120.06
ENV-3.00
G558
19083

February 3, 1993

As part of the ongoing GCES archaeological monitoring program at Glen Canyon National Recreation Area, this notebook has been developed to act as a guide for future GCES monitoring efforts, and to report the results. Enclosed are the final GCES monitoring and testing reports from the 1992 field season from the Dam to Lee's Ferry (river miles -15 to 0). Also included are copies of the Programmatic Agreement, and the Monitoring Plan for the Programmatic Agreement. These documents served as the guidelines for the research.

Cordially,

Lisa M. Leap

Lisa M. Leap
Glen Canyon National Recreation Area
P.O. Box 1507
Page, AZ 86040
(602) 645-8277

cc Balsom/GRCNP
Kincaid/GLCA
Wegner/GCES

120.06
ENV-3.00
G558
19083

COL101-gde 03

Advisory
Council On
Historic
Preservation

The Old Post Office Building
1100 Pennsylvania Avenue, NW, #809
Washington, DC 20004

Reply to: 730 Simms Street, #401
Golden, Colorado 80401

MEMORANDUM

December 1, 1992

TO: All Consulting Parties

FROM: Claudia Nissley, Director, Western Office of Project Review 12/2/92

SUBJECT: Second Final Draft Programmatic Agreement for the Glen Canyon Dam Operations

Enclosed is the ninth draft and second final draft of the referenced agreement for your review and comments. This second final draft has been altered somewhat in response to comments received regarding the first final draft, dated October 19, 1992.

Specifically, the Agreement now recognizes that Navajo Nation historic properties may be included within the area of potential effects based on land status jurisdiction issues. The Agreement takes no position with regard to the resolution of these issues, but accommodates the possible outcomes of their resolution.

The Agreement also includes changes in deadlines identified at Stipulations 1.A., and 1.B.

The Agreement now designates full signatory status to all consulting Tribes. This has been accommodated by specifying that any party to the Agreement may terminate it (Stipulation 7), and by deleting the word "CONCUR" from the signature page. With these changes, all Tribes which sign the Agreement have full and equal status with all other parties under the Agreement's terms.
We hope that all concerns have now been resolved, and that the Agreement is ready for signature. Therefore, the draft warrants careful scrutiny to ensure its acceptability. If any party has any further specific comments on additional changes, please notify us of the changes within the next 30 days. If we do not hear from you, we will assume that you find this draft to be acceptable, and will encourage Reclamation to circulate it for signature.

Thank you for your contributions and patience. If you have any questions, please contact Alan Stanfill at (303) 231-5320.

SECOND FINAL DRAFT

PROGRAMMATIC AGREEMENT AMONG THE BUREAU OF RECLAMATION, THE ADVISORY COUNCIL ON HISTORIC PRESERVATION, THE NATIONAL PARK SERVICE, AND THE ARIZONA STATE HISTORIC PRESERVATION OFFICER REGARDING OPERATIONS OF THE GLEN CANYON DAM

WHEREAS, the Secretary of Interior has directed the preparation of an Environmental Impact Statement (EIS) on the effects of the operation of the Glen Canyon Dam on the downstream environmental and ecological resources, and historic properties of Glen Canyon and Grand Canyon; and

WHEREAS, the purpose of the EIS is to "...reevaluate the operation of the Glen Canyon Dam to determine specific options that could be implemented to minimize - consistent with law - adverse impacts on the downstream environmental and cultural resources and Native American interests in Glen and Grand Canyons." (Interim Preliminary Draft EIS 7/92); and

WHEREAS, the Bureau of Reclamation, Upper Colorado Regional Office, (Reclamation) administers the releases of water from the Glen Canyon Dam and has determined that the operation of the Dam (the Program) may have effects upon properties included in or eligible for inclusion in the National Register of Historic Places and has consulted with the Advisory Council on Historic Preservation (Council), the National Park Service (NPS), and the Arizona State Historic Preservation Officer (SHPO) pursuant to 36 CFR § 800.13 of the regulations (36 CFR Part 800) implementing Section 106 of the National Historic Preservation Act (ACT) (16 U.S.C. 470f); and

WHEREAS, Reclamation is the lead Federal agency for the Program for purposes of Section 106; and

WHEREAS, NPS is responsible for the administration and management of historic properties within the boundaries of the Glen Canyon National Recreation Area and the Grand Canyon National Park pursuant to Section 110 of the Act; and

WHEREAS, given their mutual responsibilities, Reclamation and NPS have determined to coordinate their respective roles in the management and consideration of historic properties which may be affected by the Program; and

WHEREAS, the Hualapai Tribe is responsible for the administration and management of historic properties within the boundaries of its reservation lands affected by the Program; and

WHEREAS, the Navajo Nation is responsible for the administration and management of historic properties within the boundaries of the

Navajo Nation pursuant to the Cultural Resources Protection Act (CMY-19-88); and

WHEREAS, the Navajo Nation agrees to NPS administration and management of any Navajo Nation historic properties which may be included under the terms of this agreement until such time as the Navajo Nation assumes such responsibility; and

WHEREAS, the Havasupai Tribe, Hopi Tribe, Hualapai Tribe, Kaibab Paiute Tribe, Navajo Nation, San Juan Southern Paiute Tribe, Shivwits Paiute Tribe and the Zuni Pueblo (the Tribes) participated in consultation and have been invited to concur in this Programmatic Agreement;

NOW, THEREFORE, Reclamation, the Council, NPS, SHPO, and the Tribes agree that the Program shall be administered in accordance with the following stipulations to satisfy Reclamation's Section 106 responsibilities for all individual aspects of the Program.

Stipulations

Reclamation, as lead Federal agency for purposes of the Program, shall ensure that the following stipulations are carried out.

1. IDENTIFICATION AND EVALUATION

A. NPS has identified a total of 313 contributing properties, referred to as the Grand Canyon River Corridor District (District), within the Area of Potential Effects (APE). Nine additional properties within the boundaries of the District remain unevaluated. NPS shall assist Reclamation in obtaining the necessary information to complete the evaluation of these nine sites for determining their eligibility for listing on the National Register as contributing properties to the District or as eligible on their own merits. Reclamation shall submit such evaluations to the SHPO for determinations of eligibility. In the event that Reclamation and SHPO do not agree on the eligibility of any property, or if the Council or Keeper so request, Reclamation shall obtain a formal determination of eligibility from the Keeper of the National Register in accordance with 36 CFR § 800.4(c). Determinations of eligibility for the remaining nine properties shall be completed by June 1993.

B. Reclamation and NPS, in consultation with SHPO, shall identify and evaluate historic properties in the remaining 37 miles of the APE not previously intensively inventoried (Attachment A). Properties identified within the 37 mile corridor shall be evaluated on their own merits and as contributing elements to the District pursuant to 36 CFR § 800.4(c). An intensive inventory of the entire APE shall be completed by June 1993. Ongoing identification and evaluation efforts shall be a part of the

management program identified at Stipulations 2 and 3.

C. In consultation with the Tribes and SHPO, Reclamation and NPS shall identify and evaluate properties within the APE which retain traditional cultural values. Such properties shall be evaluated under criteria A, B, C, and D of the National Register Criteria pursuant to 36 CFR Part 60, and taking into consideration National Register Bulletin 38, Guidelines for Evaluating and Documenting Traditional Cultural Properties.

1. Traditional Cultural Properties shall be identified by Reclamation and NPS through the conduct of ethnographic studies. Ethnographic studies shall solicit the participation of and consultation with the Tribes.

2. Reclamation shall submit such evaluations to the SHPO for determinations of eligibility. In the event that Reclamation and SHPO do not agree on the eligibility of any property, or if the Council or Keeper so request, Reclamation shall obtain a formal determination of eligibility from the Keeper of the National Register in accordance with 36 CFR § 800.4(c). Such study and evaluations shall be completed by October 1993.

2. MONITORING AND REMEDIAL ACTION

A. Within three months of the execution of this Programmatic Agreement, Reclamation and NPS, in consultation with the SHPO and Tribes, shall develop a Plan for monitoring the effects of the Glen Canyon Dam operations on historic properties within the APE and for carrying out remedial actions to address the effects of on-going damage to historic properties. The purpose of the Plan shall be to generate data regarding the effects of Dam operations on historic properties, identify on-going impacts to historic properties within the APE, and develop and implement remedial measures for treating historic properties subject to damage. Such data shall be incorporated into Reclamation's Long Term Operating Plan governing dam releases of the EIS, scheduled for completion in 1994.

B. The Monitoring and Remedial Action Plan shall provide for the identification and evaluation of previously unrecorded properties overlooked by previous surveys or exposed subsequent to the surveys, and include measures by which any adverse effects identified during the monitoring effort shall be avoided or minimized. Remedial measures shall be implemented to mitigate on-going adverse effects and may include, but not be limited necessarily to, bank stabilization, check dam construction and data recovery, as appropriate. The Plan shall specify an expedited consultation process among the parties to this agreement to accommodate situations requiring remedial actions.

C. Reclamation shall submit a draft Monitoring and Remedial Action Plan to the parties to this agreement for review and comment. Each party shall have 30 days from receipt of the Plan to comment.

Reclamation may assume the concurrence of any party which does not issue comments within 30 days of their receipt of the Plan.

1. Reclamation shall take into consideration all comments received in their development of a final draft Plan, and submit the final draft Plan to the reviewing parties for a second review opportunity. Each reviewing party shall have 20 days from receipt to review the final draft Plan and issue comments to Reclamation.

2. If any reviewing party objects to the adequacy of the final draft Plan, Reclamation shall consult with the objecting party, and the other parties to this Programmatic Agreement as necessary to resolve the objection pursuant to Stipulation 4. When all objections are resolved, Reclamation shall implement the Monitoring and Remedial Action Plan.

3. MANAGEMENT

A. Reclamation and NPS shall incorporate the results of the identification, evaluation, and monitoring and remedial action efforts into a Historic Preservation Plan (HPP) for the long-term management of the Grand Canyon River Corridor District and any other historic properties within the APE. The HPP shall be developed in consultation with the parties to this Programmatic Agreement. The HPP shall integrate Reclamation's lead agency role pursuant to Section 106 of the Act and NPS's stewardship role pursuant to Section 110 of the Act. Specifically, the HPP shall provide management direction responsive to NPS's responsibilities under Sections 110(a)(1) and 110(a)(2); and NPS's and Reclamation's responsibilities under Sections 110(b) and 110(d).

B. The HPP shall establish consultation and coordination procedures, long term monitoring and mitigation strategies, management mechanisms and goals for long term management of historic properties within the APE.

C. Reclamation and NPS shall submit a draft of the HPP to the parties to this agreement for 30 days review. The parties to this agreement shall have 30 days from receipt to issue comments to Reclamation and NPS regarding the adequacy of the HPP. Reclamation and NPS may assume the concurrence of any party which does not issue comments within 30 days of receipt of the HPP.

1. Reclamation and NPS shall take into consideration all comments received in their development of a final draft HPP, and submit the final draft HPP to the reviewing parties for a second review opportunity. Each reviewing party shall have 20 days from receipt to review the final draft HPP and issue comments to Reclamation and NPS.

2. If any reviewing party objects to the adequacy of the final draft HPP, Reclamation and NPS shall consult with the objecting party, and the other parties to this agreement as

necessary to resolve the objection pursuant to Stipulation 4. When all objections have been resolved, Reclamation and NPS shall implement the HPP.

D. The development, and review of the HPP shall be completed prior to the issuance of a Record of Decision for the GCD-EIS, or December 1994, whichever comes first. Upon issuance of a Record of Decision, the HPP shall be reviewed by the parties to this agreement and revised, if necessary, based on the decision. The review of a revised HPP shall be conducted in accordance with the procedures of Stipulation 3.C.1. and 2.

4. DISPUTE RESOLUTION

A. Should any party to this agreement object within 30 days to any plans, specifications, or actions proposed pursuant to this agreement, Reclamation and NPS shall consult with the objecting party to resolve the objection. If any party involved in the dispute determines that the dispute cannot be resolved, Reclamation shall forward all documentation relevant to the dispute to the Council. Within 30 days after receipt of all pertinent documentation, the Council will either:

1. provide Reclamation and NPS with recommendations, which Reclamation will take into account in reaching a final decision regarding the dispute; or

2. notify Reclamation and NPS that it will comment pursuant to 36 CFR § 800.6(c)(2) with reference to the subject of the dispute.

Any recommendation or comment provided by the Council will be understood to pertain only to the subject of the dispute; Reclamation's responsibility to carry out all actions under this agreement that are not the subjects of the dispute shall remain unchanged.

B. At any time during implementation of the measures stipulated in this agreement should an objection to any such measure or its manner of implementation be raised by a member of the public, Reclamation and NPS shall take the objection into account and consult as needed with the objecting party, SHPO, the Tribes, or the Council to resolve the objection.

5. REVIEW OF THE AGREEMENT

A. The Council, SHPO, NPS and Tribes may review activities carried out pursuant to this Programmatic Agreement, and the Council will review such activities if so requested. Reclamation will cooperate with the Council, SHPO, NPS and Tribes in carrying out their reviewing activities.

B. Reclamation and NPS shall provide bi-annual summary reports of their progress toward completing the terms of this agreement to

each of the parties to this agreement. The bi-annual reports shall identify accomplishments and actions completed and provide schedules for completion of all remaining tasks. The first bi-annual report shall be submitted to the parties of this agreement six (6) months after the date of the Council's signature on this agreement and every six months thereafter until the HPP has been implemented.

6. AMENDMENT

Any party to this Programmatic Agreement may request that it be amended, whereupon the parties will consult in accordance with 36 CFR § 800.13 to consider such amendment.

7. TERMINATION

Any party to this Programmatic Agreement may terminate this agreement by providing 30 days written notice to the other parties, provided that the parties will consult during the period prior to termination to seek agreement on amendments or other actions that would avoid termination. In the event of termination, Reclamation will comply with 36 CFR §§ 800.4 through 800.6 with regard to individual undertakings covered by this Programmatic Agreement.

8. FAILURE TO CARRY OUT TERMS

In the event Reclamation and NPS do not carry out the terms of this Programmatic Agreement, Reclamation will comply with 36 CFR §§ 800.4 through 800.6 with regard to individual undertakings covered by this Programmatic Agreement.

Execution and implementation of this Programmatic Agreement evidences that Reclamation has afforded the Council a reasonable opportunity to comment on the Program and that Reclamation has taken into account the effects of the Program on historic properties.

ADVISORY COUNCIL ON HISTORIC PRESERVATION

BY:_____ Date:_____
Title:

BUREAU OF RECLAMATION

BY:_____ Date:_____
Title:

ARIZONA STATE HISTORIC PRESERVATION OFFICER

BY:_____ Date:_____
Title:

NATIONAL PARK SERVICE, WESTERN REGION

BY:_____ DATE:_____
Title:

NATIONAL PARK SERVICE, ROCKY MOUNTAIN REGION

BY:_____ DATE:_____
Title:

HAVASUPAI TRIBE

BY:_____ Date:_____
Title:

HOPI TRIBE

BY:_____ Date:_____
Title:

HUALAPAI TRIBE

BY:_____ Date:_____
Title:

KAIBAB PAIUTE TRIBE

BY:_____ Date:_____
Title:

NAVAJO NATION

BY:_____ Date:_____
Title:

SAN JUAN SOUTHERN PAIUTE TRIBE

BY:_____ Date:_____
Title:

SHIVWITS PAIUTE TRIBE

BY:_____ Date:_____
Title:

ZUNI PUEBLO

BY:_____ Date:_____
Title:

United States Department of the Interior

NATIONAL PARK SERVICE
P.O. BOX 37127
WASHINGTON, D.C. 20013-7127

IN REPLY REFER TO:

L7619(774)

July 8, 1992

To: All on the Enclosed List

Subject: Draft Monitoring Plan - Review and Comment
REPLY DUE: AUGUST 7, 1992

Enclosed herewith is a copy of the draft monitoring plan to accompany the Programatic Agreement covering Section 106 compliance for the Glen Canyon Dam Environmental Impact Statement.

Please review the plan and provide comments to this office by the above due date. If questions arise, please telephone me at: (801) 524-3315.

Sincerely,

Raymond Gunn

Raymond Gunn
National Park Service Coordinator

Enclosure

Ms. Gloria Benson, Tribal Chairperson
Kaibab Paiute
Tribal Affairs Building
Fredonia AZ 86022
Attention: Angelita Bullets
Cultural Resources Committee

Mr. Delbert Havatone, Tribal Chairman
Hualapai Tribe
P.O. Box 300
Peach Springs AZ 86434
Attention: Loretta Jackson

Ms. Evelyn James, Tribal President
San Jan Southern Paiute Tribe
P.O. Box 2656
Tuba City AZ 86045

Governor Robert Lewis
Zuni Tribe
P.O. Box 339
Zuni NM 87327
Attention: Roger Anyon

Mr. Vernon Masayesva, Tribal Chairman
Hopi Tribe
P.O. Box 123
Kykotsmovi AZ 86039
Attention: Leigh Jenkins

Dr. David Ruppert
Regional Ethnographer
Rocky Mountain Region
National Park Service
P.O. Box 25287
Denver CO 80225-0287

Mr. Michael Schene
Compliance Archaeologist
Rocky Mountain Regional
National Park Service
P.O. Box 25287
Denver CO 80225-0287

Mr. Don Watahomigie, Tribal President
Havasupai Tribal Council
P.O. Box 10
Supai AZ 86435

Mr. Peterson Zah, Tribal President
Navajo National
P.O. Box 308
Window Rock AZ 86525
Attention: Dr. Alan Downer

Monitoring Plan for the Programmatic Agreement Regarding Operations of Glen Canyon Dam
6/23/92 Revision

I. INTRODUCTION

The Bureau of Reclamation (Reclamation) is lead agency in the preparation of the Glen Canyon Dam Environmental Impact Statement (GCD-EIS). The National Park Service (NPS) is the land manager in the principal study area, including portions of Glen Canyon National Recreation Area (GLCA) and Grand Canyon National Park (GRCA). Along with the Advisory Council on Historic Preservation (ACHP) and the Arizona State Historic Preservation Officer (SHPO), Reclamation, NPS and the following tribes are signatory to a Programmatic Agreement regarding water releases from Glen Canyon Dam:

* Havasupai Tribe
* Hopi Tribe
* Hualapai Tribe
* Kaibab Paiute Tribe
* Navajo Nation
* San Juan Southern Paiute Tribe
* Shivwits Paiute Tribe
* Zuni Pueblo

As an action to meet the lead agency's responsibility with regard to Section 106 of The National Historic Preservation Act of 1966, (as amended 1980), and NPS's and Reclamation's Section 110 responsibilities, Reclamation and NPS agree to cooperate in the design and implementation of this long-term monitoring plan, in consultation with the signatory tribes.

The purpose of this plan is to guide continuing identification, inspection, analysis, evaluation and remedial protection actions, as necessary, for the preservation of the cultural properties within the Colorado River corridor of Glen and Grand Canyons.

II. IMPACT CATEGORIES

A. Definition

1. In order to evaluate site condition and impacts as they relate to the operations of Glen Canyon Dam, each identified site was evaluated based on defined criteria for impacts (Balsom 1991). This impact analysis was based upon field observations and assumptions made given the current state of understanding of erosion processes along the river. Four generalized categories were used to identify impacts; direct, indirect, potential, and no impacts. Within these categories, subcategories were identified within indirect

and potential impacts. The definitions used in the analysis are as follows:

- Direct Impact: there has been inundation or bank cutting within the site area in recent years.

- Indirect Impact 1: there is bank slumpage or slope steepening adjacent to the site.

- Indirect Impact 2: there is evidence within the site of accelerated arroyo cutting or erosion exacerbated by the proximity to river eroded sediments.

- Indirect Impact 3: there is evidence that recent changes in recreational use patterns have affected the site (i.e. walking passengers around sites to avoid dangerous rapids, the creation of new camps to replace camps that eroded away).

- 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.

- Potential Impact 2: the site is located below the 300,000 cfs river flow zone and is not situated in or on river alluvium.

- Other Indirect Impact: there is an impact to the site unrelated to erosion or river flows.

- No Impact: there is no apparent impact occurring on the site.

2. The impact categories identified in Section A.1 all have the potential for adverse effects as defined in 36 CFR 800.9 which states that "an undertaking has an effect on a historic property when the undertaking may alter characteristics of the property that may qualify the property for inclusion in the National Register. For the purpose of determining effect, alteration to features of a property's location, setting, or use may be relevant depending on a property's significant characteristics and should be considered. An undertaking is considered to have an adverse effect when the effect on a historic property many diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association". All sites are considered to have the potential for adverse effects given the possibility (albeit remote) of flood releases in excess of normal plant operations which are uncontrolled ord unplanned.

All flows, unless Glen Canyon Dam fails, would be below 300,000 cfs.

3. Baseline impact data will be updated during site condition monitoring using the revised Archaeological Site Monitoring Forms which contain more detailed information on natural, human and river-related human impacts as well as management assessments and recommendations. This information will be used to revise priorities for future monitoring and remedial actions. Additional information to define priorities will be solicited from tribal leaders and incorporated into the site ranking criteria.

B. Site Types

Within each of the four generalized impact categories, the following site types have been identified:

1. Direct Impact Category:

- Pueblo: habitation site of four or more contiguous rooms
- Small structure(s): 1 - 3 room structure, which may be small habitations, fieldhouses, etc... Includes single-course room outlines and walled-in spaces utilizing boulders, natural rock outcrops, etc...
- Ephemeral structure(s): stacked rocks or vague wall alignments, windbreaks or cleared spaces outlined by rocks, for which a temporary habitation function is presumed.
- Storage site: site with granaries (isolated room or rooms, or natural cavities enclosed by walls for which a storage function is presumed) or cists (unburned slab-lined partially subterranean pit, presumably used for storage).
- Lithic scatter: scatter or concentration of lithic debris, with or without groundstone, but lacking associated ceramics or features.
- Artifact scatter: scatter or concentration of ceramic and lithic debris or flaked or groundstone tools, without associated features. Artifact scatters may include a mix of sherds and lithics without associated tools or just sherds with associated tools such as manos, metates, scrapers, etc.
- Isolated thermal feature: hearth or scatter of firecracked rock or a single roaster (i.e. burned rock midden) without associated artifacts.
- Roaster complex: two or more well-defined roasters with or without associated discard piles, often but not necessarily associated with artifact scatters.
- Artifact scatter with thermal feature(s) (camp): agglomeration of prehistoric or historic artifacts in

direct association with hearths, animal husbandry features, or other evidence of temporary use, but without associated habitation structures.
- Isolated pot/pot cache: isolated whole ceramic vessel(s).
- Groundstone cache: one or more grinding slabs, possibly accompanied by manos, but without other associated artifacts or features.
- Other tool cache one or more complete artifacts which appear to have been deliberately placed in a sheltered location not associated with other features.
- Trail: narrow foot paths marked by cleared stones, linear sherd scatters, cairns, wood and/or masonry retaining walls, steps, hand-and-toe holds, etc...
- Rock art: isolated pecked, incised, scratched, or painted designs, symbols, or figures on rock.
- Historic structure: historic building analogous to pueblos or small structures.
- Other: catch-all category for rarely occurring or unforeseen site types.
- Traditional Cultural Properties: a property that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community.

2. Indirect Impact Category: All those site types listed above plus:

- Water/soil control: check dams, ditches, headgates, diversion walls, terraces, grid gardens, or other features used to control runoff.
- Enigmatic feature: surface or subsurface feature of unknown type or function (e.g. C-shaped wall, fishhook, or circular enclosures, stacked rocks, stone piles, rock alignments).
- Bedrock mortar: deeply ground or pecked depressions in large boulders or bedrock.
- Delta complex: complex of numerous scattered rooms and agricultural features distributed over a broad alluvial fan at the mouth of a side canyon.
- Historic trash scatter: scatter or concentration of several (3+) historic items pre-dating 1960, without associated features.
- Sherd scatter: scatter or concentration of ceramic sherds without associated tools or features.

3. Potential Impact Category: All those types listed for both direct and indirect impacts plus:

- Burial: interred human remains or other evidence suggesting the presence of a human burial.

C. Burial Sites

Separate agreements will be developed with the appropriate tribes which will describe procedures for treating exposed human remains.

D. Selection of FY92 Monitoring Sites by Impact

Impact categories as defined above generally reflect the severity of on-site river-related degradation. For FY92 monitoring, sites were selected based upon these Impact Categories. Although these categories were not initially established as a ranking for impact severity, they do reflect on-site river related degradation.

A total of 80 sites will be monitored during the months from May to September 1992. These sites were selected in the following manner; all sites in the Direct Impact category (n=33); sites in the Indirect categories (1, 2, 3) at the 20% level (n=25); Potential Impact 1 sites at a 20% level (n=22); 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.

III. Future Additional Priority Setting Factors

A. Integration with Geomorphology

Geomorphology has the potential to greatly enhance the ability to predict vulnerability of sites to erosion, and may enable us to identify the locations of buried sites not yet exposed. Preliminary geomorphic analysis by Hereford and others (1991) has suggested a model for erosion based on arroyo cutting and regrading of channel morphology to the effective base level of the Colorado River post-dam terraces. The most severe erosion will occur at Type I and Type II arroyos, which are either in the process of, or just beginning to downgrade and regrade their channels as they drain to the Colorado.

Although this model requires refinement and application to other geomorphic settings, it is potentially applicable to river corridor. Needed locations for additional geomorphic studies include:

* Glen Canyon Dam to the Paria River <u>(two areas)</u>
* Paria River to the Little Colorado River
* Kanab Creek to River Mile 277

Initial reconnaissance has been completed by the geomorphologist on all of these locales. Although initial identification of specific study sites may begin in FY92, intensive documentation and mapping will not begin until FY 93.

Hereford's model will be tested and evaluated. The most severe erosion will occur at sites impacted by Type I or II arroyos. Long-term refinement of this model therefore has the potential to help focus monitoring on these sites at greatest risk.

Interim monitoring efforts will involve the collection of geomorphological data keyed specifically to model refinement. This information may result in the elimination of some sites from further monitoring in the Direct and Indirect impact categories if they are found to be relatively stable. Conversely, some sites in the Potential I category may be given high monitoring priority if determined to be at greater risk of degradation. Refinement of the archaeological site monitoring program is intrinsically linked to the geomorphic research.

B. Integration with other monitoring programs

1. Photogrammetry

On-going research for daily terrestrial photogrammetry has been in effect since GCES Phase II began in 1990. A total of 41 sites are currently under study. Approximately 10 remote cameras will be dedicated to archaeological erosion problems. All camera locations, including archaeological sites, were chosen to provide evaluation and monitoring of conditions along cut banks and sand bars which could be impacted by flows.

2. Sediment

Ongoing research by USGS and NPS on sediment processes has the potential to contribute to the geomorphic model of site erosion. Although no archaeological sites have been included in these studies, future monitoring will integrate archaeological and sediment study concerns.

C. Traditional Cultural Information

Information provided by interested tribal groups as part of the on-going ethnographic studies will be utilized to develop and refine priorities for monitoring activities. This information will include recommendations from tribal leaders, as well as information from the research reports. Traditional

cultural properties, as well as archaeological sites, will be considered.

D. Additional data needs for site selection

The most critical factor in selection of sites to monitor is the relationship between characteristics of sites to monitor and geomorphic setting. Needs are as follows:

1. identification of Type I and Type II streams based upon interpretation of aerial photographs;

2. placement of stream locations in GRCA GIS system for overlay with archaeological site location information;

3. development of site monitoring priority list to be incorporated into other factors for monitoring and remedial actions;

4. refinement of Hereford's model for integration into monitoring program.

IV. METHODOLOGIES

A. Scope

1. Down River Monitoring (Grand Canyon National Park)

a. Numbers of Sites

It is anticipated that up to forty sites can be evaluated per trip.

b. Numbers of monitoring trips per year

The monitoring year is divided into two seasons: September through November and February through June. Two trips will be conducted during the first season, and three trips during the second season.

c. Duration

Each trip will be a maximum of eighteen days, resulting in a potential total of 90 river days annually.

d. Field Crew

Each trip will require a minimum of two archaeologists, two archaeological technicians, and three support staff.

e. Costs

The per trip cost is estimated to be $5,000 for river support, which includes boats, crew and supplies.

Professional staff time is anticipated to be a full 180-days per year/per person. This includes field evaluation, analysis and report preparation on an annual basis. Staff support costs for implementation are $72,600 (1 x GS-9, 1 x GS-7, 2 x GS-5)

2. Upriver Monitoring (Glen Canyon National Recreation Area)

a. Logistics

Upriver areas (Glen Canyon Dam to Lees Ferry) are accessible by boat on day trips. Two professional archaeologists will be required to conduct the monitoring from May through September each year.

b. Sites

A total of forty-five upriver sites have been identified. During FY92 these will be monitored according to the schedule outlined in Section II. D. of this plan. Additional work will include detailed examination of terrace arroyos, detailed documentation and photography of a major cutbank area, and implementation of remedial actions as discussed below.

c. Cost

Costs for upriver monitoring will be limited to professional staff salary, associated travel, and supplies and materials. Two staff will be on for a total of 5 months each, for an approximate cost of $22,000.

3. Field Methods/observations

a. Site Evaluations

General site evaluations will be made to determine the overall rate of change. This information will be recorded on the Archeological Site Monitoring Form which, when completed for each site, will ultimately provide a more complete basis for establishing priority rankings for monitoring and remedial action.

Traditional tribal leaders will be invited to participate in field observations and may choose to

accompany monitoring trips. Funding for such participation should be identified in each tribe's annual request to Reclamation.

b. Detailed Observations

Detailed observations within sites will be organized around a series of baseline photographic reference points which are recorded on the site map. Additional points may be identified to focus on existing or developing areas of concern.

Photographs will provide an objective basis for monitoring change. In addition measurements of active arroyo cross-section profiles will provide quantitative information on rate of loss.

c. Remedial Actions

Recommendations for remedial actions developed during monitoring may include one or more actions from the following list:

- Discontinue monitoring
- Monitor visitation with remote sensing devices
- Monitor erosion with stationary cameras
- Retrail or define existing trails
- Obliterate trails
- Install checkdams
- 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 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

V. IMPLEMENTATION

A. Sites to be monitored in FY92

A total of 80 sites will be monitored, following the sampling program discussed in Section II.D above.

B. FY92 Testing for National Register Eligibility

The SHPO has requested that 9 downriver sites receive testing for the purpose of National Register evaluation.

These sites are generally small and poorly defined, which precluded SHPO evaluation based upon initial field documentation. Scoping for this effort is not final, although it is anticipated that this work will be completed as part of the FY92 monitoring effort.

C. Reports

1. Trip Reports

Trip Reports will be prepared after each trip. These will include the following sections: dates, staff, sites visited, monitoring and remedial actions, summary of significant observations, changes noted, and recommendations.

2. Yearly Reports

Every year a single synthetic report of the year's monitoring will be prepared for upriver and downriver monitoring. This report will summarize all sites monitored, 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.

VI. COORDINATION/CONSULTATION

The Parties to this agreement will be given an opportunity to review and comment on each year's monitoring report, and on the proposed monitoring work for the coming fiscal year. Every effort will be made to accommodate the concerns of the parties, recognizing that failure to do so may result in invoking the provisions of the dispute clause of the Programmatic Agreement. This yearly review will satisfy the requirements for 106 consultation for the Monitoring Program.

In the event of emergency situations, all signatories will be consulted as to appropriate actions.

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 LEE'S FERRY

Prepared by

Lisa M. Leap
Seasonal Archaeologist

and

Lynn A. Neal
Seasonal Archaeologist

Prepared for

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

July, 1992

I. INTRODUCTION

A. EIS Overview.

1. Need for and purpose of action.

The Glen Canyon Dam was completed by the Bureau of Reclamation in 1963; however, no EIS was filed regarding the construction of the dam or the operation of the dam. Therefore, in January, 1992, the U.S. Department of the Interior, Bureau of Reclamation presented a draft environmental impact statement that analyzed the impacts of current and alternative operations of the Glen Canyon Dam on downstream environmental resources of the Glen Canyon National Recreational Area and Grand Canyon National Park. 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.

The purpose of this Glen Canyon Environmental Impact Statement (GCEIS) archaeological monitoring project is to determine the impacts of current and alternative dam operations on downstream cultural and environmental resources of the Glen Canyon National Recreational Area (GLCA) from the dam to Paria Canyon.

2. Glen Canyon work regarding the EIS.

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 Interior, Bureau of Reclamation 1992:7)?

The final analysis in the DEIS (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.

B. 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). Because of these findings, a pilot research project to evaluate archaeological site erosion at one site along the Colorado River was conducted in October, 1989 by the Grand Canyon Area (GRCA) and the U.S. Geological Survey (USGS) (Balsom et al. 1989). Analysis of the information from the project 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.

C. Objectives.

The objectives of monitoring are to identify rates of erosion and determine erosional causality, as well as to quantify rates of erosional change. In order to identify the causes and effects of erosional processes, timed flows, geographic positions and substrates are the controlled variables. This work plan describes methods for monitoring archaeological sites and the deposits in which they occur. In addition to recording the GRCA selected sites, six sites will be

monitored on a daily basis using fixed cameras during the interim flow period. From a short temporal scale database, changes in deposits (some containing archaeological materials) can be determined on several time scales: daily, monthly, seasonally and annually.

Long term monitoring objectives include comparisons of aerial photographs and recommendations for the development of future monitoring programs. These will aid in determining flow rates that will preserve river corridor resources.

Low-altitude aerials at quarterly intervals will begin in October 1992. These aerials will supplement the existing 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.

If any changes in the flow regime are suggested, effective monitoring programs should support the suggestions. The program must be able to evaluate erosional changes at a site and 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 above is adaptive, creative and linked to actions that are crucial to the preservation of the cultural resources of the river corridor.

II. 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, with low flows 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 occurred during a test flow period from August 1990 to July 1991 within the 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 will be installed overlooking deposits in the Glen and Grand Canyons. The cameras used will be Pentax 105's, housed in environmental containers. The view of each camera will be adjusted to include the area of most interest. The camera containers will be semi-permanently fixed to rock outcrops using clear silicone glue. The cameras will be hidden; however, no attempt will be made to anchor them. After the first photographs are retrieved (after 35 days), a survey expedition will be conducted to define the field of view and provide photo scaling information so that deposit areas can be scaled to real-world/mappable values.

Color transparency film will record 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 will be used to record the time each roll of film was replaced and exposure interval began. The film will be commercially processed. Only the measured images will be mounted in slide mounts by the analyst. Original images will not be released to anyone; however, duplicating services and printing may be arranged.

Measurements will be taken from images using one of two methods developed during the test flow period. First, a scaled magnifying loupe may 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 geographical units that will be directly comparable to values obtained by other investigations using vertical photography and land surveying.

The deposit areas will be measured during each evaluation period at a constant flow rate. Daily area will then be estimated based on the bracketing measurements. Periodic flows at or near 5,000 cfs are desired for measuring deposit area to maintain continuity (for comparing interim flow measurements to test flow measurements). The interim flows will be plotted on a per month basis 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 recently exposed and extensively damaged or destroyed by erosion. 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 which addresses the effects of the Glen Canyon Dam's operation 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 caused increased erosion either directly or indirectly.

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 Colorado River's activity, the short streams that drain into the river corridor, and wind erosion.

The geologic studies of Hereford et al. (1991) consisted of classification and dating of the unconsolidated sedimentary deposits within the river corridor. Classification associates a deposit with the sedimentary process that formed it. Relative and absolute dating techniques were used to place the deposits in sequence and in time. The absolute age of the older deposits was determined from radiocarbon dates of organic material associated with the deposits. Wherever present, temporally diagnostic ceramic material was also used for dating. Diagnostic ceramics provided tightly constrained absolute dates compared with radiocarbon. Younger deposits, those deposited since about 1930, were dated by the tree-ring method using the annual growth ring of 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. The topography consists of 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 river baselevel, which lowers over time.

Interpretation of the geologic and geomorphic data requires that the data be 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 GCES 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 dated using ^{14}C. The PII alluvium is dated mainly by temporally diagnostic potsherds associated with the deposit. In addition to these two deposits, 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 over 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 eroded 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 streams 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, whereas erosion of Type II arroyos has no relation to regulated flows.

Before the advent of regulated flows, the present Type I streams probably drained to a lower level terrace. Effective baselevel was maintained at this high 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.

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 within their study area. At Glen Canyon we will be able to concentrate on cutbank deposits containing archaeological sites, therefore demonstrating the potential direct effects of regulated flows on such sites.

III. PROPOSED METHODS AND SCOPE OF WORK - 1992 FIELD SEASON

A. Standard archaeological recording format for sites selected under the GRCA cultural monitoring program.

1. Actions at the sites.

   a. Forms--developed and used by GCRCS to produce comparable and replicable data set.

   b. Photographs--follow GLCA recording and archival procedures.

2. Twelve selected sites--C:2:12--Dugway
   C:2:32--Charcoal lens
   C:2:41--Structure, petroglyphs, artifacts
   C:2:53--Artifact scatter
   C:2:57--Historic cabins and pens, etc.
   C:2:72--Hearths, Hist. and Prehist. scatters

C:2:74--Alcove/shelter, mano, flakes
C:2:75--Sparse lithic scatter
C:2:80--Lithic scatter, groundstone, sherd
C:2:82--Ephemeral structure, artifacts
C:2:100--Prehistoric camp
C:2:106--Roasting feature, sherds, lithics

3. Schedule.

   a. Ten to 15 days for field work.

   b. Two days--Trip report for all 12 sites.

B. Terrestrial Photogrammetry with Cluer.

1. Actions at the sites.

   a. Installation of cameras--six Pentax 105's will be placed in discrete settings, overlooking four archaeological sites, a sand bar selected by Cluer, and a Type II stream located between two archaeological sites.

   b. Film retrieval--retrieve the film after 34 days and replace it.

   c. Film processing.

   d. Photo scale development--after the first photographs are retrieved, the 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.

2. Six selected sites--C:2:11--Feature 12, Spencer's Steamboat
   Feature 14, USGS cableway remnants
   C:2:12--Dugway
   C:2:32--Charcoal lens
   C:2:100--Prehistoric camp
   River Mile -6.5--Sand bar

With the exception of the sand bar, these locations were selected based on site descriptions and maps of direct and indirect erosional impacts. Locations were evaluated during field reconnaissance with Brian Cluer on 5-27-92. In addition to camera placement at the sites, GCRCS monitoring forms will be completed and duplicate photographs will be taken for the archaeological sites.

To accommodate the special monitoring recommendations for the Spencer Steamboat, this feature was selected for terrestrial photogrammetry to monitor the direct effects of water fluctuation. A reconnaissance dive on the wreck will also be scheduled to determine if any impacts are visible to the underwater portions of

the boat as compared to data (photos and maps) from its initial documentation (Carrell 1987).

3. Schedule.

   a. One day--completion of GCRCS monitoring forms and duplicate photographs for C:2:11, Features 12 and 14.

   b. One day--installation of fixed cameras with Cluer (tentatively the first week of August).

   c. Two days--scheduled to change camera film every 35 days.

   d. Three days--photo scale development with Cluer.

   e. One day--Steamboat reconnaissance dive with three divers (Lynn Neal, Ron Martin and Rhonda Brooks, with Lisa Leap assisting on shore).

   f. Two days--trip report for work performed at the fixed camera sites. One day--Steamboat trip report.

C. Geologic and geomorphic studies in conjunction with Hereford involving one archaeological site.

   1. Action at the site.

      Classify and correlate late Holocene deposits using absolute and relative dating techniques. Mapping the terrace configurations and drainage patterns (i.e., Type I and Type II streams).

   2. Selected site--C:2:32 is currently the only site we will be working on with Hereford. Our work will involve taking datable charcoal and flood deposit samples to supplement Hereford's studies. We will also excavate a test unit to determine the horizontal extent of the charcoal lens. This site and the other fixed camera sites were evaluated with Hereford on 6-24-92.

   3. Schedule.

      a. Three to four days--establish a site datum, excavate one to two test units, and obtain samples from the cutbank at C:2:32.

      b. One day--trip report.

D. Analysis.

   1. Completed by GRCA.

      a. Encoding of GRCRS monitoring forms.

b. Erosional impact evaluation and ranking through statistical analyses.

c. Site table of statistical results.

2. Completed by Cluer.

a. Photographic data analysis for the fixed camera sites.

b. Quarterly reports including preliminary results of photographic analysis (will be completed after the summer of 1992).

3. Completed by Hereford.

a. Dating deposits.

b. Map terrace system and stream types at selected locations.

4. Analysis of excavated materials at C:2:32.

E. Reporting.

1. Completed by GLCA--summary of work performed.

a. 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.

b. 1992 field season final report. This report will summarize all sites monitored, 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.

2. Discussion of results.

a. Completed by GRCA--analysis and reporting for sites at which GCRCS monitoring forms were completed.

b. Completed by Cluer--analysis and reporting as described above for the fixed camera sites.

IV. REFERENCES

Balsom, Janet R.
1989 October Resources Monitoring and Research River Trips, October 11-28, 1989. Ms. on file, Grand Canyon National Park, Arizona.

Balsom, Janet R., Richard Hereford and Nancy Brian
1989 Archaeological Site Erosion along the Colorado River: NPS/GRCA Study Plan to GCES. Ms. on file, Grand Canyon National Park, Arizona.

Carrell, Toni
1987 *Submerged Cultural Resources Site Report: Charles H. Spencer's Mining Operation and Paddle Wheel Steamboat, Glen Canyon National Recreation Area.* Southwest Cultural Resource Center Professional Papers No. 13. Santa Fe.

Dexter, Leland and Brian Cluer
1992 A Proposal to Monitor Sand Bar Stability on a Daily Time Scale During the Interim Flows Using Terrestrial Photogrammetry. Submitted to National Park Service, Cooperative Park Studies Unit, Northern Arizona University, Flagstaff.

Fairley, Helen C., Peter W. Bungart, Christopher M. Coder, Jim Huffman, Terry L. Samples and Janet R. Balsom
1991 The Grand Canyon River Corridor Survey Project: Archaeological Survey along the Colorado River Between Glen Canyon Dam and Separation Canyon--Draft Report. Grand Canyon National Park Report prepared in cooperation with Glen Canyon Environmental Studies (GCES), Flagstaff.

Hereford, Richard, Helen C. Fairley, Kathryn S. Thompson and Janet R. Balsom
1991 The Effect of Regulated Flows on Erosion of Archaeologic Sites at Four Areas in Eastern Grand Canyon National Park, Arizona: A Preliminary Analysis. U.S. Geological Survey Administrative Report prepared in cooperation with U.S. Bureau of Reclamation, Glen Canyon Environmental Studies (GCES), Flagstaff.

