Knife River Indian Villages
North Dakota

US Department of the Interior
National Park Service

Knife River Indian Villages National Historic Site

Archeological Resources Management Plan/ Environmental Impact Statement

DRAFT

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UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
KNIFE RIVER INDIAN VILLAGES NATIONAL HISTORIC SITE
ARCHEOLOGICAL RESOURCES MANAGEMENT PLAN / DRAFT ENVIRONMENTAL IMPACT STATEMENT

Lead Agency: National Park Service (NPS), US Department of the Interior (Interior)

This Knife River Indian Villages National Historic Site Archeological Resources Management Plan / Draft Environmental Impact Statement (plan/draft environmental impact statement) evaluates the impacts of a range of alternatives for managing and protecting archeological resources at the Knife River Indian Villages National Historic Site (park) while preserving natural resources and processes and enhancing visitor experience.

This plan/draft environmental impact statement evaluates the impacts of alternative 1: no-action, alternative 2: relocate facilities in the park, and alternative 3: locate facilities off-site. Under the no-action alternative, management of archeological resources at the park would continue as currently implemented. Existing park infrastructure would remain in place. Management activities associated with ongoing riverbank erosion, northern pocket gopher (*Thomomys talpoides*) activity, and vegetation encroachment would continue. Under both alternatives 2 and 3, archeological resources at the park would be managed within an "adaptive management framework" consistent with the objectives of the plan. Adaptive management would be used to address riverbank erosion, pocket gopher activity, and woody vegetation encroachment. Under alternative 2, the maintenance facility and museum collections storage would be relocated to one of two potential sites in the park, and the existing maintenance facility would be removed. Alternative 3 would relocate the maintenance facility and/or museum collections storage to space located outside the park boundary. Two options are considered for alternative 3—under option 1, new off-site facilities would be constructed; under option 2, off-site space would be leased for the relocation of facilities. Under either option, the existing maintenance facility would be removed. The National Park Service has identified a preferred alternative that would incorporate elements of alternative 3 (options 1 or 2) and include additional specified components. Under the preferred alternative, the museum collections storage would remain in its current location provided that efforts to address water infiltration issues prove successful. In the event efforts are ultimately ineffective, the National Park Service would move the museum collections storage off-site. In addition, under the preferred alternative, the National Park Service would identify land through a General Services Administration build-lease arrangement to build an off-site maintenance facility to suit park needs. However, the relocation of the facilities off-site is not currently feasible because of existing local regulations and lack of available space. As such, the National Park Service intends to relocate and construct the maintenance facility in the park, unless the opportunity to lease or build off-site arises.

This plan fulfills the highest priority need identified in the park's foundation document, completed in 2013, and serves as an update to the 1985 General Management Plan. This follows the National Park Service's "Planning Portfolio" construct, consisting of a compilation of individual plans, studies and inventories which together guide park decision-making. The planning portfolio enables the use of targeted planning products (such as this one) to meet a broad range of park planning needs, a change from the previous National Park Service focus on standalone general management plans. The general management plan remains a critical piece of the planning framework, and will be revised in a timely manner through the park's planning portfolio.

The review period for this document will end 60 days after publication of the US Environmental Protection Agency Notice of Availability in the *Federal Register*. During the 60-day comment period, comments will be accepted electronically through the NPS Planning, Environment, and Public Comment (PEPC) website, in hard copy delivered to the address below, and during public meetings on the plan/draft environmental impact statement. Comments will not be accepted by fax, email, or in any other form than those specified above nor will bulk comments in any format submitted on behalf of others be accepted.

For further information, visit http://parkplanning.nps.gov/knri or contact:

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SUMMARY

INTRODUCTION

The National Park Service (NPS) is proposing a plan to manage archeological resources at Knife River Indian Village National Historic Site (park). The Knife River Indian Villages National Historic Site Archeological Resources Management Plan / Draft Environmental Impact Statement (plan/draft environmental impact statement) would provide a suite of proactive management tools to preserve archeological resources and manage and curtail existing threats to these resources.

The National Park Service has prepared this environmental impact statement (EIS) in accordance with the requirements of the National Environmental Policy Act (NEPA) and Director's Order 12: *Conservation Planning, Environmental Impact Analysis, and Decision-making* (NPS 2011) and its accompanying handbook (NPS 2001, 2015a). The National Park Service is the lead federal agency under the National Environmental Policy Act.

Situated on the river bluffs and floodplains along the Missouri and Knife Rivers, the 1,748.8-acre park at the confluence of the Knife and Missouri Knife Rivers in Mercer County, North Dakota, was established to help convey they story of thousands of years of human habitation in what is now North Dakota (NPS 2013). The park is located in an area of the Northern Plains known to archeologists as the Knife River Region, the portion of the Missouri River Valley between the mouths of the Knife and Heart Rivers in central North Dakota. Three large village sites—Hidatsa Village (Big Hidatsa site), Awatixa Village (Sakakawea site), and Awatixa Xi'e Village (Lower Hidatsa site)—are the park's primary interpretive sites.

PURPOSE OF THE PLAN

The purpose of the plan is to provide a framework for proactive, sustainable archeological resource management at the park for the next 30 years.

NEED FOR ACTION

The National Park Service has identified four major threats to archeological resources at the park. While riverbank erosion is the most visible and documented threat to archeological resources, additional impacts result from northern pocket gopher (*Thomomys talpoides*) activity, vegetation encroachment, and infrastructure location (Sturdevant 2009).

A standard set of management actions is needed to address these threats. These actions should

- provide a proactive and coordinated approach to resource management
- maximize archeological resource preservation, while allowing natural processes to the extent possible
- allow for management that adjusts to the resource condition with an appropriate response mechanism
- provide for visitor use, traditional tribal use, education, and research opportunities

The major threats to the park's archeological resources are described below.

Riverbank Erosion

The Knife River, a tributary to the Missouri River downstream of the Garrison Dam, runs the length of the 1,748.8-acre park. Archeologists have identified flooding and erosion as the greatest threats to the park's archeological resources (Sturdevant 2009). Substantial portions of the bank of the Knife River have been lost over the past few decades, leading to the irretrievable loss of adjacent village remnants and archeological sites. At least twice in the last decade, massive flood and ice flow events caused serious impacts on riverbanks, archeological sites, and park infrastructure (Cummings 2011). Archeologists have resorted to excavating threatened archeological deposits at the park to document resources and preserve data before they are lost to erosion.

Additionally, riverbank erosion in the park threatens two county roads—one adjacent to the park and one running through the park to private property. Bank stabilization structures have been constructed at various locations in the park and upstream along the Knife River to protect roads and private property. These structures have affected the natural hydrology of the Knife River and likely have affected park sites downstream. Work associated with potential relocation or repair of these roads could affect archeological sites and represents another threat to these resources.

Northern Pocket Gopher

Northern pocket gophers affect archeological sites by displacing soil and artifacts from chronologically stratified deposits. Pocket gopher activity is indicated by fresh soil mounds present in the villages and other archeological sites. Artifacts are continuously exposed by gopher activity; park staff monitors the mounds for important or unusual artifacts that are later placed in the museum collections.

Vegetation Encroachment

The encroachment of woody and overgrown vegetation into archeological sites causes multiple issues for these sites. Root growth results in displacement of chronological layers, similar to the impacts of pocket gophers. Vegetative growth also makes some areas inaccessible for archeological research. Impacts from vegetation are continuing to degrade conditions at the primary village sites in the park.

Infrastructure Impacts

The NPS maintenance facility is a visual intrusion in the cultural landscape of the park, particularly for the Big Hidatsa site, one of the park's most important cultural sites and a primary interpretive site. The state historic preservation officer; the Mandan, Hidatsa, and Arikara Nation (MHA Nation) tribal historic preservation officer; and the NPS Midwest Region Tribal Relations and Indian Affairs Manager have recommended that the facility be relocated to remove this visual impact from the park. In addition, the maintenance facility is located near burial sites and areas considered sacred by the tribes traditionally associated with the resources present in the park. The tribes consider this an inappropriate intrusion.

The current visitor center was built in 1992 in the southwest corner of the park, in an area that was not associated with identified archeological sites. The museum collections and staff offices are located in the visitor center building. This building has had water infiltration problems since construction was completed and has created issues for the museum collections storage area, located in the basement. Water issues have contributed to fluctuations in the temperature and relative humidity in the storage space, creating the potential for mold growth and damage to museum archives, objects, and records if not resolved (NPS 2013). This issue has been addressed many times, but no solution has eliminated the water infiltration entirely.

PUBLIC REVIEW PROCESS

The notice of intent for the project was published in the *Federal Register* on February 13, 2014. The notice of intent announced that the National Park Service as the federal lead agency would prepare an environmental impact statement and include background information, potential alternatives, and methods for public comment. The comment period closed on September 30, 2014. The final environmental impact statement will include a summary of the draft EIS revision process and a brief description of public comments received.

Public Involvement

The National Park Service issued a public scoping newsletter on August 7, 2014. The newsletter was sent to the park's mailing list and posted on the park's Planning, Environment, and Public Comment (PEPC) website. The newsletter described the plan process and the preliminary purpose, need, objectives, and alternatives. In addition to the newsletter, the plan was also announced through local media outlets and on the park's website.

In support of the public scoping effort, the National Park Service hosted three public scoping meetings intended to obtain public input on the initial purpose, need, and objective statements for archeological resources management at the park. Meeting announcements were mailed to interested parties and public notices announcing the public scoping period and meetings were published in state newspapers at the end of July 2014. The meetings were held on:

- Wednesday, August 13, 2014, from 2:00 p.m. to 4:00 p.m. at the MHA Nation Museum, New Town, North Dakota—this meeting was advertised as a special meeting for tribal elders
- Wednesday, August 13, 2014, from 6:00 p.m. to 8:00 p.m. at the MHA Nation Museum, New Town, North Dakota
- Thursday, August 14, 2014, from 6:00 p.m. to 8:00 p.m. at the Knife River Indian Villages National Historic Site Visitor Center, Stanton, North Dakota

Concerns and Issues

Over the course of the 60-day comment period, four pieces of correspondence were received. The four letters received during the public scoping period contained a total of 70 comments. Comments received focused on management actions that could possibly be used to address pocket gophers, vegetation encroachment, and riverbank erosion. Discussion focused on clarifying the nature of the threats to archeological resources at the park.

ALTERNATIVES

The alternatives analyzed in this draft environmental impact statement include alternative 1: no-action, alternative 2: relocate facilities in the park, and alternative 3: locate facilities off-site. The National Park Service identified a preferred alternative that would incorporate elements of alternative 3 (options 1 or 2), as described below, and include additional specified components.

No-Action Alternative

Under the no-action alternative, management of archeological resources at the park would continue as currently implemented. Management would respond to archeological resource threats but without the benefit of site prioritization and a proactive adaptive management framework. Under the no-action alternative, existing park infrastructure would remain in place. Ongoing riverbank erosion, pocket gopher control, and vegetation encroachment management activities would continue.

Elements Common to All Action Alternatives

The problems affecting archeological resources in the park are described above.

However, because the risks posed by the identified resource threats vary by archeological site throughout the park, a more detailed assessment of the resource problem at the scale of individual archeological site was warranted. As a result, park management developed a process to prioritize archeological sites based on importance and level of risk to inform management decisions. This site prioritization tool is necessary because the majority of archeological sites in the park are affected by one or more resource threat, and limitations in resources, primarily annual funding and staffing, preclude the park from addressing all threats at all sites when initially implementing the plan. The site prioritization tool helps inform management decisions in the face of limited park management resources, including funding and staffing.

Decision making in an adaptive management framework involves the selection of an appropriate management action at each point in time, based on the status of the resources being managed (Williams et al. 2009). The resource threats at the park differ by archeological site. As a result, no single action or set of actions would universally address all resource problems.

Under both alternatives 2 and 3, archeological resources at the park would be managed within an adaptive management framework consistent with the objectives of the plan. Adaptive management would be used to address riverbank erosion, gopher control, and woody vegetation encroachment. Adaptive management is a continuing iterative process where (1) a problem is assessed, (2) potential management actions are designed and implemented, (3) those actions and resource responses are monitored over time, (4) data are evaluated, and (5) actions are adjusted if necessary to better achieve desired management outcomes.

The goal of the adaptive management process is to protect the condition of the park's archeological resources through informed, proactive, and transparent management. The adaptive management framework is designed to detect changes to important indicators that may be caused by major threats to archeological resources at the park and to provide park managers with a method to adaptively manage and address any changes in conditions. Effective monitoring requires (1) determining the most effective indicator that can gauge when the desired condition has been achieved, and (2) selecting the standard against which the indicator will be measured (NPS 2009). The National Park Service identified indicators and standards for managing archeological resources based on the park's purpose, significance, objectives, and desired conditions. Initial monitoring of the indicators would determine if the indicators are accurately measuring the conditions of concern and if the standards truly represent the minimally acceptable condition of the indicator. Park staff may decide to modify the indicators or standards and revise the monitoring program if better ways are found to measure changes.

Adjustments to management actions at an archeological site or the selection of management actions to be implemented at a site where actions have yet to be taken would be informed by the increased understanding gained through monitoring and evaluation.

Alternative 2: Relocate Facilities in the Park

Under alternative 2, archeological sites, riverbank erosion, pocket gophers, and woody vegetation would be managed under the adaptive management framework described above.

Under this alternative, the maintenance facility and museum collections storage would be moved to another location in the park and the existing maintenance building would be removed.

The vacated basement space of the visitor center currently housing the museum collection storage could be repurposed as an educational classroom, office space, or for other uses.

The National Park Service developed criteria to identify potential sites for relocating the facilities in the park. The goal was to identify sites that

- would allow facilities to be located at least 100 feet from a known archeological site or where acceptable mitigation opportunities were available if within 100 feet
- provide road access from locations other than County Road 18
- would not be viewed from scenic vantage points in and around the visitor center
- could accommodate the projected square footage requirements

Two relocation sites in the park were identified as meeting the necessary criteria and both are part of alternative 2. The park would relocate the facilities as follows:

- Site 1—includes approximately 17,600 square feet located adjacent to the south side of the existing visitor center. The museum collections storage and supporting administrative offices would be located in an addition to the visitor center. The addition would total approximately 3,000 square feet.
- Site 2—includes approximately 65,600 square feet located south of the existing visitor center. The maintenance offices, maintenance shop, cold storage, and tractor storage would be located in a new facility of approximately 6,000 square feet built on this site.

Alternative 3: Locate Facilities Off-Site

Under alternative 3, the park would relocate the maintenance facility and/or museum collections storage to space located outside the park. The space requirements would be the same as described for alternative 2. The following options are considered under this alternative:

- Option 1: Construct new off-site facilities—the park would identify suitable sites outside the park to relocate the maintenance facility and/or museum collections storage. The existing maintenance facility building would be removed. Sites for relocation of the maintenance facility and/or museum collections storage have not been identified but would need to meet the access and space requirements identified under alternative 2.
- Option 2: Lease space to relocate facilities off-site—the park would implement a site selection process to identify suitable leased space for the maintenance facility and/or museum collections storage. The existing maintenance facility would be removed, and the park would enter into a General Service Administration lease agreement and build a maintenance facility to suit its needs. The museum collections storage facility would meet the NPS policies, including NPS *Management Policies 2006* (NPS 2006a), Director's Order 24: *NPS Museum Collections Management* (NPS 2008a), and Director's Order 28: *Cultural Resource Management* (NPS 1998a), and procedures set forth in the NPS *Museum Handbook* (NPS 2015c) and NPS-28: *Cultural Resource Management Guidelines* (NPS 2002a).

Moving the museum collections storage would be done in conjunction with consultation with the MHA Nation tribal historic preservation officer and the North Dakota state historic preservation officer. The vacated basement space of the visitor center currently housing the museum collections storage could potentially be used as an educational classroom.

National Park Service Preferred Alternative

The "agency's preferred alternative" is the alternative that the National Park Service believes would fulfill its statutory mission and responsibilities, giving consideration to economic, environmental, technical, and other factors. The National Park Service has identified a preferred alternative that would incorporate elements of alternative 3 (options 1 or 2) and include additional specified components.

Under the preferred alternative, the museum collections storage would remain in its current location provided that efforts to address water infiltration issues are successful, ideally with an increase in staff and curation abilities. A comprehensive solution to address the problem is underway. The project, which includes installing a waterproofing exterior insulation finishing system (EIFS), installing new subgrade insulation and a drainage system, and applying a new sealing system to the existing visitor center roof, is expected to stop water infiltration and subsequently protect the museum collections. However, if efforts to address these issues are ultimately ineffective, the National Park Service would move the museum collections storage off-site.

In addition, under the preferred alternative, the National Park Service would identify land through a General Services Administration build-lease arrangement to build an off-site maintenance facility to suit park needs. However, the ability to relocate in the town of Stanton (North Dakota) would be limited by a Stanton moratorium on the construction of new maintenance structures and garages in city limits. In addition, because of a lack of knowledge about the availability of suitable property outside of the city limits and the influence of the energy industry on market prices of leases in the area, the relocation of the maintenance facility off-site is not currently feasible and would be a long-term consideration. The National Park Service is seeking to relocate and construct the maintenance facility in the park, unless the opportunity to lease or build off-site arises.

Under the preferred alternative, the National Park Service would implement all aspects of the adaptive management framework, including a priority list of archeological resources and measures addressing riverbank erosion, pocket gopher activity, and vegetation encroachment.

Environmentally Preferable Alternative

According to Council on Environmental Quality (CEQ) regulations implementing the National Environmental Policy Act (43 Code of Federal Regulations [CFR] 46.30), the environmentally preferable alternative is the alternative "...that causes the least damage to the biological and physical environment and best protects, preserves, and enhances historical, cultural, and natural resources. The environmentally preferable alternative is identified upon consideration and weighing by the Responsible Official of long-term environmental impacts against short-term impacts in evaluating what is the best protection of these resources. In some situations, such as when different alternatives impact different resources to different degrees, there may be more than one environmentally preferable alternative."

The National Park Service determined that alternative 3, option 2—lease and relocate facilities off-site—is the environmentally preferable alternative because it best meets the objectives of this plan and the purposes of the National Environmental Policy Act related to resource protection. In addition to implementing adaptive management and a wide range of management tools, the relocation of park facilities off-site to a leased space would protect resources inside the park. This conclusion is predicated on the assumption that leased property is available. If leased property proves to be unavailable in the first 12 months, then the environmentally preferable alternative would be alternative 3, option 1.

ENVIRONMENTAL CONSEQUENCES

The following topics were raised during the scoping process or the National Park Service deemed them relevant for evaluation and were selected for detailed analysis in this draft environmental impact statement: archeological resources; cultural landscapes; ethnographic resources; museum collections; fish and wildlife resources; special-status species; water quality, water resources, and wetlands; floodplain resources; and visitor use and experience. The rationale for selection of each impact topic was based on the potential for substantive impact; environmental statutes, regulations and executive orders; and/or NPS management policies and guidance.

Table 2-9 summarizes the potential impacts of each of the alternatives evaluated in the draft environmental impact statement.

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CHAPTER 1: PURPOSE OF AND NEED FOR ACTION

INTRODUCTION

Chapter 1 explains what the Knife River Indian Villages National Historic Site Archeological Resources Management Plan / Draft Environmental Impact Statement (plan/draft environmental impact statement) intends to accomplish and why the National Park Service (NPS) is taking action at this time. The plan presents two action alternatives for managing archeological resources at the Knife River Indian Villages National Historic Site (park) and assesses the impacts that could result from these action alternatives or from a continuation of current management practices (described as the no-action alternative). Once the plan and decision-making process are completed, the alternative that is selected would become the basis for managing archeological resources at the park.

Situated on the river bluffs and floodplains along the Missouri and Knife Rivers, the 1,748.8-acre park at the confluence of the Knife and Missouri Knife Rivers in Mercer County, North Dakota, was established to help convey they story of thousands of years of human habitation in what is now North Dakota (NPS 2013). Archeological evidence of human occupation at the park represents centuries of habitation prior to Lewis and Clark's journey westward. The archeological record shows the cultural changes of native peoples and provides valuable insight into the development of economies of trade, hunting, agriculture, culture, and community of native peoples, including the Hidatsa, and, to a lesser extent, the Mandan and Arikara. As such, a number of linked prehistoric and historic archeological sites are associated with the park. The park is also known for its connection to the Lewis and Clark expedition because Sacagawea and her husband Charboneau, a French fur trader, were living at the villages when Lewis and Clark recruited him to guide their expedition westward. The park is tasked with the preservation and interpretation of these resources for the public.

The park encompasses 1,748.8 acres of land at the confluence of the Missouri and Knife Rivers in Mercer County, North Dakota (figure 1-1). It is located in an area of the Northern Plains known to archeologists as the Knife River Region, the portion of the Missouri River Valley between the mouths of the Knife and Heart Rivers in central North Dakota. Three large village sites—Hidatsa Village (Big Hidatsa site), Awatixa Village (Sakakawea site), and Awatixa Xi'e Village (Lower Hidatsa site)—are the primary interpretive sites at the park.

PURPOSE OF THE PLAN

The purpose of the plan is to provide a framework for proactive, sustainable archeological resource management at the park.

NEED FOR ACTION

The National Park Service has identified four major threats to archeological resources at the park. While riverbank erosion is the most visible and documented threat to archeological resources, additional impacts result from infrastructure location, pocket gopher activity, and vegetation encroachment (Sturdevant 2009).

A standard set of management actions is needed to address these threats. These actions should

- provide a proactive and coordinated approach to resource management
- maximize archeological resource preservation, while allowing natural processes to the extent possible

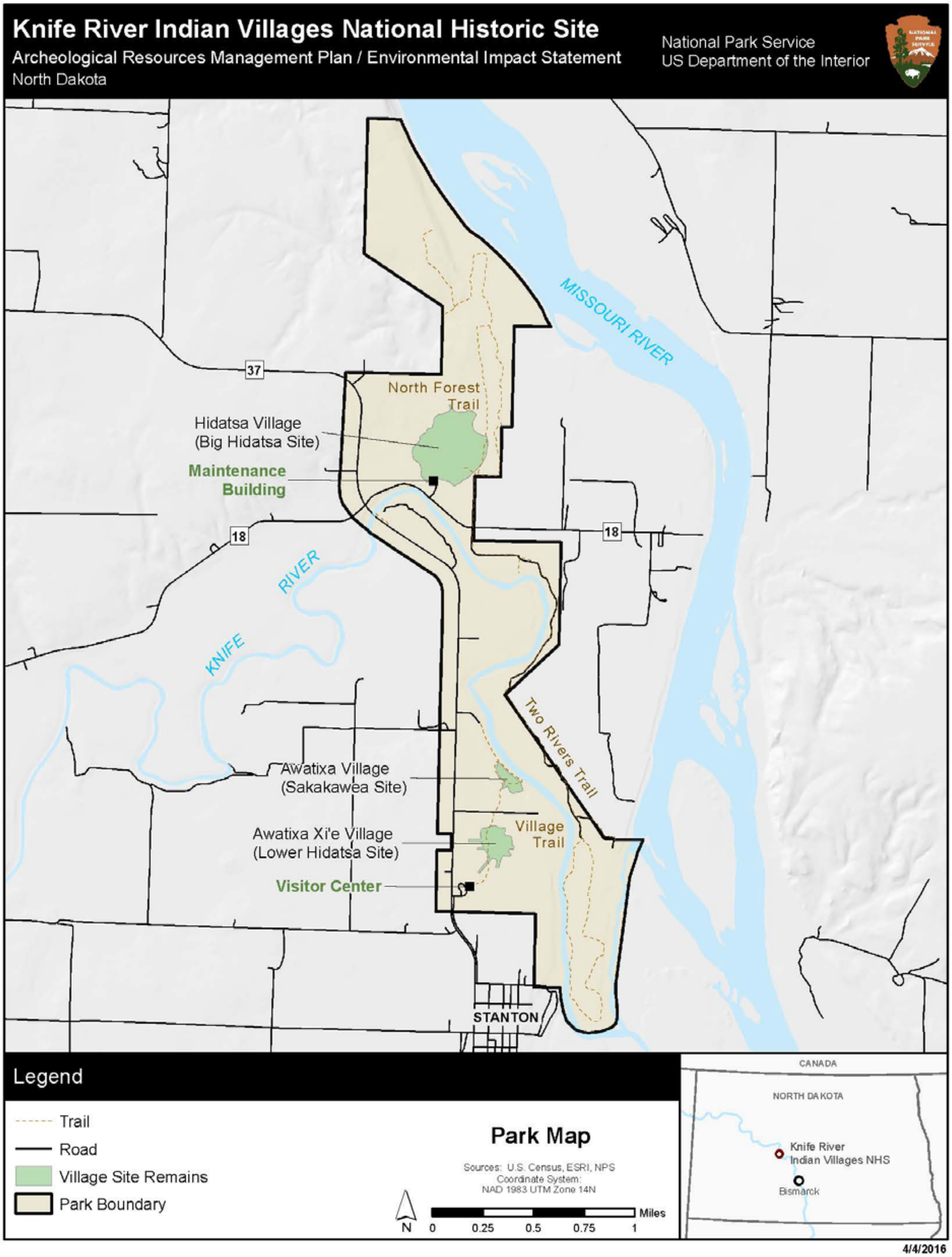

FIGURE 1-1. PARK LOCATION AND VICINITY ILLUSTRATING THE PARK BOUNDARY AND PRIMARY INTERPRETIVE SITES AND TRAILS

- allow for management that adjusts to the resource condition with an appropriate response mechanism
- provide for visitor use, traditional tribal use, education, and research opportunities

The major threats to the park's archeological resources are described below.

Riverbank Erosion

The Knife River, a tributary to the Missouri River downstream of the Garrison Dam, runs the length of the 1,748.8-acre park. Archeologists have identified flooding and erosion as the one of the main threats to the park's archeological resources (Sturdevant 2009). Substantial portions of the bank of the Knife River have been lost over the past few decades, leading to the irretrievable loss of adjacent village remnants and archeological sites (figure 1-2).

SOURCE: NPS

FIGURE 1-2. KNIFE RIVER BANK EROSION NEAR AN ARCHEOLOGICAL SITE

At least twice in the last decade, massive flood and ice flow events caused serious impacts on riverbanks, archeological sites, and park infrastructure (Cummings 2011). Record Missouri River flood levels during the summer of 2011 resulted in the saturation of Knife River banks for a five-month period. Increased frequency and severity of flood events may be a trend and may be a result of a variety of sources, including climate change or changes in upstream runoff, development, and water usage. Park staff has resorted to bank stabilization and excavation of threatened archeological deposits to document resources and preserve data before they are lost to erosion.

Additionally, riverbank erosion in the park threatens two county roads—one adjacent to the park and one running through the park to private property. Erosion along the roads has been defined as a human health and safety hazard during previous Knife River bank erosion events. Bank stabilization structures have been constructed at various locations in the park and upstream along the Knife River to protect roads and private property. These structures have affected the natural hydrology of the Knife River and likely have affected park sites downstream. Work associated with potential relocation or repair of these roads could affect archeological sites and represents another threat to the resource.

Northern Pocket Gopher

Northern pocket gophers (*Thomomys talpoides*), native to the area, affect archeological sites by displacing soil and artifacts from chronologically stratified deposits. Pocket gopher activity is indicated by the fresh soil mounds present in the villages and other archeological sites (figure 1-3). Artifacts are continuously exposed by gopher activity; park staff monitors the disturbed sites for important or unusual artifacts that are later placed in the museum collections.

In 2006, the National Historic Landmark Program listed the threat level of the Big Hidatsa site at "fair," specifically citing the effects of rodent burrowing as a cause of impending loss of site integrity. In 2009, the park instituted a regular trapping program for pocket gophers to mitigate the impacts of this species on the archeological sites.

SOURCE: NPS

FIGURE 1-3. POCKET GOPHERS BURROWING AT VILLAGE SITE

The Big Hidatsa, Sakakawea, and Lower Hidatsa sites are in "fair" condition, in part because of the ongoing impacts from pocket gophers. The National Park Service defines fair condition for archeological sites as: The site, at the first condition assessment or during the time interval since its last condition assessment, shows evidence of deterioration by natural forces and/or human activities. If the identified impacts continue without the appropriate corrective treatment, the site will degrade to a poor condition and the site's data potential for historical or scientific research will be reduced (NPS 2006b). Continuing unchecked, pocket gophers will cause irreversible damage to the archeological deposits at the park.

Vegetation Encroachment

The encroachment of woody and overgrown vegetation into archeological sites causes multiple issues for these sites. Root growth results in displacement of chronological layers, similar to the impacts of pocket gophers. Vegetative growth also makes some site areas inaccessible for archeological research. Impacts from vegetation are continuing to degrade conditions at the primary village sites as shown in figure 1-4.

SOURCE: NPS

FIGURE 1-4. VEGETATION ENCROACHMENT AT THE PARK

Infrastructure Impacts

The park's first visitor center was an acquired farmhouse located on the edge of the Big Hidatsa site and Taylor Bluff Village. Although the farmhouse was historical, it was determined not eligible for listing in the National Register of Historic Places (national register) through consultation with the state historic preservation officer (SHPO) and was moved off the site in the mid-1990s. In 1997, a new office building with a fire cache was built in the same footprint and style as the removed farmhouse. In the same complex as this office building, the maintenance facility and other associated infrastructure contribute to visual impacts at the Big Hidatsa site. A two-bay garage/shop was built in 1986. A four-bay garage and cold storage facility was built in 2000 to store equipment and vehicles. A gravel road, parking area, and materials storage area are also located on the archeological site.

The maintenance facility is a visual intrusion in the cultural landscape of the park, particularly for the Big Hidatsa site, one of the park's most important cultural sites and a primary interpretive site. The state historic preservation officer and the MHA Nation tribal historic preservation officer have recommended that the facility be relocated to remove this visual impact from the park. In addition, the maintenance facility is located near burial sites and areas considered sacred by the tribes traditionally associated with the resources present in the park. The tribes consider this an inappropriate intrusion.

The current visitor center was built in 1992 in the southwest corner of the park. Although not associated with major village areas, the area was surveyed, and existing archeological features and artifacts were removed using applicable data recovery measures before construction. The museum collections and staff offices are located in the visitor center building. The building has had water infiltration problems since construction was completed. This issue has been addressed many times, but no solution has eliminated it entirely.

State Highway 37 runs generally north-south through the western portion of the park and provides access to the visitor center and the northern areas of the park. County Road 18 runs east-west and provides the lone access to private lands located between the park boundary and the Missouri River. As described previously, these roads are threatened by riverbank erosion, and work to preserve these roads has additional impacts on park resources.

The museum collections preserve a portion of the nation's cultural heritage and increases knowledge and inspiration among present and future generations through exhibits, research, and interpretive programs. The collections consist of, lithic (i.e., ground and chipped stone tools and the debris resulting from their manufacture), ceramic, bone, centuries-old wood, and metal objects collected during archeological investigations between 1978 and 1983 (NPS 2013) (figure 1-5). An important component of the museum inventory is the Robinson Collection, a group of 19th and 20th century items of Native American material culture, including moccasins, weapons, decorated clothing, and other traded items.

SOURCE: NPS

FIGURE 1-5. MUSEUM EXHIBITS AT THE VISITOR CENTER

The museum collections also include a major ethnographic component in recorded tribal oral histories.

The museum collections storage is housed in the basement of the visitor center and continues to have water infiltration issues. Water issues have contributed to fluctuations in the temperature and relative humidity in the storage space, creating the potential for mold growth and damage to museum archives, objects, and records if not resolved (NPS 2013). Several unsuccessful attempts have been made to stop the water infiltration. Previous efforts to address the issue included placing a sealant around the foundation, making general improvements to the foundation and installing a French drain, replacing sheet rock and insulation, and touching up painting around existing bricks. In addition, in lieu of a solution to the overall problem, park staff retrofitted cabinets to be more waterproof. A comprehensive solution to address the problem is underway. The project, which includes installing a waterproofing exterior insulation finishing system (EIFS), installing a new subgrade insulation and drainage system, and applying a new sealing system to the existing visitor center roof, is expected to stop water infiltration and subsequently protect the museum collections.

OBJECTIVES AND DESIRED CONDITIONS IN TAKING ACTION

Objective 1. Preserve archeological sites in an undisturbed condition unless it is determined through an informed decision-making process that disturbance or natural deterioration is unavoidable.

Objective 2. Improve preservation and storage of archeological resources in the museum collections.

Objective 3. Promote tribal involvement in archeological resource management and decision making.

Objective 4. Foster tribal collaboration in preservation, research, and interpretation of archeological resources.

Objective 5. Develop archeological resource interpretation and research opportunities to expand knowledge of Northern Plains tribal history, culture, and lifeways.

The plan would provide a suite of proactive management tools to preserve archeological resources with site-specific mitigation recommendations. This goal must be accomplished within the overall framework of the authorized purposes for the park and existing legislation governing the National Park Service. A successful plan will achieve the following objectives to address the associated desired conditions.

Objective 1. Preserve archeological sites in an undisturbed condition unless it is determined through an informed decision-making process that disturbance or natural deterioration is unavoidable.

Desired Conditions

- Archeological sites are protected in situ (in their original location) to the maximum extent possible.
- Archeological sites are identified and inventoried, and their significance is determined and documented.
- Sites are prioritized for preservation using an established process.

Objective 2. Improve preservation and storage of archeological resources in the museum collections.

Desired Conditions

- The park's collection is housed in a climate controlled location, free of water infiltration and environmental fluctuations, which meets NPS collections standards.
- Museum collections related to archeological sites are acquired, accessioned, catalogued, preserved, protected, and made available for access and use according to NPS standards and guidelines.
- Museum collections are preserved for the long term through recommended conservation treatments performed by professional staff.
- Full curation of the museum collection is achieved. Any deficiencies documented in a collection condition survey are corrected.
- The park's collection is made accessible for tribal, research, and interpretive purposes.
- The special needs of the museum objects and records are incorporated into the park's Museum Collections Emergency Operation Plan and Structural Fire Plan (in development, expected in late 2016 and 2017, respectively).

Objective 3. Promote tribal involvement in archeological resource management and decision making.

Desired Conditions

- Tribal connection to the park is fostered, supported, and maintained.
- The park consults with traditionally associated American Indian nations to identify, record, and evaluate sensitive resources and traditional cultural properties.

- The park is managed as a national register eligible-traditional cultural property in consultation with the tribal historic preservation officer.
- Protection of culturally important sites is an integral component of park management actions.

Objective 4. Foster tribal collaboration in preservation, research, and interpretation of archeological resources.

Desired Conditions

- Sensitive archeological information is maintained in a manner acceptable to the tribes and in compliance with NPS policy.
- The park gathers traditional ecological knowledge to assist park management and provide cultural education.
- Additional collaborative research occurs through the involvement of the park and traditionally associated tribes.

Objective 5. Develop archeological resource interpretation and research opportunities to expand knowledge of Northern Plains tribal history, culture, and lifeways.

Desired Conditions

- The park has a sustainable research program that includes development of a long-range research design to guide archeological investigations.
- The park fosters an active interdisciplinary research program that enhances interpretive programs, ethnographic collections, and resource stewardship.
- Research efforts focus on how the culture, agriculture, economy, and lifestyle of Northern Plains tribes developed, and this information is used to develop and enhance park interpretation.
- The information included in the baseline inventory of archeological sites is expanded through application of current research techniques and innovative methods (e.g., geophysical technologies). New information addresses knowledge gaps and the content and condition of the resources.
- The replica earthlodge is available as an interpretive and educational aid and is maintained in good condition.
- Exhibits in the visitor center interpreting archeological resources remain current, and space is provided to present new information developed from interdisciplinary research.
- Additional collaborative research occurs through the involvement of the park and the North Dakota State Historical Society.

PARK BACKGROUND

Archeological evidence of human occupation at the park spans several thousand years, representing centuries of habitation. The archeological record at the park defines the cultural changes of native peoples from nomadic hunter gatherer inhabitants to semisedentary village sites based on horticulture and trade, and gives researchers valuable insight into the development of economies of trade, hunting, agriculture, culture, and community. This lifestyle change allowed the inhabitants to build complex, semipermanent villages composed of large earthlodge structures, defense systems, and transportation corridors. At the height of occupation, thousands of Hidatsa people lived in the villages at the confluence of the Knife and Missouri Rivers. The Mandan and Arikara, Upper Missouri peoples who lived in ways similar to the Hidatsa people, lived downstream from the Knife River Indian Villages along the Missouri River. Substantial numbers of Mandan and Arikara, and many from other tribes, were closely associated with the Knife River Indian Villages at different times during the habitation period. The Mandan, Hidatsa, and Arikara have since come together to form the Three Affiliated Tribes, a federally recognized name. The Tribes' current preference is to be referred to as MHA Nation and is reflected as such throughout the remainder of this plan.

A total of 68 known prehistoric and historic archeological sites are associated with the park, including major and minor villages, peripheral and off-village activity areas, cemeteries, trails, farmsteads/homesteads and other historic sites, and debris scatters (Ahler 1993a). These sites reflect early use of the area by nomadic, prehistoric hunter-gatherer groups to the establishment of permanent earthlodge villages by the ancestors of the modern Mandan, Hidatsa, and Arikara peoples. Three large village sites at the park—Big Hidatsa, Sakakawea, and Lower Hidatsa—have been interpreted for the public. These sites remain some of the best preserved examples of earthlodge villages along the Missouri River. The Big Hidatsa site is the largest village in the park and a national historic landmark and includes more than 100 visible earthlodge depressions as well as fortification trenches and linear earthen mounds.

The park is also known for its connection to the Lewis and Clark expedition. The expedition had extensive contact with the villages when the Corps of Discovery wintered at Fort Mandan, several miles southeast of the park. Sacagawea and her husband Charboneau, a French fur trader, were living at the villages when Lewis and Clark recruited him to guide their expedition westward.

The villages remained inhabited until the mid-1800s when the villagers moved upstream to what eventually became the Fort Berthold Indian Reservation. The lands surrounding the abandoned village sites were disbursed as homestead claims under the Homestead Act and farmed until the park was established in 1974. The archeological record at the park provides a clear timeline and tells the story of the convergence of American Indian cultures with white settlers, the effect of the introduction of new technology on hunting and agriculture (guns and steel), and the effects of disease on large Northern Plains villages.

The park is tasked with preservation and interpretation of the archeological resources for the public. The National Park Service has developed infrastructure to support this goal that includes a visitor center and offices, maintenance facility, replica earthlodge, trails, and interpretive displays located across the park. The interpretation and management of the park has become increasingly complicated because of several threats to the preservation of archeological resources. These threats include: riverbank erosion, pocket gopher activity, vegetation encroachment, and infrastructure impacts.

PURPOSE AND SIGNIFICANCE OF KNIFE RIVER INDIAN VILLAGES NATIONAL HISTORIC SITE

Public Law 93–486, signed on October 26, 1974, authorized the establishment of Knife River Indian Villages National Historic Site as a unit of the national park system. The park was established with three distinct purposes: (1) preservation of historic and archeological resources, (2) interpretation of historic and archeological resources, and (3) study of those resources for the benefit of the public.

The following purpose statement was identified in the park's foundation document (NPS 2013): The purpose of Knife River Indian Villages National Historic Site is to preserve, protect, and interpret archeological and natural resources as they relate to cultural and agricultural lifestyles of Northern Great Plains Indian peoples, and to conduct research to further understand how these lifestyles have changed over time.

Knife River Indian Villages National Historic Site is currently the only unit in the national park system with a mission designed to commemorate the culture and history of a Plains Indian group. The primary resources dedicated to carrying out this mission are the

Big Hidatsa Village National Historic Landmark and the Knife River Indian Villages National Register Archeological District, which includes the Lower Hidatsa, Sakakawea, and Elbee sites and Taylor Bluff Village. All of the sites located in the archeological district are listed in the national register. Today, the Mandan, Hidatsa, and Arikara consider the park to be an ethnographic resource and a sacred homeland where the spirits of their ancestors reside. Tribal members often visit the park to offer prayers and perform ceremonies.

Significance statements express the importance of a site to cultural or natural heritage. Statements of significance are guided by legislation and knowledge acquired through management, research, and civic engagement. Statements of significance define why, within a national, regional, and systemwide context, a park's resources and values are important enough to warrant NPS designation. They are not an inventory of a site's resources; rather, they describe a park's distinctiveness and help to place it in international, national, and regional contexts. Understanding a park's significance assists managers in making decisions that will preserve the resources and values necessary to fulfill the park's purpose.

The following significance statements have been identified for the park (NPS 2013).

- Knife River Indian Villages National Historic site contains some of the best-preserved examples of remnant earthlodge villages along the Missouri River in the Dakotas. The three main sites are Big Hidatsa, Sakakawea, and Lower Hidatsa.
- Park resources represent the extensive history and development of Northern Great Plains communities and cultures on the Knife and Missouri Rivers through the mid-19th century.
- These resources continue to be an essential part of the heritage and contemporary culture of the MHA Nation as their traditional homeland.
- The park is a cornerstone of Plains Indian archeological and ethnographic research, and it continues to offer an outstanding opportunity for the study of archeological, ethnographic, and museum resources.
- Abundant ethnographic information on Mandan, Hidatsa, and Arikara peoples adds unparalleled detail to the park's historic record. This record includes primary accounts of art, scientific observations, and anthropological writings. Notable European American travelers, including Alexander Henry, John Bradbury, George Catlin, Karl Bodmer, Prince Maximilian, John J. Audubon, David Thompson, Lewis and Clark, and later anthropologists, including Gilbert Wilson, provided much of this information by documenting life in the villages during the 19th and 20th centuries.
- Sacagawea was living in the Lower Hidatsa site when Lewis and Clark recruited her husband to guide and interpret for the Corps of Discovery expedition. The park is one of the few sites along the Lewis and Clark National Historic Trail where the explorers' presence is well documented.

ISSUES AND IMPACT TOPICS

NEPA regulations require an "early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action" (40 Code of Federal Regulations [CFR 1501.7]). Issues are defined as problems, opportunities, and concerns regarding the current and potential management elements for handling archeological resources, impacts of management actions, and management opportunities in Knife River Indian Villages National Historic Site that are included in this plan. Potential impacts on resources identified by the interdisciplinary team formed the basis for the impact topics that are summarized below and discussed in chapters 3 and 4.

Impact Topics Retained for Further Analysis

Archeological Resources. The National Historic Preservation Act (NHPA), as amended (54 United States Code [USC] 300101 et seq.), National Environmental Policy Act, NPS Organic Act, the Archaeological Resources Protection Act of 1979, NPS *Management Policies 2006* (NPS

2006a), Director's Order 12: *Conservation Planning, Environmental Impact Analysis, and Decision-Making* (NPS 2011), Director's Order 28: *Cultural Resource Management* (NPS 1998a), and Director's Order 28a: *Archeology* (NPS 2004a) require the consideration of impacts to any cultural resources that might be affected, and the National Historic Preservation Act, in particular, requires consideration of impacts on the cultural resources either listed in, or eligible to be listed in, the national register. Archeological resources are the remains of past human activity and records documenting the scientific analysis of these remains (NPS 1998a). A total of 68 known archeological sites are located in the park, the overwhelming majority of which have been evaluated for their eligibility to the national register. The Big Hidatsa site was listed as a national historic landmark in 1966. Another 51 sites are listed as contributing elements to the Knife River Indian Villages National Register Archeological District, including the Lower Hidatsa, Sakakawea, and Elbee sites and Taylor Bluff Village. The remaining sites are considered to be noncontributing or local resource types that are not monitored for condition or other management actions.

The archeological resources present at the park include village sites with stratified cultural deposits that provide extensive information about the adaptation and innovation of Northern Plains cultures prior to the arrival of Europeans and these people's response to contact with outsiders in the early 1800s. In addition, fortifications, burial sites, trails, agricultural fields, and resource collection and use sites are present throughout the park. Although many of these resources are not visible on the surface, the intact subsurface materials have the potential to provide information for future generations. This plan will assess alternative plans for comprehensive management of archeological resources at the park; therefore, this topic was carried forward for analysis.

Cultural Landscapes. According to Director's Order 28, a cultural landscape is:

> . . .a reflection of human adaptation and use of natural resources and is often expressed in the way land is organized and divided, patterns of settlement, land use, systems of circulation, and the types of structures that are built. The character of a cultural landscape is defined both by physical materials, such as roads, buildings, walls, and vegetation, and by use reflecting cultural values and traditions.

The National Park Service completed a *Cultural Landscape Inventory* for the park in 1999 (NPS 1999). The cultural landscape encompasses the entire park and eight pieces of private land on which the National Park Service holds a scenic easement. The landscape has been determined eligible to the national register. Proposed management activities intended to preserve archeological resources have the potential to affect the cultural landscape. Therefore, this topic was carried forward for analysis.

Ethnographic Resources. The National Park Service defines ethnographic resources as any "site, structure, object, landscape, or natural resource feature assigned traditional, legendary, religious, subsistence or other significance in the cultural system of a group traditionally associated with it" (NPS 1998a). The discussion of ethnographic resources for the purposes of this plan will also include traditional cultural properties. National Register Bulletin 38, *Guidelines for Evaluating and Documenting Traditional Cultural Properties* (Parker and King 1998), defines a traditional cultural property as one that is eligible for inclusion in the national register because of its association with cultural practices or beliefs of a living community that are rooted in that community's history and are important in maintaining the continuing cultural identity of the community. Guidance for the identification of traditional cultural properties is also found in National Register

Bulletin 38. An ethnographic resource assessment has been completed for the park and these resources are present at the park. Therefore, this impact topic was carried forward for analysis.

Museum Collections. The NPS legal mandate for acquiring and preserving museum collections is contained in the Antiquities Act of 1906 (54 USC 320301–320303); the Organic Act of 1916 (54 USC 100101); the Historic Sites Act of 1935 (54 USC 320101–320106); the Management of Museum Properties Act of 1955, as amended (54 USC 102501–102504); the Reservoir Salvage Act of 1960, as amended (16 USC 469–469c); the Archeological and Historic Preservation Act of 1974 (54 USC 312501–312508); the National Historic Preservation Act (54 USC 300101 et seq.); the Archaeological Resources Protection Act of 1979 (16 USC 470aa–mm); the National Parks Omnibus Management Act of 1998 (16 USC 5901), the NPS *Museum Handbook*, Parts I and II; and the US Department of the Interior (Interior) Departmental Manual (411 DM, Volume 1) *Museum Property Handbook*.

The park maintains archeologic and ethnographic collections in the visitor center. The majority of the collection consists of archeological materials recovered during NPS-sponsored excavations at the park. The collection also includes ethnographic items (the Robinson Collection) donated by a family who owned a general store near Fort Berthold Reservation and an herbarium and invertebrate collection obtained as part of natural resource baseline inventories (NPS 2013). Given the current infrastructure issues faced by the park and the potential effects on the museum collections from potential management actions, this resource topic was carried forward for analysis.

Fish and Wildlife Resources. Management actions considered in the plan have the greatest potential to affect pocket gophers; wildlife associated with pocket gophers or their habitat, including ground-feeding birds, fish, mollusks; and wildlife resources associated with riverbanks where bank stabilization projects may occur. Therefore, the resource topic carried forward for analysis focuses on those issues and species noted above that have a potential to be affected by the action alternatives.

Multiple additional species of fauna are found in the park. Large birds and mammals, including owls, raptors (bald eagles, northern harriers, red-tailed hawks, and kestrels), wild turkeys, white-tailed deer, skunks, badgers, coyotes, and beavers rely on the wooded areas for winter cover and rearing young. Other species that occur in the park include weasels, porcupine, raccoons, ground squirrels, rabbits, sharp-tailed grouse, pheasant, waterfowl, Canada geese, snow geese, white pelican, mourning doves, and great blue heron. Songbirds are also common. Currently approximately 143 bird species are noted to occur at the park (NPS 2014a). More than 200 different species of invertebrates have been identified in the park, and the river reaches in the park provide habitat for at least 26 species of mollusks and 10 species of fish (Licht 2002; NPS 2014b).

Special-Status Species. The Endangered Species Act mandates that all federal agencies consider the potential impacts of their actions on species listed as threatened or endangered to protect the species and preserve their habitats. Potential impacts are assessed in an “action” area, which can be larger than individual project areas and are determined by evaluating the geographic extent of potential environmental changes (i.e., biological, chemical, and physical effects). The US Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) share responsibility for implementing the Endangered Species Act. A list of federally listed threatened or endangered species with potential to occur in Mercer County, obtained from the USFWS Information, Planning, and Conservation System, identified three endangered and three threatened species with potential to occur (USFWS 2016a). Of those species, the least tern (*Sterna antillarum*) (endangered) and northern long-eared bat (*Myotis septentrionalis*) (threatened) were carried forward for analysis in this plan because of their documented occurrence or potential to occur in the park; other species were dismissed. Management actions may be completed in areas of the park with potential for these special-status species to occur. North Dakota does not have a state threatened or endangered species list. Rather, it uses a three-level ranking system to classify species of conservation priority as outlined in the North Dakota Wildlife Action Plan (Dyke et al. 2015). Only those species that are federally listed and could occur at the park are analyzed in this section.

Water Quality, Water Resources, and Wetlands. The 1972 Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977, is a national policy to restore and maintain the chemical, physical, and biological integrity of the nation's waters; enhance the quality of water resources; and prevent, control, and abate water pollution. NPS *Management Policies 2006* provides direction for the preservation, use, and quality of water originating, flowing through, or adjacent to park boundaries. The National Park Service seeks to restore, maintain, and enhance the water quality in the park consistent with the 1972 Federal Water Pollution Control Act, as amended, and other applicable federal, state, and local laws and regulations. Executive Order 11990 and NPS policy require that impacts on wetlands be considered in NPS undertakings. The intent of the order and policies is to protect the high resource values found in wetlands by requiring that alternatives be evaluated and mitigation be designed prior to development in wetlands. The Missouri and Knife Rivers run through and adjacent to the park. Changing hydrology has resulted in erosion along the banks of these rivers. Park wetlands are associated with the floodplains of the Knife and Missouri Rivers, which were historically forest cover. Today, these areas comprise Missouri River bottomlands (NPS 1985). Actions taken under this plan, including bank stabilization, to address threats that erosion poses to archeological resources would have the potential to affect water quality, water resources, and wetlands; therefore, this topic was carried forward for analysis.

Floodplain Resources. Executive Order 11988 and NPS policy require that impacts on floodplain resources be considered in NPS undertakings. The intent of the order and policies is to protect human safety and floodplain functions by preventing development in 100-year floodplains. Approximately 60% of the park lands comprise floodplains that are found adjacent to the Knife and Missouri Rivers. Because implementation of the action alternatives has the potential to affect floodplain resources in the park, the topic was carried forward for analysis.

Visitor Use and Experience. Within the park, remnants of large earthlodge villages marked by circular depressions are visible as honeycombed topography. Visitors can experience the unique landscape that supported large villages between the 1600s and 1845. A reconstructed earthlodge furnished with replica items provides a visual and tangible connection to daily village life. The visitor center, park film, and museum demonstrate how people survived and prospered in the villages. Events featuring crafts, dancing, music, and native stories are held throughout the year. These events give visitors a firsthand experience of modern activities that would have occurred in the villages historically. In addition, the park holds multiple educational programs throughout the year, attended by thousands of school-aged children, detailing the history of the park and native peoples. Management actions considered in this plan have the potential to affect accessibility of village sites and the manner in which they could be experienced by park visitors; therefore, this topic was carried forward for analysis.

Issues and Impact Topics Considered but Dismissed from Further Analysis

Air Quality. Air quality in parks and wilderness areas is protected and regulated through the 1916 Organic Act and the Clean Air Act of 1977 and its subsequent amendments. The Clean Air Act defines two distinct categories of protection for natural areas—class I and class II airsheds. Class I airsheds receive the highest level of air quality protection offered through the Clean Air Act; only a small amount of additional air pollution is permitted in the airshed above baseline levels. For class II airsheds, the additional air pollution above baseline levels are slightly greater than for class I areas and allow for moderate development. The park is classified as a class II airshed.

Parks designated as class I and II airsheds typically use the US Environmental Protection Agency's (USEPA) National Ambient Air Quality Standards for criteria air pollutants as the ceiling standards for allowable levels of air pollution. The US Environmental Protection Agency believes these standards, if not exceeded, protect human health and natural resources (USEPA 2008). North Dakota is in compliance with all federal and state air quality standards. Any effects on air quality under the action alternatives are anticipated to be limited to temporary impacts resulting from construction-related activities for certain management actions or emissions from the use of maintenance or operations equipment and/or vehicles during the course of park operations. These impacts would be temporary and would not contribute to an exceedance of the National Ambient Air Quality Standards or state air quality standards; therefore, air quality was dismissed from further consideration in this plan.

Dark Night Sky. The area surrounding the park offers little light pollution and development, which allows the associated tribes and visitors to the park to view the same clarity and darkness in the night sky that Northern Plains inhabitants viewed for thousands of years. Villagers gained and their descendants continue to gain spiritual meaning from the stars, planets, constellations, and natural phenomena that are visible in the park's dark night sky (NPS 2013). None of the action alternatives would have a perceptible impact to dark night skies at the park; therefore, this topic was dismissed from further consideration in this plan.

Fish and Wildlife Resources Not Expected to Be Affected by Plan Actions. Fish and wildlife resources not associated with pocket gophers, pocket gopher burrows, or riverbanks would have a low potential to be affected by management actions included in the plan alternatives and are not considered in the detailed analysis carried forward. Many of the management actions would have potential to result in beneficial impacts on wildlife and associated habitat by increasing the prevalence of native vegetation in the park.

Geological Resources. NPS *Management Policies 2006* states that the National Park Service will preserve and protect geologic resources as integral components of park natural systems. Geologic resources include both geologic features and processes. Management actions to address riverbank erosion, pocket gophers, and vegetation encroachment are not anticipated to have a noticeable effect on soils in the park, and no impacts on bedrock are anticipated. This topic was dismissed from further consideration in the plan.

Historic Structures and Districts. According to Director's Order 28, structures are defined as material assemblies that extend the limits of human capability (NPS 1998a). In plain language, this means a constructed work, usually immovable by nature or design, consciously created to serve some human activity and could include American Indian mounds. Examples are buildings, monuments, dams, roads, railroad tracks, canals, millraces, bridges, tunnels, locomotives, nautical vessels, stockades, forts and associated earthworks, American Indian mounds, ruins, fences, and outdoor sculptures. Although American Indian mounds are located in the park and meet this definition, they are included in the discussion of archeological resources. This topic was dismissed from further consideration in this plan.

Vegetation. *The Plant Community Composition and Structure Monitoring for Knife River Indian Villages National Historic Site 2013 Annual Report* (Prowatzke and Wilson 2015) found 105 plant species in the park. The park is composed of upland mixed-grass prairie and riparian forests with a long history of human use that has contributed to the invasion of nonnative species into the park (Prowatzke and Wilson 2015). Remnants of native midgrass prairie with regionally important species characteristic of prairie ecosystems are present in the park. Village inhabitants would have used these species for various purposes. Tribal use and beliefs focused on native botany and phenology of the region would have used the plants that comprise the midgrass prairie ecosystem (NPS 2013). While vegetation is an important resource of the park, the park was established primarily for cultural resources. Management actions proposed would be consistent with existing goals and desired conditions for vegetation at the park. Although vegetation would be directly affected by management actions, mitigation measures would be implemented as described below.

During all construction/demolition activities, best practices for weed management would be used, including:

- Minimize new soil disturbance and select previously disturbed areas for construction staging and stockpiling.
- Fence or clearly mark and enforce disturbance zones to prevent disturbances to vegetation outside construction limits. Ensure project personnel make daily checks of clothing, boots, laces, and gear to ensure no exotic plant propagates and no off-site soil is transported to the work site.
- Thoroughly pressure-wash equipment to ensure all equipment and machinery are clean and weed-free before being brought into the park.
- Cover all haul trucks bringing materials from outside the park to prevent seed transport and dust deposition.
- Obtain all fill, rock, topsoil, or other earth materials from approved sites.

After construction activities are completed and/or woody vegetation is removed, the following measures would be applied to maximize vegetation restoration efforts.

- Salvage available topsoil or several inches of native soil from the disturbed area for reuse during restoration of disturbed areas.
- Monitor for and treat invasive species within disturbed areas.
- Revegetate disturbed areas with native species, as necessary, to minimize long-term soil erosion and exotic plant encroachment. An attempt would be made to restore vegetation by using seed of native genotype collected in the Northern Great Plains. The use of exotic species or genetic materials would be considered only where deemed necessary to maintain a cultural landscape or to prevent severe resource damage.
- Use erosion-control blankets and waddles to reduce erosion and encourage seedling establishment.
- Institute restoration activities immediately after construction is completed. Monitor to ensure that revegetation is successful, plantings are maintained, and unsuccessful plant materials are replaced.
- Plan work on facilities in the park to reduce impacts on vegetation. Use site-specific surveys to identify areas to be avoided because of terrain or resource concerns.
- Revegetate to reconstruct the natural spacing, abundance, and diversity of native plant species as much as possible. Restore all disturbed areas as much as possible to pre-construction conditions shortly after work is completed.

- Monitor vegetation for impacts caused by maintenance of facilities and infrastructure (including fencing) associated with the plan.

Although woody vegetation removal is a primary component of this plan to protect cultural resources, following the mitigation measures described above would minimize impacts on vegetation, and adhering to NPS *Management Policies 2006* would ensure that vegetation is properly managed along with other natural resources in the park. Also, the contribution that vegetation makes to floodplains, ethnographic resources, and cultural landscapes is addressed as a component of those topics. Therefore, vegetation was not retained for full analysis in the plan.

Prime and Unique Agricultural Lands. Prime farmland is defined as soil that has the best combination of physical and chemical characteristics to produce general crops such as common foods, forage, fiber, and oil seed. Unique farmland produces specialty crops such as fruits, vegetables, and nuts. The US Department of Agriculture 2016 "Web Soil Survey" reveals that the park includes small amounts of soils classified as prime farmland. However, no action is being proposed to permanently convert the prime agricultural lands from production. Therefore, this impact topic has been dismissed from further consideration in the plan.

Minority and Low Income Populations, including Environmental Justice. Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations," requires that federal agencies identify and address any disproportionately high and adverse human health or environmental effects of their actions on minority and low-income populations. Potential management actions taken under this plan, under any alternative, would create beneficial impacts through temporary job creation and the protection of resources. Because the project would not have adverse impacts on the surrounding community, no disproportionate and adverse impacts on environmental justice populations are anticipated. This topic has been dismissed from further consideration. Any potential impacts on tribal resources and impacts are further discussed under "Ethnographic Resources."

Indian Trust Resources Secretarial Order 3175, "Departmental Responsibilities for Indian Trust Resources," requires that any anticipated impacts on Indian trust resources from a proposed project or action by agencies of the Department of the Interior be explicitly addressed in environmental impact statements. Departmental responsibilities are identified in 512 DM section 2. The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal (and allotted) lands, assets, resources, and treaty rights; it represents a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes.

No Indian trust resources exist in the park, and the lands comprising the park are not held in trust by the secretary of the interior for the benefit of Indians because of their status as Indians. Therefore, the topic of Indian trust resources was dismissed from further consideration in the plan.

Socioeconomics. Management actions that could impact socioeconomics mainly include construction jobs related to the implementation of management measures or the possible relocation of park infrastructure, including the maintenance facility. The construction workforce for these activities would likely result in a temporary increase in local revenues as construction workers spend their income on lodging or housing and retail and restaurant establishments during the construction period. This would be true if the workforce was mainly from the region or if it was brought in from outside the region. These increases would be short term and would not be anticipated to change the socioeconomic conditions in the area, including Mercer

County and Stanton, the town closest to the park. Because no increase in income, employment, or spending associated with this project is anticipated in the long term, it is not anticipated that any long-term socioeconomic impacts would occur as a result of this project. Because the impacts to the socioeconomic environment would be short term and not at a noticeable level, and nonexistent in the long term, this topic has been dismissed from further consideration.

Special-Status Species Not Expected to Be Affected by Plan Actions. Federally listed species with potential to occur in Mercer County that have not been documented at the park and are dismissed from further evaluation in this plan include the pallid sturgeon (*Scaphirhynchus albus*) (endangered), piping plover (*Charadrius melodus*) (endangered), whooping crane (*Grus americana*) (endangered), and rufa red knot (*Calidris canutus rufa*) (threatened). Sprague's pipit (*Anthus spragueii*), a former candidate species (75 *Federal Register* 56028) was previously included as a species that may potentially occur in the park. However, on April 5, 2016, the US Fish and Wildlife Service determined that Sprague's pipit was not warranted for listing under the Endangered Species Act (81 *Federal Register* 19527); therefore, this species was not carried forward for further analysis.

Soundscapes. In accordance with NPS *Management Policies 2006* and Director's Order 47: *Sound Preservation and Noise Management*, an important part of the NPS mission is to preserve natural soundscapes associated with national park system units. A soundscape is defined as the total ambient sound level of the park, including both natural ambient sound and human-made sounds. The current natural soundscape provides a quiet, contemplative experience (NPS 2013). Management actions taken to address threats to archeological resources may result in impacts to the soundscape during construction or operation. However, these impacts are anticipated to be temporary and would cease following construction or operations activities; therefore, this topic was dismissed from further consideration in this plan.

Climate Change

Climate change refers to any substantial changes in average climatic conditions (i.e., average temperature, precipitation, or wind) or climatic variability (i.e., seasonality or storm frequencies) lasting for an extended period of time (decades or longer). Recent reports by the US Climate Change Science Program, the National Academy of Sciences, and the United Nations Intergovernmental Panel on Climate Change (IPCC 2007) provide clear evidence that climate change is occurring and will accelerate in the coming decades. The effects of climate change on national parks are beginning to emerge as both science and impacts become clearer; however, it is difficult to predict the full extent of the changes that are expected under an altered climate regime.

The purpose of this plan is to provide a framework for proactive, sustainable archeological resources management. Included in this purpose is the desire to identify archeological resources management actions that anticipate and respond to the effects of climate change and, as such, would not have an appreciable effect on climate change. However, because climate change has the potential to alter resource conditions in many different ways in the park, the impacts of climate change on appropriate resources are described in chapter 3 and 4.

COMPLIANCE COVERED BY THIS PLAN

There are many laws and policies that guide management of National Park Service units. These laws and policies, as well as previous planning efforts by the National Park Service, guided the development of the plan and will provide a framework for this plan to operate. The compliance covered in this plan/draft environmental impact statement is summarized below. In addition, a more detailed description of all relevant laws, policies, and existing planning documents is included in appendix A.

Actions identified in this plan to treat pocket gophers and vegetation encroachment may be implemented without further compliance after this document is finalized, the public notified, and the Record of Decision signed. Actions to stabilize the riverbank that may affect wetlands or that are regulated by the Clean Water Act, or actions to build a new maintenance or museum storage facility on park property, will require additional compliance. Additionally, if the potential tools and environmental impacts described in this plan change after the Record of Decision is signed, additional NEPA review may be required before the treatment can be implemented.

In response to Executive Order 11990, "Protection of Wetlands," the National Park Service issued Director's Order 77-1: *Wetland Protection* (NPS 2002b). Director's Order 77-1 requires that the National Park Service avoid adverse impacts on wetlands to the extent practicable, minimize any impacts that could not be avoided, and compensate for any remaining unavoidable adverse impacts. Bank stabilization techniques that may be implemented along the Knife River could affect wetlands associated with the riverbed and banks. Before actions with the potential to have adverse impacts on wetlands are taken, a statements of findings for wetlands will be completed.

Construction activities to stabilize the riverbank will be guided by state and federal laws, including the Clean Water Act (section 40 and 404), the Rivers and Harbors Act, and regulations associated with the North Dakota Pollutant Discharge Elimination System program and permit. According to North Dakota Century Code (chapters 61-33) and the North Dakota Administrative Code article 89-10, the state engineer administers work within the ordinary high water mark of navigable streams or sovereign lands, and this work requires a permit. North Dakota Century Code (chapters 61-16) also regulates projects that affect a floodway. The National Park Service will comply with all required state and federal permits and regulations prior to and during construction activities.

The National Park Service consulted with the North Dakota state historic preservation office, the MHA Nation tribal historic preservation officer (THPO), and the Advisory Council on Historic Preservation (advisory council) to discuss actions outlined in this plan that have the potential for adverse impacts on historic properties or other sites listed or eligible for listing in the national register. Based on the actions outlined in this plan, measures to avoid and minimize effects, and an agreed upon framework for implementation actions, the National Park Service has determined, in consultation with the above groups, that there would be no adverse effect on historic properties, pursuant to 36 CFR 800.5(b) for this plan/draft environmental impact statement. Ongoing consultation under the National Historic Preservation Act will be conducted through the use of annual meetings, correspondence, and phone calls between parties to review future site specific actions. Roles and responsibilities of all parties are defined in the 2008 Programmatic Agreement between the National Conference of State Historic Preservation Officers and the advisory council (2008 Programmatic Agreement) (NPS 2008b). Avoidance and minimization measures defined in chapter 2 will be followed for all actions, where applicable.

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CHAPTER 2: ALTERNATIVES

INTRODUCTION AND OVERVIEW OF THE ALTERNATIVES

The National Environmental Policy Act requires federal agencies to evaluate and consider a range of reasonable alternatives that address the purpose of and need for action. Alternatives under consideration must include a "no-action" alternative in accordance with Council on Environmental Quality (CEQ) regulations (40 CFR 1502.14). For this plan, the no-action alternative does not mean taking no action at all. The no-action alternative would be a continuation of the actions currently being used to address the defined need. The impacts of the no-action alternative and the other action alternatives are compared to show the differences between alternatives. Concepts for the action alternatives come from many sources, including federal agencies, local government officials, and the public.

The alternatives described in this chapter were developed by an interdisciplinary planning team that included subject matter experts in archeology, biology, vegetation, ecology, planning, hydrology, and hydraulics. This chapter defines the no-action alternative and the two action alternatives. Actions that were considered but were not technically or economically feasible, did not meet the purpose of and need for the plan, created unnecessary or excessive adverse impacts on resources, and/or conflicted with the overall management of the park or its resources were dismissed from detailed analysis. These alternative elements and reasons for dismissal are discussed later in this chapter. The chapter also includes a discussion of how the alternatives meet the plan objectives and are consistent with the purposes of the National Environmental Policy Act. The environmentally preferable alternative and the National Park Service preferred alternative are identified.

ACTIONS COMMON TO ALL ALTERNATIVES, INCLUDING THE NO-ACTION

The following sections describe the components and specific measures that would occur under all alternatives described in this chapter. Implementation of actions included in the plan is subject to funding availability and park priorities.

Archeological Resources Management

The management of archeological resources on NPS lands is mandated by law and policy. NPS management policies are derived from a suite of historic preservation, environmental, and other laws, proclamations, executive orders, and regulations. Archeological resource management at the park would continue in a manner consistent with these legislative and regulatory provisions and with implementing policies and procedures, including the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation (48 *Federal Register* 44716–740), NPS *Management Policies 2006*, and Director's Order 28a. In accordance with these policies and procedures, archeological resources would be managed in situ (i.e., in their original place or position), unless the removal of artifacts or physical disturbance is justified by research, consultation, interpretation, preservation, or protection requirements. In the event of catastrophic bank erosion, salvage activities and data recovery would take place.

All alternatives (including the no-action) would include the following archeological resources management measures.

- The archeological site condition assessment program and follow-up ranger monitoring would continue as part of the broader regional and national efforts to assess and track overall archeological site conditions. The archeological site condition assessment program was initiated in 2006 as an NPS-wide program to record the condition of all archeological sites. Annual site condition assessments would be conducted, with support from the Midwest Archeological Center (MWAC), for select sites, including the main villages and Elbee sites, at intervals of between one and five years depending on the site.

- MWAC staff would continue to provide advice on section 106 consultation and Planning, Environment, and Public Comment (PEPC) projects, enter projects into the Project Management Information System, coordinate research projects, and act as an extension of park staff in an advisory capacity. MWAC staff would also continue to provide archeological services, house collections on a temporary basis until they are returned to the park or to a designated storage facility, and administer the Archeological Sites Management Information System, and geographic information systems (GIS) databases for the park.
- Park staff would continue to comply with the standard operating procedure for disposition of artifacts in situ (appendix B). This procedure provides a protocol for dealing with artifacts that are found by park staff or visitors.
- The park would continue to conduct regular consultations with the MHA Nation, including occasional assistance with ongoing archeological efforts at the park.
- THPO/SHPO consultation would continue, as needed, with both annual updates and consultation on specific actions occurring to meet the requirements of sections 106 and 110.
- Site interpretation would continue in accordance with the Knife River Indian Villages Comprehensive Interpretive Plan (in development, 2016).
- A parkwide Native American Graves Protection and Repatriation Act (NAGPRA) action plan for inadvertent discoveries and project-specific plans for the intentional archeological excavation of human remains or NAGPRA items would be completed and followed in the event that human remains or NAGPRA items are in jeopardy of damage, loss, or theft. Intentional excavation of NAGPRA items and human remains would only be done in direct consultation and coordination with the tribal historic preservation officer / state historic preservation officer.
- Public and private partnerships would be sought to achieve management objectives, opportunities for information sharing (e.g., host a research conference), and/or enter into agreements with federal, state, or local jurisdictions to further resource protection.

Tribal Consultation and Coordination

All alternatives include the following measures related to tribal consultation and coordination.

- Tribal monitoring assistance could occur at the request of the tribe(s) for archeological investigations or other activities.
- Park staff would seek to involve tribal members in site prioritization, interpretive programs, and ethnographic research. Park staff would provide opportunities for tribal events and involve tribal youth in park programs.
- The park would continue to consult with tribes per Executive Order 13175, “Consultation and Coordination with Indian Tribal Governments,” and with the Department of the Interior’s Tribal Consultation Policy.

Interdisciplinary Scholarly Research

All alternatives include the following measures related to interdisciplinary scholarly research at the park.

- Archeological research would be encouraged as part of the park’s mission. All research projects would be required to follow NPS policies and strive to limit the disturbance necessary to collect the information needed to address defined research questions.

Pocket Gophers

Park staff would continue to comply with the standard operating procedure for disposition of artifacts in situ (appendix B) as it relates to artifacts uncovered by pocket gopher activity. This procedure provides a protocol for dealing with artifacts that are found by park staff or visitors. As stated in the standard operating procedure, priority is always given to leaving archeological items in situ (i.e., in their original place). However, if park management determines that unusual or rare archeological items should be recovered, cataloged, and stored in the museum collections, these activities would be completed in accordance with the standard operating procedure and other applicable NPS guidance and regulations.

Vegetation Management

All alternatives include the following measures related to vegetation management in conjunction with archeological resource management activities.

- Nonnative vegetation management would proceed as outlined under the existing *Northern Great Plains Exotic Plant Management Plan* (*Exotic Plant Management Plan*) (NPS 2005) or other sound ecological management practices. Management would include chemical, manual, biological, prescribed fire, and mechanical methods.
- Northern Great Plains Inventory and Monitoring staff would continue annual monitoring of vegetation plots.
- The park would continue opportunistic native prairie restoration in areas with low and medium densities of archeological resources as defined by the prescribed fire program (NPS 2008c). The native prairie restoration process typically includes burning, chemical application, and, reseeding. Current native prairie establishment activities include precision prairie restoration and reintroducing forbs into the revegetated native prairie.
- In accordance with the *Knife River Indian Villages National Historic Site Fire Management Plan* (*Fire Management Plan*) (NPS 2008c) and Vegetation Inventory and Monitoring Program, study plots would continue to be marked with either buried rebar stakes or an alternative method that would not impact the identification and interpretation of archeological resources.

Infrastructure

All alternatives include the following measures related to infrastructure in the park.

- Relocation of trails in response to riverbank erosion would continue as needed. Trails would continue to be mowed paths with no additional treadwork.
- The replica earthlodge would continue to be maintained as an interpretive exhibit.
- Maintenance of existing bank stabilization structures to protect County Road 18 would continue. The park would cooperate with state and county agencies to develop an action plan dealing with relocating roads in case of emergency and for ensuring access to park areas and private property.

Museum Collection

The management of the museum collection at the park would continue to comply with NPS policies, including NPS *Management Policies 2006,* Director's Order 24: *NPS Museum Collections Management* (NPS 2008a), and Director's Order 28, and procedures set forth in the NPS *Museum Handbook* (NPS 2015b) and NPS-28: *Cultural Resource Management Guidelines*. The following measures related to management of the museum collection would occur under all alternatives.

- A collection management plan and scope of collection statement would be maintained and updated as required. The collection management plan would provide the park with guidelines and recommendations for improving collection management at the park.
- Museum objects and specimens would be cataloged and entered into the Interior Collections Management System.
- A museum collection condition assessment would be completed. This plan would build on the collection management plan and identify collection condition and treatment needs for the museum collections.
- A checklist to ensure the facility meets NPS standards would be reviewed and updated annually. Currently the park is meeting approximately 98% of NPS standards. The primary deficiency listed in the park's Checklist for Preservation and Protection of Museum Collections is related to the basement storage.
- An annual inventory of museum property would be completed. A random sample for the accession backlog and cataloged collections and 100% inventory for controlled property inventories would be conducted.
- A selection of objects, specimens, and archives would be digitized and made available to the public and researchers via the web.
- Park staff would work with regional museum representatives on project management and funding requests.
- The Museum Collections Emergency Operation Plan (update in development, 2016) would continue to be followed and updated as necessary.
- The collections would continue to be made available for interpretation, tribal needs or requests, and research activities.
- The park would continue to respond to collection research requests. Collection access requests would be reviewed and granted when appropriate.
- The museum collections would be protected from potential water intrusions.
- Implementation of integrated pest management in the museum collections facility would continue.

ALTERNATIVE 1: NO-ACTION

Under the no-action alternative, management of archeological resources at the park would continue as currently implemented. Management would respond to archeological resource threats but without the benefit of site prioritization and a proactive adaptive management framework. Under the no-action alternative, existing park infrastructure would remain in place. Specific ongoing components of the no-action alternative, in addition to those described previously in the "Actions Common to All Alternatives, Including the No-Action" section, include the following.

Riverbank Erosion Management

The no-action alternative includes the following measures related to ongoing riverbank erosion at the park.

- Future stabilization projects would be implemented as independent projects in response to emergency events rather than as part of a comprehensive archeological resources management plan.
- Existing bank stabilization maintenance and repair would continue as needed. Most stabilization maintenance would be reactive and performed as an emergency response activity (e.g., riprap was added to the stabilization at the Sakakawea site in 2003, and in 2009, the stabilization at Taylor Bluff Village was rebuilt and extended following the failure of materials during a flood event).

- Emergency response protocols for Knife River flood stages would be coordinated with Mercer County and the State of North Dakota.
- Data recovery would be performed to reduce the loss of archeological materials from riverbank erosion depending on staff and funding availability. Data recovery would include damage assessments, geophysical data collection, excavation, and mapping. These activities would be performed in reaction to impending loss of archeological material from riverbank erosion.

Pocket Gophers

The no-action alternative includes the following measures related to ongoing pocket gopher activity at the park.

- Lethal gopher trapping would continue as currently implemented. Trapping is performed annually in May, June, and/or July. The park would maintain trapping records.
- Pocket gopher activity would be documented in all archeological site condition assessments; however, there would be no formal monitoring of pocket gopher activity.

Vegetation Management

The no-action alternative includes the following measures related to ongoing vegetation encroachment on archeological sites at the park.

- Prescribed fire would be used as a vegetation management tool except for on the three main village sites (Big Hidatsa, Sakakawea, and Lower Hidatsa) in accordance with the *Fire Management Plan* (NPS 2008c).
- Exotic plant management would continue to treat existing and new exotic plant infestations using mechanical, chemical, biological, and fire treatments in accordance with the *Exotic Plant Management Plan* (NPS 2005).
- Mowing with a riding mower would continue on the Big Hidatsa, Sakakawea, and Lower Hidatsa sites.

Infrastructure

The no-action alternative includes the following measures related to infrastructure in the park.

- Museum collections storage would continue to be housed in the basement of the visitor center.
- The existing maintenance facility would continue to be maintained at its present location near the Big Hidatsa site.
- Repairs and rehabilitation of existing park facilities and associated activities would continue at current levels and locations.
- Repairs to the existing visitor center to address water infiltration issues would occur.
- The existing visitor center would be maintained

ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

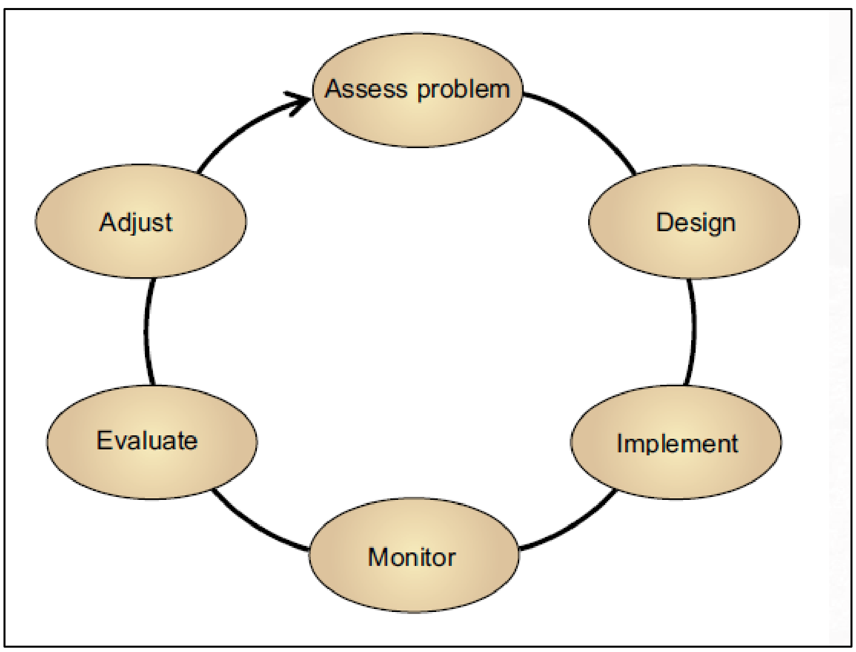
Archeological resources management at the park would be carried out in a manner consistent with the guiding principles described in chapter 1. Implementing the plan within an adaptive management framework would be common to all action alternatives. The following sections describe the proposed adaptive management framework. Adaptive management would be used for addressing riverbank erosion, gopher control, and woody vegetation encroachment.

Adaptive Management Framework

Management of archeological resources at the park would be conducted within an adaptive management framework. Adaptive management is based on the assumption that current scientific knowledge is incomplete and a level of uncertainty exists. In 2007, the Department of the Interior released its *Adaptive Management Technical Guide* (updated in 2009), defining the term and providing a clear process for building adaptive management processes into natural resource management (Williams et al. 2007, 2009). In 2008, the Department of the Interior codified the definition in regulation stating that adaptive management is "a system of management practices based on clearly identified outcomes and monitoring to determine whether management actions are meeting desired outcomes; and, if not, facilitating management changes that will best ensure that outcomes are met or re-evaluated" (43 CFR 46.30). The regulation also directs agencies of the Department of the Interior to use adaptive management (43 CFR 46.145).

Adaptive management is based on the assumption that current scientific knowledge is incomplete and a level of uncertainty exists.

Adaptive management is a continuing iterative process where (1) a problem is assessed, (2) potential management actions are designed and implemented, (3) those actions and resource responses are monitored over time, (4) data are evaluated, and (5) actions are adjusted if necessary to better achieve desired management outcomes (figure 2-1).



SOURCE: Williams et al. 2009

FIGURE 2-1. THE ADAPTIVE MANAGEMENT PROCESS

Assess Problem. The problems affecting archeological resources in the park are described in chapter 1. However, because the risks posed by the identified resource threats vary by archeological site throughout the park, a more detailed assessment of the resource problem at the scale of individual archeological sites was warranted. As a result, park management developed a process to prioritize archeological sites based on importance and level of risk to inform management decisions. This site prioritization tool is necessary because the majority of archeological sites in the park are affected by one or more resource threats, and limitations in resources, primarily annual funding and staffing, preclude the park from addressing all threats at all sites when initially implementing the plan. The site prioritization tool helps inform management decisions in the face of limited park management resources, including funding and staffing.

Sites determined not eligible for listing in the national register were excluded from the prioritization process. The existing condition of all remaining archeological sites was assessed based on the criteria presented in table 2-1. Table 2-2 describes each of the criteria. Because of the sensitivity of information related to the archeological sites at the park, only the criteria and their associated category definitions are presented.

As shown in table 2-1, importance and risk criteria are scored with 3, 2, 1, or 0 points, with the larger point totals equating to a greater importance or risk. The tribal area of concern criterion is categorized as “Yes” or “No,” with a scoring of 3 and 0 points, respectively. Risk criteria are divided into three tiers to reflect the difference in perceived level of impact associated with each risk criterion. The points for tier 3 risk criteria are weighted by a factor of 2, tier 2 criteria are weighted by a factor of 1, and tier 1 criteria are weighted by a factor of 0.5. The total points for all criteria are tallied for each site and represent a total site prioritization score. A conceptual example of the scoring process is presented in table 2-3. The combined site prioritization table detailing risk and importance factors for resources at the park is presented in table 2-4.

In addition, a long-term strategy to guide future research activities at the park would be developed. This strategy would outline a focus on how the culture, agriculture, economy, and lifestyle of Northern Plains tribes developed. It would account for the application of current research techniques and innovative methods (e.g., geophysical technologies). Knowledge gaps would be identified and addressed. This strategy would help to guide and assess potential future archeological resource conflicts.

TABLE 2-1. ARCHEOLOGICAL SITE PRIORITIZATION CRITERIA AND DEFINITIONS

Tribal Criteria	Yes (3 points)		Undetermined (0 Points)	
Areas of traditional interest	Site has been particularly noted by the tribes.		Site has not been particularly noted by the tribes and is not known to include human remains or have the potential to include human remains.	
Importance Criteria	**3 Points**	**2 Points**	**1 Point**	**Not Applicable (0 Points)**
National historic landmark site	Yes, the site is designated as a national historic landmark site.	NA	NA	No, the site is not designated as a national historic landmark site.
Relationship to park purpose and significance	The site is directly related to the park purpose and significance (i.e., village sites, cemeteries, trails, and other associated features).	The site is related to the park purpose and significance but is not considered central to the park's story.	Sites are indirectly associated with park purpose and significance. These sites lack cultural significance or provide minimal data to inform on a specific time or activity.	Sites are historic, post-homestead era, or sites determined not eligible for listing in the national register.
Tier 3 Criteria (weight by factor of 2)				
Proximity to Knife River active erosion areas (unstabilized)	0–150 feet	151–300 feet	301–450 feet	> 450 feet
Proximity to Knife River active erosion areas (stabilized)	0–100 feet	101–200 feet	201–300 feet	> 300 feet
Tier 2 Criteria (weight by factor of 1)				
Proximity to Knife and Missouri Rivers (exclusive of active erosion areas)	0–30 feet	31–50 feet	51–200 feet	> 200 feet
Presence of woody vegetation encroachment	Woody vegetation encroachment is present on the site.	NA	NA	No woody vegetation encroachment is present on the site.

Importance Criteria	3 Points	2 Points	1 Point	Not Applicable (0 Points)
Pocket gopher activity	Pocket gopher activity is present on the site.	NA	NA	Pocket gopher activity is not present on the site.
Tier 1 Criteria (weight by factor of 0.5)				
Contains highly erodible soil types	Soils have 0.32+ erosion factor and 4% or greater slope.	NA	NA	Soils do not meet the definition under the high category
Proximity to road right-of-way corridor	Site is within the road right-of-way corridor.	Site falls within 50 feet of the road right-of-way corridor.	NA	Site is more than 50 feet from road right-of-way corridor.
Visitor exposure (visitor center, trail, or parking lot within 5 feet of site)	Site is within 5 feet of the visitor center, a trail, or a parking lot.	NA	NA	Site is more than 5 feet from the visitor center, a trail, or a parking lot.
Proximity to maintenance facility	Site is within 20 feet from the maintenance facility.	NA	NA	Site is more than 20 feet from the maintenance facility.
Mowing on-site	Mowing occurs on the site.	NA	NA	Mowing does not occur on the site.

TABLE 2-2. ARCHEOLOGICAL SITE PRIORITIZATION CRITERIA DESCRIPTIONS

Prioritization Criteria	Description
Tribal area of concern	Identifies whether a site has been particularly noted by the tribes.
National historic landmark	Identifies whether a site is designated as a national historic landmark.
Relationship to park purpose and significance	Categorizes the relationship a site has with the park purpose and significance.
Proximity to Knife River active erosion areas (unstabilized)	Measures the distance from the riverbank of an unstabilized active erosion area out to defined thresholds. The unstabilized active erosion areas are those river bends that are known to be actively eroding and are currently not stabilized. The river bends considered to be unstabilized active erosion areas include Loop Bend, Elbee Bend, Noname Bend, and Unnamed Bend.
Proximity to Knife River active erosion areas (stabilized)	Measures the distance from the riverbank of a stabilized active erosion area out to defined thresholds. The stabilized active erosion areas are those river bends that are known to be actively eroding and are currently stabilized. The river bend considered to be a stabilized active erosion area is Taylor Bend.
Proximity to Knife and Missouri Rivers	Measures the distance from the Knife and Missouri River banks out to defined thresholds where impacts on sites occur because of the proximity to the rivers.

Prioritization Criteria	Description
Presence of woody vegetation encroachment	Measures the presence or absence of woody vegetation encroachment on the archeological sites.
Pocket gopher activity	Documents the presence or absence of pocket gopher activity on the archeological sites.
Contains highly erodible soil types	Measures the presence or absence of highly erodible soil on the archeological sites.
Proximity to road right-of-way	Measures the distance from the road right-of-way out to defined thresholds where impacts on sites may occur because of proximity to roadways.
Visitor exposure (visitor center, trail, or parking lot within)	Measures the distance from physical features associated with visitor exposure such as the visitor center, trails, and parking lots.
Proximity to maintenance facility	Measures the distance from the maintenance facility out to a defined threshold where impacts to sites occur because of proximity to the maintenance facility.
Mowing on-site	Identifies if a site is currently being mowed or not.

TABLE 2-3. CONCEPTUAL EXAMPLE OF SITE PRIORITIZATION SCORING PROCESS

Prioritization Criteria	Example Archeological Site			
	Site A	Site B	Site C	Site D
Tribal area of concern	3	3	3	3
National historic landmark	3	0	0	0
Relationship to park purpose and significance	3	3	3	3
Proximity to Knife River active erosion areas (unstabilized)	0	6	6	0
Proximity to Knife River active erosion areas (stabilized)	6	0	0	0
Proximity to Knife and Missouri Rivers (exclusive of active erosion areas)	3	3	3	0
Woody vegetation encroachment	2	1	2	3
Pocket gopher activity	3	3	3	3
Contains highly erodible soil types	1.5	1.5	0	1.5
Proximity to road right-of-way	1.5	1.5	1.5	0
Visitor exposure	0	1.5	0	1.5
Proximity to maintenance facility	1.5	0	0	1.5
Mowing on-site	1.5	0	0	1.5
Total Prioritization Score	**29**	**23.5**	**21.5**	**18**

Prioritization Criteria	Example Archeological Site			
	Site A	Site B	Site C	Site D

TABLE 2-4. COMBINED SITE RISK AND SITE IMPORTANCE INTO SITE PRIORITIZATION FOR KNIFE RIVER INDIAN VILLAGES CULTURAL RESOURCES

Resource Name	Common Name	Total Risk Value by Site	Total Importance Value by Site	Total Prioritization Value
32ME00012	Big Hidatsa Village	21	15	36
32ME00408	Elbee	25	11	36
32ME00010	Lower Hidatsa Village	20	15	35
32ME00496	Ramble	20	15	35
32ME00011	Sakakawea Village	19	15	34
32ME00493	Sakakawea Cemetery	19	15	34
32ME00366	Taylor Bluff	20	13	33
32ME00473	NaxpikE	18	15	33
32ME00497	Selca	18	15	33
32ME00409	Scovill	17	15	32
32ME00481	Hidatsa Trail Cemetery	17	15	32
32ME00491	Sakakawea Southwest	19	13	32
32ME00499	Lower Hidatsa West	19	13	32
32ME00411	Lobodi	16	15	31
32ME00498	Smaul	16	15	31
32ME00412	Hotrok	19	11	30
32ME00477	Hidatsa High Bench Cemetery	15	15	30
32ME00478	Hidatsa Hilltop Cemetery	15	15	30
32ME00479	Hidatsa Long Ridge Cemetery	15	15	30
32ME00480	Hidatsa Low Bench Cemetery	15	15	30
32ME00104	Stanton Mound Group	18	11	29
32ME00787	Baker Cemetery	14	15	29
32ME00008	Amahami Village	15	13	28
32ME01421	NA	17	11	28
32ME00311	Black Owl	20	7	27
32ME00312	Madman's Bluff	20	7	27
32ME00488	Lower Hidatsa South	18	9	27
32ME00407	Poly	17	9	26
32ME00414	Hump	17	9	26

Resource Name	Common Name	Total Risk Value by Site	Total Importance Value by Site	Total Prioritization Value
32ME00490	Lower Hidatsa North	17	9	26
32ME00415	Youess	16	9	25
32ME00466	Karishta	20	5	25
32ME00487	Lower Hidatsa East	16	9	25
32ME00492	Soni	18	7	25
32ME00298	NA	15	9	24
32ME00413	Forkorner	17	7	24
32ME00489	Nash	17	7	24
32ME00383	Running Deer	15	9	24
32ME00495	Sakakawea Trail Complex	17	7	24
32ME00009	Buchfink	14	9	23
32ME00299	NA	16	7	23
32ME00310	Bihohka	16	7	23
32ME00410	YCC	18	5	23
32ME00474	Rokhohl	16	7	23
32ME00494	Sakahami Trail	16	7	23
32ME00416	Elder	17	5	22
32ME01422	NA	17	5	22
32ME00464	Yellow Bear	16	5	21
32ME00471	Hadu Kexu	16	5	21
32ME01423	NA	16	5	21
32ME00465	Metsiroku	15	5	20
32ME00467	Hadu Nowassa	13	7	20
32ME00468	Hadu Duupa	15	5	20
32ME01420	NA	15	5	20
32ME00475	Bedi Ari	13	7	20
32ME00476	Scattered Board	13	7	20
32ME00417	NA	12	7	19
32ME00482	Grannis School Place	14	5	19
32ME00485	Old Corral	14	5	19
32ME00470	Hadu Topa	13	5	18
32ME00472	SGB	13	5	18
32ME00486	Rusted Stove	13	5	18
32ME00348	NA	11	5	16
32ME00469	Hadu Hawi	11	5	16

Resource Name	Common Name	Total Risk Value by Site	Total Importance Value by Site	Total Prioritization Value
32ME00483	Fowler Farmstead	11	5	16
32ME00484	Hidatsa Northern Trail Complex	11	5	16

Design and Implement. Decision making in adaptive management involves the selection of an appropriate management action at a point in time, based on the status of the resources being managed (Williams et al. 2009). The resource threats at the park differ by archeological site. As a result, no single action or set of actions would universally address resource problems. In addition, the applicability of an adaptive management framework to the varied threats facing the archeological resources differs. For example, uncertainty exists around the most effective action or combination of actions that would control pocket gopher populations to an acceptable level. Although the set of management actions that could be implemented to control pocket gopher populations is known, the most effective action or combination of actions to achieve the park's desired conditions requires learning within an adaptive management framework (i.e., implementation, monitoring, and assessment). Similarly, actions addressing riverbank erosion and vegetation encroachment are also appropriate for implementation through adaptive management.

Other management actions considered in this plan are not conducive to adaptive management but require a decision between alternatives by park management. These include actions surrounding infrastructure such as whether or not to relocate the maintenance facility or museum collections storage. Alternatives addressing these management actions are presented later in this chapter.

Decision making in adaptive management involves the selection of an appropriate management action at a point in time, based on the status of the resources being managed.

The set of management actions that the park would potentially implement to address riverbank erosion, pocket gopher activity, and vegetation encroachment have been identified and are discussed in the following sections.

Models play an important role in adaptive management. The term "model" means a plausible representation of a dynamic natural resource system (Williams et al. 2009). In the context of this plan, that definition is expanded to included how the dynamic natural resource system in the park interacts with archeological resources. Models can be as informal as a verbal description of system dynamics (e.g., a simple description of bank erosion being negatively influenced by ice scour) or as formal as a detailed mathematical expression of change (e.g., a population model of pocket gophers that includes density-dependence, age structure, and reproductive rates). An adaptive management plan is not restricted to any particular kind of model, and in the case of this plan, a variety of model types would likely be used throughout implementation. Models used in the adaptive management process should characterize system behaviors and responses to management actions (Williams et al. 2009). Monitoring efforts can then validate or invalidate the hypotheses on which the models are based.

Riverbank erosion management actions — Numerous bank stabilization techniques could be considered to address Knife River bank erosion. The most appropriate and effective techniques depend on a variety of factors determined by the hydrologic and hydraulic conditions at the point of interest. The primary factor determining the feasibility of a bank stabilization technique is shear stress. Shear stress is the stress acting parallel to a surface, in this case, the stress caused by the flow of water on the riverbank. The lower the allowable shear stress of the bank stabilization technique, the more likely the technique would be washed out or fail if high velocities and flow occur. The resistance of the bank stabilization techniques to freeze/thaw cycles and scour from river ice is also critical because the Knife River experiences heavy ice flow. The Knife River is also characterized by nearly vertical cutbanks. As a result, the angle of repose is an important consideration when selecting a bank stabilization technique. Angle of repose refers to the steepest angle at which a riverbank is stable. If the stabilization technique can handle a steeper angle of repose (i.e., if it still is a soil stabilization technique and not a structure), the banks require less grading because the soils can be maintained at steeper slopes. This is also important because any bank grading could potentially impact archeological resources in the riverbank.

Table 2-5 summarizes some of the techniques (e.g., soil bioengineering, bank armoring, flow diversion, energy reduction, geotechnical slope stabilization, and channel widening) that could be implemented to address Knife River bank erosion. An assessment of site-specific shear stress would be required as part of the design and implementation of a bank stabilization project. Any bank stabilization project would typically incorporate multiple techniques from table 2-5. Stabilization techniques that work well in combination are identified.

Soil bioengineering is often considered a "soft fix;" however, bioengineering frequently is used in combination with hard structures to protect the toe of the bank from undercutting and the flanks (end of the treatment) from eroding (Fischenich and Allen 2000). While hard protection is considered a more traditional or conventional means of stabilization, the use of vegetation predates the use of most conventional hard materials. Soil bioengineering techniques typically incorporate rock or stone to protect the toe zone. Vegetation applications (e.g., willows or brush mattressing, as seen in figure 2-2) are used in the upper bank zones to support stabilization.

SOURCE: NRCS

FIGURE 2-2. STREAMBANK SOIL BIOENGINEERING TECHNICAL TRAINING COURSE AT THE ADOBE RANCH, MONO COUNTY, CA, NOVEMBER 2007

TABLE 2-5. POTENTIAL TECHNIQUES TO ADDRESS RIVERBANK EROSION

Stabilization Techniques	Cost[a]	Efficacy Timeline	Stabilization Technique Life Span	Aesthetics[b]	Survives Fluctuating Water Levels Y/N	Resistance to Freeze/ Thaw Cycle and Ice Debris	Grading/Angle of Repose Needed[c]	Allowable Shear Stress	Technique Description	Long-Term Maintenance	Other Considerations	Other Alternatives that Work Well in Conjunction
Live stakes	$	Long term	Long term	+	N	Low	2	Low-moderate	Live hardwood material of woody species is cut to specified lengths depending on soil and site conditions.	Requires ongoing maintenance/ replacement.	Bank slopes should be moderate to shallow for success rate of stakes.	Brush mattresses, joint plantings, branch packing, live fascines, root wad, tree revetment, coconut fiber rolls, geotextile fabric
Live fascines	$	Short term	Long term	+	N	Low	1	Moderate	Live hardwood material is made into sausage-like bundles tied together. Length and diameter of a fascine depends on usage.	Requires ongoing maintenance/ replacement.	Not recommended below ordinary high water.	Brush mattresses, joint plantings, branch packing, brush layering, live stakes, root wad, tree revetment, coconut fiber rolls, geotextile fabric
Brush layering	$	Long term	Long term	+	N	Low	1	Moderate	Live hardwood material is laid in a crisscross fashion in a gently sloped soil bench. The soil bench is usually part of successive lifts of soil.	Requires ongoing maintenance/ replacement.	Does not work on outside bends. Not recommended below ordinary high water.	Brush mattresses, joint plantings, branch packing, live stakes, live fascines, root wad, tree revetment, coconut fiber rolls, geotextile fabric
Branch packing	$	Long term	Long term	+	N	Low	1	Moderate	Alternating layers of live cuttings and soil are used to fill localized slumps or gullies. The branches protrude beyond the face of the bank. The live cuttings reinforce the soil.	Requires ongoing maintenance/ replacement.	Will not prevent future stream migration. Not recommended below ordinary high water.	Live stakes, brush mattresses, brush layering, joint plantings, live fascines, live stakes, root wad, tree revetment, coconut fiber rolls, geotextile fabric
Vegetated geogrids	$$	Immediate	Long term	+	N	Moderate	1	High	Soil wall is placed on a bank or shore, made up of successive soil lifts that are separated by and wrapped in a synthetic fabric, with branch cuttings placed between each layer. Geogrids are fixed together with stakes or rebar and then covered with vegetation.	Requires ongoing maintenance/ replacement.	Can be placed below ordinary high water.	
Live cribwall	$$	Immediate	Long term	+	N	High	3	High	Live hardwood material is molded into a hollow, boxlike structure of interlocking logs and timbers. The structure is filled with rock, soil, and live cuttings or rooted plants. The live cuttings or rooted plants are intended to develop roots and top growth and take over some or all of the structural functions of the logs.	Requires ongoing maintenance/ replacement.	More effective on outside bends. Limited height allowed for structure.	Live stakes, geotextile fabric

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TABLE 2-5. POTENTIAL TECHNIQUES TO ADDRESS RIVERBANK EROSION (CONTINUED)

Stabilization Techniques	Cost[a]	Efficacy Timeline	Stabilization Technique Life Span	Aesthetics[b]	Survives Fluctuating Water Levels Y/N	Resistance to Freeze/ Thaw Cycle and Ice Debris	Grading/Angle of Repose Needed[c]	Allowable Shear Stress	Technique Description	Long-Term Maintenance	Other Considerations	Other Alternatives that Work Well in Conjunction
Joint planting	$	Long term	Long term	+	N	Low	2	Low	Cuttings of live, woody plant material are inserted between the joints or voids of riprap and into the ground below the rock.	Requires ongoing maintenance/ replacement.	Can be used to disguise riprap.	Live stakes, live fascines, brush layering, branch packing, brush mattress, live posts, tree revetment, rood wad, geotextile fabric
Brush mattress	$$	Immediate	Long term	+	N	Low	2	Low-moderate	Live hardwood material is laid in a crisscross fashion and staked down on a slope in combination with live stakes and live fascines. Soil is placed over and tamped in and around the stems.	Requires ongoing maintenance/ replacement.	Not recommended below ordinary high water.	A brush mattress incorporates live stakes, live fascines, and branch cuttings to create one comprehensive protective cover over a stream bank.
Live post	$	Long term	Long term	+	Y	Moderate	2	Low-moderate	Dormant stems, branches, or trunks of live, woody plant material are inserted into the ground to grow.	Requires ongoing maintenance/ replacement.	Bank slopes should be moderate to shallow for success rate of stakes.	Live stakes, tree revetment, root wad, coconut fiber rolls, riprap, geotextile fabric
Tree revetment	$	Immediate	Short term	+	N	Low	0	Low	Non-sprouting trees are installed along the toe of a stream bank to slow stream velocity and promote sediment deposition.	Requires ongoing maintenance/ replacement.	Not recommended for heavy ice flows. Not recommended for banks taller than 12 feet. Provides toe protection only.	Live stakes, live fascines, brush layering, branch packing, joint planting
Root wad	$	Immediate	Short term	+	N	Low	0	Moderate	Use of locally available logs and root fans to add physical habitat to streams in the form of coarse, woody debris and deep scour pockets.	Requires ongoing maintenance/ replacement.	Should be used in combination with other techniques. Provides toe protection only. Not used for high banks.	Live stakes, live fascines, brush layering, joint planting, brush mattress, live posts
Dormant post-plantings	$	Long term	Long term	+	N	Low	2	Moderate	Large cuttings of live, woody plant material is inserted into the ground. Typically, these cuttings are 5 to 20 feet long and have diameters ranging from 2 to 8 inches.	Requires ongoing maintenance/ replacement.	Water level is a concern because the ends of the plantings need to have access to the water.	Live stakes, live fascines, brush layering, branch packing, joint planting, brush mattress
Riprap and riprap with embedded toe	$$	Immediate	Long term	-	Y	Moderate	2	Moderate	Loose stone are used to form a foundation for a breakwater to prevent soil erosion.	Requires minimal maintenance/upkeep.	Overtopping and scour are important design considerations that may be exacerbated.	Live posts, geotextile fabric
Soil covered riprap	$$	Immediate	Long term	+	Y	Moderate	2	Moderate	Riprap is supplemented with soil and rooted and unfooted species on the upper portion of the slope.	Requires minimal maintenance/upkeep.	Maintenance earthwork may be required to maintain aesthetic appearance.	Live posts, geotextile fabric
Articulated blocks	$$$	Immediate	Long term	-	Y	Moderate	2	Moderate	Concrete blocks are placed along the river edge held together by steel rods or cables used to protect soil from water contact and erosion.	Requires minimal maintenance/upkeep.		Geotextile fabric

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TABLE 2-5. POTENTIAL TECHNIQUES TO ADDRESS RIVERBANK EROSION (CONTINUED)

Stabilization Techniques	Cost[a]	Efficacy Timeline	Stabilization Technique Life Span	Aesthetics[b]	Survives Fluctuating Water Levels Y/N	Resistance to Freeze/ Thaw Cycle and Ice Debris	Grading/Angle of Repose Needed[c]	Allowable Shear Stress	Technique Description	Long-Term Maintenance	Other Considerations	Other Alternatives that Work Well in Conjunction
Geogrid	$	Immediate	Long term	-	Y	Moderate	1	High	Soil wall is placed on a bank or shore, made up of successive soil lifts that are separated by and wrapped in a synthetic fabric, with branch cuttings being place between each layer. Geogrids are fixed together with the use of stakes or rebar.	May require occasional repair.	Prone to failure from debris and ice. Typically not used as a sole restoration technique.	Live stakes, joint planting
Geotextile fabrics	$	Immediate	Long term	+	Y	Low	0	Low	Permeable fabrics typically made from polypropylene or polyester are used to separate, filter, reinforce, protect, or drain soils.	May require occasional repair.	Prone to failure from debris and ice. Typically not used as a sole restoration technique.	Live stakes, live fascines, brush layering, brush mattress, joint planting, riprap, soil covered riprap
Hard points and jetties	$$	Long term	Long term	Depends on type	Y	High	2	Moderate	A structure extending from the river bank out into the riverbed is used to protect banks from erosion. Typically these structures are made of concrete or rock.	May require occasional modification based on channel conditions.	Fluctuating water levels can affect effectiveness. Streambed stabilization technique, not for stream banks.	
Cribs	$	Long term	Short term	Depends on type	Y	Low	0	Low	Timbers molded into the form of a crib in conjunction with vegetative covering and rock and fill soil are placed between the bank and river.	May require occasional modification based on channel conditions.	Fluctuating water levels can affect effectiveness. Can cause further bank erosion.	Live stakes, joint planting, geotextile fabric
Dikes	$$	Long term	Long term	Depends on type	Y	High	0	Moderate	A structure extending from the river bank out into the riverbed is used to protect banks from erosion. Typically these structures are made of concrete or rock.	May require occasional modification based on channel conditions.	Fluctuating water levels can affect effectiveness. Major reconstruction of banks that can require further bank stabilizations techniques.	Live stakes, joint plantings, dormant post plantings, riprap, soil covered riprap, geotextile fabric
Vanes	$$	Long term	Long term	Depends on type	Y	Moderate	0	Moderate	Vanes act to guide the flow away from bank, to reduce bank erosion, promote local sedimentation, and encourage vegetation growth.	May require occasional modification based on channel conditions.	Fluctuating water levels can affect effectiveness.	Live stakes, joint planting
Channel blocks	$$	Long term	Long term	Depends on type	Y	High	2	High	Blocks are used to create a lining on river banks to protect soils and guide water flow.	May require occasional modification based on channel conditions.	Fluctuating water levels can affect effectiveness. Ineffective on large streams with large side channels.	Riprap should be used on the downstream side to prevent scour.
Grading	$	Immediate	Short term	+	N	High	3	Low	Earth is moved to create a level base or a specified slope.	May require occasional modification based on channel conditions.	Should be used in combination with other techniques. Grading is typically involved in most stabilization techniques.	Live stakes, live fascines, brush layering, brush mattress, joint planting, tree revetments, root wad, riprap, geotextile fabric

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TABLE 2-5. POTENTIAL TECHNIQUES TO ADDRESS RIVERBANK EROSION (CONTINUED)

Stabilization Techniques	Cost[a]	Efficacy Timeline	Stabilization Technique Life Span	Aesthetics[b]	Survives Fluctuating Water Levels Y/N	Resistance to Freeze/ Thaw Cycle and Ice Debris	Grading/Angle of Repose Needed[c]	Allowable Shear Stress	Technique Description	Long-Term Maintenance	Other Considerations	Other Alternatives that Work Well in Conjunction
Grade control structures	$$$	Short term	Long term	-	Y	Moderate	2	Moderate	An earthen, wooden, concrete, or other structure is used to prevent gully development and bed erosion. Typically built to pass water to a lower elevation while controlling the energy and velocity of the water as it passes over.	Requires minimal maintenance/upkeep.		
Geogrids and geotextiles	$	Immediate	Long term	+	Y	High	1	Moderate	A soil wall is placed on a bank in conjunction with permeable fabrics used to separate, filter, reinforce, protect, or drain soils and slopes.	May require occasional repair.	Prone to failure from debris and ice.	
Retaining walls	$$$	Immediate	Long term	Depends on type	Y	High	0	High	A structure is placed to hold back material (soil), preventing soil from sliding or eroding away.	Requires minimal maintenance/upkeep.		
Drains	$$	Short term		Depends on type	Y	Moderate	1	Low-moderate	Drains are placed on slopes to remove excess runoff or stormwater from slopes.	Requires ongoing maintenance/ replacement.	Should be used on unstable slopes and in combination with other techniques. Unlikely to be successful in the long term. Used for stormwater drainage on slopes over bank stabilization technique.	Riprap, geotextile fabric, bank armoring techniques
Channel widening	$$$	Immediate	Long term	+	Y	Moderate	2	Moderate-high	Existing channels are widened to protect banks from high flow runoffs.	Requires minimal maintenance/upkeep.	May not resolve issue of eroding banks. Ice jams could occur because of lowered velocity with channel expansion. Major engineering design required to resolve all issues.	Live stakes, live fascines, brush layering, brush mattress, branch packing, joint planting, live cribwall, live post, tree revetment, riprap, geogrids, vanes, channel blocks, grading, retaining walls, high flow diversion channels
High flow diversion channels	$$$	Immediate	Long term	+	Y	Moderate	2	Moderate-high	Structures and measures are used that intercept high flow runoff upstream of desired bank stabilization areas, then transport the water around or through the area, discharging it downstream.	May require occasional ice jam or log jam clearing.	Ice and debris jams are likely to be reoccurring. Major engineering design required to ensure stability.	Live stakes, live fascines, brush layering, brush mattress, branch packing, joint planting, live cribwall, live post, tree revetment, riprap, geogrids, vanes, channel blocks, grading, retaining walls, channel widening

[a] $ = Low cost; $$ = moderate cost; $$$ = high cost

[b] **+ = positive aesthetic features; - = negative aesthetic features**

[c] **0 = No grading / angle of repose is not significant; 1 = minor grading needed / high angle of repose acceptable; 2 = major grading needed / low angle of repose necessary; 3 = major grading needed for structure but angle of repose not applicable or significant"**

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Fischenich and Allen (2000) group conventional (hard structure) solutions into four broad categories:

- structures whose primary function is to prevent erosion by armoring the eroding bank
- structures that prevent erosion by deflecting the current away from the bank
- methods that reduce the erosive capability in the channel
- geotechnical methods of slope stabilization

Armoring includes the placement of a protective covering, usually consisting of stone, over part or all of the stream bank. The riparian area may need to be disrupted for construction. An example of the use of riprap along a river edge is noted in figure 2-3.

SOURCE: FEMA

FIGURE 2-3. RIPRAP ALONG A RIVER'S EDGE

Flow deflection techniques are based on the principle that, by redirecting higher velocity flows away from the bank, erosion can be reduced or eliminated in areas between structures. Deflective structures are constructed approximately perpendicular to the flow, reducing the effective width of the river (Fischenich and Allen 2000). This technique usually costs less than continuous bank armoring.

Energy reduction methods function by reducing the ability of the river to erode bed and bank material. Slope stabilization techniques typically involve large-scale modification to the bank such as laying back or grading the bank to achieve a necessary angle of repose. This can disturb the riparian environment and may affect aesthetics and recreation (Fischenich and Allen 2000). Figure 2-4 shows an example of a vane being used at North Fish Creek, Wisconsin.

SOURCE: USGS

FIGURE 2-4. ENERGY REDUCTION VANES, NORTH FISH CREEK, WISCONSIN

Channel reconfiguration actions could also improve flow conveyance and alleviate high flows at active erosion areas. Examples of reconfiguration actions include excavating new side channels to capture flow during high waters, excavating point bars to allow more channel capacity at active erosion bends, or modifying the channel to allow for more connection to the floodplain resource.

The North Dakota state engineer has administrative authority over areas in the ordinary high watermark of navigable waters in the state, which includes the Knife River. Implementation of any bank stabilization techniques in table 2-5 would require a permit from the North Dakota state engineer's office.

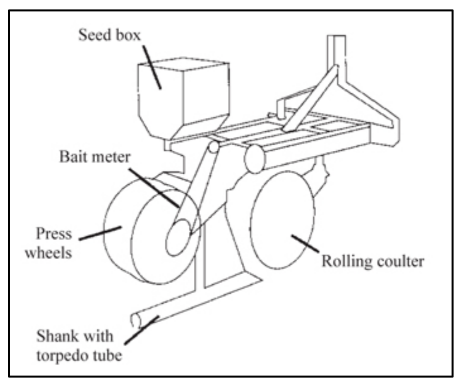
Park staff could use archeological data recovery if riverbank stabilization efforts fail to achieve the desired conditions of preservation in place. This option would only be considered after measures to preserve in place have been attempted and were not successful or have been evaluated and determined not feasible to achieve desired results.

Pocket gopher management actions — Table 2-6 summarizes pocket gopher control techniques that would potentially be used at the park. Management of pocket gophers is best accomplished through a combination of cultural and population management methods. Depending on the particular situation, eliminating or significantly reducing preferred food sources can reduce the number of pocket gophers. Cultural management methods include habitat modifications such as crop adjustments and flooding. Other population management methods, including mechanical exclusion methods, are also effective means of control (Vantassel et al. 2009; Wiscomb and Messmer 2010).

Direct population reduction is the fastest and most successful way to reduce damage by pocket gophers. Lethal trapping can be an extremely effective means of controlling small populations of pocket gophers and is best accomplished in the spring or fall when the gophers are the most active. This method is labor intensive and requires managers to locate the main tunnel of an active burrow and place traps at each end (Wiscomb and Messmer 2010). In areas with large populations, the US Department of Agriculture Animal and Plant Health Inspection Service (USDA-APHIS) recommends simultaneously deploying other management actions such as chemical controls or exclusion methods to increase the efficiency of this method and maximize results (USDA-APHIS, Shellie, pers. comm. 2015).

Chemical controls (using toxic bait) are effective in areas away from surface waters. The US Department of Agriculture Animal and Plant Health Inspection Service recommends strychnine milo as the most efficient and easiest way of controlling pocket gopher populations in relatively small areas. Only certified applicators can apply strychnine milo under the direction and regulation of the USDA-APHIS toxicant label; it should not be applied directly to water or to areas where surface water is present (USDA-APHIS 2010). This nonrestricted (when used on a small scale) toxic bait is injected into the mounds of the pocket gopher using a hand-held probe. This pesticide is applied once in spring when gophers become more active and then again if new mounds are observed after several weeks. Because the poison is applied underground and the animal dies underground, the risk of secondary poisoning to other species is minimized (USDA-APHIS, Paulson, pers. comm. 2014).

A burrow builder (figure 2-5) is designed to create an artificial gopher tunnel underground, into which toxic bait is placed. This artificial tunnel intersects the gophers' tunnels, and the gophers enter the artificial tunnel and consume the bait. Although the use of burrow builder systems is highly effective, it does cause ground disturbance. This technique may be appropriate for use at archeological sites where a plow zone already exists or the continued damage from pocket gopher activity may exceed the disturbance a burrow builder would cause.



SOURCE: Hygnstrom et al. 2010

FIGURE 2-5. BASIC PARTS OF A BURROW BUILDER

Table 2-6. Pocket Gopher Control Management Techniques

Management Techniques	Cost[a]	Efficacy Timeline	Long-Term Maintenance	Technique Description	Other Considerations
Exclusion					
Fencing	$$$	Immediate	Requires ongoing maintenance/replacement.	Placing fencing materials around existing gopher areas in an effort to restrict pocket gopher movement to the fenced in area.	Fence would need to be buried at least 18 inches deep, and the mesh should be small enough to exclude gophers (0.25-0.5 inch). Can be costly and impractical when the population is large.
Habitat Modification					
Buffer strips	$$	Long term	Requires ongoing maintenance/replacement.	Planting or cultivating a 50-foot buffer strip of grains around hay fields provides unsuitable habitat around the fields and can minimize immigration of gophers.	Cultivating or planting a 50-foot buffer-strip of grains around areas may create unsuitable habitat for gophers. Also periodic deep cultivation will destroy or expose tunnel systems.
Toxicants					
Strychnine alkaloid	$$	Long term	May require frequent application and baiting depending on size of gopher population and area.	Bait in the form of grain or pellets containing Strychnine alkaloid is placed in pocket gopher tunnel systems either by hand or by a burrow builder for pocket gopher consumption. Typically strychnine alkaloid is the most effective pocket gopher toxicant.	Hand or burrow builder baited with grain or pellets treated with strychnine (a federally registered poison). It is a nonrestricted-use pesticide (when used on a small scale) that can only be used by certified applicators. Only registered for below ground use. Effective within first week of application. Can be hazardous and harmful to all wildlife.

Management Techniques	Cost[a]	Efficacy Timeline	Long-Term Maintenance	Technique Description	Other Considerations
Zinc phosphide	$$	Long term	May require frequent application and baiting depending on size of gopher population and area.	Bait in the form of grain or pellets containing zinc phosphide is placed in pocket gopher tunnel systems either by hand or by a burrow builder for pocket gopher consumption. Typically zinc phosphide has been known to be less effective than strychnine alkaloid	Hand or burrow builder baited with grain or pellets treated with zinc phosphide (a federally registered poison). It is a restricted-use pesticide and can only be used by certified applicators. Can be hazardous and harmful to all wildlife.
Anticoagulant baits (chlorophacinone and diphacinone)	$$	Long term	May require frequent application and baiting depending on size of gopher population and area.	Bait in the form of grain or pellets containing either chlorophacinone or diphacinone is placed in pocket gopher tunnel systems either by hand or by a burrow builder for pocket gopher consumption.	Federally registered chemicals used in common rodent poisons. Diphacinone will last longer than grain bait and will poison any new gophers entering the burrow system. Can be hazardous and harmful to all wildlife.
Hand baiting	$$	Long term	May require frequent maintenance and reapplication depending on size of gopher population and area.	Bait can be placed in a burrow system by hand, using a special hand-operated bait dispenser probe, or by making an opening to the burrow system with a probe.	Practical for small areas or new infestations. A spoonful of bait is inserted into the tunnel and the hole is covered. Two to three locations should be baited in every burrow system for best results. Poisonous baits can be harmful to all wildlife.
Mechanical burrow builder	$$	Long term	May require frequent maintenance and reapplication depending on size of gopher population and area.	A burrow builder is designed to create an artificial gopher tunnel underground, into which toxic bait is placed. This artificial tunnel intersects the gophers' tunnels, and the gophers then enter and consume the bait.	Tractor pulled system excavates gopher sized tunnels and dispenses poison at set intervals. Effective in large areas. Can be hazardous and harmful to all wildlife.
Fumigants					
Aluminum phosphide	$	Long term	May require frequent application depending on size of gopher population and area.	The aluminum phosphide is placed in the gopher tunnels then the gas spreads throughout the tunnels.	Aluminum phosphide is a restricted use chemical and can only be used by certified applicators. Known to be less effective than trapping or toxicants (gases move too

Management Techniques	Cost[a]	Efficacy Timeline	Long-Term Maintenance	Technique Description	Other Considerations
					slowly and gophers can plug holes if gas is detected). Best used in damp soil (diffuses through dry soil). Should be used in combination with other techniques such as trapping.
Gas cartridges	$	Long term	May require frequent application depending on size of gopher population and area.	The placement of gas cartridges in gopher tunnels with the gas then spreading throughout the tunnels.	Known to be less effective than trapping or toxicants (gases move too slowly and gophers can plug holes if gas is detected). Best used in damp soil (diffuses through dry soil). Should be used in combination with other techniques such as trapping events.
Lethal trapping	$$$	Immediate to long term	May require frequent trapping events, depending on size of gopher population and area.	Placement of gopher specific traps for the removal of pocket gophers. Traps are then placed underground in pocket gopher tunnels.	Effective and dependable on small to moderate sized areas or sparse gopher populations. High level of effort if gopher population is large, but high level of effectiveness (possibly combine with other methods for increased effectiveness).

Source: Andelt and Case 2014; Case and Jasch 2005; Montana Department of Agriculture 2015; USDA-APHIS, Shellie, pers. comm. 2015; Wiscomb and Messmer 2010

[a] $ = Low cost; $$ = moderate cost; $$$ = high cost

Vegetation encroachment management treatments — Various vegetation management treatment options and methods are available for removing or reducing woody and overgrown vegetation. This work can be accomplished using biological, mechanical, chemical, and/or prescribed fire treatments, individually or in combination. Park staff would select the most appropriate treatments and methods depending on site factors to achieve the desired conditions as identified in this plan. Table 2-7 summarizes techniques that would potentially be used at the park.

Cultural techniques, such as prevention (e.g., inspection of equipment, vehicles, and materials to prevent importation of nonnative plant seed or materials into a park), reseeding, and grazing, reduce the opportunity for undesirable vegetation to grow. Prevention actions may include staff and volunteer training on undesirable woody species identification, including crested wheatgrass (*Agropyron cristatum*), smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*), leafy spurge (*Euphorbia esula*), Canada thistle (*Cirsium arvense*), absinth wormwood (*Artemisia absinthium*), kochia (*Kochia scoparia*), field mustard (*Brassica kaber*), Russian olive (*Eleagnus angustifolia*), Chinese elm (*Ulmus parvifolia*), Siberian elm (*Ulmus pumila*), field bindweed (*Convolvulus arvensis*), honeysuckle (*Lonicera* spp.) and sweetclover (*Melilotus officinalis*). Reseeding could be used in areas of bare soil or areas cleared of woody vegetation to encourage the reestablishment of herbaceous vegetation and prevent the establishment of woody vegetation. Once an area is cleared of woody vegetation, it would be reseeded with either native herbaceous vegetation or with nonnative species that have a negligible risk of becoming invasive. Seeding methods considered include hand broadcasting, seed drilling, hydroseeding, and seed mats. Irrigation would be used on a limited basis during plant establishment in dry periods.

Grazing can be an effective and economical vegetation management tool. Animals tend to selectively graze certain plant species because of differences in the plant's palatability. Feeding preferences change with the seasons and maturity of the plants present. Grazing practices would include a single practice or a combination of practices (i.e., standard grazing, rotational grazing, and flash grazing). Livestock species could include cattle, horses, or goats or a combination of livestock species. Flash grazing (putting a larger herd of cattle, horses, goats, or other livestock on a small area for a short period of time) is one method where woody species could be browsed by the animal. Animals would be rotated or removed from these areas to allow desirable plants to recover. Herbivores impact vegetation by defoliating, browsing, and trampling vegetation. Defoliation of individual plants frequently reduces plant growth. All herbivores are selective grazers and the intensity of defoliation and browsing varies among individual plant species and herbivores present (Heitschmidt 1990). Cattle prefer grasses and will not browse much on woody species. Goats are primarily browsers and will often select new leaves of trees/shrubs in the spring over forbs and grasses, totally strip trees/shrubs, and over time, kill the plant. In the winter and early spring, goats will feed on the buds and bark of some woody species (Rice 2014). On some ranges, goats spend more time than sheep and cattle eating leaves and shoots of trees and shrubs (Meader 1999). Removal of woody vegetation by goats typically requires multiple seasons of grazing and intensive management. A stocking rate of three to four animals per acre is recommended when woody vegetation management is the objective (Rice 2014).

The movement of grazing animals can affect surface and near surface (up to about 12 inches below ground surface) archeological remains, particularly when the ground is softened by saturation from significant rainfall, snowmelt, or thawing. Portions of the park were used for agriculture, creating a plowzone that commonly was 8 to 12 inches deep. As a result, grazing would be limited to those areas of the park where the plowzone has been previously disturbed to minimize new impacts.

Biological treatment includes the use of "natural enemies" such as insects and microorganisms to reduce the abundance of the targeted species. Approved biological agents would be host-specific and have a negligible risk of becoming pests.

Manual/mechanical removal of woody species is best accomplished by pulling or cutting stems at the base and then applying an herbicide to the cut surface. Manual pulling is most effective on shallow-rooted species, while mechanical pulling is used for deep-rooted species. Minor retreatment in the second year may be necessary to maintain control of woody species (Lett and Knapp 2003). Mowing or haying can be beneficial for control or suppression of woody vegetation, which includes shrubs, but not trees. Mowing is most effective if performed prior to flower or seed production. Most manual/mechanical methods need to be used in combination with herbicides, grazing, and/or prescribed fire to treat resprouts and new seedlings.

Chemical treatments are most effective for treating pure stands of a single species of invasive grass or herbaceous plant species or for spot treatments. Chemical treatment for vegetation encroachment management would proceed as outlined under the existing *Exotic Plant Management Plan* (NPS 2005). All pesticides used by the park must be registered with the US Environmental Protection Agency. The park would also obtain approval from either the regional or national integrated pest management coordinator before using a pesticide.

Prescribed fire can be used to control woody vegetation by suppressing the aboveground growth of woody species. However, the return interval of fire for the treatment of woody stems is species dependent and can vary from two to ten years.

Additionally, fire alone often does not reduce cover by woody species or initiate an increase in herbaceous cover. Often a combination of other methods must be used with fire to control woody vegetation encroachment. Once shrubs are established in an area, frequent fire may not be sufficient to control woody encroachment because many shrub species resprout rapidly following fire and can increase under an intermediate fire frequency (i.e., once every four years) (Lett and Knapp 2003). Resprout is a time of active growing and respiration for brush species. Application of herbicides to emerging woody growth following a fire is very effective. Additionally, the removal of stems and grasses by fire allows direct contact of herbicides to plant leaves and translocation to roots. Following prescribed fire, less herbicide would be necessary for vegetation control. Adding fuels around the base of larger woody species prior to a burn (i.e., increasing fire intensity), has been shown to reduce resprouting following growing season and dormant season burns (Knapp et al. 2009). Use of this technique would be refined through the adaptive management process and coordinated with the Midwest Archeological Center, the tribal historic preservation officer, and the state historic preservation officer because it could potentially result in fire intensities high enough to affect soil chemistry and archeological materials. All prescribed fires would be implemented in accordance with the *Fire Management Plan* (NPS 2008c). Prescribed fire would be a vegetation management tool available throughout the park, including at the Big Hidatsa, Sakakawea, and Lower Hidatsa sites. Because of their cultural importance, prescribed fire has been excluded from use on those sites to date; however, as a result of vegetation encroachment and subsequent potential impacts on the resources at the sites, prescribed fire would be considered for use in the future.

Table 2-7. Vegetation Management Treatments

Vegetation Management Treatments	Cost[a]	Efficacy Timeline	Aesthetics[b]	Maintenance Activities	Methods Used
Cultural treatments	$$	Immediate with prevention; short-term with reseeding	+	Requires ongoing prevention practices, periodic spot reseeding, and irrigation.	Examples include prevention of nonnative species and reseeding of native herbaceous species following woody vegetation removal. Reseeding method includes hand broadcasting, seed drill, hydroseeding, and seed mats.
Manual treatments	$	Immediate	+	Requires annual spot treatments.	Includes hand pulling or cutting using small hand tools and shovels. Most manual methods need to be used in combination with pesticides, grazing, or prescribed fire to treat resprouts and new seedlings.
Mechanical treatments	$	Immediate	+	Requires annual spot treatment.	Includes pulling, cutting, grubbing, and mowing using weed whippers, mowers, tractor or all-terrain vehicle-pulled mowers, chainsaws, and shovels. Most mechanical methods need to be used in combination with pesticides, grazing, or prescribed fire to treat resprouts and new seedlings. Heavy equipment could be used for treatment of woody species encroachment.
Chemical treatments	$$	Immediate to short term	+	Requires spot treatments the first year and depending on the species, requires continuing spot treatments every 1 to 3 years.	Herbicides applied using portable sprayers, all-terrain vehicles equipped with sprayers, and aerial spraying. Includes spraying, basal bark and stem treatment, cut surface treatment, cut stump treatment, and tree injection.
Prescribed fire treatments	$$	Immediate	-	Requires continuing treatment practices every 3 to 5 years. (Snowberry requires annual treatment.)	Frequency, intensity, and timing of burning are extremely important. Used in the spring to deter woody species germination. Prescribed fire used as treatment of woody species encroachment needs to be used in combination with mowing, herbicide, or reseeding with native grasses to treat resprouts and new seedlings.
Biological controls	$	Long term	+	Pending reproduction, establishment, and effect of biological control on target vegetation species, more than one release may be necessary for desired level of management.	Includes the use of insects and microorganisms to reduce the abundance of an exotic plant. Long-term solution for controlling select exotic plant species.

Vegetation Management Treatments	Cost[a]	Efficacy Timeline	Aesthetics[b]	Maintenance Activities	Methods Used
Grazing	$$	Short term to long term	-	Requires seasonal to ongoing maintenance.	Considerations include grazing practice used (i.e., standard grazing, flash grazing, rotational grazing), stocking rate, species of livestock, timing (i.e., spring, summer, fall), and fencing requirements.

Source: Lett and Knapp 2003; Knapp et al. 2009; Meader 1999; NPS 2005; NPS 2008c; Rice 2014

[a] $ = Low cost; $$ = moderate cost; $$$ = high cost

[b] + = positive aesthetic features; - = negative aesthetic features

Monitor and Evaluate. The goal of the adaptive management process is to protect the condition of the park's archeological resources through informed, proactive, and transparent management. The framework is designed to detect changes to important indicators that may be caused by the major threats to archeological resources at the park and to provide park managers with a method to adaptively manage and address any changes in conditions. Effective monitoring requires (1) determining the most effective indicator that can gauge when the desired condition has been achieved, and (2) selecting the standard against which the indicator will be measured (NPS 2009).

The interdisciplinary planning team identified indicators and standards for managing archeological resources based on the park's purpose, significance, objectives, and desired conditions. An indicator is a measurable variable that can be used to track changes in resource conditions so that progress toward attaining the desired conditions can be assessed. A standard is the minimum acceptable condition for an indicator. The indicators and standards translate the broader qualitative descriptions of desired conditions into measurable conditions. As a result, park managers can track changes in resource conditions and provide a basis for the park staff to determine whether desired conditions are being met. Figure 2-6 illustrates how indicators and standards are used in the decision-making process.

The park would implement a monitoring program to determine the effectiveness of management actions in achieving the plan objectives. The monitoring program would include

- regular updates to the prioritization tool's tribal, importance, and risk criteria for each site as described previously
- measurement of indicators and standards

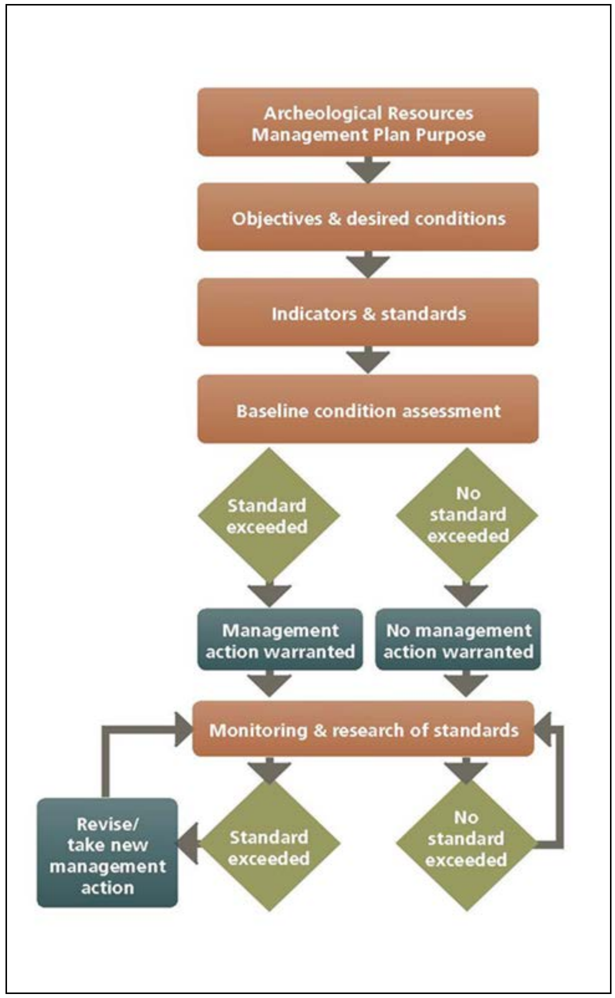


FIGURE 2-6. ROLE OF INDICATORS AND STANDARDS IN ARCHEOLOGICAL RESOURCE MANAGEMENT PLAN IMPLEMENTATION

Park staff would continue to monitor archeological resources and threats throughout the park. In addition, park staff would monitor specific indicators (table 2-8). The rigor of monitoring the indicators (e.g., frequency of monitoring cycles, amount of geographic area monitored) could vary considerably, depending on how close existing conditions are to the standards. If the existing conditions are far from meeting the standards, the rigor of monitoring could be less than if the existing conditions are close to or trending toward the standards. Monitoring is anticipated to occur annually, unless more frequent monitoring is deemed necessary through the adaptive management process.

TABLE 2-8. INDICATORS AND STANDARDS FOR THE ARCHEOLOGICAL RESOURCES MANAGEMENT PLAN

Indicator	Standard
Percent of site at high risk from bank erosion (by individual site)—in active erosion areas	0% increase in the amount of site lost or within the high risk buffer compared to baseline conditions.
Percent of site at high risk from bank erosion (by individual site)—outside of active erosion areas but in proximity to rivers	0% increase in the amount of site lost or within the high risk buffer compared to baseline conditions.
Relative abundance of pocket gophers	0% increase in abundance of pocket gophers once an acceptable population level is reached. An acceptable population level would be identified through monitoring and assessment.
Percent of site affected by woody vegetation encroachment	0% woody vegetation encroachment on archeological sites. Woody vegetation encroachment is considered to include all areas of tree and shrub species with the exception of areas that provide beneficial screening to the archeological site or areas where woody vegetation cover is the appropriate vegetative cover based on expected natural occurrence.
Change in condition in Archeological Sites Management Information System	No negative deviation from the Archeological Sites Management Information System "Good Condition" resulting from a threat other than riverbank erosion, pocket gopher activity, or vegetation encroachment.

Initial monitoring would determine if the indicators are accurately measuring the conditions of concern and if the standards truly represent the minimally acceptable condition of the indicator. Park staff may decide to modify the indicators or standards and revise the monitoring program if better ways are found to measure changes. Most of these changes would be made within the first several years of initiating monitoring. After this initial testing period, adjustments would be less likely to occur. Finally, if threats to the archeological resources at the park change appreciably, park staff may need to identify new indicators to ensure that desired conditions are achieved and maintained. This iterative learning and refining process is a strength of the adaptive management framework.

A long-term strategy to guide future research activities at the park would be developed. This strategy would focus on how the culture, agriculture, economy, and lifestyle of Northern Plains tribes developed and would consider t current research techniques and innovative methods (e.g., geophysical technologies). Knowledge gaps would be identified and addressed.

Adjust. Adjustments to management actions at an archeological site or the selection of management actions to be implemented at a site where actions have yet to be taken would be informed by the increased understanding gained through monitoring and evaluation. Prior to making an adjustment to management actions, the park would review the proposed adjustment to ascertain whether it was included in the scope of the plan. Any management action determined necessary as a result of monitoring and evaluation that was not included in the plan would be evaluated to determine the need for additional NEPA compliance or consultation under the National Historic Preservation Act prior to implementation.

Stakeholder Involvement in Adaptive Management. Stakeholder engagement is key to successful adaptive management (Williams et al. 2009). For this project, stakeholder engagement began with tribal consultation and coordination through an invitation to participate in the public scoping process (described in detail in chapter 5). Stakeholder engagement would be ongoing during the development of the plan, including consulting the MHA Nation during review of the draft environmental impact statement.

The park would coordinate all press releases regarding implementing or adjusting archeological resource management actions under the plan. The superintendent would also invite consultation with the MHA Nation on the proposed plan. The chief of interpretation and cultural resources or other designated staff member would function as public information officer and organize communication between park personnel, the public, and the media regarding actions being taken under this plan. The adaptive management framework would be explained to the public through the park's interpretive program when possible and appropriate.

The park would also engage stakeholders and consult with the MHA Nation during monitoring plan development, and when evaluating the monitoring data and proposing refinements to the prioritization tool criteria. The adaptive management decision-making process lends itself to citizen science opportunities. As part of this process, the park would explore citizen science possibilities when monitoring or data collection is warranted.

Ongoing tribal consultation and coordination on specific actions would continue. The park would increase communications concerning management decisions at key assessment points throughout the decision-making process to ensure tribal awareness and that any tribal concerns and comments are addressed. In addition, general tribal involvement in archeological research would be encouraged, facilitated, and considered an integral part of the park's research mission.

ACTION ALTERNATIVES

The actions alternatives focus on infrastructure threats and consider the possibilities for relocating the maintenance facility and/or museum collections storage on-site (alternative 2) or relocating the maintenance facility and/or museum collections storage off-site through a new building or lease (alternative 3).

Alternative 2: Relocate Facilities in the Park

Under alternative 2, archeological sites, riverbank erosion, pocket gophers, and woody vegetation would be managed under the adaptive management framework described above.

The maintenance facility and museum collections storage would be relocated to another location in the park, and the existing maintenance facility would be removed.

Once the museum collections storage is relocated, the vacant space in the basement of the visitor center could be repurposed as an educational classroom, office space, or for other uses.

The National Park Service developed criteria to identify potential sites for relocating the facilities inside the park. The goal was to identify sites that

- would allow facilities to be located at least 100 feet from a known archeological site or acceptable mitigation opportunities were available if located in closer proximity
- are not near a cemetery or known burial site
- provide road access from locations other than County Road 18
- would not be viewed from scenic vantage points in and around the visitor center
- could accommodate the projected square footage requirements

Two sites in the park were identified as meeting the necessary criteria and are both part of alternative 2. The park would relocate the facilities as follows:

- Site 1 includes approximately 17,600 square feet located adjacent to the south side of the existing visitor center (figure 2-7). The museum collections storage and supporting administrative offices would be located in an addition to the visitor center. The addition would total approximately 3,000 square feet.
- Site 2 includes approximately 65,600 square feet located south of the existing visitor center (figure 2-7). The maintenance offices, maintenance shop, cold storage, and tractor storage would be located in a new facility of approximately 6,000 square feet built on this site.

Overall, construction of an off-site maintenance facility is anticipated to result in a total cost of facility ownership for a 50-year facility lifecycle of $4.8 million, of which approximately $2.1 million would be for construction costs. If the maintenance facility were to be constructed to meet Leadership in Energy and Environmental Design (LEED) standards and include the construction and operation of a solar array, the total construction costs are estimated to be $2.9 million, and the total cost of facility ownership over a 50-year lifecycle would be $5.5 million. The total cost of facility ownership includes operational costs and anticipated, preventive, and unanticipated maintenance and facility renewal costs. Either type of facility may be chosen for construction depending on the availability of funding and changes to construction costs. Existing maintenance facility total cost of facility ownership costs are anticipated to be approximately $4.3 million. The construction of a new visitor center addition to accommodate museum collections storage is anticipated to have a total cost of facility ownership of approximately $9.5 million, with the existing visitor center having a total cost of facility ownership of approximately $5 million. Further details of space requirements and costs estimates associated with the existing and proposed facilities are located in appendix C.

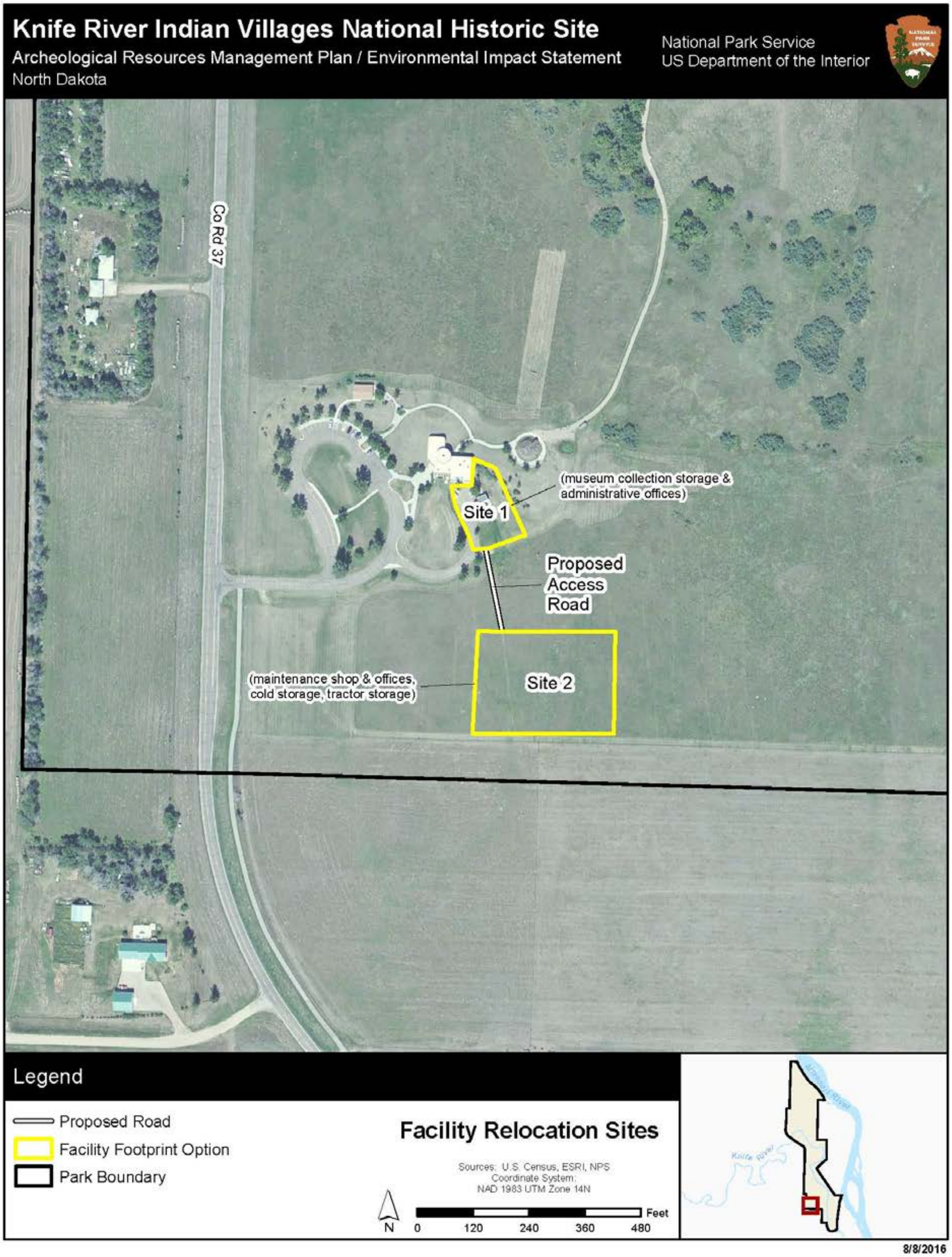


FIGURE 2-7. FACILITY RELOCATION SITES

Alternative 3: Locate Facilities Off-Site

Under alternative 3, the park would relocate the maintenance facility and/or museum collections storage to space outside the park. The space requirements would be the same as described for alternative 2. The following options are considered under this alternative.

- Option 1: Construct new off-site facilities—the park would identify suitable sites outside of the park to relocate the maintenance facility and/or museum collections storage. The existing maintenance facility would be removed. Sites for relocation of the maintenance facility and/or museum collections storage have not been identified but would need to meet the access and space requirements identified under alternative 2.
- Option 2: Lease space to relocate facilities off-site—the park would implement a site selection process to identify suitable leased space for the maintenance facility and/or museum collections storage. The existing maintenance facility would be removed, and the park would enter into a General Service Administration lease agreement and build a maintenance facility to suit its needs. The museum collections storage facility would meet NPS policies, including NPS *Management Policies 2006*, Director's Order 24, Director's Order 28, and procedures set forth in the NPS *Museum Handbook* and NPS-28: *Cultural Resource Management Guidelines*.

Moving the museum collections storage would be done in consultation with the MHA Nation tribal historic preservation officer and the North Dakota state historic preservation officer. The vacant space in the basement of visitor center could potentially be used as an educational classroom.

NATIONAL PARK SERVICE PREFERRED ALTERNATIVE

The "agency's preferred alternative" is the alternative that the agency believes would fulfill its statutory mission and responsibilities, giving consideration to economic, environmental, technical, and other factors. The National Park Service has identified a preferred alternative that would incorporate elements of alternative 3 (options 1 or 2) and include additional specified components.

The "agency's preferred alternative" is the alternative that the agency believes would fulfill its statutory mission and responsibilities, giving consideration to economic, environmental, technical, and other factors.

Under the preferred alternative, the museum collections storage would remain in its current location provided that efforts to address water infiltration issues are successful, ideally with an increase in staff and curation abilities. A comprehensive solution to address the problem is underway. The project, which includes installing a waterproofing exterior insulation finishing system (EIFS), installing a new subgrade insulation and drainage system, and applying a new sealing system to the existing visitor center roof, is expected to stop water infiltration and subsequently protect the museum exhibits. If efforts to address these issues are ultimately ineffective, the National Park Service would move the museum collections storage off-site.

In addition, the National Park Service's preferred alternative would identify land through a General Services Administration build-lease arrangement to build an off-site maintenance facility to suit park needs. However, the ability to locate in the town of Stanton would be limited because of a Stanton moratorium on the construction of new maintenance structures and garages in city limits. In addition, because of a lack of knowledge on the availability of suitable property outside of the city limits and the influence of the energy industry on market prices of leases in the area, the relocation of the maintenance facility off-site is not currently feasible and would be a long-term consideration. As such, the National Park Service intends to relocate and construct the maintenance facility in the park, unless the opportunity to lease or build off-site arises. Under the preferred alternative, the National Park Service would implement all aspects of the adaptive management framework, including a priority list of archeological resources and measures addressing riverbank erosion, pocket gopher management, and vegetation encroachment.

As previously noted, the preferred alternative must address the stated purpose of taking action and resolve the need for action. It must consider how well it would meet the objectives, stated in chapter 1, for this archeological resources management plan. Through the adaptive management framework and subsequent decision-making processes, the preferred alternative would contribute to meeting objective 1 by establishing a priority list for archeological resource protection and by providing a large suite of management tools. Efforts to address water infiltration issues at the existing facility or the potential relocation of the museum collections storage would meet objective 2.

The promotion of additional tribal involvement in archeological resource management and decision making and additional tribal research opportunities under the preferred alternative would help to meet objectives 3, 4, and 5.

ENVIRONMENTALLY PREFERABLE ALTERNATIVE

According to CEQ regulations implementing the National Environmental Policy Act (43 CFR 46.30), the environmentally preferable alternative is the alternative "…that causes the least damage to the biological and physical environment and best protects, preserves, and enhances historical, cultural, and natural resources. The environmentally preferable alternative is identified upon consideration and weighing by the Responsible Official of long-term environmental impacts against short-term impacts in evaluating what is the best protection of these resources. In some situations, such as when different alternatives impact different resources to different degrees, there may be more than one environmentally preferable alternative.

Environmentally preferable alternative: "this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources."

The National Park Service determined that the environmentally preferable alternative was alternative 3, option 2—lease and relocate facilities off-site—because this alternative best meets the objectives of this plan and purposes of the National Environmental Policy Act related to resource protection. In addition to implementing adaptive management and a wide range of management tools, relocating park facilities off-site to a leased space would protect resources inside the park. This conclusion is predicated on the assumption that leased property is available. If leased property proves to be unavailable in the first 12 months, then the environmentally preferable alternative would be alternative 3, option 1.

ALTERNATIVES OR ALTERNATIVE ELEMENTS CONSIDERED BUT DISMISSED FROM FURTHER CONSIDERATION

Riverbank Erosion

The following bank stabilization techniques are prone to failure or damage from ice and debris on the Knife River and have been dismissed from further consideration because they are not technically feasible for implementation:

- coconut fiber rolls
- gabions
- soil cement
- fence dikes
- fences
- fence revetment

Pocket Gopher Control

The following management actions to control pocket gophers were considered but dismissed from further consideration for the reasons discussed below.

Natural Predators. It is not technically feasible to increase predator abundance or predation on pocket gophers as an effective means of controlling the population in the park. Although predators such as owls, snakes, cats, dogs, and coyotes prey on pocket gophers, it is unlikely that predators would eliminate the entire pocket gopher population from sites or the park. As the prey species population thins, predators would begin to hunt elsewhere with more abundant prey. Pocket gophers also have defenses against predators that make predation as a tool for managing populations less efficient and ineffective (Salmon and Baldwin 2009; Salmon and Gorenzel 2002).

Repellents. It is not technically feasible to effectively control the pocket gopher population at the park using actions that repel or scare pocket gophers. Repellent methods that have not been proven to be effective include moth balls; dryer sheets; and electronic, magnetic, and vibrating devices (Vantassel et al. 2009; Wiscomb and Messmer 2010). Field trials have suggested that synthetic predator odor demonstrated little promise in removing pocket gophers from an area because pocket gophers simply plug the burrow emitting the odor to defend itself against the predator (Lindgren et al. 1995). Devices intended to scare pocket gophers away from an area were also found to be widely unsuccessful. Although many repellent devices are available, no scientific evidence exists to suggest that they are effective for managing pocket gopher populations (Salmon and Gorenzel 2002). The majority of work with pocket gophers focuses on control and removal. Because effective management options are available, it is not anticipated that research would lead to the development of more effective repellent techniques in the foreseeable future.

Infrastructure Relocation

The National Park Service considered a facility relocation site in the park located adjacent to State Highway 37. The site was south of County Road 18 and the Knife River, located on the northeast side of State Highway 37 and included approximately 513,000 square feet. This relocation site was dismissed from further consideration because of concerns over flooding potential at the site.

The National Park Service also considered the option of contracting for maintenance functions to potentially remove the need for a maintenance facility on-site. By contracting for maintenance activities, the park would lose some oversight and control of daily operations that could impact park resources. In addition, NPS staff still would be required to maintain resources beyond the maintenance activities that could be contracted out, and contracting these services likely would not eliminate the need for the facility. This option was dismissed from further consideration.

Archeological Resources

The Degree to Which Archeological Resources Are Managed. The National Park Service considered an alternative that would allow natural processes to occur, without any intervention for archeological resources management, including no monitoring or data recovery. This alternative would have impacts on the resources that would result in impairment. The purpose of Knife River Indian Villages is: "to preserve, protect, and interpret archeological and natural resources as they relate to cultural and agricultural lifestyles of Northern Great Plains Indian peoples, and to conduct research to further understand how these lifestyles have changed over time." Impairment is defined in the NPS *Management Policies 2006* as:

> . . .an impact that, in the professional judgement of the responsible NPS manager, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources and values. Whether an impact meets this definition depends on the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts.
>
> . . .an impact would be more likely to constitute impairment to the extent that it affects a resource or value whose conservation is:
>
> - Necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park.
> - Key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park.
> - Identified in the park's general management plan or other relevant NPS planning documents as being of significance.
>
> An impact would be less likely to constitute an impairment if it is an unavoidable result of an action necessary to preserve or restore the integrity of park resources or values and it cannot be further mitigated.

Therefore, it is the park's responsibility to take action, following careful evaluation of the benefits and detriments of such action, that will preserve the cultural and natural attributes of the park—especially those characteristics that embrace the primary reasons the park was established—for the enjoyment and use of the public.

Manage Archeological Resources Solely through Data Recovery. The National Park Service also considered an alternative under which no actions would be taken to prevent riverbank erosion, pocket gopher activity, or vegetation encroachment from occurring at the park and would allow these processes to continue without interventions. Management actions would focus on monitoring to identify areas where archeological resources would be adversely impacted, and data recovery would occur in these areas. Data recovery would be conducted based on the importance of the site as determined through a defined prioritization process and as funding allows. Mitigation would occur through data recovery. By allowing natural processes to occur without intervention and only conducting data recovery on high priority sites, this alternative would not meet the purpose of the plan for "proactive, sustainable archeological resources management." The reactive nature of this alternative, the costs associated with the continual excavation and storage of artifacts, and the fact that it would only partially protect resources make this concept unsustainable. This alternative would also not meet the need for this plan because it would not provide a proactive, coordinated approach to resource management, nor would it allow for management that adjusts to the resource condition because it does not include an adaptive management component. This alternative could also limit visitor use, traditional tribal use, and educational and research opportunities as more resources are excavated and stored in a collection, rather than in situ. While archeological data recovery would be one of the many methods used for management under the alternatives being carried forward, its use as a standalone management tool was not carried forward for further analysis because it would not meet the purpose of and need for action of this plan.

Target Management of Archeological Resources Using Least Impactful Management Techniques. The National Park Service considered an alternative that would include targeted interventions to address impacts from riverbank erosion, burrowing mammals, or woody vegetation encroachment to the sites with the highest priority, based on site prioritization. Management techniques causing the fewest impacts and incorporating natural materials and methods to the maximum extent possible would be used at these sites. NPS *Management Policies 2006* state that, "The National Park Service will employ the most effective concepts, techniques, and equipment to protect cultural resources against theft, fire, vandalism, overuse, deterioration, environmental impacts, and other threats without compromising the integrity of the resources." Limiting the range of management tools to those that are "least impactful" does not meet NPS policy because these tools may not be the most effective methods. Using only least impactful techniques would not allow for management that adjusts to the resource condition because it does not provide a robust toolbox of effective methods. Because this alternative does not fully meet the need or NPS management policies, it was not carried forward for further consideration.

Target Management of Archeological Resources Based on Site Importance Alone. The National Park Service considered an alternative that would target management interventions to address impacts from riverbank erosion, burrowing mammals, or woody vegetation encroachment to the sites of greatest importance. While the alternatives being analyzed do incorporate site prioritization, an alternative that focused on this aspect alone was considered a fragmented approach that would not meet the purpose of developing a "proactive, sustainable archeological resources management." By focusing only on the highly ranked sites, this alternative would also not meet the need of this plan because it would not provide a proactive coordinated approach to other sites. While this concept is incorporated as an element of the alternatives, it is not carried forward for further consideration as a standalone alternative.

Management of Archeological Resources Solely to Maximize Protection in Place. The National Park Service considered an alternative that would employ all necessary management actions to protect archeological material in place using a broad range of techniques, including large-scale bank stabilization throughout the park. Although resources would first be applied to high priority sites, management intervention could be taken at moderate and low priority sites to address threats to resources. While this is an important component of archeological resources protection when incorporated into the range of alternatives, as a standalone alternative, it does not provide the park with a complete range of options for resource management and does not meet the purpose of and need for action. As a result, it was not carried forward for further consideration as a standalone alternative.

MITIGATION MEASURES

Cultural Resources

- Consult with the North Dakota state historic preservation officer and tribes on the design and location of new facilities to ensure that they do not have adverse impacts on archeological resources, the cultural landscape, or ethnographic resources.
- Consult with the North Dakota state historic preservation officer and tribes to identify additional mitigation measures specific to the proposed activities to ensure that adverse impacts are avoided, minimized, or appropriately mitigated.

Fish and Wildlife Resources

- Revegetate disturbed areas following bank stabilization activities.
- Implement seasonal restrictions (if necessary) on construction activities associated with bank stabilization projects to avoid potential impacts on fish spawning, depending on the timing and intensity of the project.
- Consider the impacts of specific techniques on river flow and velocity characteristics and the impacts of mitigation measures to reduce turbidity to minimize effects on fish and mollusk species (NPS 2014a; USFWS 2001).
- Avoid applying chemicals used for vegetation control directly to water resources. If runoff potential is high or the application is occurring near the river, use nonselective herbicides that meet aquatic use standards.
- Follow standard protocols for placing pocket gopher traps to minimize adverse effects on nontarget species.

Special-Status Species

- Conduct construction and tree removal activities outside of times of the year when northern long-eared bats may be using trees in the riparian corridor for roosting to avoid or minimize impacts on bats. Bats are typically present in the park during summer and mate in early fall.
- A framework detailing the section 7 process for the northern long-eared bat requires the agency to notify the US Fish and Wildlife Service 30 days prior to implementing an action that may affect the northern long-eared bat. The notification would include a determination that the action would not cause prohibited incidental take. USFWS concurrence is not required, but the US Fish and Wildlife Service may advise the agency whether additional information indicates project-level consultation is required. If the US Fish and Wildlife Service does not respond within 30 days, the action agency may consider its section 7 responsibilities fulfilled with respect to the northern long-eared bat. If prohibited take may occur, standard section 7 procedures will apply.

Water Quality, Water Resources, and Wetlands

- Use best management practices, including erosion and sediment control practices, during construction activities and implementation of management techniques that disturb soil to minimize and prevent sediment and other pollutants from entering the surface water. These practices include, but are not limited to, sediment basins, silt fences or curtains, vegetative buffers, erosion control blankets) and instream construction techniques (i.e., temporary flow diversions and dams or barriers) (NDDH 2015b; VADCR 2004).
- Minimize the use of heavy equipment in surface waters and wetlands. If heavy equipment must be used, minimize soil disturbance with mats or other measures.
- Develop and implement (if necessary) a construction general permit or stormwater pollution prevention plan to prevent significant pollutants from entering surface waters or violating the state water quality standard.
- Revegetate disturbed areas following bank stabilization activities to prevent or minimize long-term erosion and sediment transport issues.
- Follow appropriate application methods for herbicides and other chemicals when implementing vegetation management treatments to prevent and minimize water quality degradation.
- Use appropriate fire management techniques to minimize impacts on water quality, water resources, and wetlands from prescribed burns. These techniques include consideration of weather, season, and fuel conditions; using qualified crews; avoiding steep slopes; retaining vegetative buffers adjacent to surface waters; use of appropriate firelines; and the use of the lowest-intensity fire necessary (USEPA 2005).

- Use certified applicators, application, and chemicals and fumigants under the direction and regulation of the USDA-APHIS toxicant label during the implementation of pocket gopher control techniques. Place toxicants and fumigants underground and in locations away from surface waters, shallow groundwater resources, or wetlands to prevent and minimize potential adverse impacts on water quality, water resources, and wetlands.

Floodplain Resources

- Design erosion and sediment control measures in accordance with state regulations and the specifications of best management practices. Examples include sediment basins, silt fences or curtains, vegetative buffers, erosion control blankets, and instream construction techniques (i.e., temporary flow diversions and dams or barriers) (NDDH 2015b; VADCR 2004).
- Remove existing vegetation only as required and to the limits necessary during initial bank stabilization site preparation and vegetation management activities.
- Use living vegetative and natural materials to the extent practicable for bank stabilization measures.
- Revegetate all disturbed areas using only native plant seed mixtures approved by park staff.

COMPARISON OF IMPACTS OF ALTERNATIVES

Table 2-9 summarizes the potential impacts of each of the alternatives evaluated in this draft environmental impact statement.

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TABLE 2-9. COMPARISON OF IMPACTS OF ALTERNATIVES

			Alternative 3 – Locate Facilities Off-Site	
Impact Topic	**Alternative 1 – No-Action**	**Alternative 2 – Relocate Facilities in the Park**	**Option 1 – Construct New Off-Site Facilities**	**Option 2 – Lease Space For Relocation of Off-Site Facilities**
Archeological Resources	Under the no-action alternative, erosion, pocket gopher activity, vegetation encroachment, and the proximity of the maintenance facility would continue to adversely affect archeological sites. The loss of archeological deposits by erosion along river and stream banks would continue, particularly at the Elbee and Sakakawea sites. Head-cutting at the Elbee site and Taylor Bluff Village would remain problematic. Ongoing pocket gopher burrowing would displace artifacts and damage archeological features at all of the sites currently affected. Encroachment of nonnative plant species would continue at 35 sites, and the roots of woody vegetation would continue to displace artifacts, damage archeological features, and inhibit access for archeological research. The ongoing use of the maintenance facility could indirectly impact archeological sites by accidental disturbance of in situ deposits and/or seepage or spills of hazardous materials. These threats would continue to adversely affect some of the sites most at risk and important to the park. Of these sites, four are considered to be in fair condition (Big Hidatsa, Sakakawea, Lower Hidatsa, and the Stanton Mound Group) and one is considered to be in poor condition (Elbee). This indicates that these threats are already affecting the overall integrity of the sites despite ongoing management actions. The continuation of existing conditions would not adequately address these threats, and the condition of the sites would further deteriorate. Over time, the impacts on the sites considered in good condition would accumulate, leading to further deterioration in site conditions. The ongoing loss of archeological deposits and degradation of site conditions would result in significant impacts on archeological resources. These archeological resources are central to the purpose and significance of the park. These impacts would affect the integrity of the sites and over time could reduce their eligibility to the national register. The archeological resources at the park are considered some of the best examples of Northern Plains village sites, and further degradation of these resources would be an irreplaceable loss of materials and information.	Overall, the implementation of an archeological resources management plan under both site options would have long-term, beneficial impacts on archeological resources by preserving them in situ whenever possible and minimizing existing disturbance throughout the park. The use of bank stabilization techniques and removal of pocket gophers and vegetation from high risk / high priority sites, some of which are in fair or poor condition, would ensure that the conditions of the sites do not degrade further and could improve site conditions over time. The preservation of these resources is important to the continuing mission of the park, and these resources are central to the purpose and significance of the park. Although there would be adverse impacts associated with some of the management tools being proposed, they would be mitigated prior to implementation—proactively preserving and protecting the resources. The demolition of the maintenance facility could have adverse impacts on an archeological site located in the area, if not mitigated. The options to relocate the maintenance facility in the park under this alternative would have little to no adverse impacts. Cumulative impacts associated with the alternative would be beneficial.	The impacts of adaptive management actions would be the same for alternative 3 as they would be alternative 2. The adaptive management plan would have beneficial impacts by preserving archeological resources in situ. The impacts from the removal of the maintenance facility would be the same as those described under alternative 2. Construction of off-site facilities may affect archeological sites. However, these impacts would be addressed and avoided, minimized, or mitigated prior to construction. The movement of the facilities off-site would have little to no adverse impacts on archeological resources in the park. Overall, the cumulative effects associated with the alternative are anticipated to be beneficial.	Same as option 1

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TABLE 2-9. COMPARISON OF IMPACTS OF ALTERNATIVES (CONTINUED)

Impact Topic	Alternative 1 – No-Action	Alternative 2 – Relocate Facilities in the Park	Alternative 3 – Locate Facilities Off-Site	
			Option 1 – Construct New Off-Site Facilities	Option 2 – Lease Space For Relocation of Off-Site Facilities
Cultural Landscapes	Under the no-action alternative, current threats would continue to adversely affect the cultural landscape. Management practices aimed at mitigating these threats would slow the rate of adverse effects, but would not proactively address the needs of the resource. Over time, the cultural landscape would continue to deteriorate, particularly as a result erosion processes and pocket gopher activity. Vegetation encroachment would also have an adverse impact by changing the views in the cultural landscape and disturbing intact cultural deposits. Under the no-action alternative, the potential exists for long-term, adverse impacts on the cultural landscape. These adverse impacts are anticipated to be significant because they could result in the deterioration of features of the cultural landscape that make it eligible for listing in the national register.	Under alternative 2, an adaptive management approach would be used to preserve cultural resources affected by riverbank erosion, pocket gophers, and vegetation encroachment. Some of the techniques used to address these issues would have short-term, adverse impacts on the cultural landscape as a result of the construction methods, visual changes, and introduction of new elements into the cultural landscape. However, these techniques would also preserve the cultural landscape by proactively addressing current threats and maintaining the integrity of the landscape. There would be long-term, beneficial impacts on the cultural landscape under this alternative. The movement of the maintenance facility and museum collections storage to new buildings in the park would have a beneficial impact on the cultural landscape. In particular, the relocation of the maintenance facility would benefit the views associated with the cultural landscape because the current location of the facility is a visual intrusion.	The impacts of alternative 3 on the cultural landscape would be the same as those described for alternative 2. There would be short-term, adverse impacts on the cultural landscape from the removal of the existing maintenance facility, but long-term benefits from the improvement of important views, particularly from the Big Hidatsa site. Adverse impacts are not anticipated to be significant.	Same as option 1
Ethnographic Resources	Overall, the continuation of existing conditions would have some long-term, adverse impacts on ethnographic resources. Ongoing management actions would reduce some of these impacts, but data show that park resources have degraded using this management method and continued loss of resources are anticipated. Adverse impacts are directly associated with the loss of archeological materials to erosion or pocket gopher activity and disturbance from vegetation. Ethnographic resources could also be adversely impacted from vegetation encroachment if the vegetation prevents access to these resources. There would be beneficial impacts on ethnographic resources from continuing vegetation management activities that maintain or promote native plants, which is important for defining the relationships between village life and the natural environment. This alternative, when combined with other past, present, and reasonably foreseeable projects would result in long-term, adverse cumulative impacts. Given that archaeological sites are also ethnographic resources and that significant impacts are expected on archeological resources under this alternative, the impacts on ethnographic resources are also anticipated to be significant.	Under alternative 2, management actions would be implemented to preserve cultural resources affected by riverbank erosion, pocket gopher activity, and vegetation encroachment through an adaptive management framework. Although potential adverse impacts are associated with some of the proposed methods, consultation with the MHA Nation on the timing and location of use of ethnographic resources should allow the park to avoid or minimize these impacts. Overall, the alternative is anticipated to have beneficial impacts by preserving archeological resources in situ. The removal of the maintenance facility would be have a beneficial impact on ethnographic resources.	The impacts of alternative 3 would be the same as those described for alternative 2.	Same as option 1

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TABLE 2-9. COMPARISON OF IMPACTS OF ALTERNATIVES (CONTINUED)

			Alternative 3 – Locate Facilities Off-Site	
Impact Topic	**Alternative 1 – No-Action**	**Alternative 2 – Relocate Facilities in the Park**	**Option 1 – Construct New Off-Site Facilities**	**Option 2 – Lease Space For Relocation of Off-Site Facilities**
Museum Collections	Museum collections could be adversely affected if ongoing water infiltration issues are not resolved. These impacts would be mitigated through the installation of waterproof storage, which would preserve the materials and would not result in significant impacts. The size of the collection could increase, creating additional stress on limited storage space. No cumulative impacts on museum collections are anticipated under this alternative.	This alternative would have long-term benefits for the museum collections housed at the park because the museum collections storage would be moved to a facility without water infiltration issues and could be better preserved. This alternative would ultimately have beneficial impacts on museum collections. No cumulative impacts are anticipated under this alternative.	Alternative 3 would have beneficial impacts on the museum collections because museum collections storage would be housed in a facility that would ensure their preservation. However, if the facility is moved to a distant location (e.g., outside of the Stanton area), it would be more difficult for park staff to manage and use the collection. This alternative would ultimately have beneficial impacts on museum collections. No cumulative impacts are anticipated under this alternative.	Same as option 1
Fish and Wildlife Resources	Impacts are anticipated to be short term and localized for most fish and wildlife species. Although a noticeable decline in pocket gopher abundance on the three main village sites would be expected, pocket gophers are a common and widespread species in the area and in North Dakota, and trapping is not anticipated to have a noticeable effect on the pocket gopher population in surrounding areas or regionally.	Beneficial and adverse impacts on fish and wildlife resources are anticipated as a result of bank stabilization techniques, pocket gopher control activities, and vegetation management. Adverse impacts on wildlife habitat from relocation of facilities under alternative 2 would occur; however, they would be small in scale. Less than 1 acre of impact is anticipated, only a portion of which would affect previously disturbed area. In addition, the amount of habitat that would be affected under alternative 2 is small in comparison to the amount of similar habitat available in the park.	Impacts caused by building new facilities off-site are anticipated to be equal to or slightly less than those described in alternative 2. The maintenance structures in the park would be removed and the site restored. The size of impact would be relatively small compared to habitat in the surrounding area.	Impacts caused by leasing facilities off-site are anticipated to be less than those described for alternative 2 because new structures would not be built.
Special-Status Species	The no-action alternative would result in short- and long-term, adverse impacts on special-status species and as such would contribute to adverse, cumulative effects. Adverse impacts on special-status species are not anticipated to be significant because of the relatively low probability that least terns are using the Knife River for forage. In accordance with section 7 of the Endangered Species Act, alternative 1 may affect but would not likely adversely affect least terns, but could adversely affect northern long-eared bats if tree removal is required for bank stabilization activities. However, because park is located outside of the white-nose syndrome zone, there are no incidental take prohibitions for the northern long-eared bat. No determination is required for Sprague's pipit because it is a candidate species and not protected under the Endangered Species Act.	Alternative 2 has the potential for adverse impacts on least terns if bank stabilization projects, including those implemented under the adaptive management plan, disrupt least tern foraging habitat. These impacts would be temporary during construction, and other foraging habitat is located nearby on the Missouri River. The exact timing and location of adaptive management measures cannot be predicted at this time. In addition, although least terns are known to nest and forage on the Missouri River adjacent to the park, their use of the Knife River upstream of its confluence with the Missouri River has not been documented. Under the requirements of section 7 of the Endangered Species Act, it is anticipated that alternative 2 may affect, but would not likely adversely affect least terns. Alternative 2 could result in adverse impacts on northern long-eared bats if bank stabilization projects require the removal of roosting trees. An abundance of suitable roosting trees exist in the peninsula area of the park and near the park. As stated previously, the US Fish and Wildlife Service's final 4(d) rule indicates that for areas of the country not affected by white-nose syndrome, there are no prohibitions on incidental take. The US Fish and Wildlife Service states that regulating incidental take outside the white-nose syndrome zone will not influence the future impact of the disease throughout the species' range or the status of the species (USFWS 2016b). The park is located outside of the white-nose syndrome zone. In accordance with section 7 of the Endangered Species Act, it is determined that alternative 2 may adversely affect northern long-eared bat but would comply with the Endangered Species Act because there are no incidental take prohibitions.	Impacts on special-status species under alternative 3 would be the same as those described for alternative 2 and are not anticipated to be significant. Section 7 Endangered Species Act determinations would be the same as those described for alternative 2.	Same as option 1

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TABLE 2-9. COMPARISON OF IMPACTS OF ALTERNATIVES (CONTINUED)

			Alternative 3 – Locate Facilities Off-Site	
Impact Topic	**Alternative 1 – No-Action**	**Alternative 2 – Relocate Facilities in the Park**	**Option 1 – Construct New Off-Site Facilities**	**Option 2 – Lease Space For Relocation of Off-Site Facilities**
Water Quality, Water Resources, and Wetlands	Under the no-action alternative, natural riverbank erosion from flooding and ice jams and unnatural erosion from the altered riverine systems would continue, especially in unstabilized areas, as would associated effects on channel morphology and sediment loading. Emergency bank stabilization projects to protect archeological resources may be taken in reaction to an erosion event and would adversely impact hydrology and water resources of the Knife River. Operation of the Garrison Dam would continue to affect the flow regime in the lower reaches of the Knife River. The no-action alternative would contribute adverse impacts to the impacts of past, present, and reasonably foreseeable actions. This contribution would be appreciable because of the potential alteration of natural river processes upstream, downstream, and in the park. Appreciable adverse impacts on water quality, water resources, and wetlands in the park would occur and could be significant, depending on the type and scale of river alteration.	Under alternative 2, management techniques would be implemented using an adaptive management approach that would consider the riverine ecosystem as a whole as well as site-specific issues. There would be long-term, adverse impacts on hydrology following implementation of bank stabilization techniques. Short-term, adverse impacts would result from implementation of the vegetation management treatments and localized, long-term, adverse impacts on water quality and wetlands would be possible following implementation. Depending on the condition of existing wetlands and the type and location of bank stabilization techniques, beneficial impacts to wetlands are possible. Impacts on water quality, water resources, and wetlands from alternative 2 would have the potential to be significant depending on the ultimate scale and number of bank stabilization projects implemented for archeological resources protection. Adverse impacts on water quality, water resources, and wetlands would occur in the park as a result of modifications to natural river processes, riverbanks, and wetlands. Other bank stabilization projects have already altered the Knife River in the park, and any new impacts associated with new bank stabilization projects would be as a result of projects implemented for the preservation of archeological resources, which are central to the purpose and significance of the park.	Under alternative 3, management techniques would be implemented using an adaptive management approach that would consider both the riverine ecosystem and site-specific issues. There would be long-term, adverse impacts on hydrology until the river stabilizes following bank stabilization projects. Short-term, adverse impacts would result from implementation of the vegetation management treatments and localized long-term, adverse impacts on water quality and wetlands would be possible following implementation. Depending on the condition of existing wetlands and the type and location of bank stabilization techniques, beneficial impacts on wetlands are possible. Impacts on water quality, water resources, and wetlands from alternative 3 would have the potential to be significant depending on the ultimate scale and number of bank stabilization projects implemented for archeological resources protection. Adverse impacts on water quality, water resources, and wetlands would occur in the park as a result of modifications to natural river processes, riverbanks, and wetlands. Other bank stabilization projects have already altered the Knife River in the park, and any impacts associated with new bank stabilization projects would be as a result of bank stabilization projects implemented for preservation of archeological resources, which are central to the purpose and significance of the park.	Same as option 1

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TABLE 2-9. COMPARISON OF IMPACTS OF ALTERNATIVES (CONTINUED)

Impact Topic	Alternative 1 – No-Action	Alternative 2 – Relocate Facilities in the Park	Alternative 3 – Locate Facilities Off-Site Option 1 – Construct New Off-Site Facilities	Alternative 3 – Locate Facilities Off-Site Option 2 – Lease Space For Relocation of Off-Site Facilities
Floodplain Resources	Implementation of bank stabilization projects as emergency actions to protect archeological resources would result in adverse impacts on floodplain resources. The no-action alternative would have long-term, adverse impacts as a result of hydrology modification; however, this alternative would not impede floodplain resource functioning.	Under alternative 2, management techniques would be implemented using an adaptive management approach that considers the riverine ecosystem. Implementation of management actions would temporarily disturb streambanks and associated floodplain resources and remove floodplain vegetation, resulting in short-term, adverse impacts on floodplain structure and functions until vegetation is reestablished. Some management actions would permanently remove floodplain resources, eliminate riverine-floodplain connectivity, or alter river hydrology and hydraulics that influence floodplain resources, resulting in long-term, adverse impacts. Therefore, short-term, adverse impacts would result from implementation of the management techniques and localized long-term, adverse impacts on upstream or downstream floodplain resources would be possible following implementation. Parkwide long-term, beneficial impacts on floodplain resource functions and values would result from implementation of management techniques. Alternative 2 would contribute beneficial impacts on floodplain resources in the park to the adverse impacts from other past actions. The contribution would be somewhat noticeable because most of the cumulative impacts from other actions were localized and had a limited effect on floodplain resource functions and values in the park.	Under alternative 3, management techniques would be implemented using an adaptive management approach that would consider the riverine ecosystem. Implementation of management actions would temporarily disturb streambanks and associated floodplain resources and remove floodplain vegetation, resulting in short-term, adverse impacts on floodplain structure and functions until vegetation is reestablished. Some management actions would permanently remove floodplain resources, eliminate riverine-floodplain connectivity, or alter river hydrology and hydraulics that influence floodplain resources, resulting in long-term, adverse impacts. Therefore, short-term, adverse impacts would result from implementation of the management techniques, and localized long-term, adverse impacts on upstream or downstream floodplain resource would be possible following implementation. Parkwide long-term, beneficial impacts on floodplain resource functions and values would result from implementation of management techniques. Alternative 3 would contribute beneficial impacts on floodplain resources in the park to the adverse impacts from other past projects. The contribution would be somewhat noticeable because most of the cumulative impacts from other actions were localized and had a limited effect on floodplain resource functions and values in the park.	Same as option 1
Visitor Use and Experience	Under the no-action alternative, adverse impacts on visitor use and experience would be primarily temporary and could be minimized through development of procedures and precautions that would guide implementation of any management actions with the potential to adversely impact the visitor use and experience at the park. Long-term, beneficial impacts on visitor use and experience would continue under the no-action alternative.	Under alternative 2, impacts on visitor use and experience would be both short and long term and adverse, as well as long term and beneficial with overall adverse impacts. Overall, alternative 2 would contribute both to identified beneficial and adverse cumulative impacts; however, overall impacts would be predominantly beneficial under alternative 2.	Under alternative 3, adverse impacts on visitor use and experience would be both temporary and long-term; however, some impacts could be minimized if procedures and precautions are developed to guide implementation of any management actions with the potential to harm visitor use and experience. Overall, both long-term, beneficial impacts and long-term, adverse impacts would be expected to visitor use and experience under alternative 3.	Same as option 1

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CHAPTER 3: AFFECTED ENVIRONMENT

This chapter describes the current condition of the cultural and natural resources and the values of the park that would be affected by the implementation of the proposed archeological resources management alternatives. The resource topics presented in this chapter and the organization of the topics correspond to the resource impact discussions in "Chapter 4: Environmental Consequences."

The cultural and natural resources discussed in this chapter are currently affected by the resource threats discussed in chapter 1, specifically riverbank erosion, pocket gopher activity, vegetation encroachment, and infrastructure. In addition to these resource threats, climate change is considered a threat to many of the resources that the National Park Service protects and manages (NPS 2010). Changes in temperature, precipitation regimes, and seasonal variations are expected to greatly affect water systems, wildfire regimes, species presence and distribution, archeological sites, and park facilities (NPS 2010; Monahan and Fisichelli 2014). Global climate change can be attributed to natural or human-induced causes (High Plains Regional Climate Center 2013; IPCC 2013) and can occur at both short and long-term time scales (High Plains Regional Climate Center 2013; Monahan and Fisichelli 2014). The fifth and most recent report from the Intergovernmental Panel on Climate Change (IPCC 2013) reiterated that the Earth's climate is changing rapidly, and these unprecedented alterations have already been occurring in a real and observable way. The relationship of each resource topic's existing condition to climate change is discussed in this chapter.

CULTURAL RESOURCES

Cultural resources may include several kinds of individual entities (e.g., buildings, structures, objects, or archeological sites) or groups of these entities in districts and landscapes that evoke a sense of place or feeling associated with American history. This sense of historic importance is expressed in the integrity of location, setting, feeling, design of a building or structure, workmanship, or the materials used.

Four criteria are used to assess whether a resource is important enough to be eligible for listing in the national register:

A. The resources are associated with events that have made a significant contribution to the broad patterns of our history; or
B. That are associated with the lives of persons significant in our past; or
C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
D. That have yielded, or may be likely to yield, information important in prehistory or history.

The National Park Service categorizes cultural resources as archeological resources, cultural landscapes, ethnographic resources, museum collections, and historic structures. The cultural history of the park and an overview of its cultural resources research program are described in Ahler (1993a, b) and Calabrese (1993).

Archeological Resources

A total of 68 known prehistoric and historic archeological sites are associated with the park. The types of sites present include village habitations, activity areas outside of villages, cemeteries, trails, earthen mounds, European American farmsteads/homesteads and other historic sites, and debris scatters (Ahler 1993b). These sites reflect early use of the area by nomadic, American Indian hunter-gatherer groups as well as the establishment of permanent earthlodge villages by the ancestors of the modern Hidatsa peoples. Three large village sites at the park have been interpreted for the public: Big Hidatsa, Sakakawea, and Lower Hidatsa. These sites remain some of the best preserved examples of earthlodge villages along the Missouri River.

All of the 68 known sites have been evaluated for their eligibility to the national register. The importance of some sites was recognized prior to the establishment of the park unit (Calabrese 1993). Big Hidatsa was listed as a national historic landmark in 1966. Fifty-one sites are listed as contributing elements to the Knife River Indian Villages National Register Archeological District, including the Lower Hidatsa, Sakakawea, and Elbee sites and Taylor Bluff Village. The remaining sites are considered to be noncontributing or local resource types that are not monitored for condition or other management actions.

The National Park Service routinely monitors the condition of archeological resources under its care. Site condition generally refers to the physical condition of the site and falls into three main categories: good, fair, and poor. The condition of a site is determined by (1) current impacts and (2) in the case where there is a change in condition from the first assessment or the interval since the last assessment. Conditions are defined as follows (NPS 2006b):

- **Good**: The site shows no evidence of noticeable deterioration by natural forces and/or human activities. The site is considered currently stable and its present archeological values are not threatened. No adjustments to the currently prescribed site treatments are required in the near future to maintain the site's present condition.
- **Fair**: The site shows evidence of deterioration by natural forces and/or human activities. If the identified impacts continue without the appropriate corrective treatment, the site will degrade to a poor condition and the site's data potential for historical or scientific research will be lowered.
- **Poor**: The site shows evidence for severe deterioration by natural forces and/or human activities. If the identified impacts continue without the appropriate corrective treatment, the site is likely to undergo further degradation and the site's data potential for historical or scientific research will be lost.

Site conditions have been established for 49 of the 68 archeological sites identified in the park. Forty-four sites are currently considered to be in good condition, four are in fair condition, and one is in poor condition. One additional site is likely inundated, and its exact condition is unknown. Current conditions and threats for these sites are summarized in appendix D. A condition has not been assessed for eight sites. Ten sites have been determined not eligible for listing in the national register; therefore, their condition has not been assessed.

In some areas, 20th century farmed activities that occurred prior to the creation of the park affected archeological materials. A majority of the park area was previously plowed (figure 3-1). In these plowed areas, the plowzone—an area where plowing activities have disturbed soils, including any archeological materials present—is approximately 8 to 10 inches deep. These sites, although previously disturbed in the upper portion of the deposits, do retain significance and integrity of archeological resources below the plow zone. Sites affected by historic plowing are not considered totally destroyed.

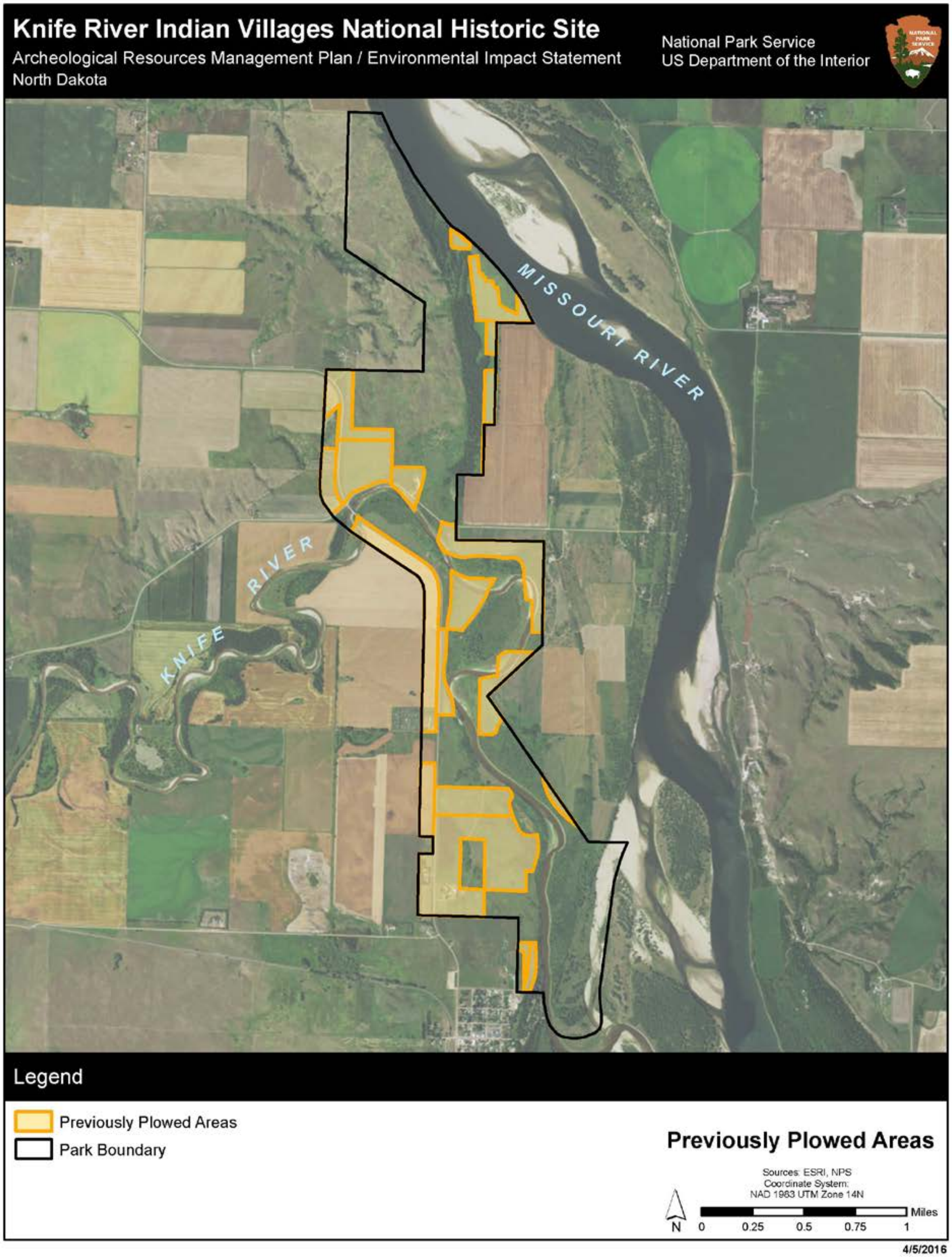


FIGURE 3-1. PLOWZONES AT KNIFE RIVER INDIAN VILLAGES NATIONAL HISTORIC SITE

Riverbank Erosion. As noted at the beginning of this chapter, some archeological sites at the park may be vulnerable to increased precipitation and flooding predicted to occur through the next century as a result of climate change (BLM 2010). In the past, the collapse of riverbanks and scouring have adversely affected portions of sites. There have been at least two major erosional events in the last decade (Cummings 2011) and likely numerous unrecorded events prior to that. A study of Knife River bank erosion in the park found that between 1965 and 2011, the mean distance of bank movement ranged from 48.3 feet to 253.1 feet for the river bends studied (Sexton 2012). Mean rate of bank movement ranged from 0.9 foot/year to 4.9 feet/year (Sexton 2012).

Archeological sites within 100 feet of an active Knife River erosion area that has not been stabilized or 150 feet from an area that has been stabilized are considered to be at high risk for impact by future riverbank erosion. Four sites fall into this category and include two of the most important sites in the park, Elbee and Taylor Bluff Village. The Elbee site was rated in “poor” condition, indicating extensive damage and the potential for the site to lose its data potential for historical or scientific research without corrective treatments. Elbee’s poor condition is directly attributable to impacts from riverbank erosion; loss of most of the northern portion of the site has already occurred, and impacts from this threat are ongoing.

Archeological sites in the park not located in active erosion areas but within 30 feet of the riverbanks (non-eroding, inside river bends) of the Knife or Missouri Rivers are also considered to be at high risk for future adverse impacts. Two sites fall in this category, including the Sakakawea site, a primary village site and visitor destination. The most recent archeological resource condition assessment for the Sakakawea site rated it in “fair” condition, indicating that natural and human activities are affecting the site. Bank stabilization work consisting of placement of rip rap for toe protection was completed at the Sakakawea site in 1979; however, riverbank erosion continues to affect the site along the unstabilized top of the river bank, contributing to its condition assessment as “fair.” Eight other archeological sites in the park are currently located in close enough to riverbanks that they are at risk of future adverse impacts from riverbank erosion.

Pocket Gophers. Currently, 49 out of the 51 archeological sites assessed for prioritization show evidence of impacts from pocket gophers. Pocket gophers can be particularly destructive to archeological sites because their burrows are both deep (between 4–79 inches) depending on soil conditions, averaging 20 inches, and cover broader areas than other burrowing mammals (Bocek 1986). They build extensive burrow systems and can create dozens of mounds in a few days. Despite the number of mounds, pocket gopher densities rarely exceed eight animals per acre (Vantassel et al. 2009; Wiscomb and Messmer 2010). Pocket gophers feed subsurface and prefer the fleshy underground parts of plants (Bocek 1986). Feeding tunnels tend to be located toward the surface (between 6–8 inches), while nesting chambers and food caches tend to be deeper (Erlandson 1984; Bocek 1986). Pocket gopher tunnels expand horizontally as gophers search for food. Studies have shown that pocket gopher burrowing results in a bimodal distribution of artifacts, with larger artifacts pushed below the tunnels and smaller artifacts moved to the surface (Erlandson 1984; Johnson 1989). In predominantly gravel soils, a stone layer or stone lines are created below the gopher tunnels as these items are pushed down by burrowing (Johnson 1989; Pierce 1992). These stone lines can sometime mimic archeological deposits, appearing to look like features, and confuse the archeological record when the site is excavated. Additionally, the movement of the stones downward displaces archeological materials below the burrows.

Woody Vegetation. Encroachment of woody vegetation degrades the condition of the primary village sites and makes areas inaccessible for interpretation and/or archeological research. Woody vegetation root growth causes displacement of chronologically stratified deposits. Vegetation can also hamper the visitor experience by obscuring sites and making interpretation difficult. The park mows some villages so that they are more visible; this mowing does not impact archeological resources.

Infrastructure. A maintenance structure, gravel road, parking area, and materials storage area at the edge of the Big Hidatsa site and Taylor Bluff Village are visual intrusions and are situated near burial sites and areas that the tribes traditionally associated with the resources present in the park consider sacred.

Cultural Landscapes

The National Park Service defines a cultural landscape as "a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values" (Birnbaum 1994). The natural landscape of the park comprises the baseline condition of the cultural landscape on which people conducted their day-to-day activities. Natural resources that are integral components of the cultural landscape include vegetation, particularly areas of native vegetation such as prairie and forested floodplain; fauna; and geographic features, such as the rivers, buttes, and terraces. Within this natural setting are cultural resources that represent human adaptation to the natural environment as well as behaviors that modified, to a greater or lesser extent, the natural conditions. In addition, topographic features, such as rivers, streams, and buttes were important to rituals, ceremonies, and traditions. Together, the natural and cultural elements of the landscape preserve the character, setting, feeling, and association of the period of significance as seen in figure 3-2.

The *Cultural Landscape Inventory* of the park completed in 1996 recorded camps, village sites, fortifications, trails, agricultural fields, grazing lands, mounds, cemeteries, and trails as well as the viewshed associated with the beginning of the Plains Village Period (AD 1200) through the abandonment of the villages at the park in 1845. The inventory was revised in 1999 (NPS 1999). Four component landscapes have periods of significance relating to the primary cultural landscape at the park: Big Hidatsa site (ca 1400 to 1845), Lower Hidatsa site (ca 1525 to 1785), Sakakawea site (ca 1790 to 1834), and Taylor Bluff Village (ca 1834 to 1835). While the focus of the cultural landscape is on the Hidatsa period of occupation, the overall period of significance spans from 5500 BC to 1845 (NPS 1999). The cultural landscape encompasses the entire park and eight tracts of private land for which the National Park Service holds a scenic easement.

SOURCE: T. Hailey, Northwestern State University of Louisiana

FIGURE 3-2. SOUTHERN PORTION OF KNIFE RIVER INDIAN VILLAGES NATIONAL HISTORIC SITE AND SURROUNDING AREA

The National Park Service initiated a revised *Cultural Landscape Inventory* for the park in 1999 to amend the existing national register nomination for the Knife River Archeological District to include the cultural landscape (NPS 1999). The cultural landscape was found to be in good condition and to contribute to the significance of the national historic district because it "preserves the contextual setting and visual relationship between the Hidatsa villages and the landscape used for daily activities" (NPS 1999). The inventory recommended that the national register nomination be amended to include the cultural landscape. The cultural landscape is considered eligible under criteria A, B, and D; the aspects of integrity associated with the landscape include location, setting, materials, feeling, and association. Final concurrence from the North Dakota state historic preservation officer on national register eligibility occurred in 2006. The cultural landscape includes multiple characteristics that are defined in the *Cultural Landscape Inventory*. These characteristics and whether they contribute to the cultural landscape are summarized in table 3-1.

Vegetation is a key element to the character, setting, and feeling of a cultural landscape. The native vegetation of the park can be divided into two broad communities—mixed grass prairie and riparian forest (Nadeau et al. 2014). The riparian forest community includes two primary types—eastern cottonwood forest and green ash / boxelder / American elm forest. Both plant communities would have sustained diverse floral and faunal biota used by the Hidatsa. The native prairie provides a sense of openness with a viewshed extending for miles. The forests create a sense of enclosure and protection from perennial and sometimes buffeting winds. For the Hidatsa, the prairie might have been associated with summer and the forest with winter. They occupied their villages on the terraces in the spring, summer, and fall, and spent the winter in the forests. Both communities were used regularly.

The viewshed is an integral component of the cultural landscape and one of the primary features that retains the setting and feeling that make it eligible for the national register (NPS 1999). Village inhabitants were able to view the Missouri and Knife Rivers; the bluffs on the east side of the Missouri River; and sightlines to the north, west, and south from the highest point of the park. The sky and landscape, which are considered sacred to native peoples associated with the site, and the viewshed are seen as a part of the interpretation of life in the villages (NPS 2013). Because the park has no historic European American structures, the landscape tells the story of past peoples and a culture of agricultural and trading practices among the Plains Village Indians (Tworek-Hofstetter 2013). Infrastructure and development both in and outside of the park currently affect the park's viewshed.

Ethnographic Resources

The National Park Service defines ethnographic resources as any "site, structure, object, landscape, or natural resource feature assigned traditional, legendary, religious, subsistence or other significance in the cultural system of a group traditionally associated with it" (NPS 1998a).

Ethnographic resources can include archeological sites, plants and animals, and places, some of which are also historic properties and/or traditional cultural properties. A traditional cultural property is defined as a property "that is eligible for 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" (Parker and King 1998). Not all ethnographic resources are traditional cultural properties but most traditional cultural properties are ethnographic resources. Therefore, for the purposes of this plan, the discussion of ethnographic resources also encompasses traditional cultural properties. Although no traditional cultural properties have been identified in the park, previous research and consultation has documented the cultural connections between resources at the park and current native peoples, and the potential for these resources to be present is high.

Table 3-1. Characteristics of the Cultural Landscape at Knife River Indian Villages National Historic Site

Landscape Characteristic		Description	Contributing to Cultural Landscape Inventory
Archeology		The archeological resources present at the park, both major and minor, are considered the most important part of the parent and component landscapes. All eligible archeological sites, with the exception of those in the Kreiger tract are considered contributing.	
Buildings and structures		The buildings and structures all date to the late 20th century and do not meet the national register criteria and are **not contributing**.	
Circulation		Village inhabitants used trails associated with the archeological resources at the park. These trails are considered part of the archeology of the cultural landscape. Modern circulation at the park includes paved walks, parking, and a gravel-surfaced trail. The modern circulation is **not contributing** to the landscape.	
Cluster arrangement		The Big Hidatsa, Lower Hidatsa, and Sakakawea sites and Taylor Bluff Village were constructed near one another. Cemeteries and periphery zones surrounded the villages.	
Cultural traditions		The cultural traditions of the inhabitants of the villages are reflected in their construction, and particularly the construction of the earthlodge. The villages were situated on the landscape to maximize access to resources.	
Land use		Village sites were situated to take advantage of the landscape (e.g., ensuring views from the sites) as well as to take advantage of resources such as water. Additionally, features located in the periphery of villages provide information on the use of the area by the inhabitants. Cemeteries, eagle traps (on the Krieger Tract), and a prairie green for starting horse races are present. Agricultural lands also reflect the land use of the area.	
Natural systems and features	Hydrology	The Knife and Missouri Rivers flow through the park. Wetlands are associated with these areas. Historically, the floodplain would have been forested.	
	Geology and soils	The geology of the park is well known. Two Pleistocene age (Hensler and Stanton) and three Holocene age (A, B, and B2) terraces are located in the park.	
	Wildlife and vegetation	The park contains prairie and riparian habitats known to support a variety of terrestrial and aquatic wildlife species, including birds, mammals, reptiles and amphibians, fish, mollusks, and insects (NPS 2014a). The park contains hundreds of plant species, consisting mostly of grasses and sedges (NPS 2014a; Prowatzke and Wilson 2015).	
	Air quality	The park is in a class II airshed, and air quality could degrade over time as a result of energy-related development in the area.	
	Climate and weather	The climate of the park is characterized by extreme temperatures: summer highs can be in the 100s and winter lows can near -50°F. Droughts occur on regular intervals of 30 to 50 year cycles, and can last up to 10 years.	
	Cultural response to natural features	The villages in the park were ideally situated for the inhabitants to take advantage of the natural systems. Terraces provided locations for villages with good views. The rivers provided water and transportation. Winter residences were situated in the forested floodplains. Floodplain resources also provided fertile ground for farming.	

TABLE 3-1. CHARACTERISTICS OF THE CULTURAL LANDSCAPE AT KNIFE RIVER INDIAN VILLAGES NATIONAL HISTORIC SITE

Landscape Characteristic	Description	Contributing to Cultural Landscape Inventory
Small-scale features	Small-scale features include a small picnic area, benches along the trail between the Lower Hidatsa and Sakakawea sites, a small interpretive garden and drying platform, wayside exhibits, a picnic table near the Sakakawea site, vehicle access gates at trail heads, and archeological interpretive posts at the Big Hidatsa site. The archeological interpretive posts date to the late 20th century and are **not contributing**.	
Spatial organization	Current spatial conditions include the locations of the village sites in relationship to each other, the layout of the villages themselves, and the organization of the interior of earthlodges. Additionally, the relationship between the villages and larger geographic features, such as buttes, are considered important for defining the territory of the Hidatsa. The visitor center and maintenance garage are considered part of the current spatial conditions.	
Topography	Topography includes the natural landforms of terraces, slopes, and floodplains, as well as the human-made features such as earthlodge, fortifications, midden piles, linear earthworks, and travois trails that cause an undulating surface.	
Vegetation	Research indicates that at the time the villages were occupied, vegetation was sparser, particularly between villages. Additionally, the forests on the floodplain are slightly different today. Despite this, native vegetation is still present, including species that would have been used in the past.	
Views and vistas	The viewsheds are considered one of the strongest features at the park. Important views include those from the villages as well as between the villages themselves. Increased vegetation between villages has impacted these views somewhat. Despite the increase in vegetation, the views are considered to be similar to those portrayed in historic paintings and described in historic documents. Previous viewshed studies indicate that vegetation could be used to screen nonhistoric features and that selective removal of vegetation could improve views.	

An extensive ethnohistorical project was conducted as part of the phase I archeological research program for the park (Thiessen 1993). This project used the ethnographic and historic resources available for the area to compile a series of reports on the ethnohistory at Knife River and nearby communities. These reports cover American Indian origins and culture and the use of the area by European American fur traders and other settlers. The impacts of infectious disease on native communities are also covered as part of this project.

More recently, the National Park Service completed a cultural affiliation study and ethnographic resource assessment for the park (Zedeño et al. 2006). The extensive archeological, historical, and ethnographic record from the park allowed researchers to add this report to the many that have previously demonstrated the Mandan, Hidatsa, Arikara, and Crow cultural associations with the park (Zedeño et al. 2006).

The study also documents the origins of each of these tribes and their relationship to the park. However, one of the overarching themes among these groups is the recognition of the park as one of the central places in the lives of all the Northern Plains tribes and the MHA Nation in particular (Zedeño et al. 2006). For the MHA Nation, the park is the location "where all the migrating ancestors of the Mandan and Hidatsa came together and eventually became who they are now; where creation stories began or ended; and where many friendly tribes—Sioux (Lakota, Dakota, Nakota), Chippewa (Ojibwe), Assiniboine, Crow and Blackfeet—gathered to visit, trade and participate in Ceremonies" (Zedeño et al. 2006). Additionally, it is from this region that the River Crows separated from the Hidatsa proper around 1750 (Ahler 1993b; Bowers 1965).

The ethnographic resource assessment for the park and ongoing consultation with the MHA Nation indicate that present-day tribal members maintain contemporary spiritual and cultural connections with the resources in the park. These resources include not only the village sites themselves, but the landscape, natural resources, spiritual places, and locations connected to the tribes through experiences and stories (Zedeño et al. 2006). Ethnographic resources that also meet the criteria of a historic property can be considered for eligibility to the national register. Some of the ethnographic resources at the park are historic properties and their eligibility to the national register as historic properties has been determined. The park staff consistently considers the importance of all ethnographic resources to present-day tribal members for all management activities.

Museum Collections

The park is responsible for museum collections housed at the visitor center. The collections include natural history specimens and cultural items. The natural history collection consists of herbarium specimens and invertebrate animal specimens that were collected as part of studies to obtain baseline information about natural species in the park. These materials provide information used to interpret the environment and as a reference for the culture of the indigenous groups that once lived in the area and the development of the park (NPS 1998b).

Similarly, the goal of the park is to use the cultural collection to document and support interpretation, manage the park's resources, and educate and benefit the public through research programs that relate to the park as a place where "certain historic and archeological remnants of the culture and agricultural lifestyle of the Plains Indians" is preserved (NPS 1983). The majority of the cultural collection consists of archeological materials recovered during NPS excavations conducted as part of the archeological research program for the Knife River Indian Villages (Theissen 1993b). These excavations ended in the late 1980s. Since that time, archeological resource management has focused on preservation of archeological sites in situ unless excavation is necessary to prevent the loss of materials (figure 3-3).

The archeological collections from the park primarily date to the Plains Village period (AD 1200–1861) and the European American period (AD 1861 to present) (NPS 2013). The materials include stone tools and debitage, pottery, bone artifacts and faunal remains, wood post fragments, beads, and other trade items.

SOURCE: NPS, Midwest Archeological Center

FIGURE 3-3. 2010 UNIVERSITY OF NORTH DAKOTA FIELD SCHOOL EXCAVATIONS AT THE ELBEE VILLAGE SITE

The collection includes ethnographic items (the Robinson Collection) donated by a family who owned a general store near Fort Berthold Reservation (NPS 2013). The Robinson Collection consists primarily of fragile materials, many of which are made of leather and decorated with quill and/or bead work (figure 3-4). These materials include clothing, moccasins, and personal adornments. Because of their fragile nature, these materials require more maintenance and monitoring than other archeological materials housed in the facility.

The research library used by park staff and researchers includes archeological reports; reports of cultural or natural resources studies; books about the Mandan, Hidatsa, Arikara, and other American Indian peoples who used the region and interacted through trade, ceremonies, and warfare; publications about the history of the region; and books about the natural resources of the region. The park manages these documents and manuscripts as part of its collection.

Three documents are used to manage park collections: the *Scope of Collection Statement*, the *Collections Management Report*, and the *Collections Management Plan* (NPS 1998b). The *Scope of Collection Statement* defines the scope of the present and anticipated future museum collections that contribute directly to the understanding and interpretation of the park's purpose, themes, and resources to ensure that the collection is relevant to the park (NPS 2011). The scope is reviewed every five years and revised to be consistent and support changes in the park's mission. The *Collection Management Report* reports on the status of collections (e.g., size, accessions, cataloging, loans, research use, and deaccessions), while the *Collections Management Plan* provides a history of the collection, current conditions of the collection, and recommendations for future conditions (NPS 1998b). The *Collections Management Plan* also supports (1) the park's mission to provide interpretation of the natural and cultural resources at the park, (2) continued research, and (3) management goals and objectives. Under this plan, the status of artifacts housed in the museum collections are reviewed, and the plan is updated as appropriate (NPS 1998b).

SOURCE: NPS

FIGURE 3-4. PAIR OF CLOTH GLOVES WITH BEADED LEATHER GAUNTLETS FROM THE ROBINSON COLLECTION

All items that have been accessioned into the collections are recorded in the NPS Interior Collections Management System. Park staff inspect a random selection of cataloged items annually; however, certain fragile artifacts are inspected every year. Under current conditions, the park's collections are not expected to grow considerably, but a policy exists for adding new finds to the collections. These artifacts are usually objects found by NPS staff or visitors that have been displaced from their context by pocket gophers or other disturbances. Additionally, the National Park Service may acquire ethnographic collections that are then housed at other museums to augment the assemblage relating to the park's themes.

The NPS *Museum Handbook* provides guidelines for developing and implementing an emergency plan for museum collections (NPS 2015b). The handbook includes both policy and mechanical means to prevent or mitigate risks to collections. The Museum Collections Emergency Operation Plan for the park outlines the procedures for responding to collection emergency events (update in development, 2016).

The visitor center has issues with water infiltration. Precipitation, in the form of both rain and snow, works its way into the building through the foundation or through wind-driven rain hitting the building and leaking into the structure. This is particularly problematic in the museum display area and in the basement where the collections are stored (NPS 2013). Several unsuccessful attempts have been made to stop the water infiltration. Previous efforts to address the issue included placing sealant around the foundation, making general improvements to the foundation and installing a French drain, replacing sheet rock and insulation, and touching up painting around existing bricks. In addition, in lieu of a solution to the overall problem, park staff retrofitted cabinets to be more waterproof. A comprehensive solution to address the problem is underway. The project, which includes installing a waterproofing exterior insulation finishing system (EIFS), a new subgrade insulation and drainage system, and applying a new sealing system to the existing visitor center roof, is expected to stop water infiltration and subsequently protect the museum exhibits. The museum collections facility meets the requirements laid out in 36 CFR 79. The park completes a yearly checklist to ensure that the facility meets standards. The facility is climate-controlled and has an encompassing security system.

FISH AND WILDLIFE RESOURCES

Archeological resource management actions at the park could affect a variety of fish and wildlife resources that live in the park. For purposes of this discussion, wildlife includes mammals, birds, fish, mollusks, reptiles, and amphibians. This section focuses on the terrestrial and aquatic species in the park that could be affected by archeological resource management practices. Vegetation management may impact habitat or food availability for mammals, birds, and reptiles. Vegetation communities provide food, prey base, and habitat for large mammals, birds, and bats, while small mammals and reptiles depend on vegetation for foraging, cover, and other life processes. Tree removal could impact bat and bird species that depend on them for nesting and roosting, and bank stabilization practices could alter river conditions, affecting the fish and mollusks in the Knife River.

In addition, climate change is expected to affect wildlife. Predicted temperature changes and water supply shortages would likely have negative impacts on the life cycles of wildlife. Higher evaporation rates and longer dry periods in the Prairie Pot Hole Region would reduce habitat and breeding ground available to waterfowl and other species that depend on the shallow lakes (USEPA 2014a). A table listing all plant, fish and wildlife species as noted in this plan/draft environmental impact statement can be found in appendix E.

Mammals

Forty-one species of mammals, including carnivores, ungulates, small mammals, and bats are found at the park. Carnivorous mammals such as red fox (*Vulpes vulpes*) and long-tailed weasel (*Mustela frenata*) are present in varying abundance, while coyote (*Canis latrans*) are common in the park. Ungulates like pronghorn (*Antilocapra americana*) and mule deer (*Odocoileus hemionus*) are present, the most common being white-tailed deer (*Odocoileus virginianus*) (Schmidt et al. 2004; NPS 2014a). White-tailed deer are the most abundant big game animal in North Dakota. When observed at the park, these deer are most commonly seen in the riparian areas. White-tailed deer are known to browse on the buds, seeds, and leaves of a variety of trees, shrubs, and forbs. Deer often socialize in small groups composed of related females, until males join with females during the breeding season, which peaks in mid-November (NDGF 2014).

Forty-one species of mammals, including carnivores, ungulates, small mammals, and bats are found at the park.

Small mammals such as meadow jumping mouse (*Zapus hudsonius*), white-footed mouse (*Peromyscus leucopus*), and deer mouse (*Peromyscus maniculatus*) are common at the park. Common burrowing small mammals include northern pocket gopher (*Thomomys talpoides*), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), and southern red-backed vole (*Clethrionomys gapperi*). Large burrowing mammals such as badger (*Taxidea taxus*) are also present at the park (Schmidt et al. 2004; NPS 2014a).

Burrowing and digging activity from northern pocket gophers threatens archeological sites at the park. These activities disturb and damage the archeological context, making management efforts to preserve park resources difficult (Kessler 2012). Northern pocket gophers are common in the central Great Plains of the United States and are present in much of North Dakota. Pocket gophers occupy a wide range of habitats from cultivated fields to prairie meadows. This species is adapted for life underground where each burrow is occupied by one individual. It is rare that gophers come aboveground, but when they do, it is on dark nights to disperse or excavate tunnels (Macdonald 2009). Typically, the main tunnel of a burrow is between 4 and 12 inches deep (O'Brien et al. 2009). Burrows can extend 400 to 500 feet and include a food storage area, nest sites, and specific use tunnels for foraging or deposition of feces (USGS 2014a). Male burrows are longer and more dendritic than female burrows, making contact with more than one female a possibility.

Pocket gophers are drawn to soils that are light in texture, porous, and well drained for their habitat. They require porous soils because their tunnels are closed off from the surface and they need oxygen to travel through the soil. Clays or soils made of small particles that hold moisture are not preferred. Gophers have trouble tunneling through rocky soils, and sandy soils do not support tunnels very well (O'Brien et al. 2009). In areas of high quality habitat, gophers tend to disperse evenly across the landscape, while in low quality habitat, gophers will concentrate burrows in the better portions of the habitat (Macdonald 2009).

Pocket gophers forage on roots, broad-leafed plants, bulbs, and tubers. Northern pocket gophers breed during the spring and give birth to four to seven young. The young are held in the burrow for approximately two months and then are forced out. Predators of northern pocket gophers include badgers, great horned owls, coyotes, and weasels (Macdonald 2009; USGS 2014a). The park introduced a trapping program in 2009 to reduce negative impacts on archeological sites from pocket gophers. Pocket gophers were trapped between May and August at three archeological sites at the park—Big Hidatsa, Sakakawea, and Lower Hidatsa. The total number of gophers trapped across all three sites declined from 113 in 2009 to 10 in 2012 (Kessler 2012).

Bat species present in the park include the big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycteris noctivagans*), small-footed myotis (*Myotis leibii*), and little brown bat (*Myotis lucifugus*) (NPS 2016a). Northern long-eared bats are also present at the park (see the "Special-Status Species" section of this chapter). Acoustic surveys conducted at the park in July 2015 confirmed the presence of all seven bat species listed above, with silver-haired bats and big brown bats being the most commonly recorded species. The greatest number of bats was recorded in a wooded area at the northern boundary of the park, which is composed of larger trees that provide excellent roosting habitat. Substantial numbers of bats were also documented in a riparian forest along the Knife River just north of the town of Stanton and at the park visitor center (NPS 2016a). Previous surveys at the park using mist-nets reported that bats were most commonly captured near puddles of water where insects swarmed and in areas where trees formed a closed canopy (Schmidt et al. 2004; USFWS 2014a).

Birds

At least 143 bird species, including shorebirds, waterfowl, raptors, and migrants have been documented at the park. An additional 20 bird species are expected to be present or use the park in some way during the year (Panjabi 2005; NPS 2014a). Any archeological resource management action that modifies habitat could affect birds. These actions could include vegetation management treatments and any bank stabilization techniques that results in disturbance to the riverbank.

Common waterfowl and shorebirds documented in the park include both residents, such as mallard (*Anas platyrhynchos*), Canada goose (*Branta canadensis*), and spotted sandpiper (*Actitis macularius*), as well as migratory birds, such as wood duck (*Aix sponsa*). The Knife and Missouri Rivers and adjacent riparian areas provide food, shelter, and breeding habitat for these species (Panjabi 2005; NPS 2014a).

Raptors such as bald eagle (*Haliaeetus leucocephalus*) and red-tailed hawk (*Buteo jamaicensis*) are common park residents. Bald eagles live near rivers, lakes, and wetlands where they can find and hunt fish. In addition to fish, bald eagles are also known to feed on waterfowl, reptiles, and small mammals. Eagles breed and nest in tall trees, returning to the same nest every year. The bald eagle is no longer listed under the Endangered Species Act, but is still protected under the Bald and Golden Eagle Act and the Migratory Bird Treaty Act (Panjabi 2005; NPS 2014a; USFWS 2014b).

Wild turkey (*Meleagris gallapavo*) and ring-necked pheasant (*Phasianus colchicus*) are abundant at the park because the riparian woodlands, agricultural fields, and grasslands provide suitable habitat. These species primarily forage on seeds, nuts, and plant matter on the ground; however, they sometimes consume insects and grubs when their primary food sources are limited. Other ground-feeding birds at the park include American crow (*Corvus brachyrhynchos*) and black-billed magpie (*Pica hudsonia*) that forage on seeds, grain, and fruit on the ground, as well as small animals, carcasses of dead animals, and eggs or nestlings of other birds (Panjabi 2005; NPS 2014a; Cornell Lab of Ornithology 2014). Pocket gopher control techniques such as poison baiting have the potential to affect ground-feeding birds.

Riparian woodland areas in the park provide habitat for many of the common species present, including lazuli bunting (*Passerina amoena*), red-winged blackbird (*Agelaius phoeniceus*), house wren (*Troglodytes aedon*), and downy woodpecker (*Picoides pubescens*). Other common species, such as lark sparrow (*Chondestes grammacus*), brown thrasher (*Toxostoma rufum*), and western meadowlark (*Sturnella neglecta*) were observed in the woody draws in the park. The common nighthawk (*Chordeleis vociferous*), common grackle (*Quiscalus quiscula*), and great horned owl (*Bubo virginianus*) are common to all habitat types throughout the park. The adjacent areas to the river and grasslands are inhabited by common species, including killdeer (*Charadrius vociferous*) and several swallow species, such as the barn swallow (*Hirundo rustica*) and cliff swallow (*Petrochelidon pyrrhonota*) (Panjabi 2005; NPS 2014a).

Reptiles and Amphibians

As many as 14 reptile and amphibian species may occur at the park (Smith et al. 2004). Reptiles known to occur include plains garter snake (*Thamnophis radix*), racer (*Coluber constrictor*), and red-sided garter snake (*Thamnophis sirtalis*). Amphibian species include Rocky mountain toad (*Bufo woodhousii*), boreal chorus frog (*Pseudacris maculate*), northern leopard frog (*Rana pipiens*), and tiger salamander (*Ambystoma tigrinum*) (NPS 2014a). Other species that are likely present, but their presence has not yet been documented, include the painted turtle (*Chrysemys picta*), common snapping turtle (*Chelydra serpentina*), Great Plains toad (*Bufo cognatus*), plains spadefoot toad (*Spea bombifrons*), western hognose snake (*Heterodon nasicus*), smooth green snake (*Liochlorophis vernalis*), and the gophersnake or bullsnake (*Pituophis catenifer*) (Smith et al. 2004).

Fish and Mollusks

Eighteen fish species are documented in the Knife River, including white sucker (*Catostomus commersonii*), red shiner (*Cyprinella lutrensis*), northern pike (*Esox lucius*), walleye (*Sander vitreus*), and channel catfish (*Ictalurus punctatus*). Shovelnose sturgeon (*Scaphirhynchus platorynchus*), the smallest of the sturgeon species, is present in the Knife River and most likely also present in the portion of the river in the park. Other fish species that likely are present in the park include blue sucker (*Cycleptus elongates*), fathead minnow (*Pimephales promelas*), and sauger (*Sander canadensis*) (NPS 2014a; USFWS 2001). Twenty-six species of mollusks are also known to occur at the park (NPS 2014b).

Insects

A 2004 butterfly inventory documented the findings of summer field surveys conducted at the park. NPS biologists documented 56 butterfly species at the park from May–August 2004. In general, the northern half of the park provides the best butterfly habitat because it contains relatively intact tracts of woodland, wetland, and native prairie habitat. A history of widespread burning in the southern half of the park has essentially eliminated native butterfly populations there (Royer 2004). Many other insect species are known to occur or are likely to occur at the park (NPS 2014a), although no comprehensive insect surveys have been completed.

SPECIAL-STATUS SPECIES

The park contains a variety of habitat suitable to special-status species. Special-status species are fish or wildlife listed under the Endangered Species Act. North Dakota does not have a state threatened or endangered species list; only those species that are federally listed and could occur at the park are discussed in this section, including the least tern and the northern long-eared bat.

The least tern is a small-bodied migratory waterbird listed as endangered under the Endangered Species Act. A 2013 census on the Missouri River reported 131 adult least terns present in the Garrison River to Lake Oahe reach of the Missouri River (USACE 2014). In August 2013, park staff witnessed least terns foraging at the mouth of the Knife River (NPS 2014c). The species nests on open and predominantly unvegetated emergent riverine sandbars throughout the Missouri River drainage (Adolf 1998; Kirsch 1996; Schwalbach 1988). Least terns typically forage in shallow waters that harbor small fish, such as in secondary channels; wetlands; tributaries; and areas bordering islands, bars, and the main channel (Dugger 1997). Small fish are a predominant part of their diet, which is further supplemented by invertebrates (Thompson et al. 1997). Because least terns have been documented to nest on the Missouri River adjacent to the park, the species may use the Knife River to forage. However, nesting has not been documented on the Knife River and is not considered likely (USFWS, Aron, pers. comm. 2015a).

The northern long-eared bat is a medium-sized bat, with a wing span of 9 to 10 inches. Its range spans much of the eastern and north central United States, including North Dakota. Because of dramatic population declines, mainly resulting from the emergence of white-nose syndrome, the northern long-eared bat was federally listed as threatened in early 2015. Although white-nose syndrome is the primary threat to northern long-eared bats, other sources of mortality such as impacts on hibernation habitat or hibernacula, loss of summer habitat, or wind farm operations, may now be more important given the widespread impact of white-nose syndrome (USFWS 2015b). Northern long-eared bats spend the summer months roosting either singly or in colonies in crevices or cavities underneath the bark of living and dead trees. Although breeding occurs in late summer or early fall, northern long-eared bats reproduce using delayed fertilization, so females do not give birth until summer after moving to summer roosting sites. At dusk, northern long-eared bats emerge to feed on moths, flies, leafhoppers, caddisflies, and beetles using echolocation while in flight (USFWS 2015b). Bat surveys conducted at the park in July 2015 confirmed the presence of northern long-eared bats at three out of the four monitoring stations (along a heavily forested reach of the Knife River just north of Stanton, in a woodlot at the northern boundary of the park, and at the visitor center). The highest number of northern long eared bats was recorded in a wooded area at the northern boundary of the park, which includes larger trees that provide excellent roosting habitat. Based on survey results, the report recommended the park should protect, and if possible, expand the forested areas in the park to conserve the threatened northern long-eared bat. Along the Missouri River, cottonwood stands 60 years or older have been found to provide better habitat for bats than younger stands (Swystun et al. 2007) and should be the focus of conservation and management efforts (NPS 2016a).

Changes in precipitation and temperature, longer periods of drought, and more frequent wildfires associated with climate change are likely to have severe effects on special-status species over the long term (USEPA 2014a). Climate change is likely to affect both aquatic and terrestrial habitats and may have negative impacts on all three special-status species potentially occurring at the park.

WATER QUALITY, WATER RESOURCES, AND WETLANDS

Archeological resources management actions could affect Knife River flows (i.e., hydrology), the bed and banks of the Knife River, including associated wetlands, and water quality. Depending on the bank stabilization techniques implemented, structures or modifications could modify river flows, river banks, the riverbed, and riverine wetlands. This section focuses on hydrology, river banks and erosion, water quality, and wetlands.

Water comprises approximately 6.5% (115.1 acres) of the surface area of the park. The water resources and wetlands of the park are located within two watersheds. The Painted Woods-Square Butte watershed encompasses land in the north and a small portion in the south. The Knife River watershed includes the area in the middle of the park. The Knife River, a sinuous, natural, free-flowing river, enters the park on the west side and meanders approximately 3.4 miles through the southern half of the park, paralleling the park's southeastern boundary, before meeting the Missouri River just outside the park (Tronstad 2013). The Missouri River forms the northern boundary of the park, meanders south outside the eastern border, and meets the park again in the southeastern corner at the confluence of the Knife and Missouri Rivers. The natural drainage pattern of the watersheds around the park consists of meltwater channels (NPS 1999). Meltwater channels are landforms that were created by glacial meltwater and are characteristic of the park area (Reiten 1983). The Knife River flows along one of these drainages, and its tributaries are characteristically long. Figure 3-5 shows the surface water resources in the area.

Regional land use influencing water quality, water resources, and wetlands in the area is dominated by cropland, pasture, and rangeland for livestock production, grassland, and a small amount of developed land (USGS 2011; Tronstad 2013). Developed land, including urban areas comprises a small part of the watershed. Development for coal, oil, and gas production and power generation is present in the watershed (Graham 2015). Historically, the park and surrounding lands were used for crop cultivation, grazing, and timber harvesting (NPCA 2006).

Hydrology

The sinuous morphology of the Knife River has been formed by erosion and deposition processes caused by high flow periods on the river (Ellis 2005). Morphology on the lower Knife River is affected directly by the hydrology of the upstream portion of the Knife River and indirectly by the Missouri River. Garrison Dam, approximately 10 miles upstream of the park on the Missouri River, has altered the hydrologic regime of the Missouri River, which has affected the Knife River. Flood magnitude, frequency, and timing on the Missouri River have decreased since construction of the dam, and large flood peaks now do not correspond temporally to those on the Knife River. The change in Missouri River flood flows, discharge, and erosion patterns has decreased the base flow of the Knife River (Ellis 2005). The lower river stage of the Knife River during Missouri River peak flows allows the waters to backup into the Knife River, causing morphological changes to the lower reaches, including a deeper, narrower channel with faster flows, more erosion, and less sediment deposition than upstream reaches (Ellis 2005). One-time measurements of maximum current velocity on the Knife River ranged from -1.9 inches (-0.05 meter) per second to 13.8 inches (0.35 meter) per second with a mean of 2.8 inches (0.07 meter) per second (Rust 2006). The negative velocity measurement shows the effect of the backflow on the Knife River.

The fast, sediment-heavy flow of the Knife River meets the slower water of the Missouri River at its confluence, resulting in a loss of sediment transport capacity and the formation of an island (Ellis 2005). Although the average annual peak discharge rate on the Knife River has decreased slightly from pre-dam conditions, the overall variability of flow is still high (figures 3-6 and 3-7) (Ellis 2005). This contrasts with the Missouri River, which has seen a drastic decrease in average annual peak flow variability, although the average annual flow rate is slightly higher than during the pre-dam period. Flood flows on the Knife River still occur during the spring snowmelt and ice breakup phase and in early summer during rain events, while flows on the Missouri River are fairly constant throughout the year with small discharge peaks in late winter and summer. Recent flooding events and overbank flow occurred in 1997, 2003, 2009, and 2011. These floods altered the geomorphology and hydrology of the Knife and Missouri Rivers (Nadeau et al. 2014). Major flooding and overland flow occurred in March 1997 as a result of ice melt (Ellis 2005; Nadeau et al. 2014), and high water and some overbank flow occurred in March 2003 as a result of an ice jam at Noname Bend (Ellis 2005). Spring flooding occurred in 2009 and 2011 for an extended period (Nadeau et al. 2014). Each of these flooding events resulted in river bank degradation, erosion, and soil loss (Nadeau et al. 2014). The 1997 flood event removed 86 feet of riverbank downstream of Elbee Bend and damaged the trail along the river terrace (Ellis 2005; Nadeau et al. 2014). The 2009 and 2011 flood events also caused erosion close to or at archeological sites.

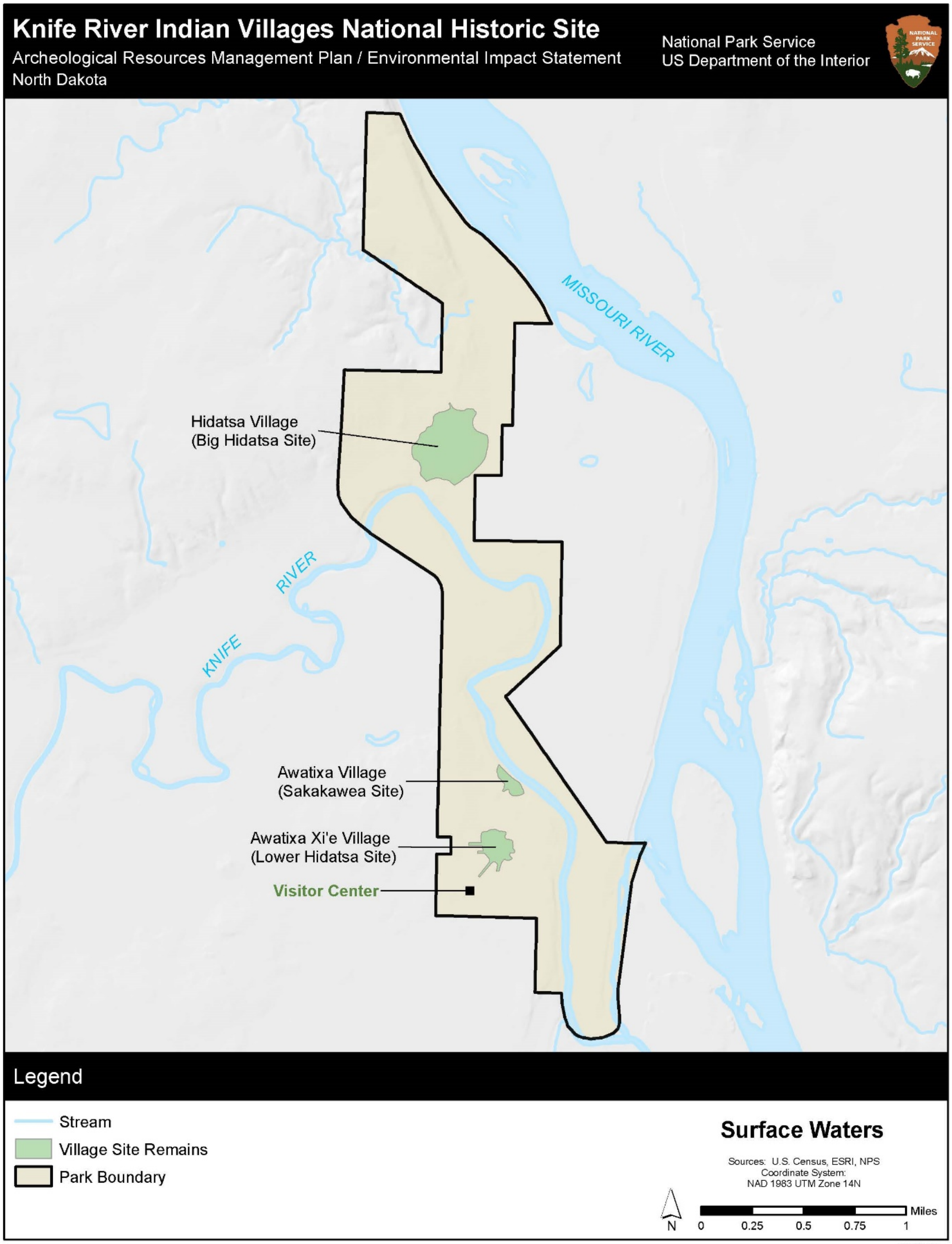
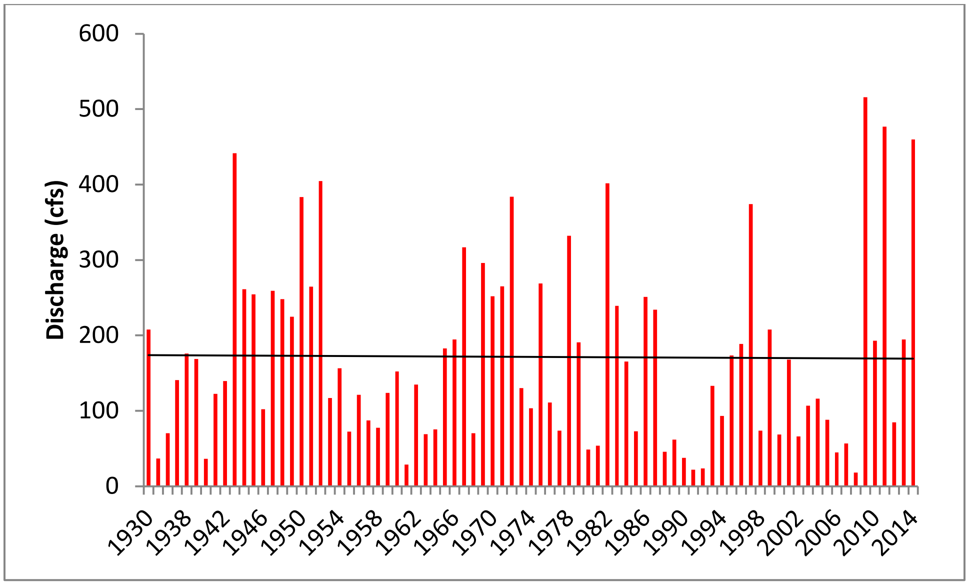
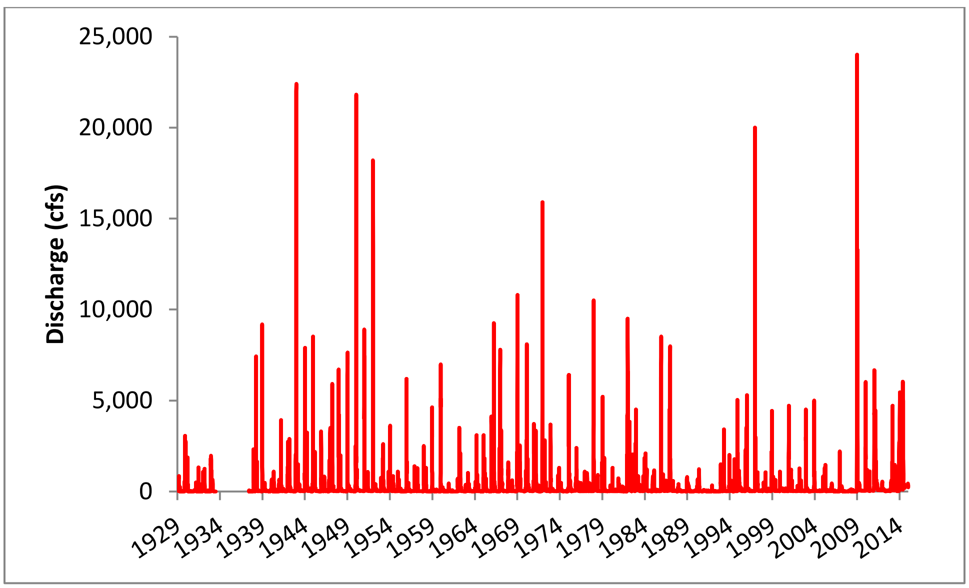


FIGURE 3-5. SURFACE WATERS AT KNIFE RIVER INDIAN VILLAGES NATIONAL HISTORIC SITE



SOURCE: USGS 2015a

FIGURE 3-6. AVERAGE ANNUAL DISCHARGE AT US GEOLOGICAL SURVEY SITE 06340500 KNIFE RIVER AT HAZEN, ND (1930–2014)



SOURCE: USGS 2015a

FIGURE 3-7. AVERAGE DAILY DISCHARGE AT US GEOLOGICAL SURVEY SITE 06340500 KNIFE RIVER AT HAZEN, ND (1929–2014)

Riverbanks and Bed

The lower reaches of the Knife River, especially at the river bends (i.e., Elbee, Loop, Noname, Taylor, and Unnamed), are eroding. Much of the erosion has been caused by river ice during spring breakup and direct river flow associated with the unnatural Knife River and Missouri River systems (Ellis 2005). In addition to scouring the banks, the ice jams can also erode the riverbed, deepening the flow channel (Ellis 2005). Heavy precipitation events and high river flows can saturate the stream banks and lead to erosion. These unstable saturated banks are also prone to bank failure and ultimately erosion in the absence of the usual erosive forces of high flows or ice (Ellis 2005). The erosion of bed and banks is a natural process of a riverine system; however, the Knife River and Missouri River systems have been altered by the unnatural regimes associated with the operation of Garrison Dam upstream on the Missouri River (Ellis 2005). Erosion and degradation on the Missouri River downstream from the dam has indirectly resulted in an altered erosional regime on the lower reaches of the Knife River (Ellis 2005). Figure 3-8 shows the active erosion areas along the Knife River in the park.

Bank erosion is typically in the form of cut banks on the outside part of a river bend, with the associated formation of point bars occurring downstream along the opposite bank. Over the period 1965 to 2011, bank movement has ranged from a minimum of 13.9 feet (4.2 meters) at Taylor Bend to a maximum of 410.7 feet (125.2 meters) at Noname Bend (Sexton 2012). Average annual rates of bank movement at the five monitored bends ranged from 0.3 feet (0.1 meter) to 7.4 feet (2.3 meters) (Sexton 2012). This erosion of bend sediments and subsequent deposition of the material downstream results in the gradual downstream movement of river meanders (Nadeau et al. 2014). This morphological process will continue until the river reaches a relatively stable state (Ellis 2005).

Stabilization efforts, using a mix of materials including soil, tri-lock, and riprap, has occurred in two locations on the Knife River in the park. The implementation of bank stabilization measures affect river flow and equilibrium processes, thereby altering morphology upstream or downstream of the structures. Impacts, which depend on specific site characteristics and the stabilization measures implemented, include alterations of water surface elevation; flow velocity; sediment erosion, scour, and deposition processes; and sediment transport capacity (Fischenich 2001). For example, coarse riprap material that was placed along the river bank close to both the road bridge and the Sakakawea site has been transported downstream from initial placements, leading to shallower Knife River depths than are natural. These reduced depths could make ice formation easier (Ellis 2005). Ice formation can impact river flow velocity and direction and sediment transport capacity (Zabilansky et al. 2002).

Water Quality

Erosion and flooding influence sedimentation and turbidity in the Knife River. Turbidity levels are important for the health of aquatic species and for potential surface water uses. North Dakota does not have a numeric turbidity standard; however, the federal water quality standards promulgated by the US Environmental Protection Agency state that turbidity should be less than or equal to 50 nephelometric turbidity units (NTU) (USEPA 2014b). Recent sampling on the two rivers showed that turbidity on the Knife River ranged from 5 NTU–20 NTU and from 3 NTU–173 NTU on the Missouri River (NPS 1997; Rust 2006; Nadeau et al. 2014).

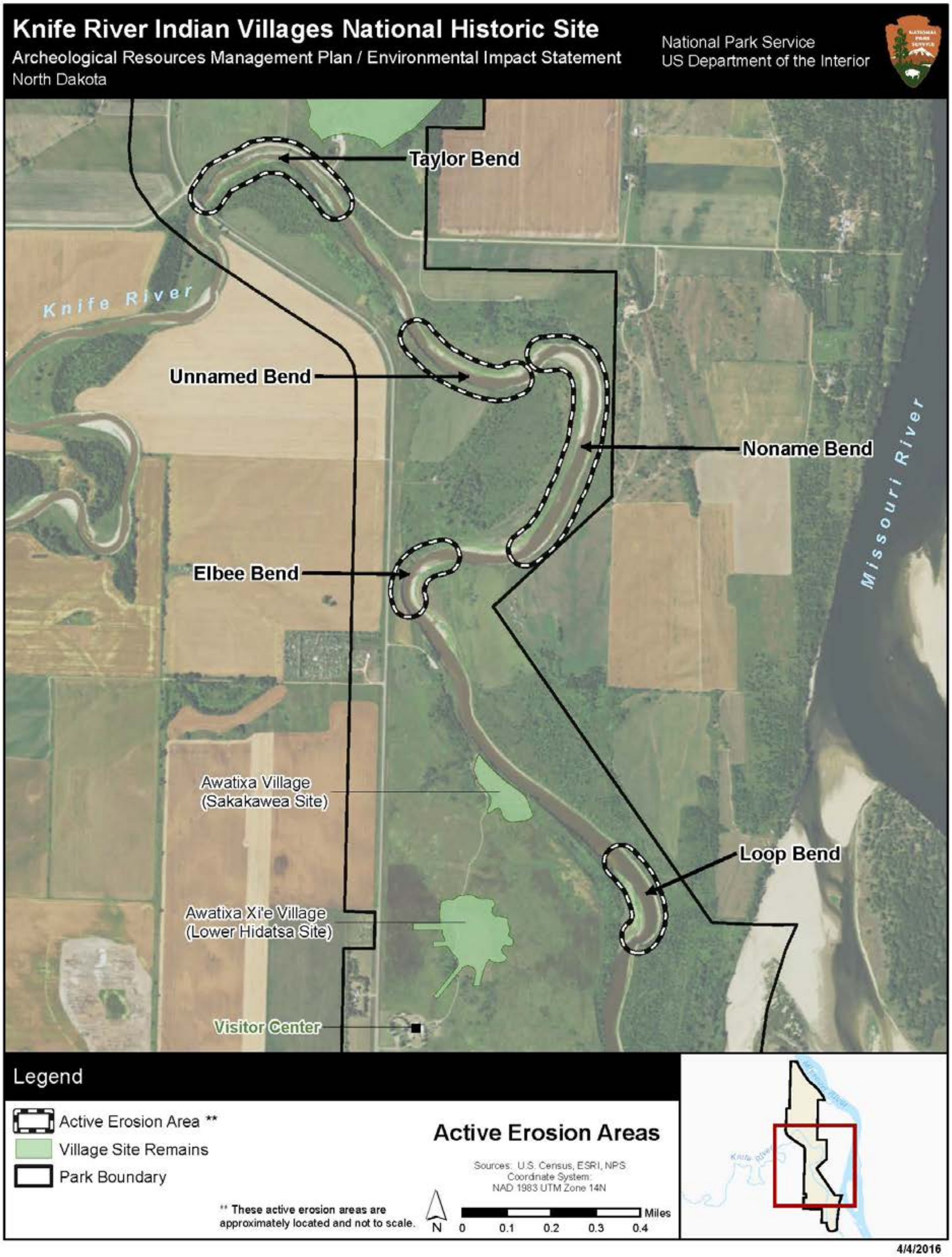


FIGURE 3-8. KNIFE RIVER ACTIVE EROSION AREAS

Although the USEPA standard is set at a certain level, many waterbodies have natural background conditions for turbidity that, at least seasonally, would commonly exceed the 50 NTU standard. The Missouri River is one such waterbody that historically has had naturally high turbidity levels (National Research Council 2010). Other than the high value (173 NTU) on the Missouri River, all other values were within the USEPA standard (Rust 2006). The current management of the Missouri River, including the operation of the mainstem dams such as Garrison Dam, has decreased the suspended sediment load throughout much of the Missouri River. Total suspended sediment measurements for the Missouri River are lower than those for the Knife River (Rust 2006). Missouri River measurements ranged from 2 milligrams per liter (mg/L) to 21 mg/L whereas Knife River values ranged from 10 mg/L to 52 mg/L (Rust 2006). This lack of sediment among other factors has led to increased erosion and degradation of the Missouri River (Ellis 2005).

Although water quality data for the Knife River adjacent to the park and for the Missouri River are limited, most parameters measured at various times (e.g., water temperature, dissolved oxygen, and pH) were within state standards for the propagation or protection of resident fish species and other aquatic biota. More turbidity in a waterbody can result in higher water temperatures and lower dissolved oxygen levels. Recent water temperature samples from the Knife and Missouri Rivers in or adjacent to the park were below the North Dakota water quality maximum standard of 85°F (Rust 2006; Tronstad 2013; Nadeau et al. 2014; USGS 2015b). Temperature measurements from the Knife River in the park were generally higher than those from the Missouri River. The tailwater discharge from Garrison Dam originates from the colder waters at the bottom of Lake Sakakawea. The lower water temperatures recorded on the Missouri River near the park are the result of this cold water release. Monitoring studies in 1991, 2004–2005, and 2011 on the Missouri and Knife Rivers showed dissolved oxygen on the Missouri River ranging from 8.0 mg/L–12.3 mg/L and from 6.9 mg/L–10.9 mg/L on the Knife River (NPS 1997; Rust 2006; Nadeau et al. 2014). Recent continuous sampling at a US Geological Survey (USGS) station on the Knife River inside the park measured average daily dissolved oxygen values that were all above the 5 mg/L minimum; only seven individual samples over two days had values below the standard (USGS 2015b). Measurements collected intermittently from 1977 and 2011 reported pH values of 7.1–9.0 on the Missouri River and 7.7–8.5 on the Knife River (NPS 1997; Rust 2006; Tronstad 2013; Nadeau et al. 2014). The Knife River sampling inside the park measured average daily pH values that were all within the 6.0 to 9.0 range; only four individual samples had values outside the standard (USGS 2015b).

Pathogens are present in both the Knife and Missouri Rivers (Rust 2006; Nadeau et al. 2014). North Dakota uses an *Escherichia coli* (*E. coli*) standard instead of a fecal coliform water quality standard. The 20.6-mile stretch of the Knife River from Antelope Creek downstream to its confluence with the Missouri River is listed on the 2014 303(d) list of impaired waters (NDDH 2015a). The Knife River does not support the designated recreation use because it exceeds the *E. coli* standard, possibly because of livestock grazing in riparian areas, nonpoint source animal feed operations, and/or municipal point sources (NDDH 2015a). Older samples that were based on the fecal coliform standard had exceedances, including monitoring in the Knife River from August 2011 that showed fecal coliform as high as 2,149 colony forming unit/100 milliliters (Tronstad 2013).

Nutrients are often associated with suspended sediments. Higher nutrient levels in a waterbody can result in greater productivity, including from algal growth, which in turn contributes to turbidity. Total phosphorus ranged from 0.058 mg/L to 0.692 mg/L in the Knife River and was below 0.1 mg/L in the Missouri River (Rust 2006). The US Environmental Protection Agency recommends a total phosphorus concentration of 0.023 mg/L for rivers and streams in the park region to protect designated uses (USEPA 2001). Although the source of phosphorus is not stated for the Knife River, typical sources of phosphorus in surface water include wastewater and industrial effluent, fertilizers, and manure (USGS 2014b). Nitrate measurements for the Knife and Missouri Rivers were all within the water quality criteria standard (NDDH 2001; Rust 2006).

The North Dakota Macroinvertebrate Biotic Integrity Multimetric Index is a tool used for assessing overall ecosystem quality in the region. The index indicated that the Knife River is in good condition compared to other rivers in the region (Tronstad 2013). This type of assessment evaluates multiple characteristics, including water quality, land use and land cover, disturbance, and habitat conditions (Tronstad 2013). Conversely, the Hilsenhoff's Biotic Index, which assesses organic pollution, rated the Knife River sites as fair to fairly poor quality. This supports the findings of *E. coli* impairment.

Macroinvertebrate collections in the Knife and Missouri Rivers showed that pollution-tolerant species were more abundant than intolerant species in both waterbodies (Rust 2006).

Climate change is predicted to have substantial impacts on water quality and water resources in the Great Plains region. Demand for water in the Great Plains is predicted to exceed groundwater recharge rates. Temperature increases, more frequent droughts, and higher evaporation rates would further stress and limit the availability of water resources (USEPA 2014a).

Wetlands

Executive Order 11990, "Protection of Wetlands" was issued in 1977. In response to this executive order, the National Park Service issued Director's Order 77-1 (NPS 2002b). Director's Order 77-1 requires that the National Park Service avoid adverse impacts on wetlands to the extent practicable, minimize any impacts that could not be avoided, and compensate for any remaining unavoidable adverse impacts (NPS 2012). Bank stabilization techniques that may be implemented along the Knife River could affect wetlands associated with the riverbed and banks.

Wetlands are areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (USACE 1987). Wetlands provide important environmental and economic functions and values to their immediate environment and to adjacent upland areas. Wetlands can store large volumes of water and function as a "sponge," reducing the likelihood of flooding during storm events and protecting the shoreline from erosion. Additionally, wetlands provide excellent habitat for fish and wildlife resources. Riverine wetlands detain floodwaters, support nutrient cycling, filter pollutants, and provide habitat for fish and wildlife resources. Palustrine wetlands provide many of the same functions, including flood flow storage and attenuation, groundwater recharge and discharge, sediment and contaminant filtration, and habitat for wildlife and plants.

The US Army Corps of Engineers is charged with regulating the discharge of dredged or fill materials in wetlands or other "waters of the United States" under section 404 of the Clean Water Act. The US Army Corps of Engineers considers areas that are dominated by hydrophytic vegetation, contain hydric soils, and display indicators of hydrology to be a wetland. The NPS definition of wetlands is similar to that of the US Environmental Protection Agency and the US Army Corps of Engineers; however, the NPS definition is broader in scope and affords a greater jurisdiction than that of the US Army Corps of Engineers. The National Park Service classifies wetlands based on the USFWS Classification of Wetlands and Deepwater

Habitats of the United States, also known as the Cowardin classification system (Cowardin et al. 1979).

Based on the Cowardin classification system, a wetland must have one or more of the following attributes.

- The habitat at least periodically supports predominantly hydrophytic (wetland) vegetation.
- The substrate is predominantly undrained hydric soil.
- The substrate is nonsoil and saturated with water, or is covered by shallow water at some time during the growing season (Cowardin et al. 1979).

The National Wetlands Inventory (NWI) identifies four wetland types in the park—three riverine wetlands and one palustrine wetland (figure 3-9) (USFWS 2000). The riverine wetlands present are riverine, lower perennial, unconsolidated bottom, permanently flooded wetland (R2UBH); riverine, lower perennial, unconsolidated bottom, intermittently exposed wetland (R2UBG); and riverine, lower perennial, unconsolidated shore, seasonally flooded (R2USC). The riverine wetlands include all wetlands in natural or artificial channels periodically or continuously containing flowing water, characterized by a low gradient and slow water velocity, or which form a connection between two bodies of standing water. These wetlands are associated with the channels of the Knife and Missouri Rivers and consist of a sand and mud substrate mixed with approximately 25% particles smaller than stones, a vegetative cover less than 30%, and are covered with water throughout the year except in years of extreme drought. The palustrine wetland is palustrine forested/palustrine emergent, seasonally flooded (PFO/EMC) and is dominated by woody vegetation taller than or equal to about 20 feet (6 meters) or by erect, rooted, herbaceous hydrophytes. Based on NWI mapping, approximately 156 acres of wetland occur in the park (figure 3-9). A table listing all plant, fish, and wildlife species as noted in this plan/draft environmental impact statement can be found in appendix E.

The National Wetlands Inventory is based on a review of aerial photographs, soil surveys, and hydrological data. While the inventory is useful as a preliminary planning tool, it is primarily a product of very limited field verification. As such, inaccuracies are not uncommon, and prior to any work occurring, wetland biologists should perform more detailed site-specific studies. Existing vegetation communities in the park, such as riparian forest communities, suggest that there could be other wetlands present that have not yet been delineated. Additionally, one shrub and two herbaceous vegetation associations could potentially contain wetlands. These include forest association dominated by green ash / snowberry, a woodland association dominated by green ash / chokecherry, a shrub association dominated by coyote willow (*Salix exigua*), an herbaceous association dominated by riverine sand flats, and the hardstem bulrush marsh association. Most of these associations occur along the Knife River, although others occur in historic or previously disturbed floodplains and floodplain terraces.

Riparian forest communities in the park consist of two primary types based on the dominant tree species—the green ash (*Fraxinus pennsylvanica*) / boxelder (*Acer negundo*) / American elm (*Ulmus americana*) forest and the eastern cottonwood (*Populus deltoides*) forest (Clambey 1985; Salas and Pucherelli 2003). The green ash / boxelder/ American elm forest is largely composed of green ash with few American elm remaining, with boxelder usually on the periphery, and few shrubs in the understory (Salas and Pucherelli 2003). Eastern cottonwood forests are restricted to the Russel floodplain in the northeast portion of the park (Nadeau et al. 2014).

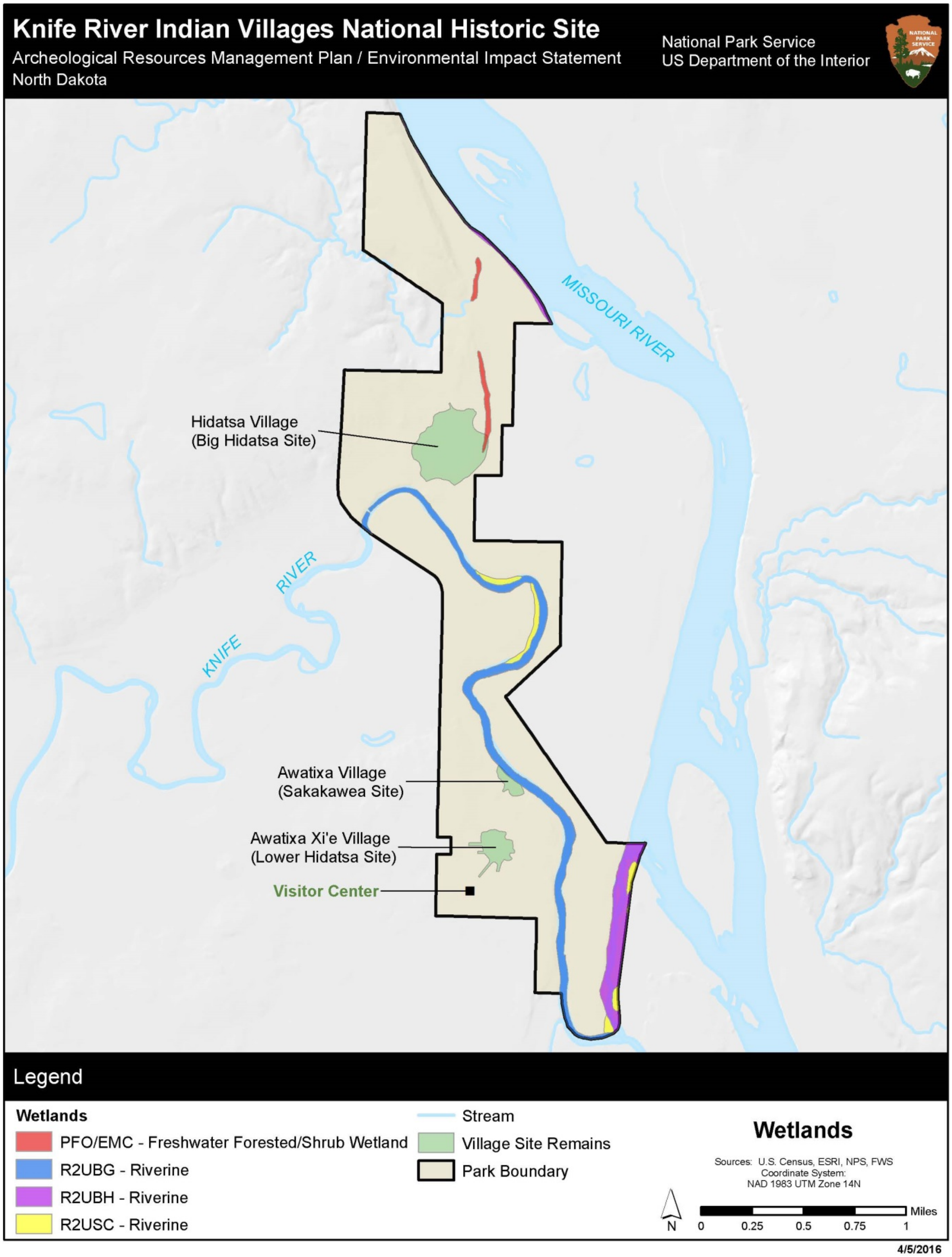


FIGURE 3-9. KNIFE RIVER INDIAN VILLAGES WETLANDS INCLUDED ON NATIONAL WETLAND INVENTORY MAPS

Riparian forest communities located along the river banks may also contain peachleaf willow (*Salix amygdaloides*) in the overstory and Virginia wild rye (*Elymus virginicus*), black medic (*Medicago lupulina*), sweet clover (*Melilotus* spp.), milkweed (*Asclepias* spp.), wild licorice (*Galium* spp.), canier flower, grape (*Vitis* spp.), fern, and strawberry (*Fragaria* spp.) in the understory (Clambey 1985; Salas and Pucherelli 2003; Nadeau et al. 2014).

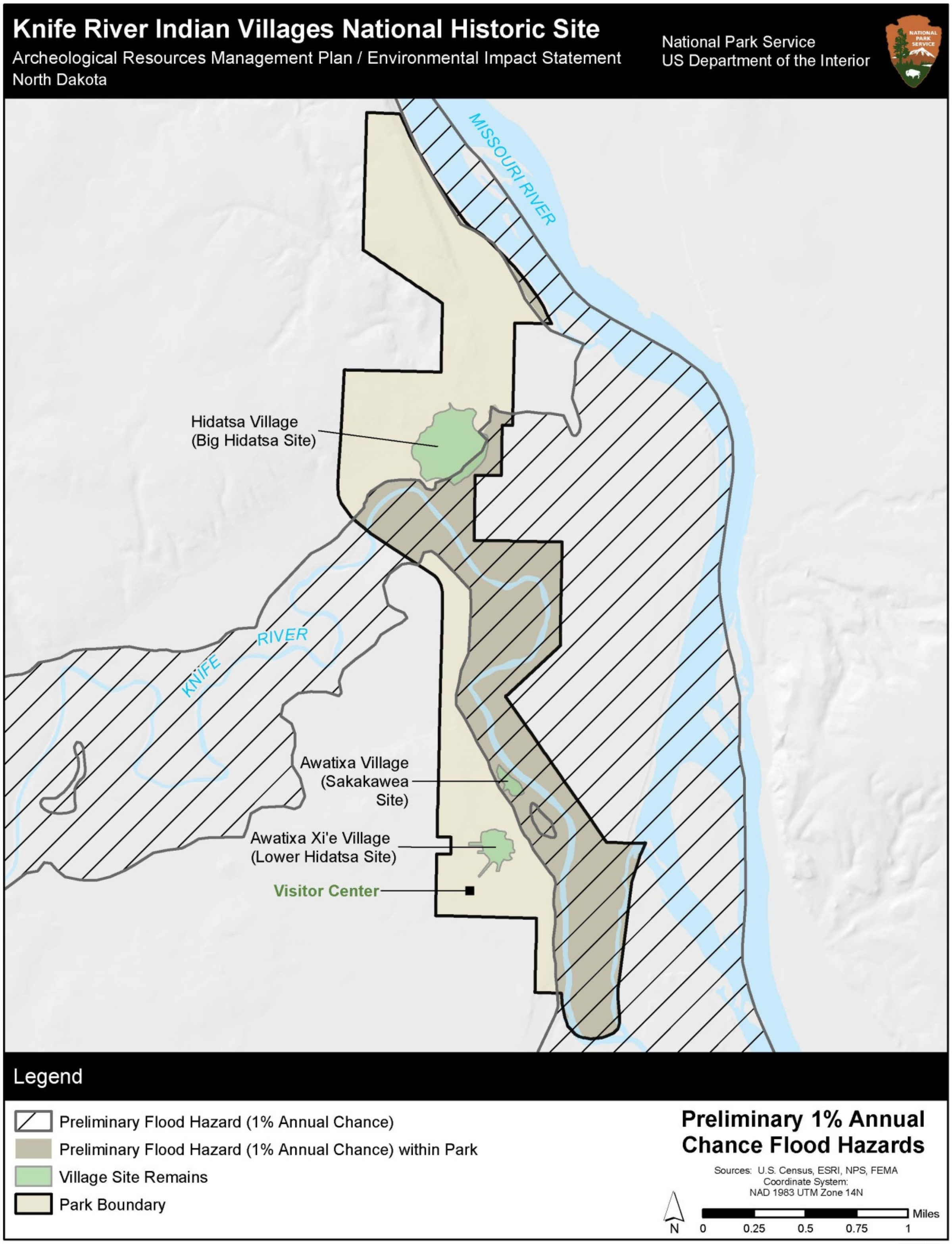
Climate change, in the form of increased precipitation, may increase the frequency and intensity of flooding, which could increase erosion, runoff, and impact other resources. Wetland quality is projected to decrease as a result of longer periods of inundation and dry spells. Specifically, the Prairie Pot Hole Region is projected to be vulnerable to predicted changes in the frequency and length of dry periods. Finally, more frequent and longer dry periods would affect groundwater recharge, the amount of available habitat for wildlife, and bird migrations (BLM 2010; Skagen and Melcher 2011; USEPA 2014a).

FLOODPLAIN RESOURCES

Executive Order 11988, “Floodplain Management,” requires the National Park Service to evaluate the likely impacts of actions in floodplain resources, avoid adverse impacts associated with the occupancy and modification of floodplain resources, and avoid support of floodplain resource development wherever a practicable alternative exists. Director’s Order 77-2: *Floodplain Management* (NPS 2003) and its companion document, Procedural Manual 77-2: *Floodplain Management* (NPS 2002c), provide NPS policies and procedures for complying with Executive Order 11988. Pursuant to Director’s Order 77-2, the National Park Service must strive to preserve floodplain values and minimize hazardous floodplain resource conditions (NPS 2003). Appendix F includes the Floodplain Management Statement of Findings. NPS Management Policy 4.6.6 also requires that the National Park Service manage streams to protect stream processes that create habitat features such as floodplain resources.

Floodplain resources are areas next to freshwater streams and rivers that experience periodic inundation. These areas provide temporary storage of floodwaters and habitat for plants, fish, and wildlife, thereby sustaining ecosystem integrity and biodiversity. In addition to their scenic value, floodplain resources can also be used for educational and/or recreational activities. They provide groundwater recharge or discharge, and can improve water quality. Approximately 747 acres of the park are below the 100-year flood elevation with a 1% chance of annual flood hazard (figure 3-10) (FEMA 2007). No 500-year floodplains (0.2% annual chance floodplain) occur in the park (FEMA 2015a, b).

The Knife and Missouri Rivers flow through portions of the park. The Knife River meanders through the southern three-quarters of the site, while the Missouri River flows through the extreme southeast boundary. Floodplain resources comprise 60% of the parklands and are found immediately adjacent to the rivers. Historically, both the Knife and Missouri Rivers were subject to inundation during spring runoff and excessive rain storms. Today, as a result of the damming of the Missouri River, much of the flooding has been eliminated. However, the Knife River still retains its historic potential for flooding (NPS 1985). Bank stabilization projects could include in-river structures and channel realignment, which could affect floodplain resources.



SOURCE: FEMA 2007

FIGURE 3-10. KNIFE RIVER INDIAN VILLAGES PRELIMINARY 1% ANNUAL CHANCE FLOOD HAZARD

Garrison Dam has altered the flood magnitude, frequency, and timing on the Missouri River allowing the floodwaters to backup into the Knife River. This backup of waters can result in changes to the channel and, at times, the floodplain resource in the lower reaches of the Knife River (Ellis 2005). Furthermore, the reduction in Missouri River flood flows has reduced the sediment scouring and deposition and reshaping of the river channel and associated floodplain resources. The flow regime change on the Missouri River has resulted in channel incision and the formation of a more stable river channel and smaller floodplain resource within the larger historic floodplain resource (Ellis 2005). These changes to the flow regime, erosional processes, and river channel and associated floodplain resource have resulted in an unnatural system on the Knife River.

Historically the floodplain areas in the park consisted of forest cover. However most of these areas have been intensely impacted and altered since the earliest human occupation and are now known as "Missouri River bottomlands." The bottomlands are composed of riparian forest communities with various portions of the floodplain resource in different successional stages, including some plants with a mixture of native and exotic grasses and large areas dominated by grasses.

VISITOR USE AND EXPERIENCE

Visitor Use Trends

The park attracted an average of 20,420 visitors a year between 1981 and 2013. Since 1981, the year that the park began recording visitation numbers, the highest visitation occurred in 2004, with 40,166 visitors and the lowest occurred in 1981, when 4,616 people visited the park (NPS 2014d). Between 2003 and 2006, visitation increased as a result of the Lewis and Clark Bicentennial Celebration. A special event held on August 17–20, 2006, marked 200 years since the Corps of Discovery's return to Knife River Indian Villages.

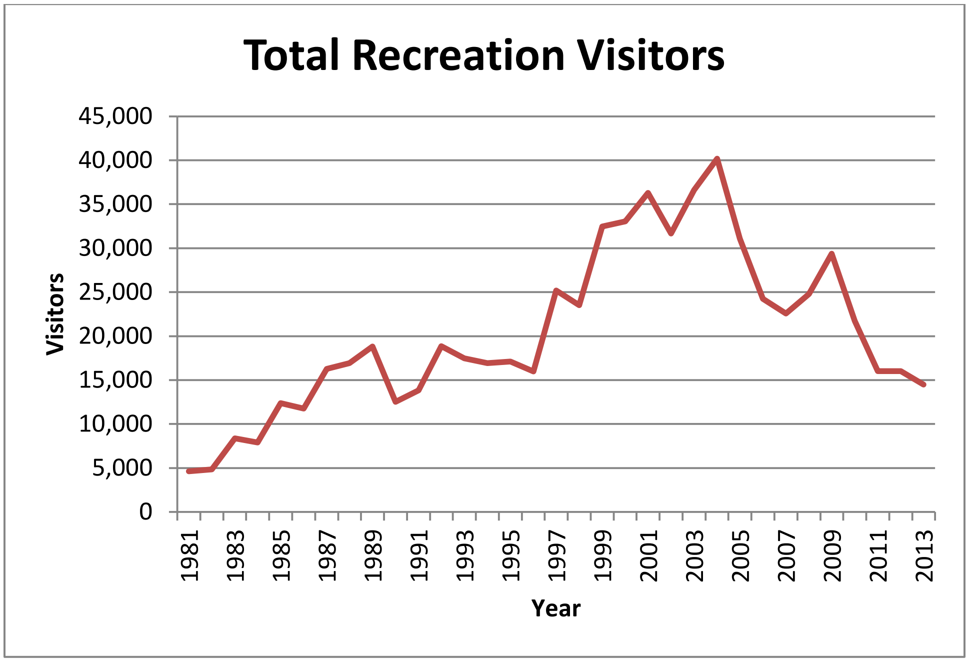
From 1981 to 2013, the park had 673,860 recreational visitors and 26,976 nonrecreational visitors. A summary of the number of recreation visitors can be found in figure 3-11. Recreational visitor count is determined by recording the number of visitors who enter the visitor center (minus self-guided and guided tours), the number of self-guided tours, number of guided tours, number of people recorded by an electric eye trail counter (divided by two to account for entering and exiting), and the number of fisherman (which is estimated to be three times the amount observed by park staff). On average, tour visitors' visits last 1.5 times longer and visits by fishermen and trail users last 2 times longer than all recreational visitors entering the visitor center (NPS 2014f).

Visitation is highest during the summer months, and the park receives the most visitors during June through August. Figure 3-12 shows park visitation by month for 2013.

Experience

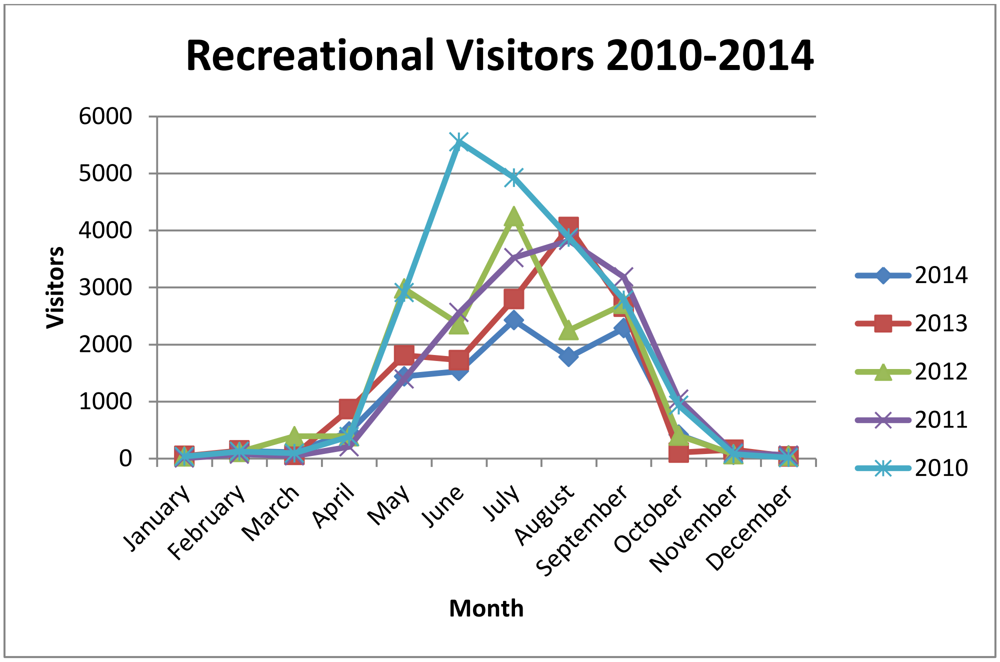
The park offers a variety of activities to experience the rich history of the area and enjoy its natural beauty. In addition to being home to the preserved historic villages of the Hidatsa, the park is also a stop on the Lewis and Clark Trail (NPS 2014e).

Visitors interested in experiencing the history of the site can visit the museum to learn more about the Hidatsa people, see artifacts, watch a short orientation video about Buffalo Bird Woman (a woman born at the site who used ancient agricultural methods to farm in the fertile soil and later served as a key source of information to anthropologists studying the tribe) (Wilson 1987), visit the full scale reconstructed earthlodge, or explore one of the three preserved villages in the area (NPS 2014e). The park offers educational opportunities, including a kid's camp and distance learning programs.



SOURCE: NPS 2014d

FIGURE 3-11. TOTAL RECREATIONAL VISITORS TO KNIFE RIVER INDIAN VILLAGES (1981–2013)



SOURCE: NPS 2014d

FIGURE 3-12. TOTAL RECREATIONAL VISITORS TO KNIFE RIVER INDIAN VILLAGES (2010–2014)

Two nature trails are on-site. The North Forest Trail loop is 2.2-miles long through bottomland forest and native prairie. From there, visitors can continue to the Missouri Overlook loop for scenic views of the Missouri River. The Two Rivers Trail is 6.2-miles long that follows the Knife River to the southern end of the park where visitors can see the Knife River flowing into the Missouri River (NPS 2014e).

The foundation document identifies several resources important to visitor use and experience that are vital to consider in planning actions (NPS 2013). The viewshed is valuable to the visitor experience because it helps interpret historic village life. The views from the highest point of the park help visitors visualize the topography and landscape of the historic villages. The soundscape of the park, including sounds of rivers, wind, wildlife, insects, and vegetation allow visitors to reflect and imagine the sounds that are missing today (i.e., the sounds from herds of bison, horse traffic, village life, and trading center sounds). The remnants of native midgrass prairie include regionally key species that played a role in tribal use and beliefs. The dark night sky is also considered a valuable resource to visitors. The remote location of the park allows for little light pollution, creating a clear view of the night sky (NPS 2013).The Knife and Missouri Rivers are also a valuable resource to visitors. They provided water, food, and transportation to the tribes. The tribes also believed that the rivers were filled with spiritual meaning (NPS 2013). Today, many visitors enjoy fishing in the park in the Knife or Missouri River.

The interpretive themes of included in the park's foundation document (NPS 2013) helped form the basis for visitor experience and are described as follows:

- Archeological remains of earthlodge village sites provide tangible evidence of the size, dominance, resilience, persistence, and culture of the Northern Great Plains peoples who lived beside the Knife and Missouri Rivers for hundreds of years.
- Access to plentiful natural resources and a fertile environment enabled the Mandan and Hidatsa people to develop prosperous, semi-permanent, agricultural communities that flourished for centuries.
- Situated on the Missouri River transportation corridor, the villages were an integral part of a vast trading empire: a crossroads of culture where trade goods, ideas, technology, spirituality, and world views were shared.
- Sacagawea became a symbol of peace for the Corps of Discovery on their expedition, giving her status as one of the most famous and mysterious figures in US history.
- The Mandan and Hidatsa welcomed 18th and 19th century explorers, traders, artists, travelers, and other visitors who produced some of the most well-known images of the life of Northern Great Plains Indians in both the United States and Europe.
- Amahami Village, one of the villages recorded by Lewis and Clark, was destroyed by modern development, making imperative the preservation of the remaining villages and their invaluable historic and cultural insight into the heritage of Northern Plains Indians.
- Present-day members of the MHA Nation remain connected spiritually and culturally to the homeland of their ancestors where the resources, topography, and landscape features sustained the villages both spiritually and physically.

A comprehensive interpretive plan that defines the overall vision and long-term (7 to 10 years) interpretive goals of the park is under development. The plan would be implemented in fiscal year 2015.

Visitor Access

The park is open from 8:00 a.m. until 5:00 p.m. Central Daylight Time from Memorial Day through Labor Day. It is open from 8:00 a.m. until 4:30 p.m. Central Standard Time for the rest of the year and is closed on Thanksgiving, Christmas, and New Year's Day (NPS 2014e).

The visitor center (including the museum), Big Hidatsa site, Sakakawea site, and Lower Hidatsa site are the main interpretive areas for visitors at the park (figure 3-13). State Highway 37 provides access to the park from the south and the northwest. North of the visitor center, the Knife River at Elbee Bend has eroded to within 200 feet of State Highway 37. County Road 18 provides access to the park from the west and is the main route of access to the Big Hidatsa site. The Knife River currently runs adjacent to County Road 18 at Taylor Bend, which is where the most extensive bank stabilization work has occurred to date. Trails provide access to the majority of the park. Trails originating at the visitor center provide access to the Lower Hidatsa and Sakakawea sites, while trails originating at the Big Hidatsa site provide access to the northernmost portions of the park. Bank erosion along the Knife River has resulted in a regular need to relocate the trails that run adjacent to it.

SOURCE: NPS

FIGURE 3-13. KNIFE RIVER NATIONAL HISTORIC SITE VISITOR CENTER

Placeholder for chapter 4 divider.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter analyzes both beneficial and adverse impacts that could result from implementing any of the alternatives related to the management of archeological resources at the park. This section includes a summary of laws and policies relevant to each impact topic, methods used to analyze impacts, and the analysis methods used for determining cumulative impacts. As required by CEQ regulations implementing the National Environmental Policy Act, a summary of the environmental consequences for each alternative is provided in table 2-9. The resource topics presented in this section and the organization of the topics correspond to the impact topics identified in chapter 1 and the resource discussions contained in chapter 3.

IMPACT ASSESSMENT METHODOLOGY AND ASSUMPTIONS

The general approach for measuring the effects of the alternatives on each impact topic includes the following elements:

- general analysis methods as described in guiding regulations
- basic assumptions used in this analysis, including the context and duration of environmental effects
- methods used to assess the significance of impacts
- methods used to evaluate the cumulative impacts of each alternative

These elements are described in the following sections.

General Analysis Method

The analysis of impacts follows CEQ and Interior regulations for implementing the National Environmental Policy Act and the NPS *NEPA Handbook* (NPS 2015a). The analysis incorporates the best available information applicable to the resource topics being evaluated and alternatives being considered. For each resource topic addressed in this chapter, applicable analysis methods, including assumptions, are discussed. When resource-specific data, observations, studies, GIS analysis, or other evidence were considered, these resources are noted in the methodology section for each impact topic.

Assessing the Significance of the Impacts. According to the CEQ regulations that implement the National Environmental Policy Act (40 CFR 1500–1508), the term "significantly" is based on the twin criteria of context and intensity (40 CFR 1508.27).

> ***Context:*** This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.

The NPS *NEPA Handbook* directs that impacts should be analyzed in several contexts when the impact varies geographically, over time, or in some other way (NPS 2015a).

> ***Intensity:*** This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The following should be considered in evaluating intensity:

1. Impacts that may be both beneficial and adverse. A significant effect may exist even if the federal agency believes that on balance the effect will be beneficial.

2. The degree to which the proposed action affects public health or safety.

3. Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.

4. The degree to which the effects on the quality of the human environment are likely to be highly controversial.

5. The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.

6. The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.

7. Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.

8. The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the national register or may cause loss or destruction of significant scientific, cultural, or historical resources.

9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

10. Whether the action threatens a violation of federal, state, or local law or requirements imposed for the protection of the environment.

An assessment of significance of the impacts of the alternatives on each resource topic is provided in the resource-specific conclusion section. The analysis and determination of significance considers the factors identified above, as applicable, and also considers other factors such as how noticeable or large the impacts on the resource topic would be overall. Examples of these other considerations include: if the impact is a primary driver of other effects, if the resource affected is of regional or national importance, or if the resource is a rare or important component of the ecosystem or considered fundamental to the park. All impacts are evaluated for significance, and those that have significance or the potential for significance are called out. If there is no call out for significance in the conclusion, there is no potential or likelihood for a significant impact.

Assumptions

Several guiding assumptions were made to provide context for this analysis:

Analysis Period. This plan establishes objectives, desired conditions, and potential management actions needed to protect archeological resources for the next 30 years.

Area of Analysis. Unless otherwise stated, the geographic study area (or area of analysis) for assessment of indirect and direct impacts includes the entire park, including the scenic easements. Study areas vary depending on the resource evaluated; therefore, the specific study area for each impact topic is defined at the beginning of each resource topic discussion. Some resource topics (e.g., water quality, water resources, wetlands, and floodplain resources) require a larger area of analysis, which considers upstream and downstream effects of bank stabilization techniques.

Specific impacts associated with alternative 3 that would occur outside the park generally cannot be determined because the specific resources that would be affected by the location of facilities outside the park cannot be identified until a specific site is identified. The National Park Service would determine the need for additional NEPA compliance prior to implementing any features of the preferred alternative that involve new ground disturbance outside of the park.

Duration and Type of Impacts. For the purpose of the analysis provided in this plan, the following assumptions are used for all impact topics:

- Duration describes the length of time an effect will occur, either short term or long term.
  - Short-term impacts are those that occur in the immediate future.
  - Long-term impacts are those occurring from archeological resource management actions over several seasons through the next 30 years.
- Type describes the classification of the impact as beneficial or adverse, direct or indirect.
  - Beneficial: A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.
  - Adverse: A change that moves the resource away from a desired condition or detracts from its appearance or condition.
  - Direct: An effect caused by an action that occurs immediately and/or in the same vicinity.
  - Indirect: A reasonably foreseeable effect caused by an action that is later in time or farther removed in distance.

Cumulative Impacts Analysis Method

CEQ regulations require the assessment of cumulative impacts in the decision-making process for federal projects. A cumulative impact is defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions” (40 CFR 1508.7). Cumulative impacts are considered for all alternatives, including the no-action alternative.

Cumulative impacts were determined by combining the impacts of the alternative being considered with other past, present, and reasonably foreseeable future actions. It was necessary to identify other ongoing or reasonably foreseeable future projects and plans at the park and, if applicable, the surrounding region. Actions that could affect or have affected the various resources at the park are described in this section.
The cumulative impact analysis was accomplished using four steps:

Step 1—Identify Resources Affected: identify resources affected by any of the alternatives.

Step 2—Set Boundaries: identify appropriate spatial and temporal boundaries for each resource.

Step 3—Identify Cumulative Action Scenario: determine which past, current, and reasonably foreseeable future actions to include for each resource. These actions are not only those within or undertaken by the park, but also include those actions by any entity that have had or will have an effect on the resources affected by this plan.

Step 4—Cumulative Impact Analysis: determine the combined impact of the proposed alternative and the other identified actions of the cumulative scenario.

The following narratives provide detailed information for actions not discussed elsewhere that have been identified for the cumulative impact scenario for this plan. Following these narratives, table 4-1 summarizes the actions by impact topic and provides spatial and temporal boundaries for each. The spatial boundaries vary for some resources, but for the majority of resources, they are the park boundary. The temporal boundaries also vary for impact topics; however, for the majority of topics the temporal boundary is back in time to the homesteading of the park area by European Americans in the 1880s; and forward 30 years (i.e., the life of the plan).

Land Cultivation, Extirpation of Bison, Livestock Grazing, Introduction of Nonnative Species, Timber Harvesting, and Gravel and Quarry Operations. Prior to the establishment of the park, the area was affected by a long history of human disturbance. European Americans began homesteading in the area in the 1880s. Cultivation of the land for agricultural purposes was common from that point forward and up to the establishment of the park. Land cultivation included ground disturbance from plows over a large portion of the area, which would have impacted any in situ archeological resources. Herds of bison that are now extirpated once grazed shortgrass prairie on the Missouri Plateau west of the Missouri River. Livestock grazed river bottoms, and homesteaders harvested trees, creating river-bottom woodlands that were open and generally limited woodland species regeneration. The intentional and unintentional introduction of nonnative species influenced the current vegetation in the park. Nearly half of the park's total area comprises disturbed plant communities, much of this dominated by nonnative smooth brome (Nadeau et al. 2014). In addition, two gravel or quarry operations once existed in the park. One was located in the north unit on the Krieger Tract and the other was south of the Sakakawea site near the river terrace.

Pre-Park Establishment Archeological Investigations and Collecting/Looting. The village sites have long attracted local residents and prominent archeologists. The earliest recorded visit to the area by an archeologist was in 1883 (NPS 1983). Professional archeologists from the State Historic Society of North Dakota conducted investigations during the first half of the 20th century. In 1938, William Duncan Strong led a Columbia University research program that conducted excavations at the Big Hidatsa, Sakakawea, and Lower Hidatsa sites. In 1965, Donald Lehmer undertook excavations at the Sakakawea and Lower Hidatsa sites. Lehmer's work was later used as part of the justification for the creation of the park. Professional archeological investigations have increased the knowledge of the archeological resources in the park and the culture of the Plains Indians. In addition, visits from local residents or nonprofessional archeologists prior to the designation of the area as a national historic site likely resulted in collecting and looting of archeological materials for private collections.

Roadway and Infrastructure Development. The first visitor center was an acquired farmhouse that was built on the edge of the Big Hidatsa site and Taylor Bluff Village that was later removed to accommodate park needs. A two-bay garage/shop was built in 1986. In 1997, a new office building with fire cache was built in the same footprint and style as the removed farmhouse. A four-bay garage and cold storage facility was built in 2000 to store equipment and vehicles. A gravel road, parking area, and materials storage area are also located in the vicinity of the Big Hidatsa site. The current visitor center was built in 1992 in the southwestern corner of the park. Although not associated with major village sites, the area was surveyed, and existing archeological features and artifacts were removed through applicable data recovery measures prior to construction. The museum collections and staff offices are located in the visitor center.

State Highway 37 runs generally north-south through the western portion of the park and provides access to the visitor center and the northern areas of the park. County Road 18 runs east-west and provides the only access to private lands located between the park boundary and the Missouri River. In September 1989, the National Park Service purchased easements from two separate landowners for the purpose of installing a waterline between Stanton, North Dakota, and the park. In 2015, a right-of-way across the park was issued to Southwest Water Authority for waterline installation and service to private properties east of the park.

Garrison Dam. Hydrologic alterations along the Missouri River have been a part of the history of the Knife River area long before the park's establishment. The construction and operation of Garrison Dam upstream of Knife River on the Missouri River altered the natural hydrology and erosion/deposition and flooding regimes. The flow regulation of the dam altered the riparian vegetation of the park along the Missouri River by reducing overbank flooding and moisture availability in riparian-adapted woodlands, which in turn reduced the regeneration of cottonwoods. Flow regulation continues to be used for hydropower generation and Lake Sakakawea water storage.

Bank Stabilization Projects. Upstream stabilization structures and other bank stabilization features (riprap) have altered natural erosion and deposition in some areas of the park. The US Army Corps of Engineers installed bank stabilization along the Sakakawea site in 1979 (Ahler 1984); additional bank stabilization was installed at Taylor Bluff Village in 1984–1985 (Clambey 1985). In a 2009 spring flooding event, portions of the tri-lock bank stabilization system failed. In response, riverbank stabilization restoration work was completed on approximately 600 feet of river bank along Taylor Bluff Village, repairing damage by filling and installing riprap. The Taylor Bluff Village bank is now a combination of riprap and tri-lock, and the stabilization features at the Sakakawea site are composed of riprap. Other bank stabilization projects include stream alteration features and structures built upstream that subsequently impact the Knife River and the park.

Knife River Indian Villages National Historic Site Cultural Resources Management Plan (NPS 1983). The *Knife River Indian Villages National Historic Site Cultural Resources Management Plan* (*Cultural Resources Management Plan*) summarizes the cultural resources present at the park and addresses and proposes solutions for specific problems that have a bearing on the management of those resources. All proposed activities involving cultural resources are expected to conform to this plan except in emergency situations.

Northern Great Plains Exotic Plant Management Plan (2005). Control of nonnative plants at the park is carried out in accordance with an exotic plant management plan. The intent of this plan is to manage exotic plants to reduce their negative effects on native plant communities and other natural and cultural resources in the park. Management actions identified in the plan employ a strategy of integrated pest management practices, including:

- cultural treatment: practices that promote the growth of desirable plants (i.e., irrigation)
- manual/mechanical treatments: physical damage to or removal of part or all of a plant
- biological treatments: use of natural enemies, including insects and microorganisms
- chemical treatments: use of pesticides
- prescribed fire treatments: use of fire to a predetermined area

Regional Energy Development. The park is in an area that has been active in energy development since the mid-1970s. Four coal surface mines, six coal-fired power plants, several wind farms, one coal gasification plant, and a new fertilizer plant in the beginning stages of construction are within a 30-mile radius of the park. While slowing, since 2011, the globally recognized Bakken Oil Field boom has increased oil production throughout western North Dakota at an unprecedented rate, with the introduction of hydrofracking technology. North Dakota has become the second largest oil-producing state in the country. Attendant infrastructure and housing has similarly increased in the area. This development is visible from all areas of the park.

Museum Storage Water Infiltration. The museum collection storage is housed in a basement that has had water infiltration issues since the building was constructed. Water issues contribute to fluctuations in the temperature and relative humidity in the storage space. Numerous repair projects have been completed to waterproof the building, but nothing has been successful to date. A new roof installed in 2010 reduced the amount of water infiltration, but the walls and foundation still allow rainwater to enter the building, and the museum collections storage is still vulnerable to flooding and subsequent damage in the event that pipes break or drains back up.

Knife River Watershed Management. The reach of the Knife River from the Spring Creek confluence to the Missouri River confluence has been declared impaired under 303(d) (NDDH 2015a). Impaired waters refer to those waters that are too polluted or otherwise degraded to meet water quality standards. Possible sources affecting water quality are pesticide use, development, cultivation, and livestock feeding operations upstream of the park. Livestock feeding operations may be contributing to fecal coliform concentrations. Fecal coliform or *E. coli* were present in the water in the park, indicating contamination and the possible presence of disease-causing pathogens (USGS 2011). Numerous stream bank stabilizations, channel alterations, and flood control structures upstream of the park have changed the natural hydrologic regime of the Knife River. Hydrologic changes include large flood peaks on the Missouri River that do not correspond temporally to those on the Knife River; decreases to the base flow of the Knife River; and a deeper, narrower channel with faster flows, more erosion, and less sediment deposition than upstream reaches.

Knife River Indian Villages Comprehensive Interpretive Plan (in development, 2016). The comprehensive interpretive plan defines the overall vision and long-term (7 to 10 years) interpretive goals of the park. The process by which the plan is being developed defines realistic strategies and actions to work to achieve the interpretive goals. The plan consists of two phases. First, the foundation phase articulates significance, themes, and target audiences. The foundation document developed in 2013 addresses these elements of the plan and includes a review of existing conditions. The second phase of plan development involves recommendations for interpretive services, media, and partnerships for the park over the next 7 to 10 years. This plan is still in development and is anticipated for implementation in fiscal year 2016.

TABLE 4-1. ACTIONS THAT CONTRIBUTE TO CUMULATIVE IMPACTS

Impact Topic	Spatial and Temporal Boundaries	Past Actions	Present Actions	Future Actions (Life of the Plan)
Archeological resources	Spatial: the park boundaries Temporal: back to the European American homesteading of the area in the 1880s and forward for the life of the plan (i.e., 30 years)	-Land cultivation -Extirpation of bison -Professional and amateur archeological investigations or recovery occurring prior to NPS oversight of the area -Roadway and infrastructure development -Garrison Dam operation -Upstream river bank modifications -Bank stabilization projects the Sakakawea site and Taylor Bluff Village -Management of cultural resources guided by *Cultural Resources Management Plan* -Implementation of *Exotic Plant Management Plan*	-Garrison Dam operations -Upstream river bank modifications -Implementation of *Fire Management Plan* and *Exotic Plant Management Plan* -Management of cultural resources guided by *Cultural Resources Management Plan*	-Garrison Dam operations -Installation of bank stabilizations in addition to those already existing
Cultural landscapes	Spatial: the park boundaries plus the area surrounding the park and in its viewshed Temporal: back to the European American homesteading of the area in the 1880s and forward for the life of the plan (i.e., 30 years)	-Land cultivation, livestock grazing, introduction of nonnative species, timber harvesting, and gravel and quarry operations -Roadway and infrastructure development -Garrison Dam operation -Upstream river bank modifications -Bank stabilization projects at the Sakakawea site and Taylor Bluff Village -Energy development -Implementation of *Fire Management Plan* and *Exotic Plant Management Plan*	-Garrison Dam operation -Upstream river bank modifications -Energy development -Implementation of *Fire Management Plan* and *Exotic Plant Management Plan* -Management of cultural resources guided by *Cultural Resources Management Plan* -Cell phone tower installation	-Garrison Dam operation -Renewable and natural resource energy development and infrastructure -Upstream river bank modifications

Impact Topic	Spatial and Temporal Boundaries	Past Actions	Present Actions	Future Actions (Life of the Plan)
		-Management of cultural resources guided by *Cultural Resources Management Plan*		
Ethnographic resources	Spatial: the park boundaries Temporal: back to the European American homesteading of the area in the 1880s and forward for the life of the plan (i.e., 30 years)	-Land cultivation, livestock grazing, introduction of nonnative species, timber harvesting, and gravel and quarry operations -Roadway and infrastructure development -Garrison Dam operation -Bank stabilization projects at the Sakakawea site and Taylor Bluff Village -Energy development -Implementation of the *Fire Management Plan* and *Exotic Plant Management Plan* -Management of cultural resources guided by *Cultural Resources Management Plan*	-Garrison Dam operation -Energy development -Implementation of *Fire Management Plan* and *Exotic Plant Management Plan* -Management of cultural resources guided by *Cultural Resources Management Plan-*	-Garrison Dam operation -Energy development
Museum collections	Spatial: the park boundaries Temporal: back to the establishment of the park in 1974 and forward for the life of the plan (i.e., 30 years)	-Management of cultural resources guided by *Cultural Resources Management Plan*		
Fish and wildlife resources	Spatial: the park boundaries Temporal: back to the European American homesteading of the area in the 1880s and forward for the life of the plan (i.e., 30 years)	-Garrison Dam operation -Land cultivation, livestock grazing, introduction of nonnative species, timber harvesting, and gravel and quarry operations -Implementation of *Fire Management Plan* and *Exotic Plant Management Plan*	-Garrison Dam operation -Management actions related to heart rot fungus -Implementation of *Fire Management Plan* and *Exotic Plant Management Plan*	-Garrison Dam operation
Special-status species	Spatial: the park boundaries Temporal: back to the	-Garrison Dam operation -Land cultivation, livestock grazing,	-Garrison Dam operation -Heart rot fungus	-Garrison Dam operation

Impact Topic	Spatial and Temporal Boundaries	Past Actions	Present Actions	Future Actions (Life of the Plan)
	European American homesteading of the area in the 1880s and forward for the life of the plan (i.e., 30 years)	introduction of nonnative species, timber harvesting, and gravel and quarry operations -Implementation of *Fire Management Plan* and *Exotic Plant Management Plan*	and cankerworm -Implementation of *Fire Management Plan* and *Exotic Plant Management Plan*	
Water quality, water resources, and floodplains	Spatial: the Knife River from Hazen to its confluence with the Missouri River Temporal: back to the closure of Garrison Dam on the Missouri River in 1953 and forward for the life of the plan (i.e., 30 years)	-Garrison Dam operation -Land cultivation, livestock grazing, timber harvesting, and gravel and quarry operations -Bank stabilization projects the Sakakawea site and Taylor Bluff Village -Pesticide use, development, cultivation, and livestock feeding operations located upstream of the park	-Garrison Dam operation -Pesticide use, development, cultivation, and livestock feeding operations located upstream of the park	-Garrison Dam operation -Pesticide use, development, cultivation, and livestock feeding operations located upstream of the park
Floodplain resources	Spatial: the park boundaries Temporal: back to the closure of Garrison Dam on the Missouri River in 1953 and forward for the life of the plan (i.e., 30 years)	-Timber harvesting in floodplain resources -Bank stabilization projects the Sakakawea site and Taylor Bluff Village -Garrison Dam operation -Upstream river bank modifications	-Garrison Dam operation -Upstream river bank modifications	-Garrison Dam operation -Upstream river bank modifications
Visitor use and experience	Spatial: the park boundaries Temporal: back to the establishment of the park in 1974 and forward for the life of the plan (i.e., 30 years)	-Roadway and infrastructure development -Bank stabilization projects at the Sakakawea site and Taylor Bluff Village -Energy development -Implementation of *Fire Management Plan* and *Exotic Plant Management Plan* -Management of cultural resources guided by *Cultural Resources Management Plan*	-Energy development -Implementation of *Fire Management Plan* and *Exotic Plant Management Plan* -Management of cultural resources guided by *Cultural Resources Management Plan*	-Knife River Indian Villages Comprehensive Interpretive Plan (in development) -Energy development

CULTURAL RESOURCES

Cultural resource impacts resulting from the alternatives are discussed separately for archeological resources, cultural landscape, ethnographic resources, and the museum collections. The following section on guiding regulations and policies applies to all of these categories.

Guiding Regulations and Policies

Federal actions that have the potential to affect cultural resources are subject to a variety of laws. The National Historic Preservation Act (54 USC 300101 et seq.) is the principal legislative authority for managing cultural resources associated with NPS projects. Generally, section 106 of the act requires all federal agencies to consider and minimize the effects of their actions on cultural resources listed in or determined eligible for listing in the national register. Such resources are termed historic properties. Agreement on how to mitigate effects on historic properties is reached through consultation with the state historic preservation officer, the tribal historic preservation officer, and the advisory council, as necessary. Section 110 of the act requires federal agencies to establish preservation programs for the identification, evaluation, and nomination of historic properties in the national register.

Other important laws or executive orders designed to protect cultural resources include, but are not limited to

- American Indian Religious Freedom Act (42 USC 1996)—to protect and preserve for American Indians access to sites, use and possession of sacred objects, and freedom to worship through ceremonials and traditional rites
- Archaeological Resources Protection Act (16 USC 470aa–470mm)—to secure, for the present and future benefit of the American people, the protection of archeological resources and sites that are on public lands and American Indian lands
- Native American Graves Protection and Repatriation Act (25 USC 3001 et seq.)—to provide for the repatriation of human remains, associated and unassociated funerary objects, sacred objects, and objects of cultural patrimony found on federal and tribal lands or in federally funded institutions
- Executive Order 11593, "Protection and Enhancement of the Cultural Environment"—to provide leadership in preserving, restoring, and maintaining the historic and cultural environment of the United States
- Executive Order 13007, "Indian Sacred Sites"—to accommodate access to and ceremonial use of American Indian sacred sites by American Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites

Through these laws, the National Park Service is charged with protecting and managing cultural resources under its jurisdiction. NPS managers are required to avoid or minimize, to the greatest degree practicable, adverse impacts on these resources and values. While the National Park Service has the discretion to permit certain impacts in park units to effectively operate the park for the benefit of the public, statutory requirements provide that park resources remain unimpaired, unless a specific law directly provides otherwise.

This responsibility to protect and manage cultural resources is further implemented through NPS policies and guidelines that are specific to the agency and include

- Director's Order 12 and the 2015 NPS *NEPA Handbook*
- Director's Order 28
- NPS *Management Policies 2006*
- 2008 Programmatic Agreement (NPS 2008b)

Additionally, several park-specific documents guide the management of resources, including cultural resources in the park. These include: the *Collections Management Plan* (NPS 1998b); the *Scope of Collection Statement*; the *Cultural Resources Management Plan* (NPS 1983); the Knife River Indian Villages Comprehensive Interpretation Plan (in development); the park's foundation document (2013a); the *Fire Management Plan* (NPS 2008c); and the *Exotic Plant Management Plan* (NPS 2005).

Methodology and Assumptions for All Cultural Resource Topics

NEPA Methodology and Assumptions. This analysis assesses the impacts of the alternatives on the cultural resources present at the park. Impacts on these resources can be direct or indirect as well as beneficial or adverse. Direct impacts are those that physically alter the setting or character of the archeological sites as a result of the implementation of an activity, while indirect impacts are those that may occur inadvertently during or after an activity. Adverse impacts are those that alter an archeological site in a way that could change its eligibility for the national register. Beneficial impacts are those that promote the preservation of the resource in situ.

Impacts are analyzed within the context of a particular resource and the intensity or severity of the impact. In this case, the context for the impact analysis is all of the known archeological sites in the park that have been determined eligible for the national register or are unevaluated. Impacts on cultural resources under the National Environmental Protection Act are not equivalent to effects on historic properties under the National Historic Preservation Act.

In the analysis below, ground-disturbing activities have been classified based on their potential negative impacts on cultural resources. A classification of "minor" indicates that (1) there would be no ground disturbance, (2) ground disturbance would occur within previously disturbed areas, or (3) ground disturbance would be so minimal that there would be little chance to affect in situ cultural deposits. "Major" indicates that the ground-disturbing activity would extend outside of previously disturbed areas and affect in situ cultural materials. More detailed definitions for these terms, such as the percentage of a site impacted by an activity or volume of material disturbed, would need to be determined through consultation with the state historic preservation office and the tribes.

NHPA Section 106 Methodology and Assumptions. The following impact analysis is intended to comply with the requirements of the National Environmental Policy Act, not section 106 of the National Historic Preservation Act. In accordance with the advisory council's regulations implementing section 106 (36 CFR 800), impacts on historic properties are identified and evaluated by (1) determining the area of potential effects; (2) identifying historic properties present in the area of potential effect that are listed in or eligible for listing in the national register; (3) applying the criteria of adverse effect to these historic properties; and (4) identifying methods to avoid, minimize, or mitigate any adverse effects, if they exist.

Under the advisory council's regulations, a determination of either *adverse effect* or *no adverse effec*t must be made for affected historic properties eligible for or listed in the national register. An *adverse effect* occurs whenever an undertaking alters, either directly or indirectly, any characteristic of a historic property that qualifies it for inclusion in the national register (e.g., diminishes the integrity of the property's location, design, setting, materials, workmanship, feeling, or association). Adverse effects also include reasonably foreseeable effects that could occur later in time, be farther removed in distance, or be cumulative (36 CFR 800.5). A determination of *no adverse effect* means the undertaking would not diminish the historic property's integrity in a manner that alters any characteristics of the property that qualify it for the national register.

CEQ regulations and Director's Order 12 also call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact. However, any resultant reduction in intensity of impact resulting from mitigation is an estimate of the effectiveness of mitigation only under the National Environmental Policy Act. It does not suggest that the level of effect as defined by section 106 is similarly reduced—although an *adverse effect* under section 106 may be mitigated, the effect remains adverse.

The National Park Service has consulted with the North Dakota state historic preservation office, the MHA Nation tribal historic preservation officer, and the advisory council to discuss actions outlined in this plan with potential to have adverse impacts on historic properties or other sites listed or eligible for listing in the national register. Based on the actions outlined in this plan, measures to avoid and minimize effects, and an agreed-upon framework for implementation actions, the National Park Service has determined, in consultation with the above groups, that this plan would have no adverse effect on historic properties, pursuant to 36 CFR 800.5(b). Ongoing consultation under the National Historic Preservation Act would be conducted via annual meetings, correspondence, and phone calls between parties to review future site-specific actions. Roles and responsibilities of all parties are defined in the 2008 Programmatic Agreement (NPS 2008b). Avoidance and minimization measures defined in chapter 2 would be followed for all actions, where applicable.

Section 106 of the National Historic Preservation Act directs federal agencies to consider the effect of any undertaking (a federally funded or assisted project) on historic properties. A historic property is any district, building, structure, site, or object (including resources considered by American Indians to have cultural and religious significance) that is eligible for listing in the national register because the property is significant at the national, state, or local level in US history, architecture, archeology, engineering, or culture. Section 106 provides the advisory council, the North Dakota state historic preservation office, and federally recognized American Indian tribes a reasonable opportunity to comment on assessment of effects by the undertaking. In this document, the undertaking is the implementation of the actions outlined in this plan's preferred alternative.

In addition to the standard process for reviewing the impacts on historic properties under section 106, the National Park Service also entered into the 2008 Programmatic Agreement that covers all parks and entities within the NPS system (NPS 2008b). The 2008 Programmatic Agreement defines roles, qualifications, responsibilities, training requirements, and the general review process for signatories of the agreement. It also includes a list of various undertakings that are eligible for streamlined review if they meet the required criteria. Generally, actions that fall within the streamlined review process are frequent with minimal to no impacts that require no additional consultation with each state historic preservation officer if the criteria for streamlined review can be met. Nothing in this plan will supersede elements of the 2008 Programmatic Agreement. The 2008 Programmatic Agreement forms the basis for continued consultation with the North Dakota state historic preservation officer for undertakings that qualify for section 106 review.

The entities that the park are required to consult with as part of the section 106 process include the North Dakota state historic preservation officer and the MHA Nation tribal historic preservation officer. Because the park includes the Big Hidatsa Village National Historic Landmark, park managers also consult with the advisory council, although on a less frequent basis.

The plan/draft environmental impact statement is designed to improve the preservation of archeological and other related cultural resources in the park over the next 30 years. The National Park Service has made a determination of no adverse effect for the overall plan and the majority of actions described in the plan. In places where there is less specific information (e.g., actions proposed within the adaptive management framework), some additional review and consultation may be needed to make a determination of effect. The actions taken as part of this plan may have some impact on the preservation of archeological resources. These actions are done to improve preservation of the overall resource and therefore are considered preservation actions that enhance preservation to maintain content and integrity of the archeological resources within the park. Preservation actions described in this plan with the potential to affect archeological resources are considered to have no adverse effect on the qualities and characteristics that made an archeological site eligible for listing in the national register. In this case, the current reactive strategy represented by the "no action" alternative is considered an "adverse effect" for section 106 because it does not enhance archeological preservation by taking a proactive approach to preservation actions and allows for the degradation and loss of important information over time. Therefore, the National Park Service has arrived at a finding of no adverse effect for this plan and the undertakings described as part of the preferred alternative.

Actions designed to reduce or mitigate impacts to archeological resources are as follows:

- The goal of this plan is to preserve resources in situ. Therefore, actions resulting from this plan will have beneficial effects on resources and will not adversely affect content or characteristics that make archeological resources eligible for listing in the national register.
- Monitoring programs will evaluate the effectiveness of actions taken as part of the adaptive management framework described in chapter 2.
- The park will facilitate an ongoing archeological research program that will generate new information for park visitors, professional researchers, and traditionally associated peoples. One of the benefits of an ongoing research program is to balance the loss of information through natural processes (e.g., erosion, burrowing mammals) with the generation of new knowledge from preserved archeological resources. An ongoing archeological research program will be guided by a parkwide research design that will follow from this plan/draft environmental impact statement.
- If actions are taken that will disturb in situ archeological deposits, archeological data recovery will be used to recover information contained within archeological sites. As part of any data recovery project, the National Park Service will develop a data recovery plan in consultation with the North Dakota state historic preservation officer and the MHA Nation tribal historic preservation officer. All archeological investigations for data recovery must have an Archeological Data Recovery Plan that is agreed upon in writing by the North Dakota state historic preservation officer and MHA Nation tribal historic preservation officer.
- As part of the finding of no adverse effect, this plan will require, at a minimum, annual consultation meetings with the North Dakota state historic preservation officer and the MHA Nation tribal historic preservation officer. Additional consultation meetings will be initiated when an undertaking has impacts that are not anticipated by this plan or are not directly tied to a preservation action to improve archeological resource conditions. The standard section 106 review, as described in the 2008 Programmatic Agreement, will occur for any projects that are not addressed in this plan.

The adaptive management framework described in chapter 2, which includes monitoring provisions to track and evaluate how resources respond to actions, will inform park management on the necessity and frequency of additional consultations. Future consultations will need to consider whether a proposed action is within the scope of this planning framework, whether it deviates to an extent where an adverse effect finding is anticipated, and where future projects can be changed or redesigned to reduce the impact on a resource.

Future archeological investigations for research purposes will not be subject to additional reviews under section 106. Archeological research investigations will be guided by a parkwide research design and a written project-specific work plan. The park and its research partners should seek input from the North Dakota state historic preservation officer and the MHA Nation tribal historic preservation officer during project development. Annual or more frequent consultations with the North Dakota state historic preservation officer and MHA Nation tribal historic preservation officer will include updates on any archeological research or activities taking place in the park.

IMPACTS OF THE ALTERNATIVES ON ARCHEOLOGICAL RESOURCES

Methods and Assumptions

The methodology for assessing impacts on archeological resources included reviewing published literature, archeological site information, maps and tables showing reported impacts on archeological resources, and discussions with the park and MWAC staff in workshops and telephone conference meetings related to developing this plan.

The analysis in this document assumes that the National Park Service would avoid direct and indirect adverse impacts on archeological resources whenever practicable, and that decisions would be implemented that either minimize adverse impacts or protect threatened archeological resources through intervention. Any adverse impacts on archeological sites would be permanent because these resources are non-renewable. The analysis also assumes that the park would continue with its mission to "preserve, protect, and interpret archeological and natural resources as they relate to cultural and agricultural lifestyles of Northern Great Plains Indian peoples, and to conduct research to further understand how these lifestyles have changed over time" (NPS 2013) with special attention to the Knife-Heart region and the Plains Village period (AD 1200 to 1861).

Area of Analysis

The geographic area of analysis for archeological resources includes archeological sites in the park (figure 1-1). Although alternative 3 would include actions taken outside of the park, site-specific analysis was not performed because potential sites under that alternative have not been identified.

Impacts of Alternative 1 (No-Action Alternative)

Under the no-action alternative, impacts on archeological resources would continue as a result of riverbank erosion, pocket gopher activity, and vegetation encroachment. Infrastructure function and location would also continue to affect archeological resources. The following sections discuss these impacts in more detail.

Riverbank Erosion Management. Substantial portions of the bank of the Knife River have been lost over the past few decades, causing irretrievable loss of adjacent village remnants and archeological sites. Massive flood and ice flow events (including ice damming) have resulted in serious impacts on riverbanks, archeological sites, and park infrastructure (Cummings 2011).

Under the no-action alternative, a high potential for loss of archeological deposits and irreplaceable cultural information from riverbank erosion exists, particularly at the

Elbee site, which is in an active erosion area. These impacts would most likely occur where the soil matrix is weak from weathering, saturation, undercutting of lower stratigraphic deposits, ice buildup on the river, and/or flood events. Without a proactive plan and funding to stabilize riverbanks upstream and terraces downstream of archeological sites, the park is left to react to erosion emergencies. In these situations, archeological work would salvage threatened site deposits rather than conduct proactive research-directed investigations prior to stabilization efforts. In these instances, much of the archeological materials along the riverbank would be lost or highly disturbed during an erosion event, leading to a loss of information that could not be retrieved from the site. If these conditions continue, the conditions of all sites located near riverbanks would further degrade. This would represent a long-term, adverse impact on archeological resources at the park.

Pocket Gophers. Northern pocket gophers affect archeological sites by displacing soil and artifacts from chronologically stratified deposits.

Under the no-action alternative, continued lethal trapping at the current scale and intensity is not anticipated to reduce pocket gopher activity at these sites to a level that would achieve the park's goal of a reduced population that does not expand into undisturbed areas. Pocket gopher activity would continue to displace soil and artifacts from their chronologically stratified deposits and expose them on the surface, and damage would continue to accumulate over time. This would represent a long-term, adverse impact on archeological resources at the park.

Vegetation Management. Vegetation encroachment is occurring at 35 of the 51 archeological sites assessed for prioritization—the roots of the vegetation cause displacement of chronologically stratified deposits. Under the no-action alternative, woody vegetation root growth and movement would continue to displace archeological deposits and artifacts. Additionally, vegetation encroachment would continue to restrict access to archeological sites for research. Over time, efforts by park staff to implement the vegetative management plans identified previously may curtail advancement of woody and invasive vegetation and gradually remove these species from archeological sites. However, these activities would not be taken with the intent of archeological resources protection and would not occur on the three main village sites. Any benefits would be incidental to the primary purposes of those programs. Damage to chronically stratified archeological deposits would persist and accumulate, representing a long-term, adverse impact on archeological resources.

Infrastructure. The no-action alternative includes the following ongoing measures related to infrastructure in the park:

- Trails would be relocated in response to riverbank erosion as needed. Trails would continue to be mowed with no additional treadwork.
- The replica earthlodge located near the visitor center would to be maintained as an interpretive exhibit. See figures 4-1 and 4-2.

SOURCE: NPS

FIGURE 4-1. REPLICA EARTHLODGE AT KNIFE RIVER INDIAN VILLAGES NATIONAL HISTORIC SITE

SOURCE: NPS

FIGURE 4-2. REPLICA EARTHLODGE FIREPIT WITH BOUNDARIES AT KNIFE RIVER INDIAN VILLAGES NATIONAL HISTORIC SITE

- Existing bank stabilization structures to protect County Road 18 would be maintained. The park would cooperate with state and county agencies to develop an action plan to relocate roads in case of emergency and to ensure access to park areas and private property.
- The existing visitor center would be maintained. Staff would continue to remove water in the building when necessary and closely monitor environmental conditions of the museum collections.
- Repairs and rehabilitation of existing park facilities and associated activities would continue at current levels and locations. The maintenance facility would remain in its location near the Big Hidatsa site.

When erosion requires that trails be moved, the park would avoid archeological deposits to minimize impacts from trail construction and use (figure 4-3). The grass on mowed trails would provide some protection to surface archeological deposits from compaction and erosion. Maintenance of existing riverbank stabilization structures along the Knife River near the County Road 18 bridge would result in beneficial impacts because it would prevent loss of archeological deposits associated with an archeological site located near the bridge, resulting from undercutting and/or bank collapse. The area around the visitor center has been surveyed for archeological resources, and the potential for impacts from the maintenance of this facility or the replica earthlodge is low. Leaving the maintenance facility in its current location could indirectly impact archeological resources as a result of its proximity to sensitive sites. Ongoing use of the maintenance facility could cause accidental disturbance of in situ deposits and/or seepage or spills of hazardous materials, like fuel into surface deposits.

SOURCE: NPS, Midwest Archeological Center

FIGURE 4-3. ARCHEOLOGISTS CONDUCTING A PEDESTRIAN SURVEY

Cumulative Impacts. Past, present, and future activities have the potential to affect archeological resources, both adversely and/or beneficially. Adverse impacts have accrued to archeological resources from past land cultivation, amateur archeological investigations, roadway and infrastructure development, gravel quarrying, and the operation of Garrison Dam. Adverse impacts from these activities include loss of archeological resources, displacement of artifacts and damage to archeological deposits.

Beneficial impacts on archeological resources, such as the restoration of native, nonwoody vegetation through prescribed fire, prairie species planting, and removal of exotic plants, have occurred and would continue to occur as a result of the implementation of the following plans:

- *Exotic Plant Management Plan* (NPS 2005)
- *Fire Management Plan* (NPS 2008c)

Overall, these actions contribute to cumulative, long-term, adverse and beneficial impacts on archeological resources. The no-action alternative would have long-term, adverse impacts on archeological resources and contribute slightly to adverse, long-term, cumulative effects.

Conclusion. Under the no-action alternative, erosion, pocket gophers, vegetation encroachment, and the proximity of the maintenance facility would continue to adversely affect archeological sites. The loss of archeological deposits by erosion along river and stream banks would continue, particularly at the Elbee and Sakakawea sites. Head-cutting at the Elbee site and Taylor Bluff Village would remain problematic. Pocket gopher burrowing that displaces artifacts and damages archeological features would continue at all of the sites currently affected. Encroachment of nonnative plant species would continue at 35 sites, and the roots of woody vegetation would continue to displace artifacts, damage archeological features, and inhibit access for archeological research. The continued use of the maintenance facility could indirectly impact archeological sites by accidental disturbance of in situ deposits and/or seepage or spills of hazardous materials.

These threats would continue to adversely affect some of the sites most at risk and important to the park. Of these sites, four are considered to be in fair condition (Big Hidatsa, Sakakawea, Lower Hidatsa, and the Stanton Mound Group) and one is considered to be in poor condition (Elbee). This indicates that these threats are already affecting the overall integrity of the sites despite ongoing management actions. The continuation of existing conditions would not adequately address these threats, and the condition of the sites would further deteriorate. Over time, the impacts on the sites considered in good condition would accumulate, leading to further deterioration in site conditions.

The continued loss of archeological deposits and degradation of site conditions would result in significant impacts on archeological resources. These archeological resources are central to the purpose and significance of the park. These impacts would affect the integrity of the sites and over time could reduce their eligibility to the national register. The archeological resources at the park are considered some of the best examples of Northern Plains village sites, and further degradation of these resources would be an irreplaceable loss of materials and information.

Impacts Common to Both Action Alternatives

Bank Stabilization Techniques. Park staff has identified bank stabilization as a potential action to protect archeological sites threatened by riverbank erosion and ice damming.

Under alternatives 2 and 3, the park would implement a range of bank stabilization techniques as described in chapter 2. The general categories of these techniques include soil bioengineering, bank armoring, flow diversion, energy reduction, geotechnical slope stabilization, and channel widening. Potential impacts on archeological sites from stabilization techniques are summarized in table 4-2.

Potential archeological impacts from bank stabilization techniques are directly related to the degree of ground disturbance associated with each technique. Impacts on archeological resources would come from ongoing disturbance from roots; excavation of bank slope to improve the angle of repose; excavation to place materials such as posts, tree revetments, root wads, riprap, retaining walls, and drains to anchor hard points or jetties, cribs, dikes, vanes, channel blocks; and grade control structures. In general, it was assumed that for archeological resources, aesthetics are less important than the preservation of the resource in situ. Also, it was assumed that the majority of ground disturbance would occur during construction and that maintenance, whether ongoing or sporadic, would not introduce new ground disturbance.

Soil bioengineering techniques are more likely to have adverse impacts on archeological sites because they require a greater grading / angle of repose (i.e., layback and ground disturbance) of the bank to be installed successfully, which could affect intact archeological deposits. Soil bioengineering techniques have a higher chance of failure than other methods because they are more vulnerable to freeze/thaw cycles and fluctuating water levels. While the potential exists for all bank stabilizations to fail, the short lifespan of soil bioengineering techniques are more likely to fail and remove the intact archeological deposits they are protecting, resulting in an impact similar to a flood event. Incorporating hydrology and hydraulic analyses, including measurement of shear stress in the selection and design of specific bank stabilization projects throughout the park would minimize the potential for failure of any techniques implemented. Appropriate monitoring and maintenance of the stabilization structure would avoid these impacts.

The use of vegetation to stabilize banks can have adverse impacts on intact archeological deposits, particularly if larger woody vegetation is used. The roots of the vegetation can penetrate archeological deposits and displace them from their context. These impacts can be mitigated by building out from archeological deposits using sterile soils and creating a buffer between the stabilizing vegetation and archeological deposits.

Bank armoring and geotechnical slope stabilization techniques can have similar adverse impacts on archeological sites because of the degree of grading / angle of repose required to install the stabilization structures. However, these techniques are less likely to be affected by fluctuating water levels and freeze/thaw cycles, and they are more likely to withstand higher sheer stress. As a result, they are less prone to failure than soil bioengineering techniques.

Table 4-2. Impacts on Archeological Resources Associated with Bank Stabilization Techniques

Stabilization Techniques	Stabilization Technique Life Span	Construction Disturbance Level[a]	Grading/Angle of Repose Needed[b]	Impacts on Archeological Resources[c]
Soil Bioengineering				
Live stakes	Long term	Minor-moderate	2	Adverse impacts on site deposits as a result of root action, impacts would be contingent on the type of plant used and the depth of roots and the grading/angle needed to obtain a successful planting.
Live fascines (wattles)	Long term	Minor	1	Adverse impacts on site deposits from excavation of trenches to emplace fascines and root action and a small amount of grading/angle needed for installation.
Brush layering	Long term	Minor	1	Adverse impacts on site deposits from excavation into slope to create locations on which to set branches and a small amount of grading/angle needed for installation.
Branch packing	Long term	Minor	1	Adverse impacts on site deposits from excavation into slope to set branches and low amount of grading/angle needed for installation.
Vegetated geogrids	Long term	Moderate	1	Adverse impacts on site deposits from excavation to install geogrid and low amount of grading/angle needed for installation.
Live cribwall	Long term	Moderate	3	Adverse impacts on site deposits from excavation of slope to place cribbing (major grading needed for installation) and impacts on site from root action.
Joint planting	Long term	Moderate	2	Adverse impacts on site deposits from root action and contouring of slope.
Brush mattress	Long term	Moderate	2	Adverse impacts on site deposits from staking to secure mattresses and contouring bank slope.
Live post	Long term	Minor-moderate	2	Adverse impacts on site deposits from augering 3 to 5-foot-deep holes for live tree posts and root action as well as from contouring the slope.
Tree revetment	Short term	Moderate	0	Adverse impacts on site deposits from excavation into base of riverbank to emplace tree revetment.
Root wad	Short term	Moderate	0	Adverse impacts from excavation into base of riverbank to set long sections of tree roots
Dormant post-plantings	Long term	Minor	2	Adverse impacts on site deposits from contouring bank slope and augering of 3 to 5-foot-deep holes for dormant tree posts.

Table 4-2. Impacts on Archeological Resources Associated with Bank Stabilization Techniques

Stabilization Techniques	Stabilization Technique Life Span	Construction Disturbance Level[a]	Grading/Angle of Repose Needed[b]	Impacts on Archeological Resources[c]
Bank Armoring				
Riprap	Long term	Major	2	Adverse impact on site deposits from contouring bank slope.
Soil covered riprap	Long term	Major	2	No additional impact beyond that described for placement of riprap.
Articulated blocks	Long term	Major	2	Adverse impacts on site deposits from contouring bank slope.
Geogrid	Long term	Minor	1	Adverse impacts on site deposits from contouring bank slope.
Geotextile fabrics	Long term	Minor	0	Adverse impacts on site deposits from contouring bank slope.
Flow Diversion				
Hard points and jetties	Long term	Moderate	2	Adverse impacts on site deposits by excavation into base of slope to anchor structures and potential for eddy scour behind the structures.
Cribs	Short term	Moderate	0	Adverse impacts on site deposits from excavation into base of slope to anchor structures and from undercutting.
Dikes	Long term	Major	0	Adverse impacts on site deposits from excavation into base of slope to anchor structure and from bank loss because of ice blockage.
Energy Reduction				
Vanes	Long term	Moderate	0	Adverse impacts on site deposits from excavation into base of slope to anchor structures and from bank loss because of ice blockage.
Channel blocks	Long term	Moderate	2	Adverse impacts on site deposits from excavation into base of slope to anchor structures from bank loss because of debris or ice blockage.
Grade control structures	Long term	Major	2	Adverse impacts on site deposits from excavation into base of slope to anchor structures.
Geotechnical Slope Stabilization				
Grading	Short term	Moderate	3	Adverse impacts on site deposits from contouring bank slope.
Geogrids and geotextiles	Long term	Minor	1	Adverse impacts on site deposits from contouring bank slope.

Stabilization Techniques	Stabilization Technique Life Span	Construction Disturbance Level[a]	Grading/Angle of Repose Needed[b]	Impacts on Archeological Resources[c]
Retaining walls	Long term	Major	0	Adverse impacts on site deposits from excavation into slope to construct walls.
Drains	Long term	Moderate	1	Adverse impacts on site deposits from trench excavation to place drains.
Channel Development				
Channel widening	Long term	Major	2	Adverse impacts on site deposits—this technique would not be used in areas where archeological sites are present to avoid impacts.
High flow diversion channels	Long term	Major	2	Adverse impacts on site deposits—this technique would not be used in areas where archeological sites are present to avoid impacts.

[a] Construction disturbance level can vary depending on current condition of banks and depends on bank slope / angle of repose necessary for structure technique, as well as depth/footprint of grading needed for installation

[b] 0 = No grading / angle of repose is not significant; 1 = minor grading needed / high angle of repose acceptable; 2 = major grading needed / low angle of repose necessary; 3 = major grading needed for structure but angle of repose not applicable or significant

[c] Although many of the proposed bank stabilization techniques could have adverse impacts on archeological resources, these impacts could be mitigated through techniques such as data recovery or alternative mitigation, if appropriate.

Despite the adverse impacts associated with above techniques, a proactive approach to implementing bank stabilization techniques would allow for data recovery at a site, which would represent a beneficial impact. A controlled investigation of a deposit is beneficial when compared to its total loss during an erosion event. Also, bank stabilization would ensure that the remaining site is preserved would have a long-term beneficial impact on the resource.

Flow diversion and energy reduction techniques are less likely to have adverse impacts on archeological sites than soil bioengineering, bank armoring, and geotechnical stabilizations because the ground disturbance associated with these techniques would occur predominately in the riverbed. Also, it may be possible to situate portions of the stabilization structure that tie into the riverbank to avoid archeological sites. However, the position of these structures is tied to the flow of the river, and the potential exists that for these structures to be successful, they may need to be placed in an area with archeological deposits; thereby, displacing materials and having adverse impacts on these deposits.

Channel development could result in adverse impacts on archeological sites, particularly if channel widening were to occur in an area with archeological deposits (see figure 4-4). However, no archeological sites are located along the river bends most conducive to channel development. Appropriate placement would avoid or minimize impacts on archeological deposits. Similarly, the impacts associated with flow diversion channels could be minimized if the channels are positioned to avoid archeological sites. Because of the degree of ground disturbance associated with these actions, they would not be implemented in areas where construction would affect archeological sites.

Impacts associated with all of the proposed bank stabilization techniques would be long term and adverse. Most of these impacts would result from the ground disturbance required to install the stabilization structures. Despite these impacts, stabilization is preferred to the uncontrolled loss of archeological deposits to erosion. Archeological data recovery or other investigations would be required to minimize or mitigate the adverse impacts and would result in a controlled removal of deposits, allowing for additional information to be obtained from the site. In the long-term, bank stabilization would have beneficial impacts on archeological resources by preserving the remaining deposits in situ.

Pocket Gopher Control. Burrowing mammals displace artifacts, destroy subsurface stratification and soil horizons, eat faunal remains and other organic materials that are part of the archeological record, and change soil chemistry (Worman 2009). Additionally, soil disturbance creates a favorable environment for invasive species, and the piles of dirt from the burrowing animals affect the visual character of the site.

The total damage caused by pocket gophers over time is not known, but archeological investigations and monitoring by the park have shown that the disturbance is common (49 out of the 51 archeological sites assessed for prioritization show evidence of pocket gophers). Management of pocket gophers is best accomplished through a combination of cultural and population management methods, including installing surface and subsurface fencing to prevent gophers from entering an area (exclusion), habitat modification, use of fumigants and toxicants, and trapping.

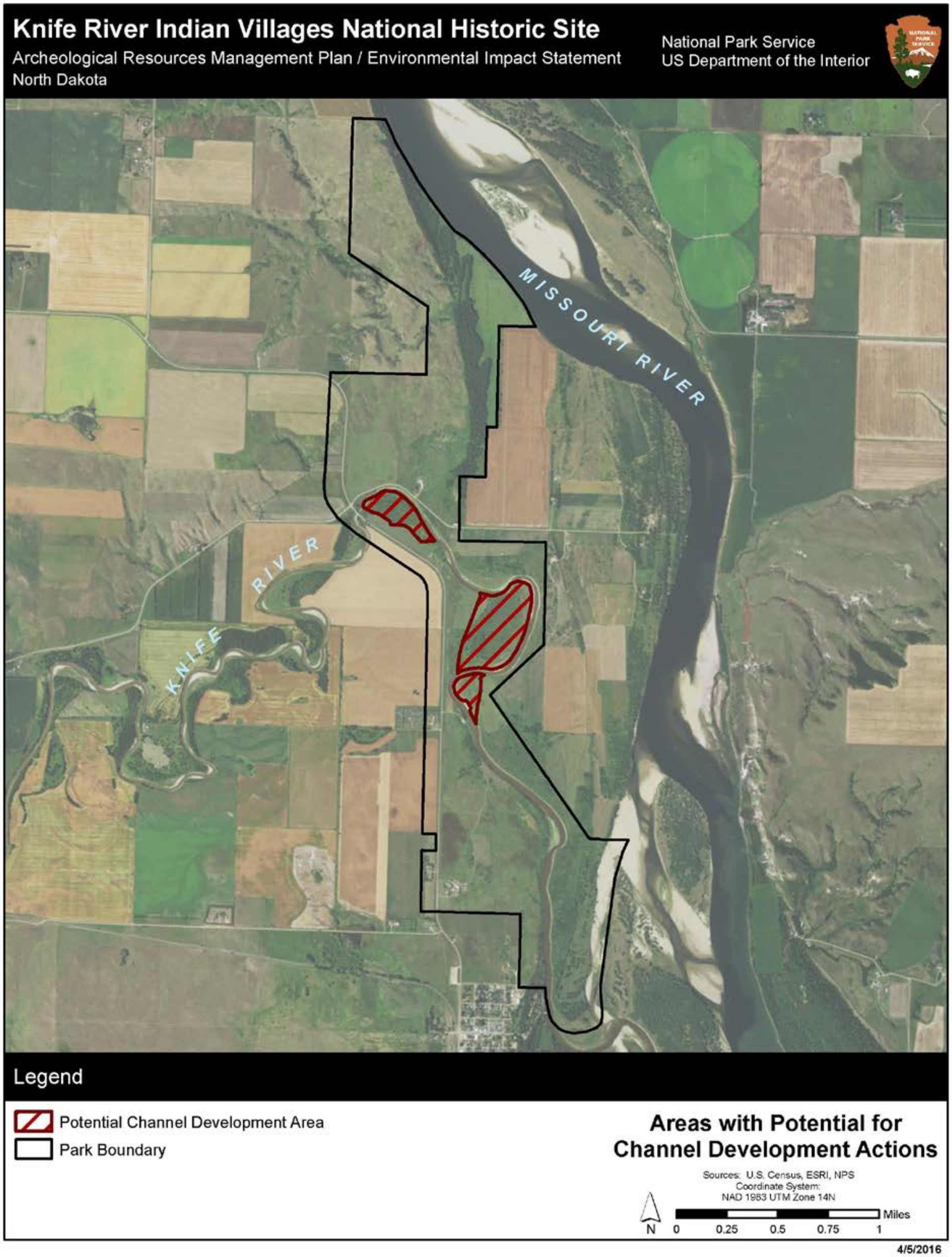


FIGURE 4-4. AREAS WITH POTENTIAL FOR CHANNEL DEVELOPMENT ACTIONS

Similar to the other management actions being considered, the impact of these techniques on archeological resources is directly related to their potential to cause ground disturbance. Levels of ground disturbance would vary by technique. Minor ground disturbance would be considered slight and site-specific and difficult to detect. Moderate levels would result in a considerable amount of ground disturbance and a noticeable change to the environment, while major ground disturbance would be extensive and distinctive. As described above, detailed definitions for these terms, such as the percentage of a site impacted by an activity or volume of material disturbed, would need to be determined through consultation with the state historic preservation office and the tribes.

Exclusion fencing would have a high potential for adverse impacts on archeological resources if installed in an archeological site. Although this approach may be effective, it would require extensive ground disturbance. The impacts of this approach could be mitigated by placing the exclusion fences outside of site boundaries; however, encountering unknown deposits would still be possible. The impacts from the installation of exclusion fencing could also be minimized or mitigated through archeological investigations prior to installation to identify subsurface deposits. Data recovery could be used to minimize or mitigate potential impacts if subsurface deposits are identified.

Habitat modification would also have the potential to affect archeological resources. Habitat modification involves changing the environment in archeological sites to make it less desirable for pocket gopher habitation, thereby encouraging the animals to move. Mechanical vegetation management treatments may be necessary to accomplish this change and could cause adverse impacts on archeological resources. These impacts could be avoided by using a variety of vegetation management treatments. However, habitat change would occur more slowly and may not remove the pocket gophers in a timely manner, allowing them to continue disturbing archeological deposits.

The use of toxicants and fumigants are least likely to cause adverse impacts on archeological resources, especially if any ground disturbance necessary to ensure their success is restricted to the burrow system or plowzone because these areas have already been disturbed. A burrow builder may be used to apply toxicants; however, this method would be restricted to previously disturbed areas such as the plowzone. Trapping would also have minimal impacts on archeological resources, because little ground disturbance would be required to install and remove the traps and it would occur in the already disturbed burrow system.

Currently, pocket gophers are affecting 49 archeological sites in the park. The use of additional methods to reduce pocket gopher populations would have a beneficial impact on archeological resources by reducing the disturbance to archeological deposits (table 4-3). The application of minimization or mitigation measures for treatments, such as exclusion and habitat modification, would ensure that impacts are not adverse.

Vegetation Management. Under alternatives 2 and 3, the park would use a variety of vegetation management treatments and methods to remove woody and overgrown vegetation that adversely affect archeological sites. The work would be accomplished using biological, mechanical, chemical, and/or prescribed fire treatments, individually or in combination, as described in chapter 2. Park managers would select the most appropriate treatments and methods depending on site factors to achieve the desired conditions identified in this plan/draft environmental impact statement and other park planning documents.

TABLE 4-3. IMPACTS OF POCKET GOPHER CONTROL ON ARCHEOLOGICAL RESOURCES

Management Techniques	Description	Efficacy Timeline	Ground Disturbance Level	Long-Term Maintenance	Impacts on Archeological Resources
Exclusion	The installation of subsurface and surface fencing to exclude animals from areas	Immediate	Minor to major	Requires continued maintenance/replacement.	Potential for adverse impacts on site deposits.
Habitat modification	Vegetation control and flood irrigation	Long term	Minor to major	Requires continued maintenance/replacement.	Potential for adverse impacts on site deposits.
Toxicants	Zinc phosphide, chlorophacinone, diphacinone, strychnine milo	Long term	Minor to major	May require frequent maintenance and reapplication depending on size of gopher population and area.	Little potential for adverse impacts on site deposits unless chemicals contaminate archeological materials.
Fumigants	Aluminum phosphate and various gas cartridges	Long term	Minor	May require frequent application depending on size of gopher population and area.	Little potential for adverse impacts unless chemicals contaminate archeological materials. Phosphate sampling could be compromised.
Trapping	Live and lethal trapping	Immediate to long term	Moderate	May require frequent trapping events, depending on size of gopher population and area.	Little potential for adverse impacts on site deposits to place and remove traps.

The impacts of vegetation management treatments on archeological deposits are associated with the ground disturbance that would be required for the technique to be successful (table 4-4). Only prescribed fire is exempt from ground-disturbing impacts; the heat of the fire can affect archeological deposits depending on the temperature and duration of the fire and the types of artifacts present on the surface.

In general, vegetation management treatments have potential for ground disturbance, much of which can be avoided by using a combination of approaches. For example, cutting trees in archeological sites using chainsaws, hand removing the downed material, and applying pesticide to the stump to avoid regrowth can effectively remove vegetation with no adverse impacts on archeological resources. Ground disturbance associated with vegetation removal is generally restricted to the shallow deposits that may have been previously disturbed by vegetation or farming and does not penetrate the more deeply buried, stratified archeological materials. Ground disturbance levels would be similar to those described above for pocket gopher management techniques with more detailed definitions for these terms, such as the percentage of a site impacted by an activity or volume of material disturbed, determined through consultation with the state historic preservation office and the tribes.

TABLE 4-4. IMPACTS ON ARCHEOLOGICAL RESOURCES ASSOCIATED WITH VEGETATION MANAGEMENT TREATMENTS

Vegetation Management Treatments	Methods Used	Extent of Ground Disturbance	Maintenance Activities	Extent of Impacts on Archeological Resources
Cultural treatments	Examples include prevention and reseeding of native herbaceous species following woody vegetation removal. Reseeding methods include hand broadcasting, seed drill, hydroseeding, and seed mats.	None to moderate	Requires continuing prevention practices, periodic spot reseeding, and irrigation.	Minimal potential for adverse impacts on site deposits.
Manual treatments	Includes hand pulling or cutting using small hand tools and shovels. Most manual methods need to be used in combination with pesticides, grazing, or prescribed fire to treat resprouts and new seedlings.	Moderate	Requires spot treatments annually.	Minimal potential for adverse impacts on site deposits from removal of woody vegetation. Heavy grazing could cause eroding trails or wallows.
Mechanical treatments	Includes pulling, cutting, grubbing, and mowing using weed whippers, mowers, tractor- or all-terrain vehicle-pulled mowers, chainsaws, and shovels. Most mechanical methods need to be used in combination with pesticides, grazing, or prescribed fire to treat resprouts and new seedlings. Heavy equipment could be used for treatment of woody species encroachment.	Moderate to major	Requires spot treatment annually.	Potential for adverse impacts on site deposits from removal of woody vegetation and heavy equipment tearing up surface deposits.

Vegetation Management Treatments	Methods Used	Extent of Ground Disturbance	Maintenance Activities	Extent of Impacts on Archeological Resources
Chemical treatment	Examples include herbicides applied using portable sprayers, all-terrain vehicles equipped with sprayers, and aerial spraying. Includes spraying, basal bark and stem treatment, cut surface treatment, cut stump treatment, and tree injection.	None to minor	Spot treatments the first year; depending on the species requires continuing spot treatments every 1 to 3 years.	Minimal potential for adverse impacts on site deposits from removal of woody vegetation and heavy equipment tearing up surface deposits. Chemicals could contaminate site deposits.
Prescribed fire treatments	Frequency, intensity, and timing of burning are extremely important. Used in the spring to deter woody species germination. Prescribed fire used as treatment of woody species encroachment needs to be used in combination with mowing, herbicide, or reseeding with native grasses to treat resprouts and new seedlings.	Minor to major	Requires continuing treatment practices every 3 to 5 years. (Snowberry requires annual treatment.)	Minimal potential for adverse impacts on surface site deposits from heat of fires where dense vegetation is being burned.
Biological controls	Includes the use of insects and microorganisms to reduce the abundance of an exotic plant. Long-term solution for controlling select exotic plant species.	None to minor	Pending reproduction, establishment, and effect of biological control on target vegetation species, more than one release may be necessary for desired level of management.	No potential for adverse impacts on site deposits unless insects create burrows in the ground or are food sources for burrowing animals.
Grazing	Considerations include grazing practice used (i.e., standard grazing, flash grazing, rotational grazing), stocking rate, species of livestock, timing (i.e., spring, summer, fall), and fencing requirements.	Minor to moderate	Requires seasonal to continual maintenance.	Minimal potential for adverse impacts on surface site deposits by eroding trails or wallows if heavily grazed and fence construction.

Cultural methods of vegetation management (i.e., those practices that promote the growth of desirable plants and reduce opportunities for exotic plants to grow) generally have little to no impact on archeological sites when employed on their own. Ground disturbance associated with reseeding or the use of vegetation mats is generally shallow (less than 3 inches). There would be no impact on archeological sites when these methods are employed in areas that have been previously farmed (i.e., plowzones, which are 8 to 12 inches deep). Even in areas that have not been previously farmed, these methods are anticipated to have little impact if they are restricted to the top 10 inches of soil where existing root systems are present.

Similar to cultural methods, manual treatment (i.e., pulling weeds by hand or using hand tools to remove vegetation) would have little to no impact on archeological resources. These methods often result in no or minimal ground disturbance. The ground disturbance that does occur would be shallow, less than 10 inches, and would occur in the root zone of existing vegetation or to depths previously disturbed by plowing.

Mechanical treatments using heavy equipment (i.e., large-wheeled tractors, grubbers, or vehicles on tracks) could compact archeological deposits and create ruts or furrows with their treads. These impacts could be minimized by using the equipment outside of sites or in areas where previous ground disturbance has occurred. Additionally, restricting the use of some of these techniques to seasons when the ground is dry or frozen could minimize potential damage from compression or tire furrowing associated with the weight of heavy equipment.

Chemical treatments would have no impact on archeological sites when used on their own because there would be no ground disturbance. Chemicals applied directly to the outside of the plant or injected into the plant would not impact archeological materials.

The impact of broadcast spraying of chemicals on archeological materials is unknown. It is believed that little residual chemical would remain, and any impacts should be short term.

The effects of both wildland and prescribed fire on archeological resources have been well-documented at the park, regionally, and nationally. The University of North Dakota conducted an early study on the impacts of fire on archeological resources in 1988–1989 (Sayler et al. 1989). The goals of the study were to document the impacts of prescribed fire on various types of archeological materials and recommend a burn plan for vegetation management at the park. This study made several recommendations regarding the types of archeological sites that could tolerate fire and those that should be avoided (Sayler et al. 1989). The park still uses some of the recommendations, such as categorizing sites as high, moderate, and low density, to determine where prescribed fire may occur. Sayler et al. (1989) defined these categories as follows:

- High density sites—sites with high densities of visible surface artifacts and greatest susceptibility to impact from prescribed fires; sites at which intensive, controlled artifact collection should definitely occur prior to prescribed burning
- Moderate density sites—potentially sensitive sites that exhibited moderate densities of surface-visible artifacts when examined during previous surveys and that are known to contain items, such as bone and chipped stone material, particularly sensitive to fire damage
- Low density sites—sites and areas in the park where damage to cultural resources from prescribed burning is not believed to present a problem (this group includes all nonsite zones and sites identified as bone concentrations along the Knife River shoreline, European American historic sites that do not contribute to the cultural

significance of the park, and archeological sites, such as trails and cemeteries, which exhibit surface ground features, but no artifacts known to be subject to fire damage)

The impact of fire on archeological resources is directly related to burn duration and intensity, the amount of fuel consumption, and artifact type (Sturdevant et al. 2009). Fires with lower temperatures and shorter durations are less likely to affect archeological resources than fires that burn hot and for longer periods of time. Burn duration and intensity are directly related to the type of fuel present and the fuel load (how much fuel is present). A fast-moving grass fire may heat the soil to only 140°F, whereas a long-smoldering fire in a pile of logs may heat the soil to more than 932°F, well above the melting point of lead (Ryan et al. 2012; Sturdevant et al. 2009).

Sturdevant et al. (2009) found that artifacts burned during prescribed fire were not significantly impacted. In fact, "[t]he adherence of combustive residue to artifacts was the most frequent impact observed on artifacts" (Sturdevant et al. 2009). However, impacts on archeological resources vary not just by the duration and intensity of the burn but also depend on the material of the artifact. As expected, fire would be more likely to affect combustible artifacts (e.g., wood, leather) or artifacts with a low melting point, while stone, ceramic, and metal are less likely to be affected.

The National Park Service provides guidance for managing cultural resources and fires in the *Cultural Resources and Fire Module of Resource Manual No. 28A: Archaeology*. Additionally, studies of fire impacts on archeological resources have led to the development of recommendations to minimize impacts on these sites (NPS, Sturdevant, pers. comm. 2006c; Ryan et al. 2012; Sturdevant et al. 2013). Adherence to these guidelines and recommendations would ensure that impacts on archeological sites are minimized during prescribed fire treatment. In addition, using these guidelines would allow for prescribed burns in the "high" density archeological sites as defined in Sayler et al. (1989).

Biological controls include the use of insects or microorganisms to remove undesirable vegetation. Biological methods themselves are not likely to have an impact on archeological resources because the control is released and targets a specific vegetation type. No ground disturbance is associated with this technique. However, the die-off of vegetation may necessitate additional treatments to remove the vegetation; these treatments may be ground disturbing (e.g., mechanical removal or prescribed fire) and could indirectly affect archeological resources.

Grazing animals such as bison, cattle, horses, and goats can have negative impacts on archeological resources. Trampling and wallowing, especially in wet areas, can cause ground disturbance and disturb in situ archeological materials. Additionally, animals can also damage the artifacts themselves. In a study completed for Capitol Reef National Park, researchers found that livestock cause artifact breakage, increased visibility, and displacement (Osborn and Hartley 1987). Ceramic artifacts are more likely to be broken by livestock trampling than lithic materials (Osborn and Hartley 1987). However, Osborn and Hartley also found that lithic artifacts are more likely to be displaced horizontally than ceramics (Osborn and Hartley 1987).

The impacts of livestock on archeological sites can be avoided or minimized by locating water sources away from archeological deposits to minimize trampling, avoiding archeological sites during particularly wet seasons, or reducing the length of time that the animals are grazed on any one area. At the park, grazing animals would be limited to areas that have been previously plowed. This method is anticipated to have no impact on intact archeological resources. The inclusion of other impact minimization measures, such as placing water sources outside of archeological sites and reducing grazing time in each area would ensure that grazing animals do not affect archeological sites.

Although adverse impacts from some of the proposed vegetation management methods could occur, these impacts could be avoided or minimized through the implementation of standard operating procedures, such as avoiding the use of heavy machinery when the ground is wet. Additionally, if a combination of approaches is used, it is possible to remove vegetation from archeological sites with no adverse impacts on the resource (e.g., cutting woody vegetation and applying chemicals to the stump or reseeding an area with native plants after a prescribed fire). When mitigation measures and/or a combination of methods are employed, the removal of vegetation is likely to have long-term, beneficial impacts on archeological resources by reducing the impacts of root systems on subsurface archeological deposits. Additionally, vegetation management would allow for better access to archeological sites for research and monitoring. Finally, restoring the native vegetation would enhance the visitor experience by recreating the historic setting of the archeological remains.

An adaptive management approach with built in measures to avoid or minimize the potential impacts of treatments would result in more effective vegetation removal than strategies currently in place and would have little to no adverse impacts on archeological resources. Overall, the use of these treatments would have long-term, beneficial impacts on archeological resources by removing vegetation that is affecting subsurface deposits. As a result, it is anticipated that there would be a reduction in the number of sites where woody vegetation encroachment is a problem.

Impacts of Alternative 2

Under alternative 2, archeological sites, riverbank erosion, pocket gophers, and woody vegetation would be managed under the adaptive management framework discussed in chapter 2. The maintenance facility and museum collections storage would be relocated to another location in the park, and the existing maintenance facility would be removed. Two potential relocation sites in the park have been identified that would meet the necessary criteria outlined in chapter 2:

- Site 1 includes approximately 17,600 square feet located adjacent to the south side of the existing visitor center (figure 2-7). The museum collections storage and supporting administrative offices would be located in an addition to the visitor center. The addition would total approximately 3,000 square feet.
- Site 2 includes approximately 65,600 square feet located south of the existing visitor center (figure 2-7). The maintenance offices, maintenance shop, cold storage, and tractor storage would be located in a new facility of approximately 6,000 square feet built on this site.

Both sites have been selected to avoid archeological resources. While two known archeological sites are near these locations: Lobodi (32ME0411) and Hotrok (32ME0312), they would be avoided or properly mitigated during construction activities; therefore, no direct impacts are expected. Given the distance of the archeological sites from the proposed building locations, the potential for indirect impacts from the use of these areas for the maintenance facility or museum collections storage is small. The National Park Service has surveyed the area surrounding the visitor center, including the two locations proposed for new construction. Within the zone surrounding the current visitor center facility, all archeological features were recorded and excavated prior to construction. If the zone surrounding the visitor center is expanded beyond the area investigated previously, additional archeological investigations may be required to appropriately manage the resource in accordance with applicable NPS policies. Vegetation screening could be used to ensure that vehicles and people stay in the facility area and do not accidentally encroach on archeological sites.

The existing maintenance facility would be demolished. The removal or demolition of the existing maintenance facility could affect archeological resources by disturbing a known archeological site. The potential exists for intact subsurface deposits to be present underneath existing structures; however, the extent and integrity of these resources in the vicinity of the existing structures is not known. Removing the foundations of existing facilities could increase the potential for archeological deposits to be adversely affected because the ground disturbance would extend farther underground to where these deposits may be present. These impacts could be avoided if foundations are left in place or the disturbance associated with removal is limited to areas that have been previously disturbed.

Cumulative Impacts. When considered with past, present, and reasonably foreseeable projects, the implementation of alternative 2 would have beneficial impacts on archeological resources. The adaptive management framework, in combination with other management plans, would ensure that the resources are preserved in situ whenever possible, resulting in long-term, beneficial impacts on archeological resources. Relocating the maintenance facility in the park would have little to no adverse impacts on archeological resources. In the event unknown archeological resources are discovered during construction, resource management steps would be triggered to appropriately manage the resource in accordance with applicable NPS policies. Long-term, beneficial, cumulative effects are anticipated under this alternative.

Conclusion. Overall, the implementation of an archeological resources management plan under both site options would have long-term, beneficial impacts on archeological resources by preserving them in situ whenever possible and minimizing existing disturbance throughout the park. The use of bank stabilization techniques and removal of pocket gophers and vegetation from high risk / high priority sites, some of which are in fair or poor condition, would ensure that the conditions of the sites do not degrade further and could improve site conditions over time. The preservation of these resources is important to the continuing mission of the park, and these resources are central to the purpose and significance of the park. Although there would be adverse impacts associated with some of the management tools being proposed, they would be mitigated prior to implementation—proactively preserving and protecting the resources. The demolition of the maintenance facility could have adverse impacts on an archeological site located in the area, if not mitigated. The options to relocate the maintenance facility in the park under this alternative would have little to no adverse impacts. Cumulative impacts associated with the alternative would be beneficial

Other aspects of the adaptive management plan could adversely affect archeological resources. For example, habitat modification or exclusion fencing, mechanical vegetation removal, and the removal of the existing maintenance facility could cause ground disturbance within archeological sites. However, appropriate planning and the use of multiple methods (e.g., a combination of manual and chemical treatments to avoid impacts within sites) could avoid or minimize potential impacts and would result in no adverse effects on archeological resources.

Impacts of Alternative 3

Under alternative 3, the maintenance facility complex and/or museum collections storage would be relocated to space outside of the park. The space requirements would be the same as described for alternative 2. Two options are under consideration for alternative 3. Under either option, the existing maintenance facility would be demolished. Demolition of the maintenance facility in this location could have adverse impacts on the archeological site located in that area. The potential impacts would be the same as those described under alternative 2.

The construction of a new off-site facility may impact archeological resources if they are present. The park would conduct a NHPA section 106 review prior to construction to identify archeological resources and assess potential impacts. Leasing existing space off-site is anticipated to have no adverse impacts on archeological resources.

The impacts from the removal or demolition of the existing facility would be the same as those described under alternative 2.

Cumulative Impacts. Cumulative effects are anticipated to be the same as those described under alternative 2.

Conclusion. The impacts of adaptive management actions would be the same for alternative 3 as they would be alternative 2. The adaptive management plan would have beneficial impacts by preserving the resource in situ. The impacts from the removal of the maintenance facility would be the same as those described under alternative 2. Construction of off-site facilities may affect archeological sites. However, these impacts would be addressed and avoided, minimized, or mitigated prior to construction. The movement of the facility off-site would have little to no adverse impacts on archeological resources in the park. Overall, the cumulative effects associated with the alternative are anticipated to be beneficial.

Impacts of the Preferred Alternative

Under the preferred alternative, the National Park Service would keep the museum collections storage in place provided that efforts to address water infiltration issues are successful. If efforts are ultimately unsuccessful, museum collections storage would be moved off-site. In addition, under the preferred alternative, the National Park Service would identify land through a General Services Administration build-lease arrangement to build an off-site maintenance facility to suit park needs. However, based on supply and regulatory constraints, this action is currently not feasible. As such, the National Park Service is seeking to relocate and construct the maintenance facility in the park, unless the opportunity to lease or build off-site arises. Under the preferred alternative, the National Park Service would implement all aspects of the adaptive management framework, including developing a priority list of archeological resources and measures to address riverbank erosion, pocket gopher activity, and vegetation encroachment. Under the preferred alternative, impacts on archeological resources would be the same as those described under alternative 3 and would include potential adverse impacts associated with the demolition of the existing maintenance facility and potential adverse impacts from the construction of a new off-site facility. These impacts could be mitigated through appropriate planning for removal and siting of new facilities. If suitable land or lease options for an off-site facility cannot be identified, the National Park Service would defer to building a new maintenance facility in the park and under this scenario, impacts would be the same as those described under alternative 2.

The impacts from bank stabilization techniques, vegetation management, and pocket gopher control would be the same as those presented previously under "Impacts Common to Both Action Alternatives."

Cumulative Impacts. Cumulative impacts are anticipated to be the same as those described under alternative 2 or 3, depending on the new facility considerations discussed previously.

Conclusion. Impacts of the preferred alternative would be the same as those described under alternative 3 and "Impacts Common to Both Alternatives." If the water infiltration project being implemented under the no-action alternative proves successful, the museum collections storage would not be relocated unless the park identifies funding or partnership opportunities to relocate the museum collection from the basement to a more suitable location. If the collection is moved, it would be done in consultation with the MHA Nation tribal historic preservation officer and North Dakota state historic preservation officer and comply with NPS museum collection standards. If suitable off-site property or lease arrangements for a new maintenance facility cannot be identified, the National Park Service would defer to building a new facility on-site and impacts would be the same as those described under alternative 2. Cumulative impacts would be the same as those described under alternatives 2 or 3, respectively.

IMPACTS OF THE ALTERNATIVES ON CULTURAL LANDSCAPES

Methods and Assumptions

The analysis focuses specifically on the characteristics considered to be contributing to the cultural landscape. Cultural landscape characteristics are described in chapter 3. Buildings and structures, circulation, and small-scale features are not considered to contribute to the cultural landscape and are not analyzed. Cultural landscape characteristics are analyzed by comparing the activities considered under each alternative to the characteristic to determine its potential to affect the resource.

The analysis of the cultural landscape is predicated on the assumption that the locations within the park identified for new structures or facilities would meet certain criteria (e.g., avoid archeological sites, retain important viewsheds) to ensure there are no long-term impacts on the cultural landscape.

Several aspects of the cultural landscape would not be affected by any of the alternatives, and they are not analyzed. These include: cluster arrangement, cultural traditions, land use, and spatial organization. These characteristics are defined by the internal arrangement of the archeological sites, the relationships between sites (and features), and the relationships between the sites and the environment. Because none of the alternatives propose to change the location of sites or the relationship between sites and past land use (e.g., field, trails), these characteristics would not be affected and are not analyzed.

Archeological resources are considered to be a characteristic of the cultural landscape. Impacts on archeological resources, as part of the cultural landscape, are considered to be the same as those described under the "Archeological Resources" section above. Impacts are summarized in this section and not repeated in detail.

Area of Analysis

The area of analysis for cultural landscapes encompasses the entire 1,748.8-acre park as defined in the *Cultural Landscape Inventory* (NPS 1999). The area is bounded on the east by the Missouri and Knife Rivers and on the west by County Road 37. The northern boundary is approximately 1 mile north of where County Road 37 turns west, while the southern boundary is adjacent to the town of Stanton. Four secondary component landscapes fall under the larger parent landscape of the park (NPS 1999). A component is a discrete area within a larger cultural landscape that may contribute to the importance of the landscape and its eligibility to the national register. The component landscapes of the larger cultural landscape at the park include the Big Hidatsa component landscape, the Sakakawea component landscape, the Lower Hidatsa component landscape and the Taylor Bluff component landscape.

Impacts of Alternative 1 (No-Action Alternative)

Under the no-action alternative, riverbank erosion, pocket gophers, and the encroachment of woody vegetation on archeological sites, would continue to adversely affect several characteristics of the cultural landscape. As described in chapter 2, the park would continue to manage these impacts, but the majority of actions would be reactionary in nature.

Erosion commonly occurs during flood events and can result in the removal of large portions of the riverbank. Archeological sites are considered to be the most important characteristic of the cultural landscape. Erosion is affecting these resources, particularly at the Elbee and Sakakawea sites, permanently removing archeological materials and causing long-term, adverse impacts on the cultural landscape. Archeological sites are also an important component of topography and views the park. The loss of earthlodge depressions or other archeological features as a result of erosion changes the subtle human-made topography of the landscape (figure 4-5). Also, the views between sites may change as portions of sites are lost to erosion and the views of and from those areas are no longer available.

SOURCE: NPS

FIGURE 4-5. THE SOUTHERN HALF OF SAKAKAWEA VILLAGE SHOWING ARRANGEMENTS OF EARTHLODGE DEPRESSIONS

Erosion may also affect vegetation along the floodplain resource by removing established native species, although these impacts are likely to be short term. Different from the historic forests, the forested areas along the floodplain resource are still considered important components of the vegetation characteristic of the cultural landscape. The scar-like areas left behind after an erosion event can affect views of the larger cultural landscape; however, these areas are temporary and part of the natural processes of the river system.

Vegetation is a key characteristic of the cultural landscape, the continued encroachment of woody vegetation, particularly nonnatives, on archeological sites has the potential to adversely affect the cultural landscape by altering the native vegetation regime and obscuring views of and from these resources. The existing vegetation management undertaken by the park does not prevent encroachment in all areas of the park. The *Cultural Landscape Inventory* (NPS 1999) notes that the park contains remnants of plant communities that are some of the best left in the area. Vegetation encroachment, particularly by nonnative species, threatens this key part of the vegetation in the park. Ongoing vegetation management aimed at restoring native species to the park would be beneficial because it is an important part of both the natural systems/features and vegetation characteristic of the cultural landscape. The park continues to work to restore native species, but vegetation encroachment, particularly on archeological sites, continues to be a problem.

The *Cultural Landscape Inventory* (NPS 1999) notes that vegetation growth has already affected the views between the prominent village sites. These impacts could be mitigated if current vegetation management practices aimed at retaining and/or restoring native plant species and prairie continue (see chapter 2). However, given that the woody vegetation is a persistent problem affecting the views, it is unlikely that current management practices would completely solve the problem.

The park would continue to lethally trap pocket gophers on the three main village sites. Currently, pocket gophers are affecting almost all of the archeological sites in the park. In addition to removing archeological materials from their contexts and changing the archeological characteristic of the cultural landscape, pocket gopher burrows create a landscape pockmarked by gopher activity. The visible sign of pocket gopher activity affects views, particularly of the archeological sites themselves. Finally, pocket gophers change the topography of the cultural landscape, particularly human-made topography, by creating burrows and mounds in earthlodge depressions. Although pocket gophers were present at the time the villages were occupied, they were not likely as concentrated in the area as they are now because of the presence of people and associated activities and their presence would not have been as noticeable as it is now. Trapping would reduce some of these impacts. Pocket gopher communities would not be completely eradicated from these sites, and they would continue to have adverse impacts on the cultural landscape.

Under the no-action alternative, the visitor center and other facilities would remain in their current locations. Trails would be moved in response to erosion, if determined necessary. Moving a trail involves mowing a different route through grass and does not require ground or other disturbance. These movements are anticipated to have minimal impacts on the cultural landscape. The current location of the maintenance facility has an adverse impact on the views associated with the cultural landscape, particularly those from the nearby Big Hidatsa site.

Cumulative Impacts. Past, present, and future management plans have had adverse and beneficial impacts on the cultural landscape. Cultivation of park lands prior to its designation as a park and the operation of Garrison Dam, which has contributed to riverbank erosion in the park, have adversely affected the cultural landscape. Some of these impacts have been minimized through management activities, such as the *Fire Management Plan* (NPS 2008c) and the *Exotic Plant Management Plan* (NPS 2005) and bank stabilization projects, which assist in restoring or maintaining a more natural environment and preserve components of the cultural landscape. Cell phone towers and energy development outside of the park could impact the cultural landscape by introducing new features and disrupting the views of the larger landscape from the park itself.

Under the no-action alternative, riverbank erosion, pocket gopher activity, vegetation encroachment, and the placement of infrastructure would continue to adversely affect the cultural landscape. These impacts would be somewhat mitigated by ongoing management actions, but these actions are not anticipated to provide long-term solutions. However, the long-term, adverse impacts associated with the no-action alternative, combined with past, present, and future projects would result in adverse, cumulative impacts on the cultural landscape.

Conclusion. Under the no-action alternative, current threats would continue to adversely affect the cultural landscape. Management practices aimed at mitigating these threats would slow the rate of adverse effects, but would not proactively address the needs of the resource. Over time, the cultural landscape would continue to deteriorate, particularly as a result erosion processes and pocket gopher activity. Vegetation encroachment would also have an adverse impact by changing the views in the cultural landscape and disturbing intact cultural deposits. Under the no-action alternative, the potential exists for long-term, adverse impacts on the cultural landscape. These adverse impacts are anticipated to be significant because they could result in the deterioration of features of the cultural landscape that make it eligible for listing in the national register.

Impacts Common to Both Action Alternatives

An adaptive management plan would be employed under both action alternatives to manage the impacts on cultural resources from erosion, vegetation encroachment, and pocket gophers. The impacts of the adaptive management plan on the cultural landscape are described below.

Bank Stabilization Techniques. In general, bank stabilizations can have short and long-term, adverse impacts on the cultural landscape depending on the type of bank stabilization being installed and the constructions efforts required for completion. Overall, bank stabilization techniques are likely to have both adverse and beneficial impacts on the cultural landscape. Short-term impacts are generally associated with construction (e.g., the greater the ground disturbance required for a bank stabilization project, the greater the short-term, adverse impacts). Short-term impacts include removal of established vegetation, creation of areas of barren soil, storage of materials in the cultural landscape, and use of heavy equipment. However, these impacts are generally restricted to the construction phase and for a short while after until the affected areas are vegetated to reduce the potential for nonnative species.

Long-term impacts are more commonly associated with the type of bank stabilization being completed. Overall, soft stabilizations, such as those that use vegetation and soil to reinforce a bank have few long-term, adverse impacts on the cultural landscape. The adverse impacts associated with these techniques would include the removal of archeological deposits to construct the stabilization and the potential to introduce vegetation that is inconsistent with the cultural landscape. However, with proper planning, the end result blends with the natural surroundings and has beneficial impacts on the cultural landscape by ensuring the views remain consistent and that important areas of the landscape remain intact. Harder bank stabilization approaches (i.e., riprap, articulated blocks, and retaining walls) are more likely to have long-term, adverse impacts on a cultural landscape by introducing new elements into the environment that do not blend with the cultural landscape.

Impacts on the cultural landscape are considered to be directly related to the ground disturbance needed for installation and the aesthetics of the final structure. This assumes that bank stabilization methods that use vegetation would be constructed with native vegetation and designed to blend with or enhance the cultural landscape (e.g., preserve the vegetation characteristic of the cultural landscape). In general, most stabilization efforts would affect the archeology, topography, vegetation, and view characteristics of the cultural landscape. The exceptions to this are flow diversion, energy reduction, and channel development techniques. These methods involve changing the hydrology of the river and would have additional impacts on the cultural landscape because they would affect an additional characteristic of the cultural landscape, mainly natural systems and features.

Although adverse impacts are associated with some methods, bank stabilizations, regardless of type, have beneficial impacts on the cultural landscape. They preserve the natural and cultural environment and ensure that important components of the landscape are retained. In particular, the preservation of archeological resources is paramount because these resources are considered the most important characteristic of the cultural landscape. While natural appearing bank stabilizations would have less of an impact on the cultural landscape because they preserve the aesthetics (and thus the views), hardscaping may be a more permanent solution that better preserves important aspects of the cultural landscape (e.g., the archeology). The benefits of preserving important characteristics of the cultural landscape may outweigh the preservation of the aesthetics and views of the cultural landscape.

Potential impacts of each bank stabilization method on the cultural landscape are described in table 4-5.

TABLE 4-5. POTENTIAL IMPACTS OF BANK STABILIZATION TECHNIQUES

Stabilization Techniques	Stabilization Technique Life Span	Construction Disturbance Level[a]	Aesthetics	Grading/Angle of Repose Needed[b]	Impacts on Cultural Landscape
Soil Bioengineering					
Live stakes	Long term	Minor-moderate	+	**2**	Short-term, adverse impacts from ground disturbance during construction. Potential long-term, adverse impacts from changes to the angle of the riverbank. Long-term, beneficial impacts from the use of a technique that preserves important landscape characteristics and is aesthetically pleasing.
Live fascines	Long term	Minor	+	1	Short-term, adverse impacts from ground disturbance during construction. Long-term, beneficial impacts from the use of a technique that preserves important landscape characteristics and is aesthetically pleasing.
Brush layering	Long term	Minor	+	1	Short-term, adverse impacts from ground disturbance during construction. Long-term, beneficial impacts from the use of a technique that preserves important landscape characteristics and is aesthetically pleasing.
Branch packing	Long term	Minor	+	1	Short-term, adverse impacts from ground disturbance during construction. Long-term, beneficial impacts from the use of a technique that preserves important landscape characteristics and is aesthetically pleasing.
Vegetated geogrids	Long term	Moderate	+	1	Short-term, adverse impacts from ground disturbance during construction. Long-term, beneficial impacts from the use of a technique that preserves important landscape characteristics and is aesthetically pleasing.
Live cribwall	Long term	Moderate	+	3	Short-term, adverse impacts from the ground disturbance during construction. Potential long-term, adverse impacts from changes to the angle of the riverbank. Long-term, beneficial impacts from the use of a technique that preserves important landscape characteristics and is aesthetically pleasing.
Joint planting	Long term	Moderate	+	2	Short-term, adverse impacts from ground disturbance during construction. Potential long-term, adverse impacts from changes to the angle of the riverbank. Long-term, beneficial impacts from the use of a technique that preserves important landscape characteristics and is aesthetically pleasing.

Stabilization Techniques	Stabilization Technique Life Span	Construction Disturbance Level[a]	Aesthetics	Grading/Angle of Repose Needed[b]	Impacts on Cultural Landscape
Brush mattress	Long term	Moderate	+	2	Short-term, adverse impacts from ground disturbance during construction. Potential long-term, adverse impacts from changes to the angle of the riverbank. Long-term, beneficial impacts from the use of a technique that preserves important landscape characteristics and is aesthetically pleasing.
Live post	Long term	Minor-moderate	+	2	Short-term, adverse impacts from ground disturbance during construction. Potential long-term, adverse impacts from changes to the angle of the riverbank. Long-term, beneficial impacts from the use of a technique that preserves important landscape characteristics and is aesthetically pleasing.
Tree revetment	Short term	Moderate	+	0	Short-term, adverse impacts from ground disturbance during construction. Long-term, beneficial impacts from the use of a technique that preserves important landscape characteristics and is aesthetically pleasing.
Root wad	Short term	Moderate	+	0	Short-term, adverse impacts from ground disturbance during construction. Long-term, beneficial impacts from the use of a technique that preserves important landscape characteristics and is aesthetically pleasing.
Dormant post-plantings	Long term	Minor	+	2	Short-term, adverse impacts from ground disturbance during construction. Potential long-term, adverse impacts from changes to the angle of the riverbank. Long-term, beneficial impacts from the use of a technique that preserves important landscape characteristics and is aesthetically pleasing.
Bank Armoring					
Riprap	Long term	Major	-	2	Short-term, adverse impacts from the ground disturbance associated with construction. Long-term, adverse impacts from changes to the angle of the riverbank, vegetation, and views from the use of a nonaesthetic technique.
Soil covered riprap	Long term	Major	+	2	Short-term, adverse impacts from the ground disturbance associated with construction. Potential long-term, adverse impacts from changes to the angle of the riverbank. Long-term, beneficial impacts from the use of a technique that preserves important landscape characteristics and is aesthetically pleasing.
Articulated blocks	Long term	Major	-	2	Short-term, adverse impacts from the ground disturbance

Stabilization Techniques	Stabilization Technique Life Span	Construction Disturbance Level[a]	Aesthetics	Grading/Angle of Repose Needed[b]	Impacts on Cultural Landscape
					associated with construction. Long-term, adverse impacts from changes to the angle of the riverbank, vegetation, and views from the use of a nonaesthetic technique. Long-term benefits to archeology.
Geogrid	Long term	Minor	-	1	Short-term, adverse impacts from ground disturbance during construction. Long-term, adverse impacts on vegetation and views from the use of a nonaesthetic technique. Long-term benefits to archeology.
Geotextile fabrics	Long term	Minor	+	0	Short-term, adverse impacts from ground disturbance during construction. Long-term, beneficial impacts from the use of a technique that preserves important landscape characteristics and is aesthetically pleasing.
Flow Diversion					
Hard points and jetties	Long term	Moderate	Depends on type	2	Short-term, adverse impacts from ground disturbance during construction. Potential long-term, adverse impacts from changes to the angle of the riverbank, views, and potential alteration of the river hydrology. Long-term benefits to archeology.
Cribs	Short term	Moderate	Depends on type	0	Short-term, adverse impacts from ground disturbance during construction. Potential long-term, adverse impacts from changes to views and potential alterations of the river hydrology. Long-term benefits to archeology.
Dikes	Long term	Major	Depends on type	0	Short-term, adverse impacts from ground disturbance during construction. Potential long-term, adverse impacts from changes to views and potential alterations of the river hydrology. Long-term benefits to archeology.
Energy Reduction					
Vanes	Long term	Moderate	Depends on type	0	Short-term, adverse impacts from ground disturbance during construction. Potential long-term, adverse impacts from changes to views and potential alterations of the river hydrology. Long-term benefits to archeology.
Channel blocks	Long term	Moderate	Depends on type	2	Short-term, adverse impacts from ground disturbance during construction. Potential long-term, adverse impacts from changes to the angle of the riverbank, views, and potential alteration of the river hydrology. Long-term benefits to archeology.

Stabilization Techniques	Stabilization Technique Life Span	Construction Disturbance Level[a]	Aesthetics	Grading/Angle of Repose Needed[b]	Impacts on Cultural Landscape
Grade control structures	Long term	Major	-	2	Short-term, adverse impacts from ground disturbance during construction. Potential long-term, adverse impacts on views from the use of a nonaesthetically pleasing technique and potential alterations of the river hydrology. