



United States Department of the Interior

NATIONAL PARK SERVICE
Water Resources Division
1201 Oak Ridge Drive, Suite 250
Fort Collins, CO 80525

April 1, 2021

To: Karen Bradford, Superintendent, Arkansas Post National Memorial (ARPO),
National Park Service (NPS), Gillett, Arkansas

From: Nic Medley, Hydrology and Watershed Management Program, NPS Water
Resources Division (WRD), Fort Collins, Colorado

Through: Mike Martin, Lead, Hydrology and Watershed Management Program, NPS,
WRD, Fort Collins, CO *Michael Martin*

cc: Kirby McCallie, Resource Manager, ARPO, NPS, Gillett, AR
Tim Schilling, Archeologist, NPS Midwest Archeology Center, Lincoln, NE
Forrest (Ed) Harvey, Chief, NPS WRD, Fort Collins, CO

Subject: Technical Assistance Request, #10752 –Bank Erosion and Stabilization, Arkansas
Post National Memorial, Gillett, Arkansas. A request for technical assistance
from WRD to recommend best management practices to protect archaeology
resources and preserve site.

Technical Assistance Request

ARPO has requested technical assistance from WRD to assess the cause of continuing and widespread shoreline erosion, and to make a recommendation on how the park should seek to address the problem while conserving the parks archaeological resources. Additionally, there are more localized areas of erosion associated with site specific drainage patterns that need to be addressed. Other than a general need to assess and fix the problem, the park contains considerable archeological resources that are at risk of loss as shoreline erosion encroaches on known historic sites.

In making a recommendation, the underlying assumption is that whatever action is prescribed, it must fully protect any remaining archeology. Accordingly, remediation actions cannot result in the removal or regrading of any material that may contain archeology, which creates considerable constraints on the types of actions that can be implemented.

It should be noted that the recommendations offered are provided without the benefit of a site visit due to Covid-19 restrictions, and based only on discussions with, and materials provided by park staff, and the authors' research. Thus, recommendations are somewhat general, and there will be a need for a comprehensive, site-specific analyses to address what will be continuing long term erosion challenges that are likely to occur.

Recommendation Summary

- ARPO should consult with and seek technical and planning expertise and funding from the U.S. Army Corps of Engineers (USACE), the agency with primary responsibility for managing and maintaining Arkansas River Navigation System (ARNS).
- The park should work with USACE to conduct a detailed survey of the shoreline and an assessment of the condition of the previous rock revetment erosion control, leading to the development of a long-term shoreline management plan and appropriate mitigation actions, including pathway for conducting necessary environmental compliance.
- Within a clear planning and compliance framework, the park and cooperators should address general and localized erosion by:
 - Control erosion at water-land interface by repairing and/or “shotcreting” existing rock revetment, or construction of new shoreline bulkhead.
 - In areas of active drainage where gullies are forming, reinforcement of drainage bottom with rock, concrete, small dams, woody vegetation, and/or confining flow within pipes/culverts of sufficient size to accommodate large flow events associated with stormwater runoff.
 - Back filling and regrading to an appropriate slope
 - Reseeding with native cover.
 - Replanting with native riparian woody vegetation where appropriate.
 - In areas of high use, such as fisherman access points in existing gullies, creation of permanent infrastructure such as paved footpaths and steps.

Background Information

Throughout its history Arkansas Post has undergone cycles of settlement, loss, and relocation in response to natural lateral erosion caused by seasonally high, unregulated flows in the Arkansas River (Thornberry-Ehrlich 2013). In 1946, Congress authorized the McClellan-Kerr Arkansas River Navigation System (ARNS) (<https://encyclopediaofarkansas.net/entries/mcclellan-kerr-arkansas-river-navigation-system-2309/>). The goal of ARNS was to control the unpredictable flows of the Arkansas River and to convert the wide, shallow, highly dynamic, sand bedded river into a stable, navigation corridor originating at the Tulsa Port of Catoosa and running southeast through Oklahoma and Arkansas to the Mississippi River. The Project is operated by the U. S. Army Corps of Engineers (USACE).

(https://en.wikipedia.org/wiki/McClellan%E2%80%93Kerr_Arkansas_River_Navigation_System). A component of the project included construction of the Wilbur D. Mills Dam (WMD) located on the Arkansas River, approximately three-quarters of a mile below ARPO.