U.S. Department of Interior, Bureau of Reclamation
1992 Draft Environmental Impact Statement: Operation of Glen Canyon Dam Colorado River Storage Project, Arizona. U.S. Department of Interior, Bureau of Reclamation, Colorado River Studies Office, Salt Lake City.

TESTING PLAN FOR SITE AZ C:2:32 AT RIVER MILE -9.8LB ON THE COLORADO RIVER, GLEN CANYON NATIONAL RECREATION AREA

Prepared by

Lynn A. Neal
Seasonal Archaeologist

and

Lisa M. Leap
Seasonal Archaeologist

Prepared for

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

August 1992

I. BACKGROUND

A complete archaeological inventory survey of the Colorado River corridor was conducted by the National Park Service between August 30, 1990 and August 15, 1991 (Fairley et al. 1991). This was done as part of the Environmental Impact Statement process required of the Bureau of Reclamation for the operation of Glen Canyon Dam. The survey zone included about 10,506 acres along the 255-mile stretch of the river between Glen Canyon Dam and Separation Canyon. All archaeological sites were recorded and evaluated based on criteria set by Grand Canyon National Park. A total of 475 archaeological sites and 489 isolated occurrences were documented within the project area. Direct impacts from recent inundations were observed at 33 sites, including AZ C:2:32. Indirect impacts in the form of bank slumpage or slope steepening, accelerated arroyo cutting, and increased visitation due to changing river runner use patterns were observed at 127 sites. Among this total is site C:2:32 which is severely impacted by bank slumpage and steepening. C:2:32 is also among another 176 sites which have the potential for future impacts due to their location below the 300,000 cfs flood level. The Arizona State Historic Preservation Office has determined that at least 313 of the 336 sites with direct, indirect or potential impacts from dam operations are significant cultural resources eligible for inclusion on the National Register of Historic Places.

Based on the evaluated impacts affecting C:2:32, the site was recommended for continual monitoring by the survey team. This recommendation prompted the current use of a stationary camera at the site for documenting river-related impacts due to dam operations. In addition to the monitoring efforts at C:2:32, it is necessary to determine the site's cultural significance and thus its potential eligibility for the National Register of Historic Places. The best means for determining the site's eligibility is to date the charcoal lens and to find out through testing whether or not cultural materials are associated with the lens. Therefore, a testing plan for C:2:32 is outlined below.

II. INTRODUCTION

Site AZ C:2:32 is currently the only site we will be working on in conjunction with Richard Hereford's geologic and geomorphic studies. Our work will involve taking datable charcoal and flood deposit samples to supplement Hereford's studies. We will also excavate one or two test units to determine the horizontal extent of the charcoal lens exposed in the site's cutbank.

III. FIELD METHODS

Standard excavation procedures will be followed during the testing of AZ C:2:32, including the use of the original site datum for determining provenience.

A. Cutbank Samples

1. A total of two radiocarbon samples will be collected in aluminum foil.

2. No more than two macrobotanical samples from the flood deposit/duff zone material will be collected in plastic bags.

B. Test Unit(s)

We will excavate a .50 x .50 m area approximately 5 m north of the cutbank. This unit will be expanded to a 1 x 1 m unit if cultural subsurface materials are found. If not, a second .50 x .50 m unit will be excavated to the east or west of the first unit, and this second unit will be expanded if necessary.

1. Up to two radiocarbon samples will be taken from each discernable level if available.

2. A total of two float samples and one pollen sample will be collected from each discernable level in the units and the cutbank if good samples are located.

IV. OBJECTIVES

A. Determine absolute age of terrace deposits.

1. Are prehistoric cultural deposits and dates present?

2. Are dates consistent with Hereford's predictions?

B. Determine the absence or presence of subsurface cultural materials; determine the horizontal extent of the site.

V. SCHEDULE AND REPORTING

A. Three to four days will be needed to complete the provenience mapping, excavation of the one or two test units, and to obtain datable samples.

B. Radiocarbon samples will be sent to Beta Analytic, Inc. with a 30-day turn around period.

C. Botanical samples will be sent to Linda Scott Cummings at Paleo Research Laboratories.

D. A testing report will be completed after field work is finished and sample results are received.

VI. REFERENCE

Fairley, Helen C., Peter W. Bungart, Christopher M. Coder, Jim Huffman, Terry L. Samples and Janet R. Balsom

1991 The Grand Canyon River Corridor Survey Project: Archaeological Survey along the Colorado River Between Glen Canyon Dam and Separation Canyon--Draft Report. Grand Canyon National Park Report prepared in cooperation with Glen Canyon Environmental Studies (GCES), Flagstaff.

SUBJECT: Stationary Camera Site Selection and Installation Trips

TO: Chris Kincaid and Jan Balsom

FROM: Lisa Leap and Lynn Neal

DATE: September 3, 1992

On May 27, 1992 Brian Cluer, Christopher Coder, Lisa Leap and Lynn Neal met at the Lees Ferry boat ramp at 9:30 AM, launched the GCES boat and proceeded upriver to inspect areas for time-lapse camera installation. Prior to the trip, Leap and Neal chose 11 sites for inspection because they are located on or near the river bank or near Type I or Type II arroyos. Brian Cluer also expressed interest in placing a stationary camera on a beach site. As a result of the inspection, six of the 12 sites were selected to be photographed by stationary cameras: the beach area at river mile -6.5, C:2:32 (charcoal lens), C:2:11--Features 12 (Spencer Steamboat) and 14 (USGS Cableway), C:2:100 (charcoal lens), and C:2:12 (Dugway).

On August 24, 1992 Brian Cluer, Karen Cluer, Lynn Neal and Lisa Leap met at the Lees Ferry courtesy dock at 9:30 AM, launched the GCES boat and traveled to C:2:32, the first camera station. We placed the first camera on the right bank at river mile -9.8 across from the C:2:32 charcoal lens, which is located in a large cutbank. Brian Cluer showed Leap and Neal the maintenance procedures for setting up the camera and the camera station, then Leap and Neal duplicated the procedures at the following two camera stations. The second camera was placed on the left bank, river mile -0.5 at C:2:11--Feature 6. This camera has in view a large Type II arroyo, the charcoal lens at C:2:100, which is located in the arroyo, and C:2:11, Features 12 and 14. The third camera is located on the left bank at river mile +0.25, photographing two large washed out areas of the Dugway. A fourth camera was to be placed on the beach area at river mile -6.5, right bank. Although no archaeological sites are located in this area, Brian Cluer believes that it is a good site to photograph beach migration. Unfortunately, the tamarisks inhibited the camera's view from all angles and a camera station was not chosen.

The cameras have 36 exposure film that will be changed every 34 days. Our first film change will be September 24, 1992. Beyond September 24 it is uncertain who will continue replacing the film. After the film is processed it will be sent to Brian Cluer for analysis.

We would like to thank Chris Coder, Karen Cluer and especially Brian Cluer for their time and expertise.

Sincerely,

Lisa Leap and Lynn Neal
Glen Canyon NRA
P.O. Box 1507
Page, AZ 86040
(602) 645-8278

Table 1. Sites Inspected and Selected for Stationary Cameras.

Site	Type	River Mile and Bank
C:3:10	Charcoal lens with lithics	-14.6LB
C:2:77	Lithic scatter	-11.3LB
C:2:75	Sparse lithic scatter	-11.1LB
*C:2:32	Charcoal lens	-09.8LB
C:2:35	Structure with artifacts	-09.6LB
C:2:74	Shelter with lithics	-08.5LB
C:2:91	Charcoal lens with sherds	-03.9LB
*C:2:11F.14	USGS Cableway	-00.5LB
*C:2:100	Charcoal lens with artifacts	-00.5LB
*C:2:11F.12	Spencer Steamboat	-00.1RB
*C:2:12	Dugway	+00.1LB
Beach Area		-06.5RB

* = Sites selected for stationary cameras.

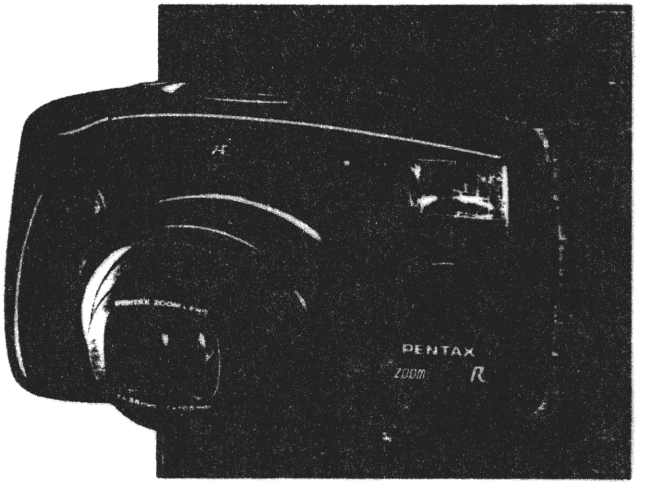
CAMERA OPERATING MANUAL

PENTAX®

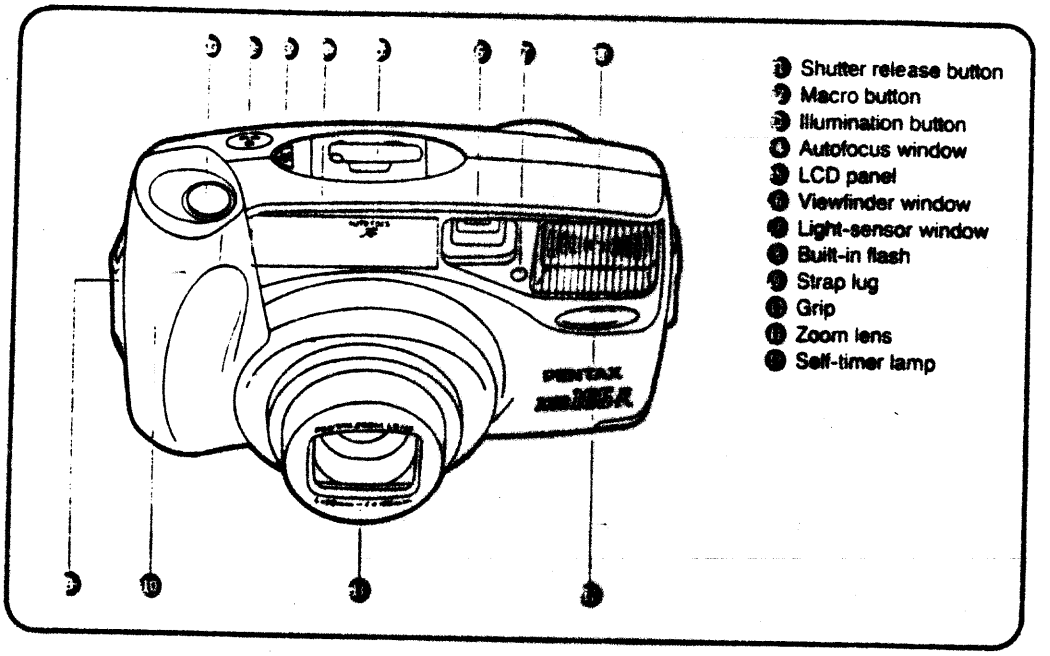
zoom 105-R

zoom 105-R DATE

OPERATING MANUAL

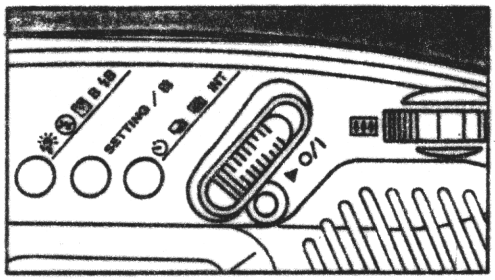


NAMES OF WORKING PARTS



1. Shutter release button
2. Macro button
3. Illumination button
4. Autofocus window
5. LCD panel
6. Viewfinder window
7. Light-sensor window
8. Built-in flash
9. Strap lug
10. Grip
11. Zoom lens
12. Self-timer lamp

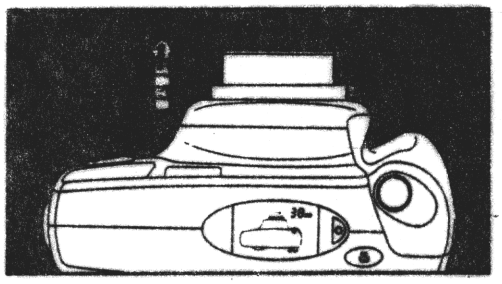
2. POWER SWITCH AND BATTERY CHECK



Power switch

To switch on, slide the power switch upward. The lens cover opens, and the LCD indications appear. The camera is now ready for setting and shooting. To switch off, slide the power switch upward again. Make sure to switch it off when the camera is not in use.

Caution:
The lens cover automatically opens when the power switch is turned on, and closes when the power switch is turned off. Never attempt to open the lens cover by hand.



Battery check

After power is switched on, the lens extends slightly and the lens cover opens. The camera is then ready to shoot.

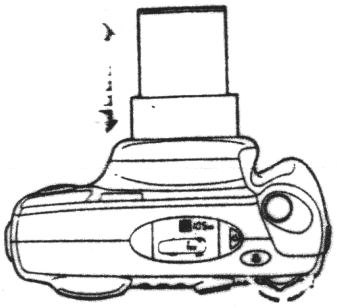
Notes:

- When the camera is left unused with the power on for over 3 minutes, its power automatically switches off.
- If you have a DATE model, do not remove the batteries until they are exhausted, since they are used by the date function to keep constant track of time.
- Refer to page 41 for directions on battery insertion.

4. OPERATING 38 ~ 105 mm ZOOM LENS

105 mm
85 mm
70 mm
55 mm
46 mm
38 mm

⑥



When you press the zooming lever to the right (⧫), the lens moves towards the 105 mm telephoto setting. When you press to the left (⧫⧫⧫), the lens moves towards the wide-angle 38 mm setting.

Step Zoom and Continuous Zoom

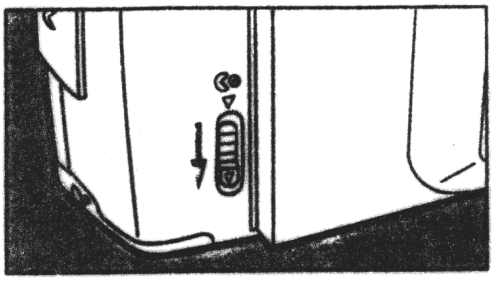
When you press the zooming lever lightly, the lens zooms to and stops at an adjacent step among 6 successive zoom settings: 38, 46, 55, 70, 85, and 105 mm. This is the Step Zoom function. When you press the lever further, the lens zooms quickly and continuously to any desired zoom setting from 38mm ~ 105mm, until you release the lever. This is the Continuous Zoom function.

Note:

- To stop at a next step using Step Zoom, return the zooming lever to the center position, then press it lightly again.

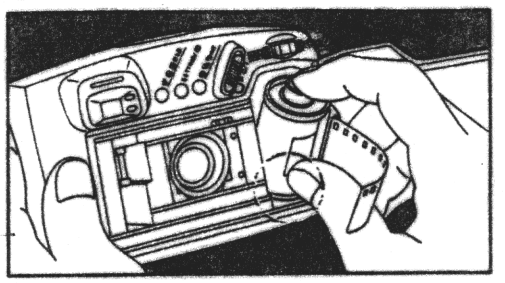
2. FILM LOADING First, make sure that the power is off.

1

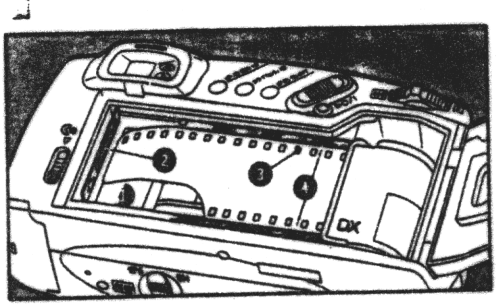


1 Slide the back cover release lever in the direction of the arrow, as illustrated, to open the back cover.

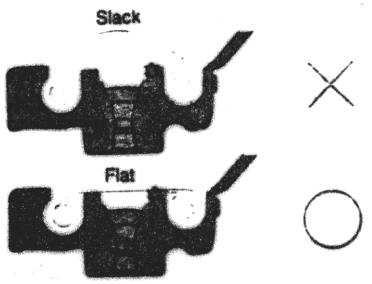
2



2 Place the film cartridge in the film chamber, fitting its flat side on the top of the rewind shaft.



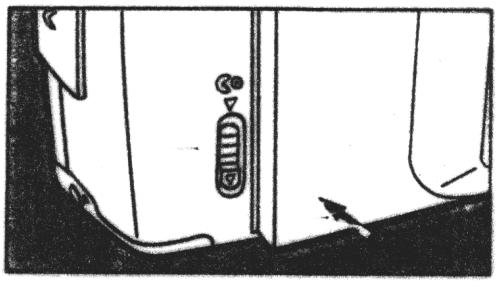
4 Pull the film leader out far enough from the cartridge to reach the take-up spool ①. Align the film's tip with the film leader end mark ③.



Notes:

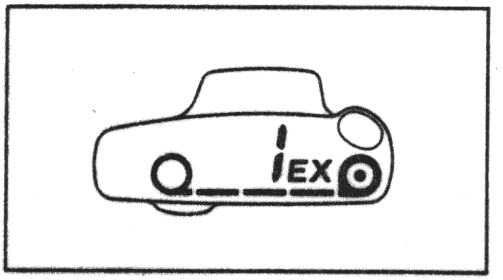
- Make sure the film perforations properly engage the sprocket teeth ②.
- Make sure the film is properly placed between the guide rails ③.
- Make sure the film is taut as illustrated. Take up any slack in the film by pushing it back into the cartridge.
- If the end of the film leader is extremely bent, straighten it or cut off the bent portion.

4



4 Close the back cover. The film automatically advances to the first frame.

5



5 When " 1 " appears in the exposure counter on the LCD panel, the film automatically stops winding. If " 1 " does not appear on the LCD panel, the film is not properly loaded. Reload the film.

Notes:

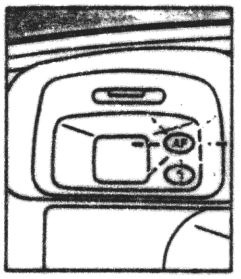
- Even if no film is loaded, the motor operates for a second or two after the back cover is closed.
- The exposure counter remains visible even when the power is off.

8. FOCUS-LOCK SHOOTING

If you shoot without positioning the autofocus frame ( ) on the main subject of the picture as shown above, only the background will be in focus. When the main subject of your picture is off the autofocus frame in the center of the viewfinder, use the focus-lock technique.

1

2



1 First position the autofocus frame ( ) on the main subject.

2 As you press the shutter release button halfway, the green lamp (**AF**) glows, and focus and exposure are temporarily locked.

3 While continuing to press the shutter release button halfway, re-aim the camera or recompose the picture, then fully depress the shutter release button.

Notes:

- You can cancel focus lock simply by taking your finger off the shutter release button.
- When in the Consecutive Shooting mode, focus lock cannot be used.

Hard-to-autofocus subjects

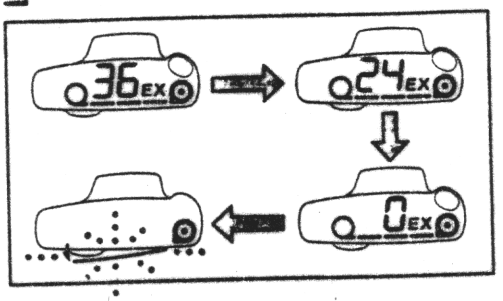
Like many other autofocus cameras, this camera's autofocus system is highly precise, but it may not focus as you wish on certain subjects. In such cases, use the focus-lock technique on a subject which is both near the actual one and at an equal distance from the lens.

Subjects which are hard to autofocus include:

1. Black objects like hair, which don't reflect much light (and therefore don't reflect infrared autofocus beams).
2. Wire netting, latticework, iron exercise-bars, etc.
3. Flickering light sources such as neon signs, fluorescent lamps, TV images, sunlight coming through trees, etc., and subjects illuminated by these light sources.
4. Glossy and reflective surfaces like glass, mirrors, car bodies, etc.
5. Fast-moving objects, like trains in motion.
6. Water jets, water surface, smoke, flame, fireworks, etc., which have no distinct or consistent form, or a subject in mist.

9. UNLOADING FILM **Be sure to remove the film from the camera in the shade.**

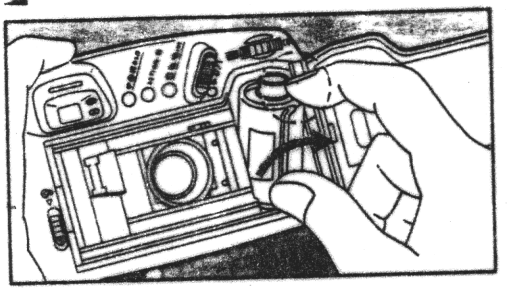
1



1 After you have exposed the last frame of the roll, film rewinds automatically. Then, the motor stops, and the back cover open mark ( ) flickers as shown to indicate end of rewind.

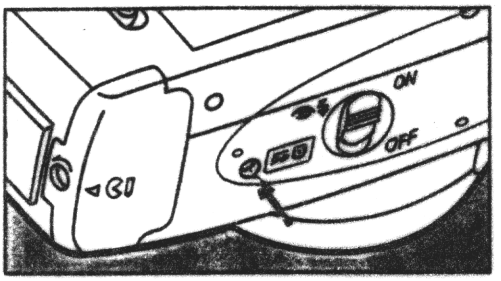
Notes:
- The shutter will be released for a frame or two after the assigned number of exposures have been shot, but the last frame may not be developed.
- During rewinding, the exposure counter counts frame numbers in reverse.

