3 was placed overlooking site C:2:12, the Dugway. It was vandalized between January 22 and February 23, 1993. The camera box was removed from its location and hidden in a rock crevice nearby. It was recovered by Clive Pinnock. As of May 10, Cluer has not decided what he wants to do about the situation. The camera location should be reestablished.

b. Photo scale development--after the first photographs are retrieved from the reestablished camera station, a one-day survey expedition will be conducted to define the field of view and provide scaling information so that the areas of interest can be scaled to real-world values.

c. Film retrieval and replacement every 34 days will continue from May 27 through October 1, 1993. Scheduled days are May 27, June 30, July 28, August 31, and October 4, 1993.

d. All monitoring trips will be documented in trip reports.

2. Level of Effort.

a. Reestablish Stationary Camera Site 3, requiring one day with Cluer and one GCEIS person = two person days

b. Photo scale refinement for the reestablished camera site, requiring one day with Cluer and one GCEIS person = two person days

c. Film retrieval and replacement from April 1 to October 1, 1993 = 6 one-person days

d. Trip reporting and filing film processing requisitions = 2 one-person days

Table 3. Proposed tasks for FY93 sites.

AZ Site Number, Feature	1993 Tasks to Complete
C:2:11, F. 10	GCES monitoring form, photos, camera location, determine necessary cfs flow to keep the keel submerged, GLCA monitoring and maintenance forms 9 and 11.
C:2:11, F. 14	GCES monitoring form, photos, camera location, GLCA monitoring and maintenance forms 9 and 11.
C:2:12	GCES monitoring form, photos, reestablish camera location, GLCA monitoring and maintenance forms 9 and 11.
C:2:13	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:32	GCES monitoring form, photos, camera location, sample charcoal lens, GLCA monitoring and maintenance forms 9 and 11.
C:2:35	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:36	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:38	GCES monitoring form, GLCA monitoring and maintenance forms 9 and 11, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:48	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:57	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:58	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:59	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:60	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:71	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:72	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:73	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:75	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:76	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:77	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:81	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:82	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:83	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:84	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:86	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:87	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:90	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:91	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:95	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:99	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:2:100	GCES monitoring form, photos, camera location, GLCA monitoring and maintenance forms 9 and 11.
C:2:106	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:3:3	GCES monitoring form, photos, GLCA monitoring and maintenance forms 9 and 11.
C:3:10	GCES monitoring form, photos, data recovery program, GLCA monitoring and maintenance forms 9 and 11..

D. Spencer Steamboat tasks

1. Field Work. Establish elevation of the top of the exposed keel of the boat using survey equipment. Photograph site over Memorial Day weekend when river flows will be a constant 8000 cfs. Need known cfs output to establish necessary cfs for complete submergence, requiring one day with two persons = two person days

2. Trip report, requiring one person day

E. Site C:3:10 data recovery program

FY92 monitoring activities at site C:3:10 recorded the highly eroded condition of a charcoal lens. The 1992 monitoring summary recommended that a data recovery program be undertaken before the lens is completely lost to erosion. A work plan will be forthcoming following the completion of FY93 monitoring activities at this site.

F. FY93 Monitoring Report

1. Completed by GLCA.

   a. Encoding of GRCRS monitoring forms.

   b. Trip reports (see above for trip report scheduling). These will include the following sections: dates, staff, sites visited, monitoring and remedial actions, summary of significant observations, changes noted, and recommendations for mitigating actions.

   c. 1993 Final Monitoring Report. This summary report will include current erosion status, impact categories, the presence of Type I and Type II drainages, the presence of severely eroding charcoal lenses/features, existing site condition prior to monitoring, changes in site condition, remedial actions implemented during the year, and a recommended monitoring plan for the following fiscal year identifying sites to be monitored and proposed remedial actions.

   d. A summary of the Paiute ethnographic interviews conducted in FY92 by Richard Stoffle and Michael Evans of the Bureau of Applied Research in Anthropology, University of Arizona.