Prior to construction of ARNS, what remained of the Post was situated high on an easily erodable terrace, ~25 feet above the river, on a narrow peninsula bounded by the Arkansas River to the east, and a small tributary stream to the west. However, upon construction of the dam and impoundment of water behind it, the level of the river rose approximately 20ft and is currently managed to maintain an elevation of less than 162ft elevation above mean sea level (MSL) at the dam. Relative to the new water level, the park is now a low-lying peninsula bounded by Post Bayou (West) and Post Bend Lake (East) which were created behind WMD (Figure 1). At the time of construction, it was recognized by the USACE that the increase in water surface elevation associated with high energy wave action would lead to severe erosion of the new shoreline if nothing was done to mitigate such a response (USACE 1962a). Accordingly, in 1963, after consultation with ARPO, the USACE variously placed rock revetment around the new ARPO shoreline between 160ft and 165 ft above MSL to protect from wave wash at elevation 162 ft, back-filled with compacted earth, regraded steep banks and seeded. In 1991 during consultations between ARPO and USACE concerning the extension of the “occasional flowage easement” to elevation 167ft (USACE 1991), ARPO expressed its concern about the increased potential for erosion and loss of archeological resources, and requested that the Corps conduct an archeology survey before the easement was granted. At this time, the USACE argued that the original mitigation was still functioning as designed and adequately protecting the site from adverse effects of wave-wash, and that a site assessment was unnecessary.

However, analysis of Arkansas River water surface elevations (WSE) since the construction of WMD shows that while the USACE have done an excellent job of managing to maintain the desired WSE elevation, the data also shows that water surface elevations in excess of 165 ft have occurred 42 days during the period of record and have reached as high as 169 ft into the extended flowage easement, above the original revetment. While high WSE’s are uncommon, it is likely that during such times, considerable erosion can occur during windy storm events that create intense high energy wave action that extend well above 165 ft. Additionally, given the unconsolidated nature of the shoreline material it is likely that erosion from behind the rock revetment occurs at all water surface elevations when conditions allow. The implementation of two previous, partial shoreline stabilization projects through the construction of wooden bulwarks to protect the toe of the shoreline bank slope, confirm that in some shoreline areas, the original mitigation was insufficient to fully prevent bank erosion and exemplifies the problem that ultimately faces much of the shoreline at ARPO (USACE 1999).



Figure 1. Aerial photograph of ARPO, showing low-lying peninsula bounded by Post Bayou (West) and Post Bend Lake (East).

Causes of Erosion at ARPO and Management Recommendations

Shoreline Erosion

The cause of bank erosion and retreat of the shoreline at some places at ARPO has likely occurred through adverse erosional effects at the toe of the bankline slope as the shoreline establishes a new equilibrium position as a general response to increase WSE associated with construction of WMD on the Arkansas River. In photos provided by the park, this is indicated by erosion beyond the rock revetment, steep shoreline slopes, and exposed tree roots.

The longterm challenge is to prevent loss of archeological artifacts by permanently stabilizing the shoreline to prevent further landward retreat. While the placement of rock revetment has certainly reduced the rate of erosion, and in some areas still largely protects the shoreline, it is likely that over time, the shoreline will continue to retreat in many areas before it reaches a stable configuration for the new WSE.

The primary recommendation is to conduct a detailed survey of the shoreline and an assessment of the current condition of the original erosion prevention. Of particular interest would be to assess the current elevation of the rock revetment which in some places may have slumped due

to erosion from behind the rock, and to make an assessment of whether, and where it is meeting its original design specifications and intended function. A better understanding of the causes and extent of shoreline erosion could then lead to the development of a long-term shoreline management plan as a vehicle to seek funding for the maintenance of, and/or design and construction of additional shoreline stabilization projects, as found necessary.

Towards this goal, WRD recommends that the park initially consult with, and seek technical and planning expertise and funding from the USACE, the agency with considerable experience to address such erosion issues and the agency with primary responsibility for managing ARNS. Consistent with the June 20, 1962 letter to the Honorable Charles A. Buckley, Chairman, Public Works Committee, House of Representatives, the USACE is “.... responsible for periodic maintenance to repair damages to the banks within the Memorial resulting from the Navigation Project. The National Park Service will be responsible for preventative maintenance and continuing maintenance of a ‘housekeeping’ nature in the protected area” (USACE 1962b).