2



2 Open the back cover, and remove the cartridge from the chamber by pulling on its top with your fingertip as shown.

- A 24-exposure film roll takes about 20 seconds to be rewound.
- The entire roll of film including the film leader is always rewound into the cartridge to avoid leakage of light onto any part of the film.

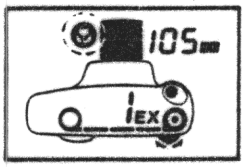


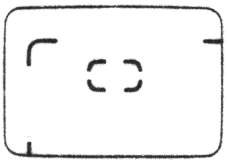
Rewinding the film in mid-roll
If you wish to unload the film before exposing all the frames, push the auxiliary rewind button with the protrusion ③ (⊙⊣) (see page 3) of the strap's tool; film rewinding starts. When rewind is completed, the motor stops, and the back cover open mark (⟵) flickers, indicating the cover may be safely opened.

Caution:
Never open the back cover until rewinding is completed.

TAKING BETTER PHOTOGRAPHS

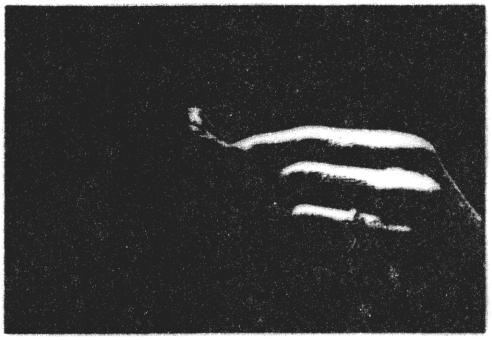
There are a variety of ways to take the picture you want.





This is one of two modes used to take close-up pictures. Compose the shot within the macro frame.

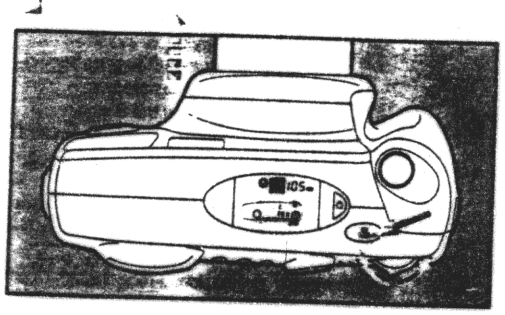
MACRO PICTURES



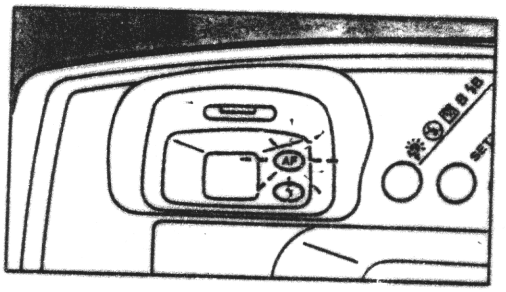
Note:

- When the autofocus frame ( ) is off-center of the picture area in macro photography, use the techniques described in "Focus-Lock Shooting" on pages 16 and 17.

Shooting Range: 0.75 m/2.5 ft ~ 1.35 m/4.4 ft



Press the macro button ( ) to engage the Macro mode. " " appears on the LCD panel, and the lens moves forward. To cancel the Macro mode, just move the zooming lever to the left ( ) or right ( ).

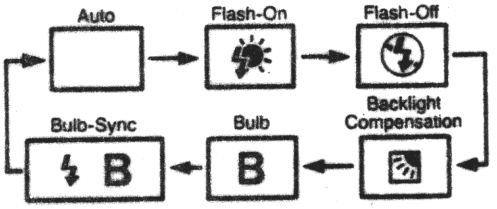


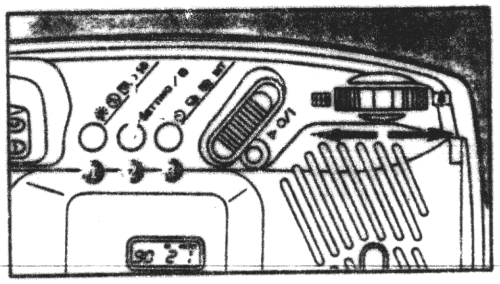
The macro shooting range is 0.75 ~ 1.35 meters (2.5 ~ 4.4 ft). Press the shutter release button halfway, make sure the green lamp (**AF**) glows, then release the shutter.

If the camera-to-subject distance is more than 1.35 meters (4.4 ft), the Macro mode will automatically shift to the 105 mm telephoto setting when the shutter release button is pressed halfway. Press the shutter release button all the way down to shoot. The Macro mode will be restored after the shot.

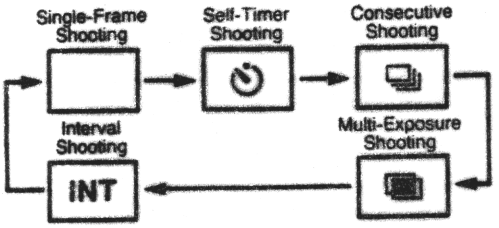
HOW TO SELECT MODES

To select an exposure mode, press the yellow mode button ⑨.





To select a drive mode, press the blue drive button ⑩.

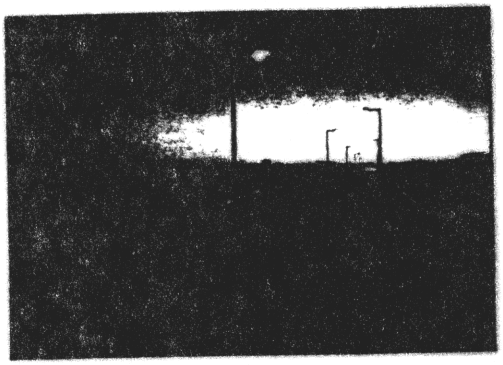


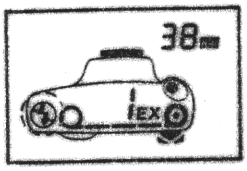
Press buttons ⑨ and/or ⑩ in succession to set the required modes.

To finely adjust the settings of the Self-Timer Shooting, Bulb, Bulb-Sync, and Interval Shooting modes, move the zooming lever to the left (⧫⧫⧫) or right (⧫) while keeping the black SETTING button ⑫ pressed.

To reset the timer of the Self-Timer shooting, Bulb, Bulb-Sync, or Interval Shooting mode once the timer is activated, slide the power switch upward: the timer of each mode is canceled, and the power will not be switched off.

FLASH-OFF (FLASH OVERRIDE)



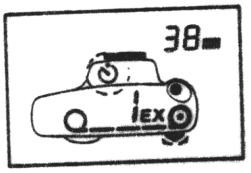


In this mode, the flash does not fire, and a picture is taken at shutter speeds down to approx. 1/3 sec. Use this in situations where flash photography is prohibited, such as in theaters, museums, etc., or when you want to capture the natural-looking ambience of softer light.

Notes:

- When shooting in darkness, the flash emission mark (⚡) warns against underexposure. Press the shutter release button halfway; the flash emission mark (⚡) on the LCD panel flickers to recommend use of the flash.
- When shooting in dimly lit places, the shutter speed gets slower, and camera shake is more likely to blur your shot, so use a tripod.

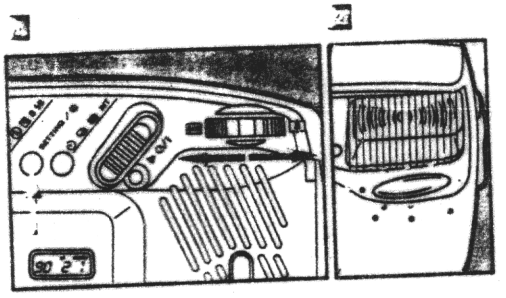
SELF-TIMER SHOOTING



Use the self-timer when you wish to get yourself into the picture. The number of frames to be automatically shot can be set from 1 frame to 5 frames. Use of a tripod is recommended.

Notes:

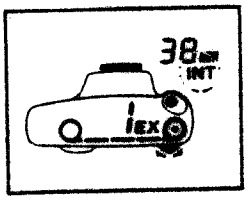
- To cancel the Self-Timer Shooting mode at any time after it has been activated, slide the power switch upward.
- When using the flash, the charging time will be added to the normal interval between successive shots.
- Exposure is adjusted frame-by-frame, but focus remains fixed at the first shot.
- For a setting of 2 shots, the second follows the first by 5 sec. For a setting of 3, 4, or 5 shots, each shot follows the preceding one by 2 sec.



Shooting procedure:

1. While pressing the black SETTING button, move the zooming lever to set on the LCD panel the desired number of frames (from 1 to 5) to be shot.
2. Focus on a subject where the subject will appear, then depress the shutter release button. The shutter will be released in about 10 seconds. The self-timer lamp on the front of the camera starts flickering 3 seconds before the shutter is released.

INTERVAL SHOOTING



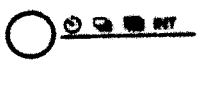
For automatic shooting in this mode, set the time to elapse until shooting starts, the timed interval between shots, and the number of pictures to be taken.

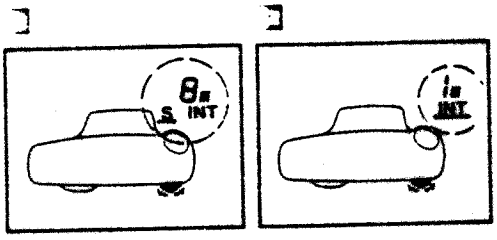
Time settings:
- "10s" — 10 seconds
- "60m" — 60 minutes
- "12h" — 12 hours

Adjustable time to elapse before shooting starts:
0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 40, and 50 minutes; 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 12 hours. (At a setting of 0 min., shots will be taken beginning 3 sec. after the shutter is released).

Adjustable shooting intervals:
10, 20, 30, 40, and 50 sec; 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 40, and 50 minutes; 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12 and 24 hours.

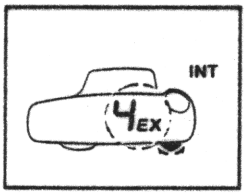
Number of photos to be taken:
0 to 38 frames. When the indication is at 0 frame, shooting continues to the end of the film.





Method for setting interval shooting adjustments:

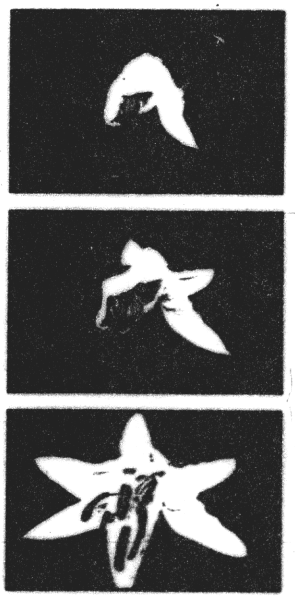
1. To set the time to elapse before shooting starts, push the zooming lever to the left (⏮⏮) or right (⏭) while depressing the black SETTING button until the desired time appears on the LCD panel.
2. To set the shooting interval, push the zooming lever to the left (⏮⏮) or right (⏭) while depressing the black SETTING button again until the desired time appears on the LCD panel.



3 To set the number of photos to be taken, push the zooming lever to the left (⏷⏷⏷) or right (⏷) while depressing the black SETTING button once again. (If 0 is selected, shooting continues to the end of the film.) Release the button. Interval shooting adjustments will be complete.

Note:

- Every time the black SETTING button is pressed, the numeric indication on the LCD panel switches in the following order: The time to elapse before shooting starts, the shooting interval, and the number of photos to be taken.



Starting interval shooting

After the shutter release button is pressed, interval shooting starts. Focusing is fixed at the first exposure. The self-timer lamp flashes 3 sec. before the shutter is released. The interval mark (**INT**) on the LCD panel flickers while this mode is in operation.

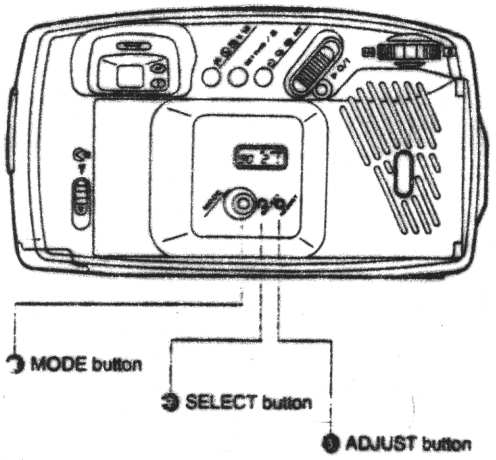
Notes:

- Use a tripod for interval shooting.
- The green (**AF**) and red (⚡) lamps to the side of the viewfinder will light up momentarily only when interval shooting is to begin.
- To cancel this mode, slide the power switch upward.
- The minimum shooting interval time varies according to the Exposure mode to be used as follows;
  (A)Auto or Flash ON: 20sec.
  (B)Flash OFF or Backlight compensation: 10sec.
  (C)Bulb: Shutter speed + 8sec.
  (D)Bulb-Sync: Shutter speed + 15sec.
- When combining these modes with Bulb or Bulb-Sync, press the black SETTING button to set the Bulb Timer. To set the interval time, press the black SETTING button again.
- If you run out of film before the preset number of exposures have been taken, interval shooting will end; the film will automatically rewind.
- Once all interval shooting adjustments have been set, they will be held in memory until the film is replaced. To start interval shooting anew, set each setting again.
- When replacement film is loaded in the camera, interval shooting reverts to the following default values: Time elapsed before shooting starts — 0 min (actually approx. 3 sec.); shooting interval — 1 min.; number of pictures — 0 (shoots to the end of the film).
- If film is not loaded while the interval shooting mark is activated, and the number of exposures is set to 0, the camera goes through the motions of taking five shots before stopping if the shutter release button is pressed.

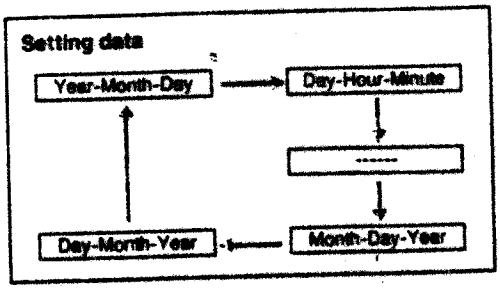
DATE MODEL

If you purchased the DATE model, read this section.
The DATE model records dates up to the year 2019 on pictures.

The date in the picture above is simulated.



Setting data



Switching the mode

Each time you press the MODE button ❸ with your fingernail, the data mode on the data indicator switches in succession as shown in the chart. Stop pressing the button when the desired data mode appears on the date indicator.
"----" indicates no data will be imprinted.

Notes:
- "M" on the date indicator indicates "Month".
- Use the strap tool's pin-shaped protrusion (ⓒ-11) (see page 3) to press the SELECT ❷ and ADJUST ❸ buttons.

Correcting the data

1. Each time you press the SELECT button ❷, a different category of digits on the date indicator flickers. Press the SELECT button ❷ until you reach the flickering digit(s) which you wish to change. The digit(s) will cycle in the following order as you press the SELECT button ❷.
   Date: Year – Month – Day
   Time: Hour – Minute – " : " (Second)
2. Press the ADJUST button ❸ to change digits within the specified category chosen. Digits increase by one each time you press the ADJUST button ❸. If you hold down the button, the digit will advance continuously after two or three seconds.
3. After the adjustment is made, press the SELECT button ❷. The bar mark (═) appears on the date indicator, indicating that data imprinting choices are possible.

Notes:

- When the flickering data on the date indicator is being corrected, it cannot be imprinted even if the shutter is released.
- Date and time are indicated as follows:

  Year = 87 ~ 19 (1987 ~ 2019)
  Month = 1 ~ 12
  Day = 1 ~ 31
  Hour = 0 ~ 23
  Minute = 00 ~ 59

- The flickering " : " allows precise fine-tuning of the internal clock to the beginning of a specified minute. To do so, press the "SELECT" button ❯ until ":" will flicker. And press the ADJUST button ❯ in sync with a time-signal.

Date imprinting:

The (Year-Month-Day) or (Day-Hour-Minute) data is recorded on film as in the picture on page 37. The data on the date indicator is imprinted on each frame you expose.

Notes:

- If the corner of the picture has a white or yellow object, the imprinted data will be difficult to see. When composing, try to avoid a brightly colored subject in that corner.
- "Year-Month-Day" and "Day-Hour-Minute" cannot both be imprinted at the same time.
- As you release the shutter, the bar mark (—) on the date indicator flickers for a few seconds, indicating the data has been imprinted.

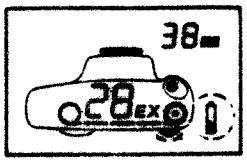
Power source of the data-imprinting section

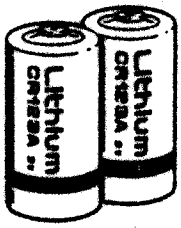
The data imprinting section is powered by the batteries in the camera's main unit. When the batteries are replaced, the date and time may change. So, after replacing the batteries, make sure to confirm the date and time before use.

- Refer to page 38 for data correction.

MAINTENANCE CONSIDERATIONS

Read this section to keep this camera working as well as possible at all times.





When the batteries are nearly exhausted, the battery mark (▯) appears on the LCD panel to warn you. Replace the batteries as soon as possible. When " ▯ " starts flickering, no operations can be performed.

BATTERY EXHAUSTION WARNING

Precautions on batteries

- Battery performance may temporarily decrease in low temperatures, but it will recover in normal temperature.
- Keep spare batteries on hand for convenience when shooting outdoors or traveling.
- When the camera is in a bag, make sure the power switch is off. Otherwise, battery power may be wasted with the accidental push of the shutter release button.
- When the batteries are incorrectly installed, " E " will flicker on the LCD panel as a warning. Insert the batteries correctly.

Battery life (using 24-exposure film rolls):

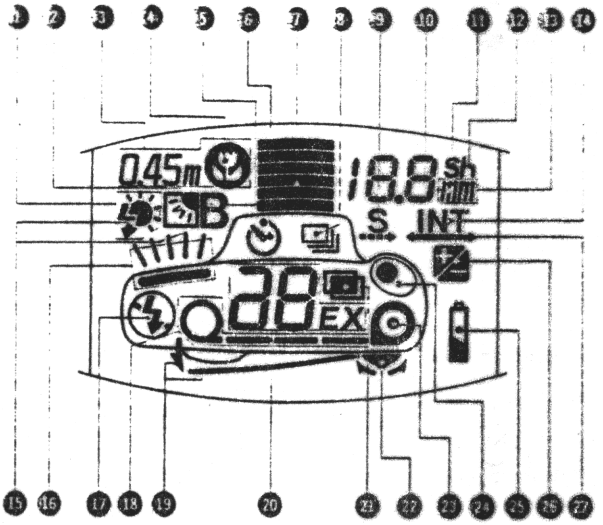
Ordinary picture taking mode, 50% of shooting employs flash	Approx. 30 rolls

(The CR-123A batteries were used based on our own test conditions. Actual battery life/performance may vary drastically depending on either usage of Auto-Focus, Power Zoom and Flash and external conditions such as temperature and freshness.)

Caution:
Replace all batteries at the same time. Do not mix battery brands, types or old battery with new one. It may cause explosion or overheating.

LCD PANEL

All indications will not actually appear simultaneously as shown.

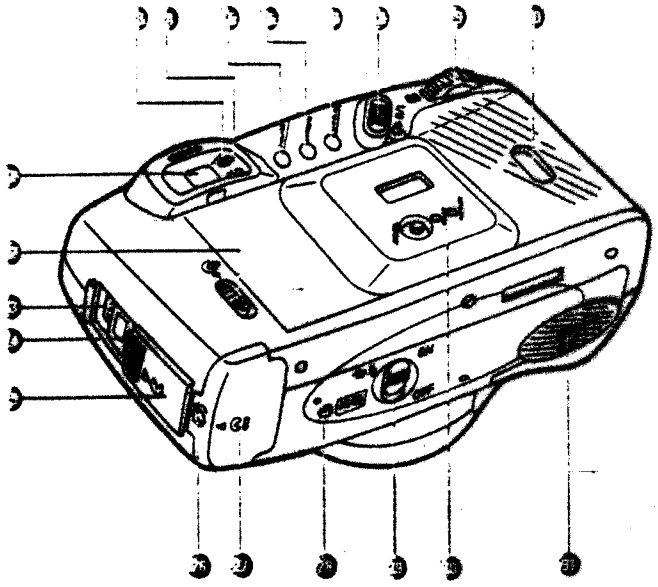


1. Flash-On mode
2. Backlight Compensation mode
3. Super Macro mode
4. Macro mode
5. Bulb mode
6. Self-Timer Shooting mode
7. Zoom lens
8. Consecutive Shooting mode
9. Interval Shooting starting time setting
10. Minute
11. Second
12. Hour
13. Millimeter (focal length)
14. Interval Shooting mode
15. Bulb-Sync mode
16. Flash emission
17. Flash-Off mode
18. Frame advanced
19. Back cover open
20. Exposure counter
21. Multi-Exposure Shooting mode
22. Zooming lever
23. Film cartridge
24. Shutter release button
25. Battery exhaustion warning
26. Exposure Compensation mode
27. Interval Shooting time setting

Notes:

- At a high temperature of approx. 60°C, the LCD panel may blacken. It returns to normal when normal temperature is restored.
- At lower temperatures, the response speed of the LCD panel may be slower.
  This is an LCD characteristic, not a defect.