2. Completed by Cluer.

   a. Photographic data analysis for the fixed camera sites.

   b. Quarterly reports including preliminary results.

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VII. ATTACHMENTS

ATTACHMENT 1

Archaeological River Site Monitoring Form

ARCHAEOLOGICAL RIVER SITE MONITORING FORM

MANAGEMENT INFORMATION

1. Site # AZ 2. Monitor session #

3. Monitor(s) ____

4. Date ________________

5. USGS Quad map 7.5' ________________ 6. Use Area Name ____________________

7. Date of first visit / /

8. UTM location (Zone 12) __________ East __________ North

9. General location description

10. Does this site have any visible structures? 0 = no, 1 = yes ___

11. River mile _____ River bank (L=left, R=right, B=both) ___

12. Is this site located in or on Colorado River fluvial deposits?
0=no, 1=yes ___
If yes, describe the setting specifically:

13. Distance/direction from and height above current high water (approx. 30,000 cfs) to lowest boundary of site area:
Distance _____ mtrs Direction _____ degrees Height _____ mtrs Slope ____ degrees

14. Distance/direction from and height above current high water to a central site datum
Distance _____ mtrs Direction _____ degrees Height _____ mtrs Slope ____ degrees

ENVIRONMENTAL SITUATION

15. **PRIMARY physiographic setting:** 1. Riverside beach/dunes 2. Alluvial terrace 3. **Talus slope 4. Base of cliff** 5. Bedrock Ledges 6. Non-riverside dunes 7. Other ______________________ ___

16. Degree of shelter: 1. Open 2. Overhang/cave 3. Combination ___

17. DOMINANT soil type: 1. Alluvium/Aeolian 2. Colluvium 3. Bedrock 4. Residual ___

18. DOMINANT soil texture: 0. Not sandy or gravelly 1. Gravelly 2. Sandy 3. Gravelly and Sandy ___

NATURAL IMPACTS (use the following scores: 0=none, 1=minor (<10% of site area affected), 2=moderate (>10% but less than 50% of site area affected), 3=extensive (50% of site area affected)

19. Evidence of surficial sheet washing? ___

20. Evidence of gullying (cuts 10-100 cm deep)? ___

21. Active arroyo cutting (cuts >100cm)? ___

22. Evidence of animal-caused erosion? (Sum of items below) ___
   (a) general trampling ___
   (b) trailing through site ___
   (c) burrowing ___
   (d) Other ___
   ____

23. Evidence of other erosion? (Sum of items below) ___
   (a) wind deflation ___
   (b) bank slumpage ___
   (c) dune migration ___
   (d) Other ___
   ____

TOTAL NATURAL IMPACT

24. First method: if score for items 18-23 is greater than zero, item # = 1. (Sum total - maximum total = 5). First Method Total ___

25. Second method: sum actual scores for all items. Maximum score for items 19-21 equals 3 each; maximum score for items 22 and 23 equals 12 each. (Maximum possible for all items combined is 33.) Second Method Total ___

26. Characterize the stability of the site: 0=stable (no active erosion) 1=incipient erosion, 2=active erosion ___

27. Do any of the above impacts appear to be related to river/dam operation? 0=no, 1=yes ___

   Indicate with a '1' any that apply:
   (a) direct inundation within past 30 years (post-dam) ___
   (b) bank slumpage/steepening adjacent to current highwater zone ___
   (c) headward migration of arroyos due to lowered base level ___
   (d) Other ______________________________ ___

28. If arroyos or gullies are present, do they drain all the way to the river? (Note: Some drainages die out in dune fields or on terraces before reaching the river.) 0=no, 1=yes, 2=N/A

29. Comments: (Explain/describe river-related impacts in more detail; any new features or structures exposed by erosion; changes in types or degree of erosion; imminent threats; what to look at on next visit, etc.):