Since it is unlikely that the park will get enough money to implement a comprehensive plan in one funding cycle, it should work with the USACE, or consultant, to develop a park wide, phased, erosion control plan, that addresses priority areas and then slowly work to implement a park-wide plan as funds become available. Any plan should also identify the need, and a pathway, to conduct the necessary environmental compliance to implement any proposed projects. Such compliance would include review under the National Historic Preservation Act, National Environmental Policy Act, Clean Water Act, and other state and federal laws as appropriate.

Generally, NPS Management Policies might suggest that bio-engineering techniques be appropriate for many parks, but given the potential for high energy wave action in this easily erodible environment, and the need to keep park lands in an undisturbed condition to protect the remaining archeology and its context, it is likely that repositioning and concreting of rock, or replacement by a vertical, hard structure is most practical in areas of severe erosion. While “greener” bioengineered approaches should not be ruled out and used where appropriate, the best indication of the need for a hard structure is the previous park projects to construct wood bulkhead on some parts of the shoreline where the original revetment was not sufficient to prevent erosion. In the future, such a bulkhead will likely be needed in additional areas. The placement of such a structure relative to the shoreline and its depth and height will need to be based on specific design criteria in order to affordably prevent further erosion, while avoiding and/or minimizing the need for soil disturbance, regrading, and backfilling. The decision on whether to treat the entire shoreline as one large project, or as a series of smaller scale projects implemented as need arises, is something that can be determined during such a planning process

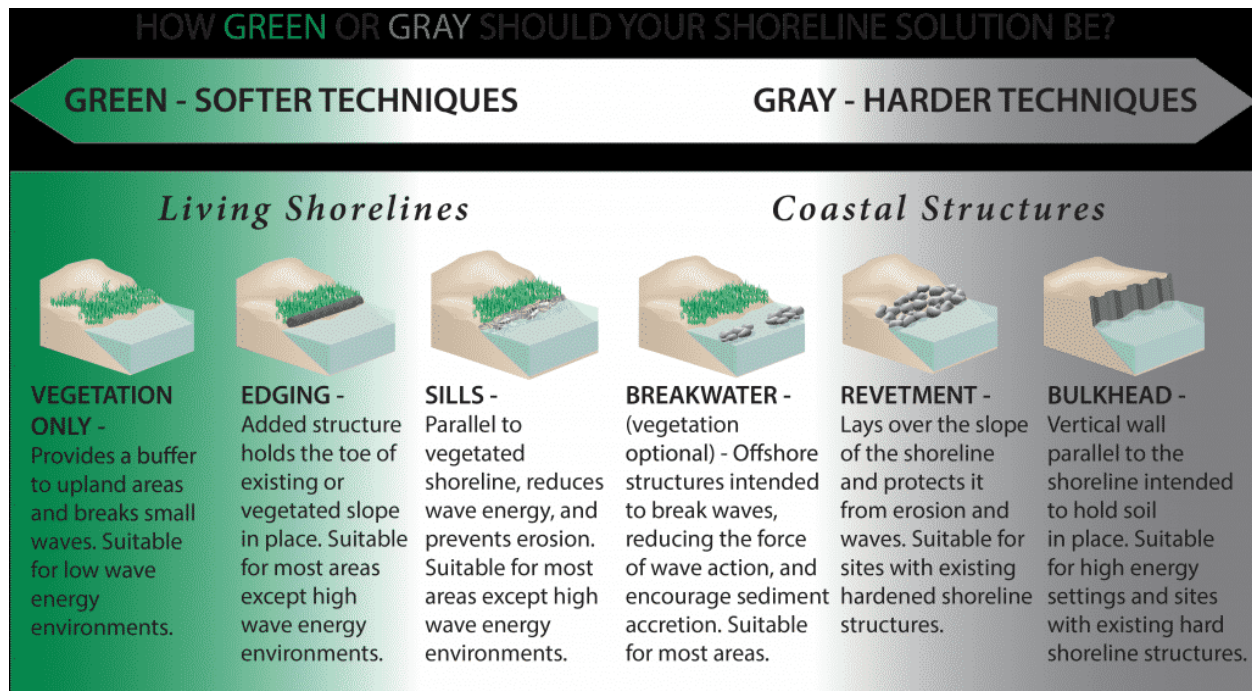


Figure 1. Range of approaches to shoreline stabilization. Given the general high energy environment at ARPO, hard engineered structures will likely be necessary in areas of severe shoreline erosion. From: <https://ncbs.ifas.ufl.edu/extension/dealing-with-coastal-erosion/coastal-erosion/>