NAMES OF WORKING PARTS



1. AF (green) lamp
2. Flash (red) lamp
3. Mode (yellow) button
4. SETTING (black) button
5. Drive (blue) button
6. Power switch (timer reset)
7. Zooming lever
8. Film information window
9. Viewfinder eyepiece
10. Back cover release lever
11. Release socket
12. Super Macro button
13. Sliding cover
14. Battery chamber cover fixing screw
15. Battery chamber cover
16. Auxiliary rewind button
17. Red-eye reduction flash switch
18. Back cover
19. Tripod socket

CAMERA OPERATION AND LOCATIONS

CHECKLIST FOR TERRESTRIAL CAMERA OPERATION

1) Clean box lens if needed. Remember, it is plastic, so use only soft cloth with fluid.

2) Fill out log books, and master log.

3) Photograph camera log book with 1st photo on new roll. Use macro setting and get as close as camera will focus. Focus is set by depressing shutter button half way, green light flashes if too close, or is steady when focus distance is within range. Shutter release button must released and depressed half way each time you adjust distance from camera to log book. If there are photos left on the roll in the camera, turn intervalometer off by turning power off, then back on, then take panorama of river conditions from upstream to downstream, use remaining photograhs so that you don't have to remove camera from base for manual rewinding.

4) Setting camera:

   a) set lens length, most 38mm, but some are unique 50, 60, & 70mm. If lens length is not 38mm, it is written on box lid and in log book.

   b) turn flash off

   c) set intervalometer

      i) time before starting, depends on when you service camera, set to start camera at estimated low river stage.

      ii) time between photos, always 24 hours, last option

      iii) number of photos, default is 0. 0 takes whole roll then shuts camera off.

   d) aim camera at sand bar, or further away, and depress shutter release button fully to start timer and lock lens focus. INT sign will begin flashing, indicating that timer is counting down to first photo.

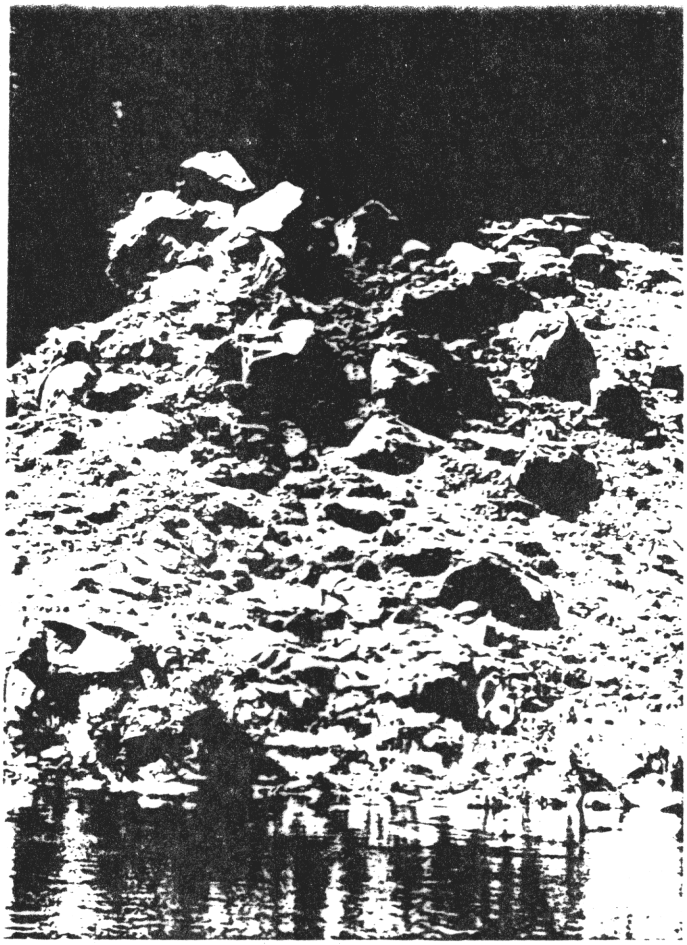
   e) replace camera in box, carefully aligning camera base on positioning blocks so that images are identically registered from roll to roll.

   f) the rest is obvious, but please cover box with rocks to shield from direct sunlight, and camoflage camera.

Others reminders: the top LCD panel will tell you if batteries are low; check databack to see that the date is correct; if you get stuck, shut off power and try again, or read operators manual!!

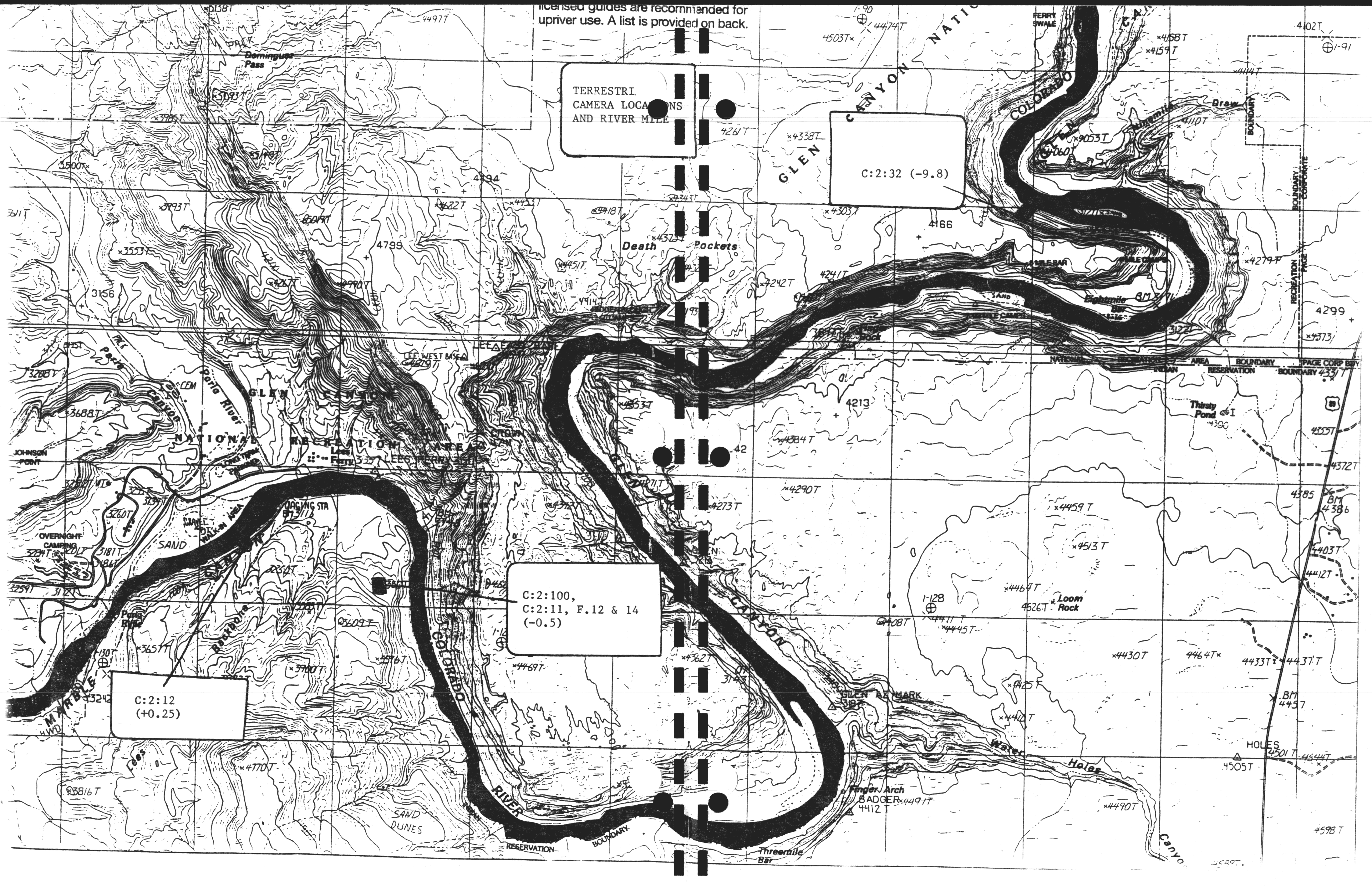
CAMERA LOCATIONS

C:2:32 (-9.8RB)
PHOTO 92-40:10



C:2:12 (+0.25LB)
PHOTO 92-40:7

C:2:100 (-0.5LB)
PHOTO 92-40:8


licensed guides are recommended for
upriver use. A list is provided on back.
TERRESTRI
CAMERA LOCA
AND RIVER MILE
C:2:32 (-9.8)
C:2:100,
C:2:11, F.12 & 14
(-0.5)
C:2:12
(+0.25)
GLEN CANYON NATIONAL RECREATION AREA
COLORADO RIVER
Paria River
Dominguez Pass
Death Pockets
Lees Ferry
JOHNSON POINT
OVERNIGHT CAMPING
SAND DUNES
Loom Rock
Finger Arch
BADGER
Threemile Bar
Water Holes Canyon
Thirsty Pond
Eightmile Bar
RESERVATION BOUNDARY
MARBLE
4799
4166
4213
4299

SUBJECT: Trip Report for Archaeological Monitoring of 15 Selected Sites

TO: Chris Kincaid and Jan Balsom

FROM: Lynn Neal and Lisa Leap

DATE: September 5, 1992

During various dates between June 25, 1992 and August 24, 1992, Lynn Neal and Lisa Leap completed archaeological monitoring at 15 sites along the Colorado River corridor from Glen Canyon Dam to above the Paria Riffle. Laura Millett assisted in the field on June 29, 1992, and Ariel Leonard assisted August 22, 1992. Twelve of these sites were randomly selected for monitoring under the Grand Canyon cultural monitoring program. C:2:32 was chosen for monitoring because of dam-related direct impacts to the site; it was also selected as a stationary camera location. C:2:38 was monitored due to the high level of visitation, and three features at C:2:11 (Lees Ferry Historic District) were monitored and/or photographed because they are in the view of a stationary camera.

Fourteen sites and one feature (C:2:11, F.14) were monitored (using the GRCA monitoring form) and photographed in seven field days. In addition to the GRCA monitoring form, GLCA's monitoring forms 9 and 11 were completed for C:2:38. Photographs were also taken at C:2:11, Features 5 and 6. The work schedule varied due to raft availability, travel time and mechanical difficulties.

Generally, sites are in the same condition with little or no changes occurring since they were last monitored in 1991. Exceptions to this include: (1) evident, continued arroyo and/or gully cutting at C:2:75, C:2:72, C:2:12, C:2:100 and C:2:106; and (2) new abrasive graffiti at C:2:38 ("HELEN").

A shin-high, crescent-shaped sandstone wall was built around the C:2:38 petroglyph panel this summer by Glen Canyon natural and cultural resources personnel and valuable assistance from several ARA river guides. This wall and native vegetation planted between the panel and the wall should help to direct visitor (and ARA guide) traffic away from the panel. The trail leading from the river to the site was lined with sandstone to further direct traffic to the panel.

Sincerely,

Lynn Neal and Lisa Leap
Glen Canyon NRA
P.O. Box 1507
Page, AZ 86040
(602) 645-8278

Table 1. Archaeological Sites and Features Monitored from 6-25-92 to 8-24-92.

Date	Site	Type	River Mile and Bank	Condition
6-25-92	C:2:75	Sparse lithic scatter	-11.1LB	Active Erosion
6-26-92	C:2:38	Rock art	-09.9LB	Incipient Erosion
	C:2:32	Charcoal lens	-09.8LB	Active Erosion
6-29-92	C:2:74	Shelter with lithics	-08.5LB	Stable
7-01-92	C:2:82	Shelter with artifact scatter	-02.6LB	Incipient Erosion
8-19-92	C:2:95	Shelter with artifact scatter	+00.1RB	Incipient Erosion
	C:2:72	Prehistoric and hist. artifact scatter	-00.1LB	Active Erosion
8-20-92	C:2:57	Historic homestead	-00.1LB	Incipient Erosion
	C:2:12	Dugway	+00.1LB	Active Erosion
8-21-92	C:2:100	Charcoal lens and artifacts	-00.5LB	Active Erosion
	C:2:11F.14	USGS Cableway	-00.5LB	Incipient Erosion
	C:2:11F.6	Walls on Cable Crossing Hill	-00.5LB	Stable
	C:2:11F.5	Historic inscriptions	-00.5LB	Stable
8-22-92	C:2:41	Prehistoric structure and artifacts	-01.3LB	Stable
	C:2:106	Artifact scatter and roasting feature	-02.2LB	Incipient Erosion
8-23-92	C:2:80	Lithic scatter with sherd	-03.1RB	Stable
8-24-92	C:2:53	Artifact scatter	+00.2RB	Stable

EXAMPLE FORMS

Archaeological Site Monitoring Form

Management Information

1. Site Number AZ ___:___:___
2. Recorders _____ 3. Date ___-___-___
4. USGS quad map _____ 5. Use Area _____
6. Date site first recorded ___-___-___
7. List number of previous monitoring efforts _____
8. UTM location (Zone 12) _____ North _____ East
9. General location description _____

_____

_____

10. Does this site have any visible structures? 0 = no, 1 = yes _____
11. River mile _____ Bank (L = left, R = right, B = both) _____
12. Is this site located in or on modern (post-1850) or prehistoric 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 _____ meters direction _____ degrees height _____ m/ft
14. Distance/direction from and height above current high water to central site datum point
    distance _____ meters direction _____ degrees height _____ m/ft slope _____ degrees

Environmental Situation

15. Primary physiographic setting (circle one): 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 (circle one): 1. open 2. overhang/cave 3. combination (part sheltered/part open)
17. Soil type (circle one): 1. alluvium/aeolian 2. colluvium (talus) 3. residual 4. bedrock 5. other
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 >100 cm deep?) _____

22. Evidence of other erosion? _____

(a) wind deflation _____

(b) bank slumpage _____

(c) dune migration _____

(d) other _____ _____

23. Evidence of animal-caused erosion? _____

(a) general trampling _____

(b) trailing through site _____

(c) burrowing _____

(d) other _____ _____

Total Natural Impacts

24. (First method: if score for items 19, 20, 21, 22, or 23 is greater than zero, item number equals 1. Sum total—maximum total equals 5.) First method total _____

25. (Second method: sum actual scores for all items. Maximum score for items 19-23 equals 4 each; maximum score for items 22 and 23 equals 9 each; maximum possible for all items combined is 27.) 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 operations? 0 = no, 1 = yes _____

(circle 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? 0 = no, 1 = yes _____

Explain/describe above river-related impacts in more detail (is entire site affected or just certain areas? Are impacts incipient or well developed?) _____

_____

_____

Comments (any new features or structures exposed by erosion? Changes in types or degree of erosion occurring? Imminent threats? What to look at on next visit, etc.) _____

_____

_____

Human Impact Evaluation

29. Collection piles: 0 = none, 1 = one pile, 2 = >1 pile. _____
If more than one pile, list total number _____

30. Trails: 0 = no distinct trails, 2 = 1-2 distinct trails, 4 = >2 distinct trails _____

31. Trails eroded >5 cm below ground level? 0 = no, 1 = yes _____
List number of trails eroded below ground level _____
(show all distinct trails on site map)

32. Evidence of on-site camping? 0 = none, 2 = minimal (1 of below), 4 = considerable (two or more of below). What kinds of evidence are present? _____

(a) fire scars	No _____	Yes _____
(b) rearrangement/clearing rocks	No _____	Yes _____
(c) recent trash	No _____	Yes _____
(d) concentrated soil compaction	No _____	Yes _____
(e) other_____	No _____	Yes _____
Does this evidence appear to be recent (< 5 years old?)	No _____	Yes _____
Did evidence appear since last visit?	No _____	Yes _____

33. Evidence of deliberate vandalism? 0 = none, 1 = surficial disturbance only (i.e. graffiti), 2 = slight subsurface disturbance (< 1 m^2 excavated) or portable items removed (pots, metates, etc.), 3 = substantial subsurface disturbance (> 1 m^2 excavated). _____

Does this evidence appear to be recent (< 5 years old?)	No _____	Yes _____
Did evidence appear since last visit?	No _____	Yes _____

34. Any obvious erosion/compaction from human trampling (other than above?) 0 = no, 1 = yes _____

Total Human Impact Rating _____

35. Human impact condition class (see rating system below) _____

Condition Class 1: no human impacts	(total rating = 0)
Condition Class 2: minimal impacts	(total rating 1-3)
Condition Class 3: moderate impacts	(total rating 4-6)
Condition Class 4: high impacts	(total rating 7-9)
Condition Class 5: very high impacts	(rating 10-12)
Condition Class 6: extreme impacts	(rating 13-15)

Describe changes/new human impacts since last visit _____

_____

_____

River-related Human Impacts

36. How close is the nearest regularly used river camp to this site? 1 = >1 km; 2 = <1 km but >500 m; 3 = <500 m but >100 m, 4 = <100 m _____

37. Are any of the human impacts clearly related to river/dam operations? 0 = no, 1 = yes _____
If yes, which ones/how? (circle any that apply) (a) development of new trails to avoid highwater; (b) availability of new beaches in proximity to site; (c) other _____

38. Any human impacts directly related to recent recording/monitoring activities? 0 = no, 1 = yes _____
If yes, which ones/how? (circle any that apply) (a) development of new trails/trampling; (b) increased visitation due to new public awareness of site location; (c) removal of artifacts; (d) other _____

Management Assessment and Recommendations

39. What types of impacts threaten this site? In other words, what should future monitors be looking out for? Rank each threat according to the criteria listed below:

0 = not a threat now or in the foreseeable future
1 = possible threat 5 years or more from now
2 = possible threat within the next 1-4 years
3 = definite long-term threat (will likely occur after 5 or more years)
4 = definite imminent threat (will occur within 1-4 years)
5 = actively occurring at the present time

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

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)

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 armour or similar technique _____
Stabilize structures _____
Surface collect entire site _____
Map as a form of data recovery (excavation not warranted) _____
Full data recovery (excavation) _____
Close site to all public visitation _____
Develop for public interpretation _____
Stop monitoring site _____

Justify your recommendations _____

_____

_____

What is the monitoring priority rank of this site? (see page 5) _____

Has this value changed from previous visit? Explain _____

_____

_____

_____

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

Archaeological Site Monitoring Form

Management Information

1. Site Number AZ C:2:80
2. Recorders L. LEAP / L. NEAL 3. Date 8-22-92
4. USGS quad map LEES FERRY 1985 5. Use Area N/A
6. Date site first recorded 3-15-91
7. List number of previous monitoring efforts 1
8. UTM location (Zone 12) 4077700 North 450760 East
9. General location description THE SITE IS NEAR 3-MILE BAR ON AN AEOLIAN DUNE TERRACE AT THE BASE OF A NAVAJO SANDSTONE CLIFF. IT IS 250 M FROM THE RIVER AND 26 FT. ABOVE THE 28,000 CFS LEVEL.
10. Does this site have any visible structures? 0 = no, 1 = yes 0
11. River mile 3.1 Bank (L = left, R = right, B = both) R
12. Is this site located in or on modern (post-1850) or prehistoric Colorado River fluvial deposits? 0 = no, 1 = yes 0. If yes, describe the setting specifically N/A
13. Distance/direction from and height above current high water (approx. 30,000 cfs) to lowest boundary of site area: distance 250 meters direction 180 degrees height 26 m (FT)
14. Distance/direction from and height above current high water to central site datum point distance 260 meters direction 180 degrees height 26 m/(FT) slope 2 degrees

Environmental Situation

15. Primary physiographic setting (circle one): 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 (circle one): (1.) open 2. overhang/cave 3. combination (part sheltered/part open)
17. Soil type (circle one): (1.) alluvium/aeolian 2. colluvium (talus) 3. residual 4. bedrock 5. other
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? 1
20. Evidence of gullying (cuts 10-100 cm deep?) 2
21. Active arroyo cutting (cuts >100 cm deep?) 0

22. Evidence of other erosion? 1

(a) wind deflation 1

(b) bank slumpage 0

(c) dune migration 0

(d) other _____ ✓

23. Evidence of animal-caused erosion? 0

(a) general trampling 0

(b) trailing through site 0

(c) burrowing 0

(d) other _____

Total Natural Impacts

24. (First method: if score for items 19, 20, 21, 22, or 23 is greater than zero, item number equals 1. Sum total—maximum total equals 5.) First method total 3

25. (Second method: sum actual scores for all items. Maximum score for items 19-23 equals 4 each; maximum score for items 22 and 23 equals 9 each; maximum possible for all items combined is 27.) Second method total 4

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

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

(circle 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 N/A

28. If arroyos or gullies are present, do they drain all the way to the river? 0 = no, 1 = yes 0

Explain/describe above river-related impacts in more detail (is entire site affected or just certain areas? Are impacts incipient or well developed?) N/A

Comments (any new features or structures exposed by erosion? Changes in types or degree of erosion occurring? Imminent threats? What to look at on next visit, etc.) ONE ADDITIONAL MANO WAS FOUND NEAR THE RETAKE NEAR THE OVERHANG. OTHER LOCATIONS OF PLOTS OF MANOS ON THE ORIGINAL MAP WERE CORRECTLY PLOTTED.