HUMAN IMPACTS EVALUATION

30. Collection Piles: 0= None 1= 1 pile 2= > 1 pile ___
If more than one pile, list total number: ____

31. Trails: 0 = No distinct trails 2 = 1-2 distinct trails
4 = >2 distinct trails ___

32. Trails eroded >5 cm below ground level? 0=no, 1=Yes ___
(Show all distinct trails on site map.)

33. Evidence of on site camping? 0=None; 2=minimal (1 of the below);
4=Considerable (2 or more of the below) ___

Indicate with a '1' what kinds of evidence are present?
a. Fire scars, fire pits, recent charcoal: ___
b. Rearrangement/clearing of rocks: ___
c. Recent camper trash: ___
d. Obvious concentrated soil compaction (tent site): ___
e. Other: ____________________

Does this evidence appear to be recent (< 5 years old)? ___

Did evidence appear since last visit? ___

34. Evidence of deliberate vandalism? ___
0= None
1= Surficial disturbance only (e.g., grafitti)
2= Slight amount of subsurface disturbance(<1 m2 excavated)
3= Substantial subsurface disturbance (>1 m2 area excavated)

Does this evidence appear to be recent (<5 years old)? ___

Did evidence appear since last visit? ___

35. Any other evidence of visitation other than above (e.g. obvious erosion/compaction from human trampling, scattered surface trash, etc)
0=no, 1=yes ___
If yes, describe:

TOTAL HUMAN IMPACT RATING ____

36. Human Impact Condition Class (see rating system below) ___
Condition Class 1: No human impacts (Impact rating = 0)
Condition Class 2: Minimal impact (Impact rating 1-3)
Condition Class 3: Moderate impact (Impact rating 4-6)
Condition Class 4: High impact (Impact rating 7-9)
Condition Class 5: Very high impact (Impact rating 10-12)
Condition Class 6: Extreme impact (Impact rating 13-15)

37. Describe changes/new human impacts since last visit:

RIVER-RELATED HUMAN IMPACTS

38. How close is the nearest rivercamp to this site?
1=>1 km; 2=<1 km but >500 m; 3=<500 m but >100 m; 4=<100 m ___

39. Are any of the human impacts directly related to river fluctuations and/or dam operations? 0=no, 1=yes ___
If yes, indicate with a '1' any that apply)
(a) development of new trailing to avoid highwater ___
(b) availability of new beaches in proximity to site ___
(c) other: ___
____

40. Any human impacts directly related to recent recording/monitoring activities? 0=no, 1=yes ___

If yes, indicate with a '1' any that apply
(a) development of new trails ___
(b) damage to cryptogamic crust ___
(c) other: ___
____

MANAGEMENT ASSESSMENT AND RECOMMENDATION

41. What types of impacts threaten this site? (i.e. what to watch out for)
Rank each threat according to the criteria listed below:

0: Not a threat now or in the foreseeable future
1: Possible threat
3: Definite threat
5: Actively occurring at the present time

a) bank slumpage from river/dam related processes ___
b) development of new gullies and/or headward migration of arroyos due to river/dam related base level lowering ___
c) bank slumpage from non-river related processes ___
d) deepening/widening of arroyos from non-river related natural processes (i.e. side canyon flooding) ___
e) exposure/destabilization of features due to a or b ___
f) exposure/destabilization of features due to c, d, or weathering ___
g) exposure/destabilization of features due to visitation ___
h) impacts from human visitation (other than g) ___
i) burial or exposure of features due to dune migration ___
j) other ______________________________ ___

42. Recommended Actions: 0=never/not necessary or applicable; 1=eventually (>3 years from now); 2=soon (within 1-3 years) 3=immediately (within 1 year/less if possible); 4=action currently in progress

Discontinue monitoring	___
Monitor visitation with remote sensing devices	___
Monitor erosion with stationary cameras	___
Retrail or define existing trails	___
Obliterate trails	___
Install check dams	___
Plant vegetation to stabilize site surface	___
Stabilize banks with rock armor or similar technique	___
Stabilize structures	___
Surface collect entire site	___
Test for presence/depth of subsurface cultural deposits	___
Map as a form of data recovery (excavation not warranted)	___
Full data recovery (excavation)	___
Close site to all public visitation	___
Develop for public interpretation	___