To inform how the park may choose to proceed, there are examples from other parks that have had to address similar issues. Perhaps the best example of the efforts and approaches required is the erosion control installed to protect archeology sites at Voyageurs National Park, MN, where increased erosion and lake-wide shoreline adjustment occurred in response to an increase in water surface elevation associated with the building of a small hydropower dam (Lynott 1984). While the solution in Voyageurs was less intrusive, but perhaps no less expensive than the one recommended here, it does illustrate the difficulty and expense of protecting archeology to avoid any further disturbance or loss. Another more recent example is the effort to protect archeology resources at Fort Laramie National Historical Park, WY, where river incision and lateral erosion is threatening known archeological sites. Again, the bioengineered prescription is both technically complex, expensive, and prone to early failure if not correctly designed, planned and implemented.

Site Specific Erosion

Several sites within ARPO exhibit some indication of more localized erosion due to stormwater runoff and flow concentration exacerbated by human use patterns such as easier fisherman

access in small eroding gullies. However, it is also likely that the change in the location and elevation of the shoreline control point in response to the change in WSE has also caused some head-cutting and knickpoint migration leading to channel lowering and incision. Consequently, while implementation of best management practices to mitigate the local causes of erosion are recommended, it should again be emphasized that it is also desirable assess the current state of the shoreline, and to stabilize the toe of the slope at the water-land interface to address more general causes of local erosion.

It should also be noted that the geology and unconsolidated sediments of the park makes it highly susceptible to considerable widespread erosion and that the park should always be proactive to identify and control knickpoints when they are first observed so that they do not become bigger problems.

The following best management practices recommended include:

- Control erosion at water-land interface by repairing and/or shotcreting existing rock revetment, or construction of new shoreline bulkhead.
- In areas of active drainage where gullies are forming, reinforcement of drainage bottom with rock, concrete, small dams, woody vegetation, and/or confining flow within pipes/culverts of sufficient size to accommodate large flow events associated with stormwater runoff.
- Back filling and regrading to an appropriate slope
- Reseeding with native cover.
- Replanting with native riparian woody vegetation where appropriate.
- In areas of high use, such as fisherman access points in existing gullies, creation of permanent infrastructure such as paved footpaths and steps.

References

Lynott 1984. Stabilization of the Clyde Creek Site, 21SL35, Voyageurs National Park. Mark J. Lynott, Midwest Archeological Center, National Park Service, Lincoln, Nebraska. July 1984.

Thornberry-Ehrlich 2013. Arkansas Post National Memorial: Geologic resources inventory report. Natural Resource Report NPS/NRSS/GRD/NRR—2013/731. National Park Service, Fort Collins, Colorado.

USACE 1962a. Map showing bank protection proposed to protect Arkansas Post National Memorial from wave action at elevation 162ft. December 1962.

USACE 1962b. Letter from USACE to Honorable Charles A Buckley, Chairman, Public Works Committee, House of Representatives, concerning proposed protection of Arkansas Post National Memorial and responsibility for maintenance and repair of damages resulting from ARNS. June 20, 1962.

USACE 1991. Letter from USACE District Engineer to Advisory Council on Historic Preservation Western Office of Project Review for comment on the USACE request to Arkansas Post National Memorial for extension of occasional flowage easement. March 14, 1991.

USACE 1999. Letter from USACE to NPS re Consent to Easement Structures for the construction, use, and maintenance of bank stabilization and placement of rip rap at the location shown in red on Exhibit A. Consent No. DACW03-9-99-1027. Project: Wilbur D. Mills Dam and Lock No. 2. Tract No: 147E-4. July 22, 1999.