Human Impact Evaluation

29. Collection piles: 0 = none, 1 = one pile, 2 = >1 pile. 0
If more than one pile, list total number _____

30. Trails: 0 = no distinct trails, 2 = 1-2 distinct trails, 4 = >2 distinct trails 0

31. Trails eroded >5 cm below ground level? 0 = no, 1 = yes 0
List number of trails eroded below ground level _____
(show all distinct trails on site map)

32. Evidence of on-site camping? 0 = none, 2 = minimal (1 of below), 4 = considerable (two or more of below). What kinds of evidence are present? 0

(a) fire scars	No ✓	Yes _____
(b) rearrangement/clearing rocks	No ✓	Yes _____
(c) recent trash	No ✓	Yes _____
(d) concentrated soil compaction	No ✓	Yes _____
(e) other _____	No ✓	Yes _____
Does this evidence appear to be recent (< 5 years old?)	No ✓	Yes _____
Did evidence appear since last visit?	No ✓	Yes _____

33. Evidence of deliberate vandalism? 0 = none, 1 = surficial disturbance only (i.e. graffiti), 2 = slight subsurface disturbance (< 1 m^2 excavated) or portable items removed (pots, metates, etc.), 3 = substantial subsurface disturbance (> 1 m^2 excavated). 0

Does this evidence appear to be recent (< 5 years old?)	No ✓	Yes _____
Did evidence appear since last visit?	No ✓	Yes _____

34. Any obvious erosion/compaction from human trampling (other than above?) 0 = no, 1 = yes 0

Total Human Impact Rating 0

35. Human impact condition class (see rating system below) 1

Condition Class 1: no human impacts (total rating = 0)
Condition Class 2: minimal impacts (total rating 1-3)
Condition Class 3: moderate impacts (total rating 4-6)
Condition Class 4: high impacts (total rating 7-9)
Condition Class 5: very high impacts (rating 10-12)
Condition Class 6: extreme impacts (rating 13-15)

Describe changes/new human impacts since last visit NONE OBSERVED.

River-related Human Impacts

36. How close is the nearest regularly used river camp to this site? 1 = >1 km; 2 = <1 km but >500 m; 3 = <500 m but >100 m, 4 = <100 m 1

37. Are any of the human impacts clearly related to river/dam operations? 0 = no, 1 = yes 0
If yes, which ones/how? (circle any that apply) (a) development of new trails to avoid highwater; (b) availability of new beaches in proximity to site; (c) other N/A

38. Any human impacts directly related to recent recording/monitoring activities? 0 = no, 1 = yes 0
If yes, which ones/how? (circle any that apply) (a) development of new trails/trampling; (b) increased visitation due to new public awareness of site location; (c) removal of artifacts; (d) other _____

Management Assessment and Recommendations

39. What types of impacts threaten this site? In other words, what should future monitors be looking out for? Rank each threat according to the criteria listed below:

    0 = not a threat now or in the foreseeable future
    1 = possible threat 5 years or more from now
    2 = possible threat within the next 1-4 years
    3 = definite long-term threat (will likely occur after 5 or more years)
    4 = definite imminent threat (will occur within 1-4 years)
    5 = actively occurring at the present time

(a)	bank failures from excessive government regulation	0
(b)	development of new gullies and/or headward migration of arroyos due to river/dam related base level lowering	1
(c)	bank failures from non-river-related processes	0
(d)	deepening/widening of arroyos from non-river natural processes (i.e., side canyon flooding)	0
(e)	exposure/destabilization of features due to a, b, c, d	1
(f)	exposure/destabilization of features due to weathering	0
(g)	exposure/destabilization of features due to visitation	0
(h)	burial or exposure of features due to dune migration	1
(i)	impacts from human visitation	1
(j)	other _____	

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)

Monitor visitation with remote sensing devices	0
Monitor erosion with stationary cameras	0
Retrail or define existing trails	0
Obliterate trails	0
Install check dams	0
Plant vegetation to stabilize site surface	0
Stabilize banks with rock armour or similar technique	0
Stabilize structures	0
Surface collect entire site	0
Map as a form of data recovery (excavation not warranted)	1
Full data recovery (excavation)	0
Close site to all public visitation	0
Develop for public interpretation	0
Stop monitoring site	1

Justify your recommendations STOP MONITORING ONLY IF ARTIFACTS HAVE BEEN TAKEN OFF THE SITE. A GOOD MAP HAS BEEN SKETCHED BUT THE SCALE IS OFF A LITTLE. DRAW BETTER MAP AND CONTINUE MONITORING ON A YEARLY BASIS.

What is the monitoring priority rank of this site? (see page 5) 3

Has this value changed from previous visit? Explain THIS IS THE FIRST TIME THE SITE HAS BEEN MONITORED USING A PRIORITY RANK SYSTEM.

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

SUBJECT: Trip Report for Surface and Underwater Archaeological Monitoring of the Charles H. Spencer Steamboat

TO: Chris Kincaid and Jan Balsom

FROM: Lynn Neal and Lisa Leap

DATE: October 9, 1992

On September 10, 1992 Lisa Leap and Lynn Neal drove to Lee's Ferry to meet Ron Martin and Rhonda Brooks, Wahweap Maintenance personnel, at 8:00 am to dive the Spencer Steamboat. Neal took new and comparative photographs of the steamboat, bow to stern, from the Lee's Ferry interpretive trail while Leap waited for Brooks and Martin. They arrived at 9:15 am accompanied by Roe Barney, Wahweap Maintenance, and Ken Hawkins, Lee's Ferry Maintenance and boat operator for the dive. We launched the Lee's Ferry boat around 9:30 am, and the divers prepared for the dive; Leap took photographs of the dive preparation.

Lynn Neal and Rhonda Brooks were the divers, and they got into the water at 10:07 am. They shot two rolls of 35 mm color film (one 36 exp., one 24 exp.), but it was not possible to keep a photo log due to the rising water level, current and time constraints based on the cold water temperature. (For best possible results, the photo logs were completed in the office soon after film development.) The underwater photographs were taken semi-systematically by first taking panoramic shots from stern to bow on the starboard side of the steamboat with the general view to port. Features such as the overhanging guard and features on the deck above were photographed because of their exposure. A second panoramic sweep was done from stern to bow starting at the paddle wheel stern guard and continuing to the boiler, concentrating on the deck with views to stern and starboard. The second roll of film includes photos of the firebox. The remaining roll shots were used to photograph the divers and wreckage detached from the boat and scattered on the river bottom below the starboard side. Moving bow to stern, these scattered pieces represented a few pipes and planks.

Generally, the steamboat is in good condition when compared to 1986 photographs, maps and notes, despite the continued active erosion of wet-dry cycling caused by the fluctuating water levels. Particularly, the often exposed boiler, firebox and bow posts show minor signs of further deterioration. The current condition of these features does not mean, however, that they are stable since they are being impacted by wet-dry cycling.

Few major changes were noted that were not discussed in the 1987 Submerged Cultural Resources Unit report (Carrell 1987). The main difference was the abundance of green algae (Cladophora) growing on the boat's deck and deck features, including the tow bitt, bow, pitman and pitman jaws. (The cylinder timber and crank were not visible due to siltation and algal cover.) This difference in quantity was visible in both shore and underwater photographs. Accompanying the increased algal growth is more deposition of silt, most noticeably on the port side and stern end of the vessel. This was determined by comparison with 1989 surface photographs. Additionally, one long, narrow piece of wood, most likely a deck beam, is disarticulated and lying diagonally across the port side of the boat aft of the northernmost paddle wheel hub. The beam was not detached in the 1989 photographs.

As stated in the 1987 report, at low water levels (below approx. 10, 000 cfs) the boiler and a portion of the bow are exposed and are impacted by both wind-driven waves and boat wake wash. The lapping of waves also results in erosion of the bank, the deterioration of algae, and movement of sand and silt over the steamboat, all of which have stabilized the current preservation of it. Wet-dry cycling has been documented to be one of the most severe impacts to cultural remains in riverine environments (Lenihan et al. 1981, referenced in Carrell 1987). The lower water levels furthermore invite more human activity at the site, which is documented in Carrell 1987 and in more recent 1989 photographs.

Finally, the increased current of high water flows above the current high flow (20,000 cfs) could result in the removal of silt from the boat's hull causing destabilization and disarticulation of wood planks.

It is therefore recommended that under ideal conditions the vessel would be best preserved and protected from the impact of wind- and boat-driven waves and wet-dry cycling if it remained underwater at all times. However, at water levels between the current interim flows of approximately 8,000 to 20,0000 cfs, the steamboat is being effectively preserved. To further preserve the site under these current conditions, an extension of the no wake zone around the Lee's Ferry boat launch area to incorporate the Spencer would reduce splashing at the site and stabilize bank erosion.

REFERENCE:

Carrell, Toni (editor)
Submerged Cultural Resources Site Report: Charles H. Spencer's Mining Operation and Paddle Wheel Steamboat. Southwest Cultural Resources Center Professional Papers No. 13. Santa Fe, New Mexico.

Sincerely,

Lynn Neal and Lisa Leap
Glen Canyon NRA
P.O. Box 1507
Page, AZ 86040
(602) 645-8278

TESTING AND CHARCOAL SAMPLING AT C:2:32, RIVER MILE -9.8LB AND C:2:100, RIVER MILE -0.4LB GLEN CANYON NATIONAL RECREATION AREA

Prepared by

Lisa M. Leap
Seasonal Archaeologist

and

Lynn A. Neal
Seasonal Archaeologist

Prepared for

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

and

Janet Balsom
Archaeology Department
Grand Canyon National Park
P.O. Box 129
Grand Canyon, Arizona 86025

November 27, 1992

I. INTRODUCTION

Charcoal and flood deposit samples were collected for radiocarbon dates at archaeological sites C:2:32 (river mile -9.8, left bank) and C:2:100 (river mile -0.4, left bank). Three samples were collected at C:2:32 (Figure 1)--two charcoal and one flood deposit, and one charcoal sample was taken from a probable hearth at C:2:100 (Figure 2). These sites were tested and sampled for three reasons. One reason is based on the associated archaeological sites and features in the areas. C:2:32 is a dark, ashy charcoal lens in a cutbank that appears to be cultural, yet no artifacts exist on the surface. However, it is located in close proximity to a petroglyph site, C:2:38, and a structure with artifacts, C:2:35. The hearth at C:2:100 is also located in a cutbank and is loosely associated with two charcoal stains (Features 1 and 2), and eight Tusayan Corrugated sherds and two Black Mesa Black-on-white sherds near Feature 1.

The second reason for selecting these sites is because of the initial GCES erosional monitoring survey. This survey illustrated that both sites are considered to be at high risk due to fluctuating river flows. C:2:32 is located in a cutbank that is directly adjacent to the Colorado River, and the C:2:100 charcoal lens is located in the cutbank of a secondary (almost primary) arroyo approximately 75 m south of the river. Therefore, in addition to testing and collecting charcoal samples, stationary cameras have been photographing the erosional processes at these sites since August 24, 1992.

Finally, in conjunction with fluctuating river releases, Richard Hereford, USGS geologist, has been dating terraces along the river corridor in the Grand Canyon and is extending his research into Glen Canyon. Dating the samples will aid in his ongoing study.

II. METHODS

Lynn Neal and Lisa Leap conducted the field work in five and one half days--Five days (Sept. 8 and 9, and Oct. 2, 5 and 6) at C:2:32, and one half day (Oct. 6) at C:2:100. The first objective was to create temporary datums at the flood deposit and unit at C:2:32. Temporary datums were established by placing a nail at the original site datum and extending a string from this datum (tied on the nail 10 cm above ground surface) first to the flood deposit and then to the unit, leveling the string and measuring the distance every 2 m for accuracy. The temporary datum at the flood deposit was the north stake at 4.44 m below the original site datum, and the unit's northeast stake served as the datum at 2.70 m below the original site datum. (The 10 cm that were added to the original datum were subtracted when calculating the heights of the temporary datums.) Temporary datums were not established at the charcoal lens/deposit in the cutbank, or at C:2:100. These samples were taken from a depth based on the ground surface.

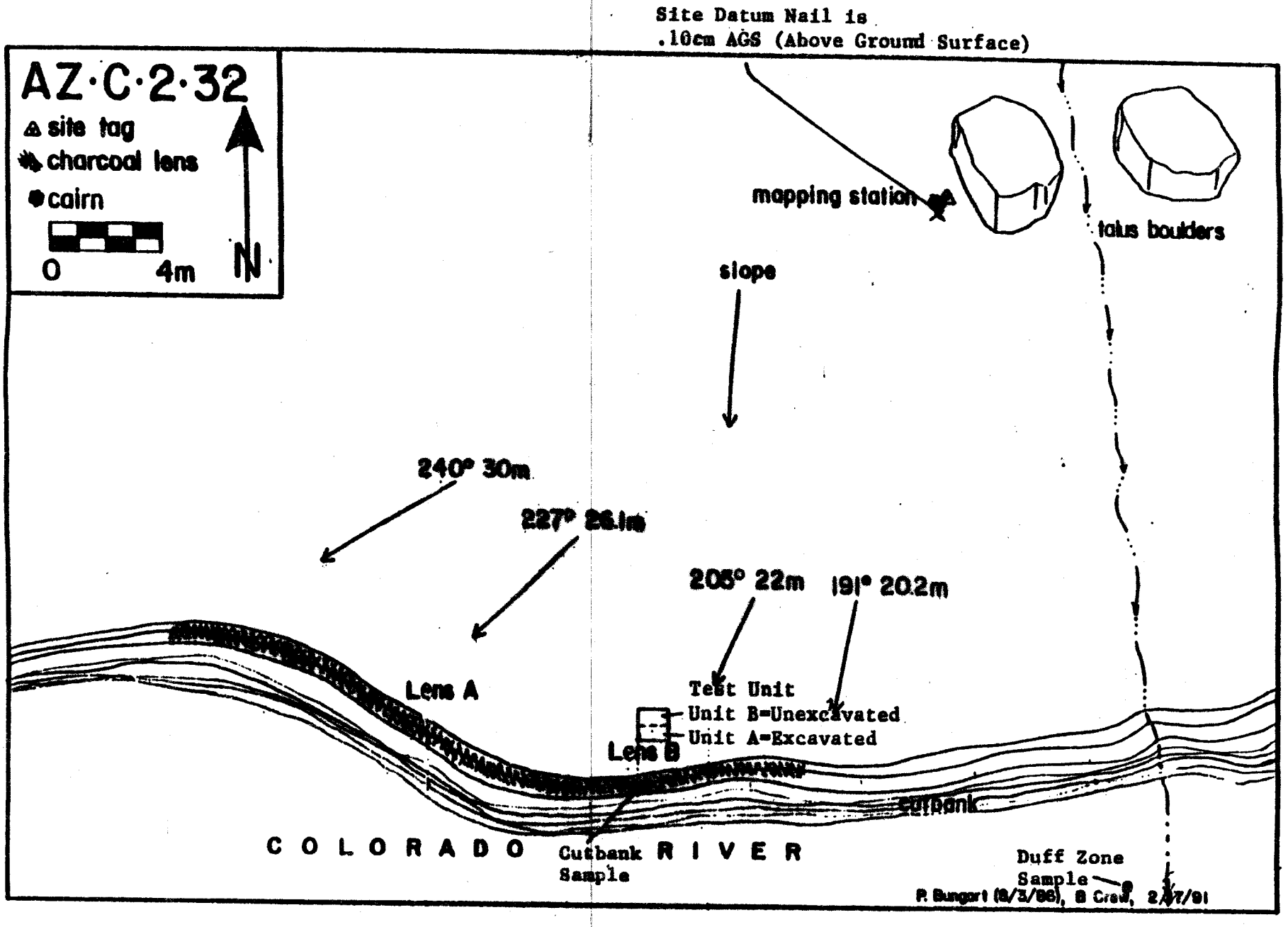


Figure 1. Planview of site C:2:32 with the tested areas.

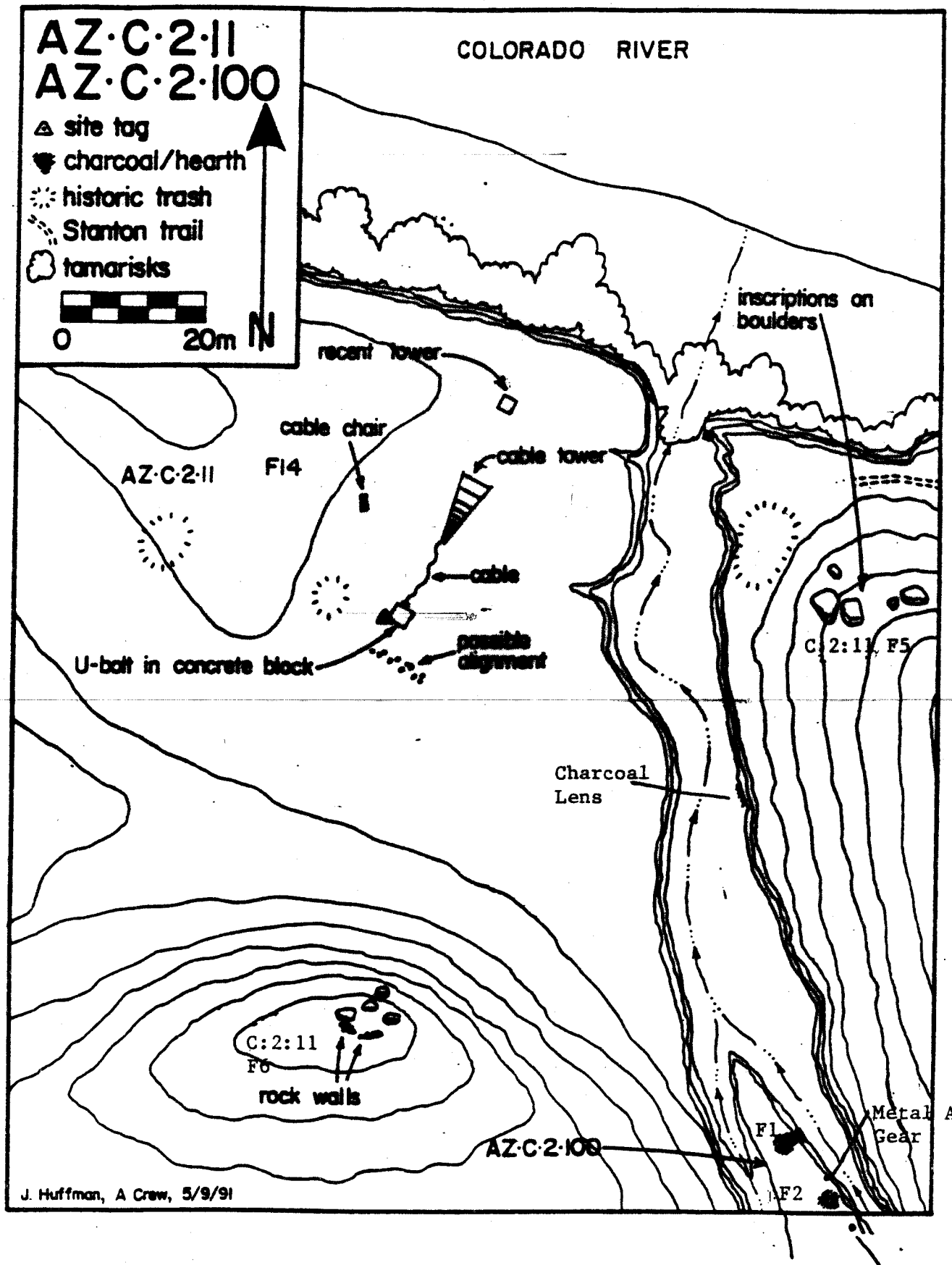


Figure 2. C:2:100 site map with charcoal lens.

Samples located in the cutbanks (C:2:32--flood deposit and charcoal lens and C:2:100--hearth) were removed by a trowel and placed into large plastic freezer bags and/or aluminum foil. Before and after photographs of the sample areas were taken, profiles were sketched, and brief stratigraphic descriptions were recorded.

Excavation of the 1 X 1 m unit involved removing sediment with a shovel or trowel unsystematically until a feature was encountered. Upon uncovering a feature, detailed notes including measurements and physical descriptions were recorded and photographs were taken. If a feature contained charcoal, the charcoal was collected and placed into aluminum foil. When the excavation of the entire unit was completed photographs were taken and a profile of the north wall was drawn documenting the various stratigraphic levels.

III. SAMPLE DESCRIPTIONS

A. C:2:32--Flood Material

The flood material stratum is located in the southeast section of the site and extends 29 to 94 cm below the datum. It ranges from 2 to 14 cm in thickness. The material was collected from a sample area 35 cm wide and ranging in depth from 34 to 82 cm below the datum (Figure 3). The material consists of discontinuous, flood-deposited plant remains in a matrix of fine-grained red sand mottled with gray silty clay peds and layers.

The sample was sent to Linda Scott-Cummings at Paleo Research Laboratories for macrofloral and pollen identification. A radiocarbon date will be extracted from one fraction of the majority of identified material. All test results will be sent to Glen Canyon in February, 1993.

B. C:2:32--Unit

The 1 X 1 m unit was located on the terrace, one meter above and to the north of the thickest and darkest portion of the charcoal lens/deposit in the cutbank. The purpose of placing the unit here was to determine if the charcoal lens, visible in the cutbank, continued northward into the terrace. Additionally, we wanted to see if any subsurface cultural materials were present to justify C:2:32 as a cultural site. We bisected the unit with a east/west string and excavated the southern half (unit A). The northern half (unit B) was not excavated due to our findings in unit A.

The first feature we encountered in unit A was a charcoal deposit beginning at 20 cm and extending to 58 cm below the temporary datum. The feature contained large, dense, burned wood fragments, many smaller roots, and some large sandstone cobbles. A charcoal sample was collected 30 cm below the unit datum, yet after further excavation it was determined that the feature was not cultural; therefore, the sample was not sent in for ^{14}C dating.

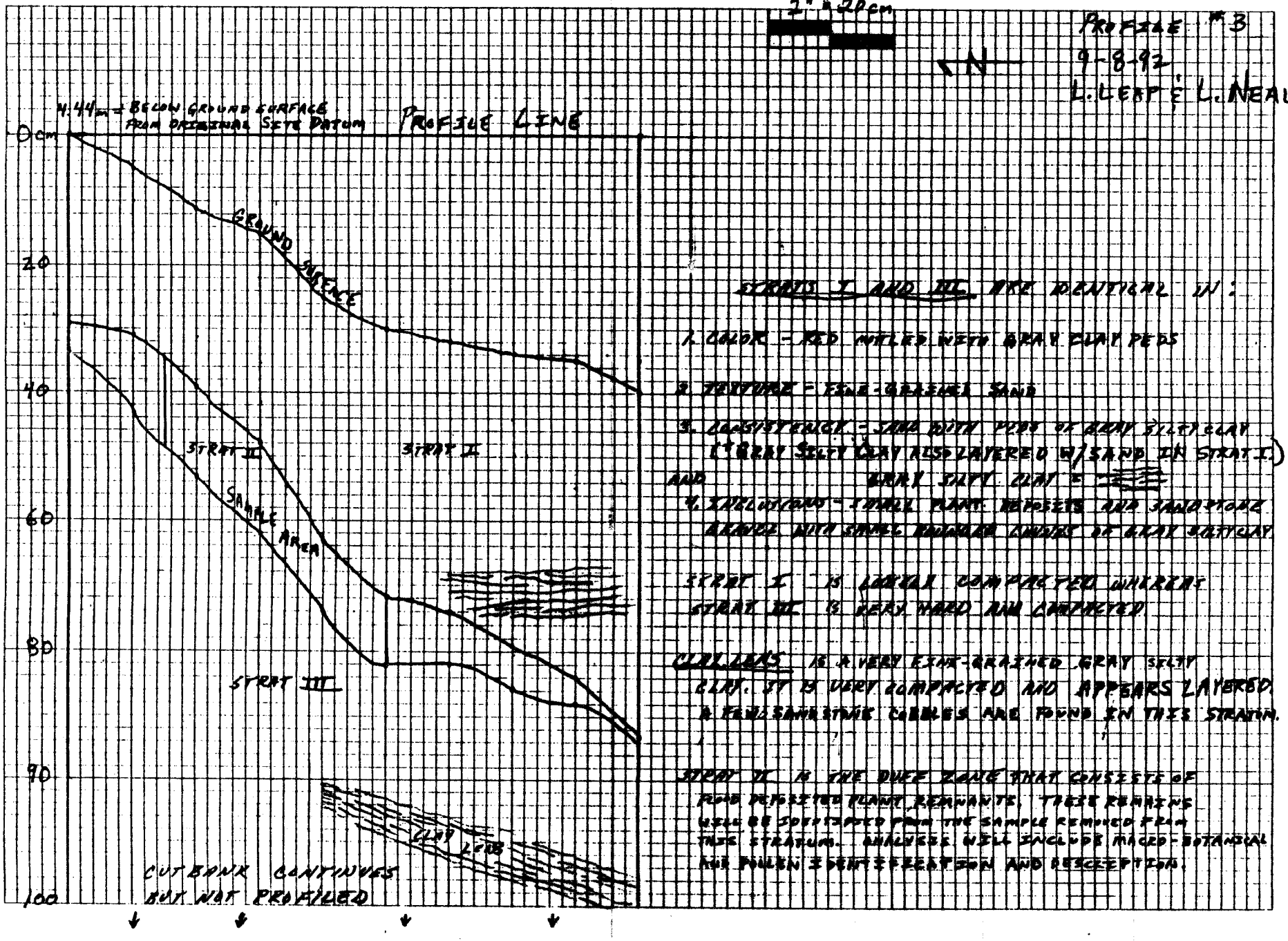


Figure 3. Flood deposit/duff zone sample area and profile.

Photographs were taken of the feature from start to finish, and a planview map was sketched. After the unit was excavated to a 1 m depth and additional features were absent, we decided to excavate the east half of unit A.

In the eastern half of unit A, a continuous charcoal lens was uncovered at 1.27 m below the temporary datum. The lens was 4 cm thick and consisted of charcoal-stained, ashy, compact red sand with some charcoal fragments. The charcoal fragments were collected for dates, and excavation ended 8 cm below this lens at 1.38 m below the datum (Figure 4). The north wall was profiled and photographed, the unit was backfilled, and the temporary datum (nail) was left for future mapping by Hereford.

No artifacts were found in the unit or on the surface surrounding it. This finding may raise some skepticism as to whether the charcoal lens at C:2:32 is of cultural origin.

C. C:2:32--Cutbank Sample

The sample area in the cutbank begins 90 cm below ground surface and is located more than 15 m above the river. A 20-foot ladder was necessary to excavate the sample from the charcoal lens. The lens extends from 90 cm to 1.29 m below ground surface, and the width of the sampled area was 30 cm (Figure 5). The deposit consists of charcoal-stained, ashy, fine- to medium-grained red sand with charcoal fragments and less than 10% root inclusions. A nail was placed in the sampled area for a future reference point. Artifacts were also absent in this sample. The only defining difference between this charcoal lens and the lens at the bottom of the unit is the thickness. It is very likely that the two lenses are contemporaneous.

D. C:2:100--Hearth

The charcoal deposit in the arroyo cut at C:2:100 is 68 cm wide, 6 to 9 cm thick, and begins 94 cm below ground surface. It serves as a transitional stratum between stratum III (a very fine-grained red sand mottled with gray sand, few root inclusions and less than 10% angular sandstone pebbles and cobbles) and stratum IV (a very consolidated, medium- to large-grained red sand with numerous [up to 90%] angular sandstone pebbles and cobbles). The deposit is charcoal-stained and is more similar to stratum III than to IV but with charcoal fragments (some larger than 5 mm) (Figure 6).

All the charcoal samples were sent to Beta Analytic for accelerator-AMS radiocarbon dates. The results will be sent to Glen Canyon by January or February, 1993.

IV. DISCUSSION AND RECOMMENDATIONS

No artifacts were located in the test unit, cutbank or flood deposit of C:2:32. Charcoal samples were obtained from all three areas to date the different burned and depositional episodes. Based on depth and stratigraphy, the charcoal lens exposed in the

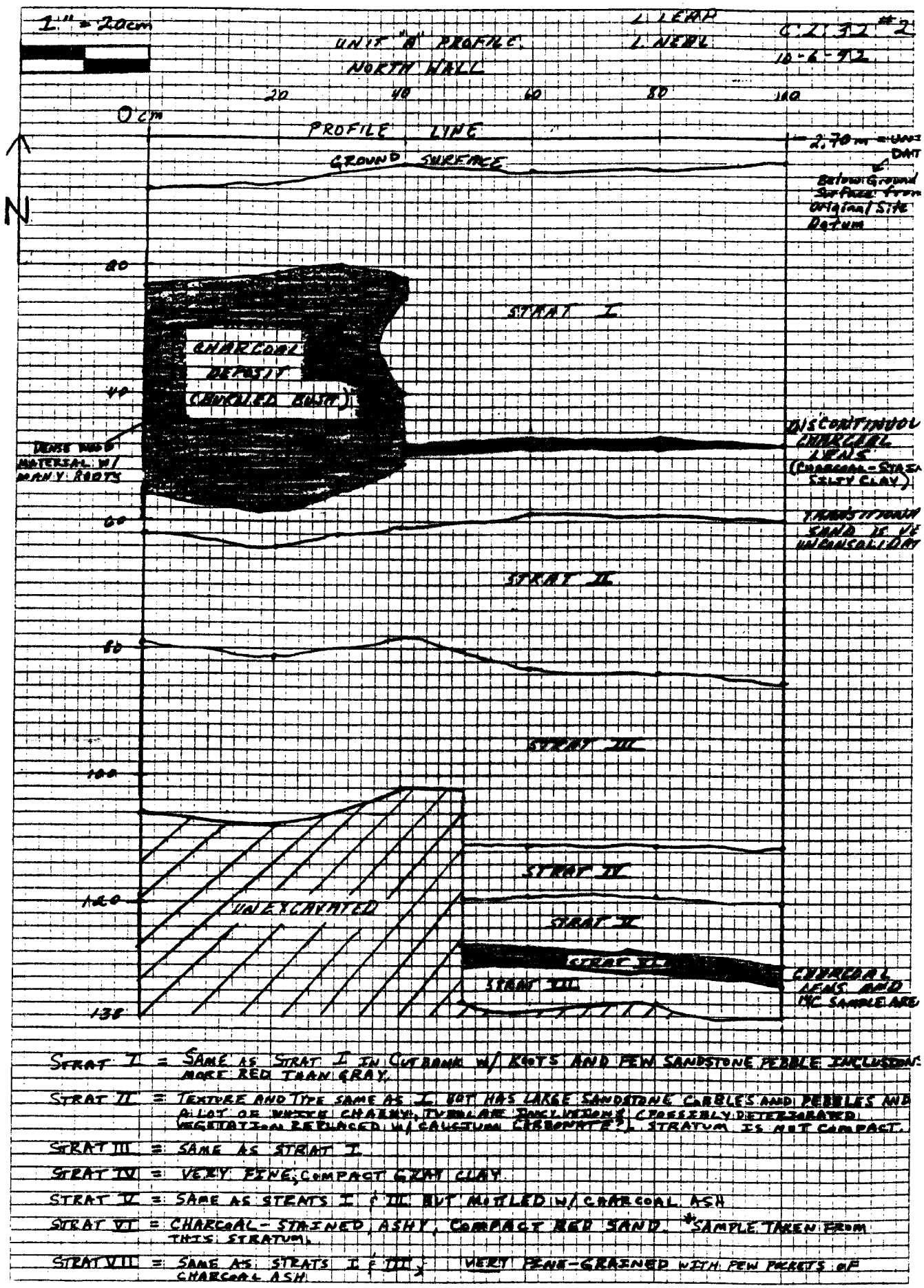


Figure 4. Unit "A" profile and sample area.

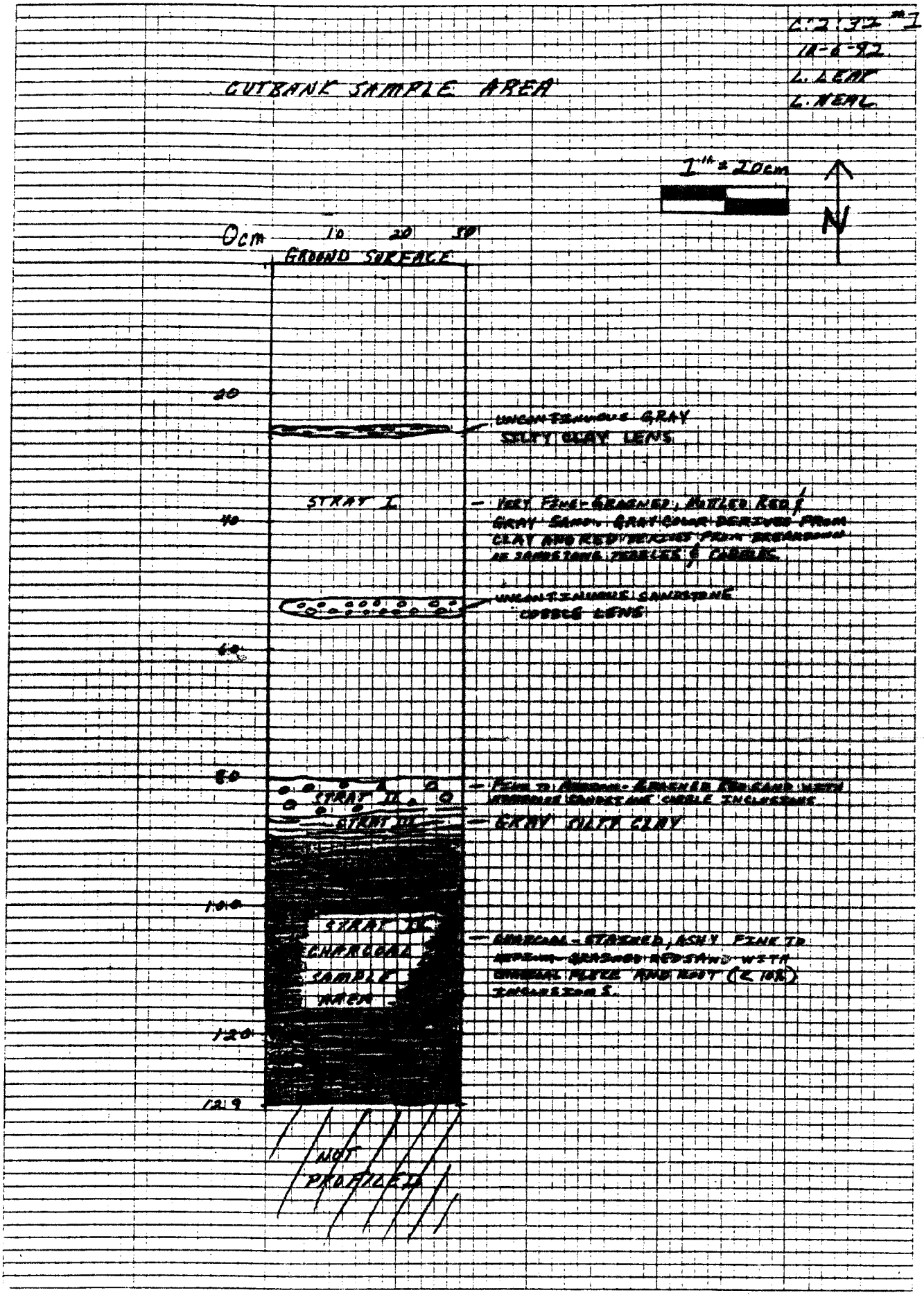


Figure 5. Cutbank sample area and profile.

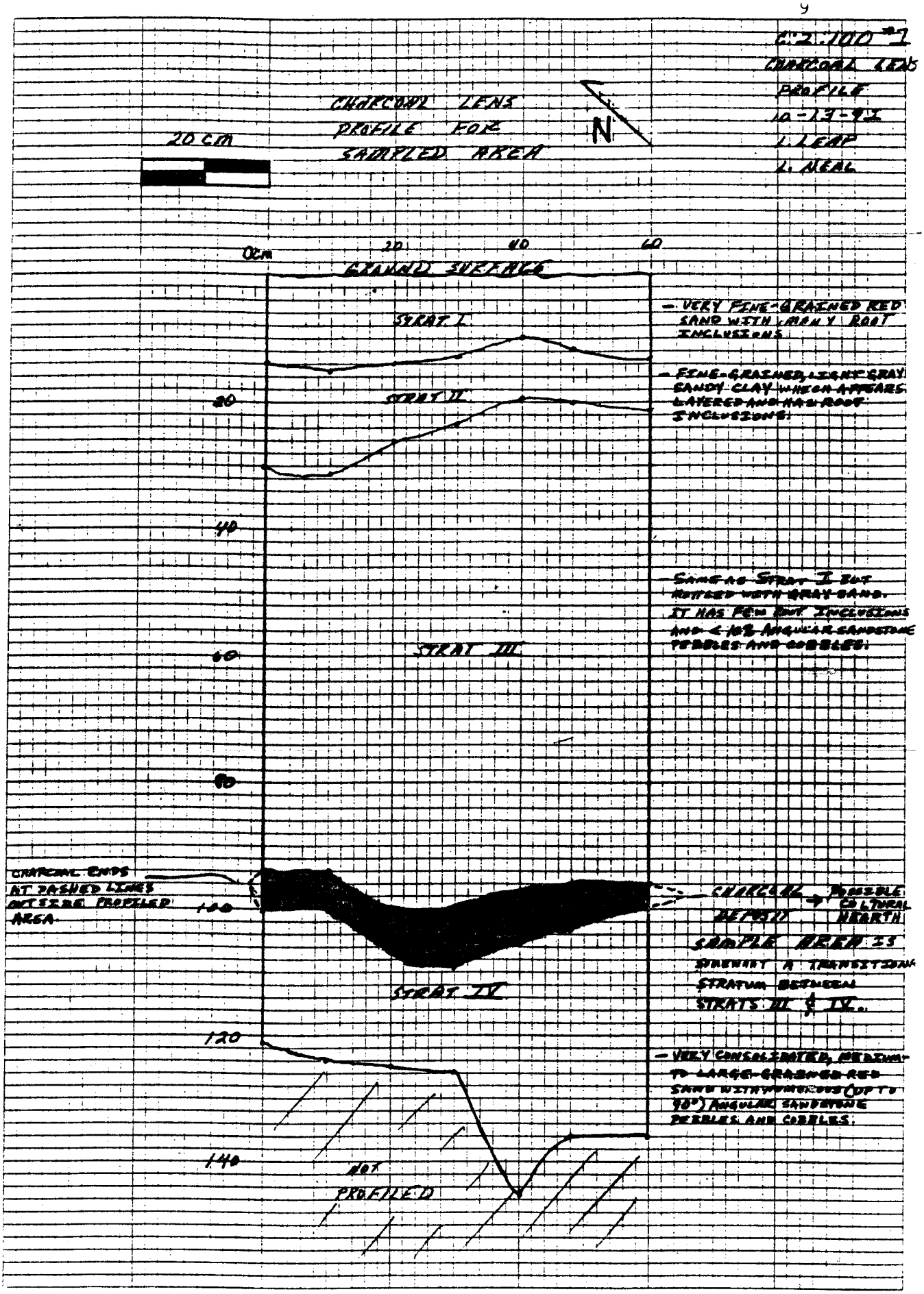


Figure 6. Charcoal lens profile and sample area.

cutbank appears to be the same charcoal lens present at the bottom of unit A. However, the lens in the unit is much thinner than the cutbank lens. Hopefully, radiocarbon dates from both locations will provide more reliable evidence as to whether the lenses are directly associated.

Another dense charcoal deposit exposed in unit A's north wall was associated with a discontinuous charcoal lens. The deposit consists of dense wood material with many roots and may represent a burned scrub that is still very much intact and identifiable. Both the deposit and lens were quite different in content and texture when compared to the charcoal lens at the bottom of unit A. Additionally, they occurred 70 cm above the lower lens. The more recent charcoal deposits, therefore, do not appear to be associated with the older lens. In fact, the dense charcoal deposit and charcoal lens are probably much more recent in age than the lower lens based on stratigraphy and content.

The flood-deposited macrofloral material is located approximately 16 m east of the unit and cutbank sample area. A sample was collected from this deposit solely to obtain geological dates; it is not associated with any cultural materials. Furthermore, the sample was taken with minimal impact to the deposit, and a profile map was drawn to insure data recovery should the material naturally erode out of the cutbank.

The urgency to test and sample the charcoal deposits at C:2:32 and C:2:100 resulted due to the exposure of these deposits in actively eroding cutbanks. Whether or not these charcoal features were exposed and eroded due to the dam's interim flows is a question that is being addressed through various GCES long-term monitoring activities, such as terrestrial photogrammetry and erosional monitoring. Nevertheless, since the features were exposed, it was important to deal with them in a timely and efficient manner. Furthermore, the testing results will aid in the park's ability to evaluate the cultural significance of these sites. If continuing monitoring efforts reveal further erosion and exposure, additional testing and sampling and possibly complete excavation may be necessary.

MACROFLORAL AND CHARCOAL RESULTS

POLLEN AND MACROFLORAL ANALYSIS AT SITE AZ C:2:32, GLEN CANYON NATIONAL RECREATION AREA, ARIZONA

By

Linda Scott Cummings
and
Kathryn Puseman
PaleoResearch Laboratories
Denver, Colorado

Prepared For

National Park Service
Glen Canyon National Recreation Area
Page, Arizona

January 1993

INTRODUCTION

One sample from the Duff Zone in the flood deposit from the Colorado River corridor in Glen Canyon National Recreation Area, Arizona, was sampled for pollen and macrofloral remains. The flood deposit is exposed in a cutbank above the Colorado River's water level. The Duff Zone is found across the Colorado River from a charcoal lens defining the site. Pollen and macrofloral analyses will identify vegetation associated with this zone.

METHODS

A chemical extraction technique based on flotation is the standard preparation technique used in this laboratory for the removal of the pollen from the large volume of sand, silt, and clay with which they are mixed. This particular process was developed for extraction of pollen from soils where preservation has been less than ideal and pollen density is low.

Hydrochloric acid (10%) was used to remove calcium carbonates present in the soil, after which the samples were screened through 150 micron mesh. The samples were rinsed until neutral by adding water, letting the samples stand for 2-4 hours, then pouring off the supernatant. A small quantity of sodium hexametaphosphate was added to each sample once it reached neutrality, then the beaker was again filled with water and allowed to stand for 2-4 hours. The samples were again rinsed until neutral, filling the beakers only with water. This step was added to remove clay prior to heavy liquid separation. Zinc bromide (density 2.0) was used for the flotation process. The samples were mixed with zinc bromide while still moist, immediately after centrifugation to remove the dilute hydrochloric acid and water. All samples received a short (10 minute) treatment in hot hydrofluoric acid to remove any remaining inorganic particles. The samples were then acetolated for 3 minutes to remove any extraneous organic matter.

A light microscope was used to count the pollen to a total of 100 to 200 pollen grains at a magnification of 500x. Pollen preservation in these samples varied from good to poor. Comparative reference material collected at the Intermountain Herbarium at Utah State University and the University of Colorado Herbarium was used to identify the pollen to the family, genus, and species level, where possible.

Pollen aggregates were recorded during identification of the pollen. Aggregates are clumps of a single type of pollen, and may be interpreted to represent pollen dispersal over short distances, or the actual introduction of portions of the plant represented into an archaeological setting. Aggregates were included in the pollen counts as single grains, as is customary. The presence of aggregates is noted by an asterisk (*) next to the pollen frequency on the pollen table. A plus (+) on the pollen table indicates that the pollen type was observed outside the regular count while scanning the remainder of the microscope slide.

Indeterminate pollen includes pollen grains that are folded, mutilated, and otherwise distorted beyond recognition. These grains are included in the total pollen count, as they are part of the pollen record.

The macrofloral sample was floated using a modification of the procedures outlined by Matthews (1979). One liter of sample was added to approximately 3 gallons of water. The sample was stirred until a strong vortex formed, which was allowed to slow before pouring the light fraction through a 150 micron mesh sieve. Additional water was added and the process repeated until all visible macrofloral material was removed from the sample (a minimum of 5 times). The material which remained in the bottom (heavy fraction) was poured through a 1mm mesh screen. The floated portions were allowed to dry.

The light fraction was passed through a series of graduated screens (US Standard Sieves with 2mm, 1mm, .5mm and .25mm openings) to separate charcoal debris and to initially sort the seeds. The contents of each screen were then examined. Charcoal pieces larger than 2mm in diameter were broken to expose a fresh cross-section and examined under a binocular microscope at magnifications up to 80x. The material which remained in the 2mm, 1mm, and .5mm sieves was scanned under a binocular stereo microscope at a magnification of 8x, with some identifications requiring magnifications of up to 40x. A portion of the finest material in the .25mm screen was also examined under a magnification of 8x. The material which passed through the .25 mm screen was not examined. The coarse or heavy fraction was also examined. Macrofloral remains were identified using manuals (Martin and Barkley 1973; Musil 1978; Schopmeyer 1974) and by comparison with modern and archaeological references. The term "seed" is used to represent seeds, achenes, caryopses, and other disseminules. Remains were recorded as charred and/or uncharred, whole and/or fragments.

DISCUSSION

Site AZ C:2:32 is located along the Colorado River in the Colorado Canyon, Glen Canyon National Recreation Area, Arizona. The site consists of an extensive lens-shaped charcoal deposit in the cutbank along the Colorado River. Local vegetation on the terrace above the cutbank consists of a desert shrub community and includes Atriplex canescens (four-wing saltbush), Opuntia polyacantha (prickly pear cactus), Salsola iberica (Russian thistle), Lepidium densiflorum (dense flowered peppergrass), Sphaeralcea parvifolia (globemallow), Allionia incarnata (trailing four-o-clock), Cryptantha sp., Ephedra nevadensis (Nevada Mormon tea), Sarcobatus vermiculatus (greasewood), Tessaria sericea (arrowwood), and various forbs and grasses (Lisa Leap, personal communication, October 20, 1992).

One pollen and one flotation sample were collected from Stratum II of the Duff Zone, approximately 20 feet above the current water level of the Colorado River (Table 1). Pollen sample 3 exhibits both Pinus and Juniperus pollen, indicating proximity to scattered pinyon/juniper woodlands (Table 2). The pollen record is dominated by Cheno-am pollen, most likely representing local Atriplex (four-wing saltbush), abundant in the local desert scrub community. Smaller quantities of Sarcobatus, Artemisia, Low-spine and High-spine Compositae, Ephedra torreyana-type, Gramineae, Cruciferae, and Opuntia pollen were noted. This pollen assemblage represents plants typical of those noted in the modern local vegetation community. The Cruciferae pollen is consistent in morphology to Lepidium (pepperweed) pollen.

Flotation sample 3 from the Duff Zone contained one piece of Pinus charcoal. Uncharred wood and numerous uncharred floral remains represent components of the local, modern vegetation and include a probable Amaranthus seed; Atriplex wood, fruits, and seeds; Cactaceae spines and glochids; Opuntia seeds; probable Chenopodium seeds; Gramineae seeds; unidentified seeds; Tessaria sericea wood; and various leaves and stems. The sample also contained one bone fragment and insect fragments. Numerous rodent feces may indicate disturbance by rodents.

SUMMARY AND CONCLUSIONS

Pollen and macrofloral analyses were conducted on one sample from Site AZ C:2:32 in Glen Canyon National Recreation Area, Arizona. Identification of pollen and macrofloral remains from the apparently modern Duff Zone confirms a plant assemblage similar to that noted for the modern vegetation community. At the time this flood deposit was laid down, vegetation appears to have bee very similar to that of the present.

TABLE 1
PROVENIENCE DATA FOR THE SAMPLE FROM SITE AZ C:2:32

Sample No.	Stratum No.	Description	Analysis	Pollen Counted
3	II	Soil from Duff Zone, about 20 ft. above current water level	Pollen	300
3	II	Soil from Duff Zone, about 20 ft. above current water level	Flotation	

TABLE 2
POLLEN TYPES OBSERVED IN SAMPLE 3 FROM SITE AZ C:2:32

Scientific Name	Common Name	Count	Percent
ARBOREAL POLLEN:			
Juniperus	Juniper	4	1.33
Pinus	Pine	19	6.33
NON-ARBOREAL POLLEN:			
Cheno-ams	Includes amaranth and pigweed families	251*	83.67*
Sarcobatus	Greasewood	1	0.33
Compositae:	Sunflower family		
Artemisia	Sagebrush	11	3.67
Low-spine	Includes ragweed, cocklebur, etc.	1	0.33
High-spine	Includes aster, rabbitbrush, snakeweed, sunflower, etc.	5	1.67
Cruciferae	Mustard family	2	0.67
Ephedra torrevena-type	Mormon tea	1	0.33
Gramineae	Grass family	5	1.67
Opuntia	Prickly pear cactus	+	+
Total		300	

* = Aggregates

TABLE 3
MACROFLORAL REMAINS FROM SITE AZ C:2:32

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F
3	FLORAL REMAINS:					
	cf. Amaranthus	Seed				1
	Atriplex	Fruit			52	61
	Atriplex	Seed			73	21
	Atriplex canescens	Leaf				X
	Cactaceae	Spine				X
	Cactaceae	Glochid				X
	Opuntia	Seed			7	19
	cf. Chenopodium	Seed			5	
	Gramineae	Seed			2	
	Unidentified	Seed			11	
	Leaves					X
	Stems					X
	CHARCOAL/WOOD:					
	Atriplex	Dominant				X
	Pinus	Present		1		
	Tessaria sericea	Present				X
	NON-FLORAL REMAINS:					
	Bone					1
	Insect					201
	Rodent feces				X	

W = Whole
F = Fragment

TABLE 4
INDEX OF MACROFLORAL REMAINS RECOVERED FROM SITE AZ C:2:32

Scientific Name	Common Name
FLORAL REMAINS:	
Amaranthus	Pigweed, amaranth
Atriplex	Saltbush, orache
Atriplex canescens	Four-wing saltbush
Chenopodium	Goosefoot
Cactaceae	Cactus family
Opuntia	Prickly pear cactus
Gramineae	Grass family
CHARCOAL/WOOD:	
Atriplex	Saltbush
Pinus	Pine
Tessaria sericea	Arrowwood

REFERENCES CITED

Martin, Alexander C. and William D. Barkley
1973 Seed Identification Manual. University of California Press, Berkeley, CA.

Matthews, Meredith H.
1979 Soil Sample Analysis of 5MT2148; Dominguez Ruin, Dolores, Colorado. Appendix B IN The Dominguez Ruin: A McElmo Phase Pueblo in Southwestern Colorado by Alan D. Reed. Bureau of Land Management Cultural Resource Series No. 7, Denver.

Musil, Albina F.
1978 Identification of Crop and Weed Seeds. Agricultural Handbook No. 219, U.S. Department of Agriculture, Washington, D.C.

Schopmeyer, C. S.
1974 Seeds of Woody Plants in the Unites States. Agricultural Handbook No. 450. Forest Service, U. S. Department of Agriculture, Washington, D.C.

BETA ANALYTIC INC.

JERRY J. STIPP, PH.D.
MURRY A. TAMERS, PH.D.
CO-DIRECTORS

4985 S.W. 74 COURT
MIAMI, FLORIDA
33155 U.S.A

Mr. Chris Kincaid
Glen Canyon NRA
PO Box 1507
Page, AZ 86040

December 22, 1992

Dear Mr. Kincaid:

Please find enclosed our report on the three very-small charcoal samples (C:2:32#1 & #2, & C:2:100#1) that you recently converted to AMS radiocarbon dating analyses. A fourth sample (C:2:32#3) was cancelled with the intention to resubmit.

Each of the charcoal samples was first boiled/washed free of all adhering mineral matter and carefully examined/picked under magnification for any intrusive rootlet contamination. The charcoals were then lightly crushed for increased surface reaction area and subjected to repeat-soakings in dilute hot acid and alkali solutions to remove any carbonate or humic acid contaminants. After final thorough rinsings to neutrality in hot distilled water, the clean charcoals were gently dried, combusted to CO2, purified and reacted with hydrogen on cobalt catalysts to produce graphite. The AMS measurements were made in the Zurich laboratory (ETH). The chemical pretreatments and target material conversions were done at Beta Analytic. In discussing the dates in reports or papers, both the Beta- and ETH- numbers should be cited.

This work was billed in advance. Please don't hesitate to call us at any time you have questions or would like to discuss the dates. With best regards I remain

Sincerely yours,

Jerry J. Stipp

TELEPHONE: 305-667-5167 / FAX: 305-663-0964 / BITNET: XNRBET22@SERVAX

BETA ANALYTIC INC.
DR. J.J. STIPP and DR. M.A. TAMERS
UNIVERSITY BRANCH
4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305/667-5167 FAX: 305/663-0964

REPORT OF RADIOCARBON DATING ANALYSES

FOR: Mr. Chris Kincaid
Glen Canyon NRA

DATE RECEIVED: Authorized Nov. 6, 1992
DATE REPORTED: December 22, 1992
SUBMITTER'S PURCHASE ORDER #

OUR LAB NUMBER	YOUR SAMPLE NUMBER	C-14 AGE YEARS B.P. ±1σ			
Beta-57294 ETH-9956	C:2:32#1	3150 +/- 55	BP	(charcoal)	CUTBANK
Beta-57295 ETH-9957	C:2:32#2	1715 +/- 55	BP	(charcoal)	UNIT A
Beta-57297 ETH-9958	C:2:100#1	2430 +/- 55	BP	(charcoal)	HEARTH

Note: these samples were done using the AMS technique. The reported dates have been adjusted by carbon 13.

These dates are reported as RCYBP (radiocarbon years before 1950 A.D.). By international convention, the half-life of liocarbon is taken as 5568 years and 95% of the activity of the National Bureau of Standards Oxalic Acid (original ...tch) used as the modern standard. The quoted errors are from the counting of the modern standard, background, and sample being analyzed. They represent one standard deviation statistics (68% probability), based on the random nature of the radioactive disintegration process. Also by international convention, no corrections are made for DeVries effect, reservoir effect, or isotope fractionation in nature, unless specifically noted above. Stable carbon ratios are measured on request and are calculated relative to the PDB-1 international standard; the adjusted ages are normalized to -25 per mil carbon 13.

SUMMARY REPORT FOR 1992 GCES MONITORING OF ARCHAEOLOGICAL SITES FROM GLEN CANYON DAM TO LEE'S FERRY, GLEN CANYON NATIONAL RECREATION AREA

Prepared by

Lynn A. Neal
Seasonal Archaeologist

and

Lisa M. Leap
Seasonal Archaeologist

Prepared for

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

December 11, 1992

I. INTRODUCTION

A total of 15 archaeological sites and four features (part of C:2:11) were monitored for erosional and human impacts this season between Glen Canyon Dam and Lee's Ferry. Compared to the 1991 GCES monitoring results, changes in site conditions are minimal (see Table 1). Seven of the sites are actively eroding, six are eroding incipiently, and six are stable. Three stationary cameras were installed to monitor erosion at three sites and two features of C:2:11. These camera sites were also recorded under the GCES archaeological monitoring format. A testing and sampling project was conducted at one of the camera sites, C:2:32. A reconnaissance underwater dive was done on the Spencer Steamboat, also selected for camera monitoring. Finally, we conducted a site tour from the Dam to Lee's Ferry for five members of the Paiute tribe. All of these particular projects are discussed below and are outlined in detail in individual trip reports.

II. MAIN OBJECTIVE -- GCES EROSIONAL MONITORING OF ARCHAEOLOGICAL SITES FROM GLEN CANYON DAM TO LEE'S FERRY

Twelve of the monitored sites were selected from a stratified random sample generated by Grand Canyon National Park, Archaeology Department. 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. Table 2 outlines the level of work completed for each site.

Two other sites were monitored for specific reasons. C:3:10 was selected due to its highly eroded condition and the necessity to obtain as much data as possible before it is potentially lost. We recommend that the charcoal lens at this site be tested. C:2:38 was chosen because of the high level of visitation it receives from ARA rafters.

The stationary camera monitoring involved the installation of three cameras, the generation of on-site photo scales, and film retrieval and development. The cameras overlook C:2:12; C:2:100; C:2:11, F.12 and F.14; and C:2:32. Brian Cluer, Grand Canyon National Park/GCES geologist, directed the installation and photo scale processes. We have changed and developed the film three times to date, and this process will be continued by Glen Canyon Resource Management personnel. The film is changed approximately every 34 days, and it is sent to Kodak with specific processing instructions. Upon development, the uncut, unmounted processed film is sent to Brian Cluer for photo data analysis. The stationary camera sites were also recorded under the GCES archaeological monitoring format.

III. TESTING AND CHARCOAL SAMPLING AT C:2:32 AND C:2:100

Charcoal and flood deposit samples were collected for radiocarbon dates at archaeological sites C:2:32 and C:2:100. Three samples were collected at C:2:32 -- two charcoal and one of flood-deposited macrofloral material, and one charcoal sample was taken from a probable hearth at C:2:100. All four samples have been sent in for analysis, and we are waiting for the results.

The purpose of excavating a test unit at C:2:32 was to determine if the charcoal lens, visible in the cutbank, continued northward into the terrace. Additionally, we wanted to see if any subsurface cultural materials were present

TABLE 1. SITES AND FEATURES MONITORED BETWEEN 6-25-92 AND 10-27-92.

DATE	SITE	TYPE	RIVER MILE AND BANK	PREVIOUS (1991)/ CURRENT CONDITION
6-25-92	C:2:75	Lithic scatter	-11.1LB	Active Erosion
6-26-92	C:2:38	Rock art	-09.9LB	Incipient Erosion
	C:2:32	Charcoal lens	-09.8LB	Active Erosion
6-29-92	C:2:74	Shelter with lithics	-08.5LB	Incipient/Stable
7-01-92	C:2:82	Shelter with artifact scatter	-02.6LB	Incipient Erosion
8-19-92	C:2:95	Shelter with artifact scatter	+00.1RB	Incipient Erosion
	C:2:72	Prehistoric and hist. artifact scatter	-00.1LB	Active Erosion
8-20-92	C:2:57	Historic homestead	-00.1LB	Incipient Erosion
	C:2:12	Dugway	+00.1LB	Active Erosion
8-21-92	C:2:100	Charcoal lens and artifacts	-00.5LB	Active Erosion
	C:2:11 F.14	USGS Cableway	-00.5LB	Stable/Incipient
	C:2:11 F.6	Walls on Cable Crossing Hill	-00.5LB	Incipient/Stable
	C:2:11 F.5	Historic inscriptions	-00.5LB	Incipient/Stable
8-22-92	C:2:41	Prehistoric structure and artifacts	-01.3LB	Stable
	C:2:106	Artifact scatter and roasting feature	-02.2LB	Incipient Erosion
8-23-92	C:2:80	Lithic scatter	-03.1RB	Stable
8-24-92	C:2:53	Artifact scatter	+00.2RB	Stable
9-10-92	C:2:11 F.10	Spencer Steamboat	-00.5RB	Active Erosion
10-27-92	C:3:10	Charcoal lens	-14.6LB	Active Erosion

TABLE 2. LEVEL OF WORK COMPLETED FOR EACH MONITORED SITE.

SITE	RIVER MILE AND BANK	LEVEL OF WORK
C:2:11 F.5	-00.5LB	Photos
C:2:11 F.6	-00.5LB	Photos, updated IMACS
C:2:11 F.10	-00.5RB	GCES monitoring form, terrestrial & underwater photos, camera location, trip report
C:2:11 F.14	-00.5LB	GCES monitoring form, photos, camera location
C:2:12	+00.1LB	GCES monitoring form, photos, camera location
C:2:32	-09.8LB	GCES monitoring form, photos, camera location, tested and sampled, testing report
C:2:38	-09.9LB	GCES monitoring form, GLCA monitoring & maintenance forms 9 & 11, photos, edited IMACS
C:2:41	-01.3LB	GCES monitoring form, photos
C:2:53	+00.2RB	GCES monitoring form, photos
C:2:57	-00.1LB	GCES monitoring form, photos
C:2:72	-00.1LB	GCES monitoring form, photos, updated map
C:2:74	-08.5LB	GCES monitoring form, photos, updated IMACS
C:2:75	-11.1LB	GCES monitoring form, photos, updated IMACS
C:2:80	-03.1RB	GCES monitoring form, photos, edited map
C:2:82	-02.6LB	GCES monitoring form, photos
C:2:95	+00.1RB	GCES monitoring form, photos

C:2:100	-00.5LB	GCES monitoring form, photos, camera location, sampled, testing report, edited IMACS, updated map
C:2:106	-02.2LB	GCES monitoring form, photos, updated IMACS, edited map
C:3:10	-14.6LB	GCES monitoring form, photos, edited IMACS

to justify C:2:32 as a cultural site, particularly since no artifacts exist on the surface.

No artifacts were located in the test unit, cutbank or flood deposit of C:2:32. Charcoal samples were obtained from all three areas to date the different burned and depositional episodes. Based on depth and stratigraphy, the charcoal lens exposed in the cutbank appears to be the same charcoal lens present at the bottom of the test unit. However, the lens in the unit is much thinner than the cutbank lens. Hopefully, radiocarbon dates from both locations will provide more reliable evidence as to whether the lenses are directly associated. Based on these findings, our preliminary conclusions are as follows: (1) the charcoal lens at C:2:32 most likely is not of cultural origin and was derived from natural cause; (2) the lens does not extend far to the north of the cutbank; and (3) the samples are still extremely useful for dating the terrace deposits in which they occur.

The urgency to test and sample the charcoal deposits at C:2:32 and C:2:100 resulted due to the exposure of these deposits in actively eroding cutbanks. Whether or not these charcoal features were exposed and eroded due to the dam's interim flows is a question being addressed through various GCES long-term monitoring activities, such as terrestrial photogrammetry and erosional monitoring. Nevertheless, since the features were exposed, it was important to deal with them in a timely and efficient manner. Furthermore, the testing results will aid in the park's ability to evaluate the cultural significance of these sites. If continuing monitoring efforts reveal further erosion and exposure, additional testing and sampling and possibly complete excavation may be necessary.

IV. SPENCER STEAMBOAT RECONNAISSANCE DIVE

In addition to the completion of GCES archaeological monitoring documentation for the steamboat (C:2:11, F.12), a dive was done to assess the boat's underwater condition. Many photographs were taken under good diving conditions. The boat looks in relatively good shape when compared with the last underwater photographs taken in 1986. Overall, the Spencer appears in better condition underwater, but the portions exposed above the water's surface are being heavily impacted by wet/dry cycling. Recommendations for best preserving the steamboat are extending the no wake zone around the Lee's Ferry boat launch area to incorporate the Spencer, and keeping the vessel underwater at all times. An "ideal" flow of 10,000 cfs or higher would accomplish the latter recommendation.

V. PAIUTE FAMILIARIZATION TRIP

Five members of the Paiute tribe (three Kaibab and two Shivwits) were given a tour of the various resources on the Colorado River from the Dam to Lee's Ferry. Two affiliates with the Bureau of Applied Research in Anthropology at the University of Arizona conducted ethnographic interviews at two prehistoric archaeological sites. In preparation for this trip, we visited five sites that were previously documented as having possible Paiute affiliation. Two of these, C:2:57 and C:2:106, are located on the Colorado River corridor. One (C:2:56) is located within the boundaries of the Lee's Ferry Historic District (C:2:11). The

remaining two are located off the Colorado River: C:2:2 is situated on the right bank of the Paria River, and C:2:43 is located just north of Cathedral Wash on the left hand side of the Lee's Ferry access road. C:2:57 and C:2:106 were monitored for erosion this season. We attempted to relocate C:2:56 but could not find it; however, additional prehistoric petroglyphs not previously recorded were found and were plotted on the site map. C:2:2 and C:2:43 were difficult to relocate since they were both misplotted on the topographic maps. We changed the plots for both sites and also completed GLCA Monitoring and Maintenance forms 9 and 11 for C:2:2.

We highly recommend that the next group of Paiutes to take a raft trip from the Dam to Lee's Ferry visit at least sites C:2:57 and C:2:106 since they are located directly on the Colorado River corridor.

VI. RECOMMENDATIONS AND IDENTIFICATION OF SITES TO BE MONITORED

The monitoring of all sites within the Colorado River corridor should continue under the random selection process. 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 impacted directly by the river's interim flows, and any sites with eroding charcoal features. If charcoal features are severely eroding, they should be tested. The level and frequency of monitoring at a given site is dependent on the erosional processes active at the site and the urgency to document any features that might be eroded or impacted by these processes.