43. Justify your recommendation:

44. Ranking - See MONITORING PRIORITY RANKING CRITERIA

Stability	___
Accessibility	___
Visibility	___
Natural Impacts	___
Human Visitation	___

45. What is the monitoring priority rank of this site. ___

46. Has this value changed from previous visit? 0=no, 1=yes ___
If yes, explain below.

47. Additional comments/continuations

Monitoring Priority Scores

Circle one value within each category:

Stability

1 Stable—no exposed fragile features such as rock art, standing masonry, middens, etc.

2 Moderately stable—fragile features present but not deteriorating (protected by overhang, etc.)

3 Moderately unstable—fragile features present with definite potential for deterioration

4 Unstable—fragile features exposed and deteriorating

Accessibility

1 Protected—located more than 1 km from road/trail/camp or difficult access (technical climbing)

2 Moderately protected—located 1 to 1/2 km from road/trail/camp with moderate to difficult access (exposure)

3 Moderately unprotected—located 1 to 1/2 km from road/trail/camp with easy access, or 500-100 m with moderately difficult access (exposure but no technical climbing)

4 Unprotected—located less than 100 m from road/trail/camp with easy access

Visibility

1 Low profile—site difficult to recognize, few or no artifacts, subtle features

2 Moderately low profile—site not readily apparent, sparse scattered artifacts, features not obvious

3 Moderately high profile—site is easily recognized from close proximity, abundant surface artifacts, features obvious

4 High profile—site sticks out, attracts attention from a distance, lots of artifacts, well-defined features

Natural Impacts

1 None—natural impact score (Method 1) equals 0

2 Slight—natural impact score equals 1

3 Moderate—natural impact score equals 2-3

4 High—natural impact score > 4

Human Impacts/Visitation

1 None—human impact condition class equals 1 (no impact)

2 Slight—human impact condition class equals 2 (minimal)

3 Moderate—human impact condition class equals 3

4 High—human impact condition class equals 4 or more

Rank	Total Score	
1	20-17	Sites with these scores require monitoring biannually or quarterly; high priority
2	16-13	Sites with these scores require at least annual monitoring; second-highest priority
3	12-9	Sites with these scores require a longer monitoring cycle, perhaps every 2 to 3 years
4	8-5	Sites with these scores should be monitored every 3-5 years; lowest priority

ATTACHMENT 2
GLCA Form 9
Monitoring and Maintenance Site Log Sheet

MONITORING AND MAINTENANCE SITE LOG SHEET

SITE NUMBER ______________________ SITE NAME ______________________

USGS QUAD ______________________ LOCATION ______________________

DATE OF VISIT ______________________ TIME ______________________

Description of Monitoring Activities: Describe all work performed at site in summary form. Include location of work, the nature of the work, and whether or not photographs were taken. List all Monitoring points at which observations were made or work was done, but provide primary documentation of these activities on the Monitoring Observation Record.

Assessment of Site Condition: Summarize changes in site condition, agents of deterioration, rate of deterioration. Discuss problems in site preservation. Is cyclic Maintenance recommended for specific areas on the site? If so, where? Have Cyclic Maintenance Evaluation forms been filled out for the site? Is so, when?

Recorder: ______________________ Date: ______________________

Title: ______________________

ATTACHMENT 3
GLCA Form 11
Monitoring Point Observation and Routine Maintenance Record

MONITORING POINT OBSERVATION AND ROUTINE MAINTENANCE RECORD GLCA 7/88
MONIT. & MAINT. - 11 REVISED

SITE NAME/NUMBER ______________________ MA NUMBER ______________________

FEATURES INCLUDED IN MA ______________________

CONDITIONS OBSERVED: ______________________

MAINTENANCE PERFORMED ______________________

MAINTENANCE NEEDED ______________________

MONITORING FOCUS ______________________

PHOTOS? _____ TYPE __________ ROLL NO __________ FRAME NOS __________

INSPECTED BY ______________________ DATE __________

REMARKS ______________________