Technical Assistance Request

STAR Request Id - 10752

Requestor	Kirby McCallie(Kirby_McCallie@nps.gov)	
Created By	Kirby McCallie(Kirby_McCallie@nps.gov)	
Current Status	Accepted	
Park	Arkansas Post National Memorial	
Region	Midwest Region	
Title	Bank Erosion and Stabilization	
Fiscal Year	2020	
Primary Subject Area	Archeology	
Problem Statement		
Problem: Park's shoreline is rapidly eroding and in need of stabilization. Background: The park is a peninsula bounded by Post Bayou, Post Bend Lake, and the Arkansas River. Post Bayou and Post Bend Lake were "created" when the Army Corps of Engineers (USACE) constructed dam number two on the Arkansas River, which is located approximately three-fourths of a mile south of the park. The dam construction was completed in the late 1960's and this caused a marked increase in the water level surrounding the park. Additionally, the USACE placed rip-rap at expected water levels along the shoreline of the park. The shoreline above the rip-rap appears to have eroded and is in need of stabilization. To further complicate matters, the entire park contains known and unknown archeological and cultural resources. Maps and photos have been uploaded to the documents section.		
Target Expertise		
Archaeologist including Dawn Bringelson		
What are you asking the NRSS to do?		
Identify and document cultural features and recommend best management practices to preserve site		
Super Approved	Yes	
Travel Needs?	Request NRSS travel assistance	
Park has Travel Funding	No	
Requires Private Land Access	No	
Expected date of completion	03/31/2020	

Other Fiscal Years		2019		
Park Rank		1		
Region Rank				
TAR Comments				
3/12/2019 11:01 AM	McCallie, Kirby	General	Dawn Bringleson from the Midwest Archaeological Center is our park Archaeologist and I request that she is added to review and add her expertise advice.	Park Ranker, Creator, Requester
3/20/2019 8:40 AM	Stumpf, Julie	General	Also see Request #10742	Region Approver
Documents				
ARPO_bank_erosion.pdf		McCallie, Kirby	03/12/2019	
ARPO_bank_erosion_zoom.pdf		McCallie, Kirby	03/12/2019	
Photos of erosion..docx		McCallie, Kirby	03/12/2019	
Data Store References				
Alternate Contacts				
Dawn	Bringelson	dawn_bringelson@nps.gov	402-437-5392 ext. 105	
Park Ranker(s)				
Kirby McCallie		Kirby_McCallie@nps.gov		
Region Approver(s)				
Julie Stumpf		Julie_Stumpf@nps.gov		
Carmen Thomson		Carmen_Thomson@nps.gov		
Christopher Holbeck		Chris_Holbeck@nps.gov		
Robert Bryson		Robert_Bryson@nps.gov		
Program Area		Hydrology and Watershed Management		
Secondary Program Areas				
Program Area Leads				

Mike Martin		Program Area Lead
Technical Assistance Lead		
Martin, Mike	Mike_Martin@nps.gov	
Actual Hours		
Park Visit Log		
No Visits Found		
History		
3/12/2019 10:56:17 AM	McCallie, Kirby	Request Created
3/12/2019 11:01:13 AM	McCallie, Kirby	Request has been updated
3/12/2019 11:04:02 AM	McCallie, Kirby	Request has been updated
3/12/2019 11:05:22 AM	McCallie, Kirby	Program Area set to Soil Resources Management
3/12/2019 11:06:43 AM	McCallie, Kirby	Request has been updated
3/12/2019 11:07:00 AM	McCallie, Kirby	Request has been updated
3/12/2019 11:08:02 AM	McCallie, Kirby	Request has been updated
3/12/2019 11:08:30 AM	McCallie, Kirby	Request has been updated
3/12/2019 11:08:30 AM	McCallie, Kirby	Lifecycle set to Park & Region Review
3/12/2019 11:08:41 AM	McCallie, Kirby	Request has been updated
3/20/2019 8:40:21 AM	Stumpf, Julie	Request has been updated
3/20/2019 8:40:30 AM	Stumpf, Julie	Lifecycle set to Program Area Review
6/21/2019 4:11:53 PM	Commins, Bill	Program Area set to Hydrology and Watershed Management
6/21/2019 4:11:53 PM	Commins, Bill	Lifecycle set to Accepted
1/9/2020 7:11:05 AM	Martin, Mike	Technical Assistance Lead Added: Mike Martin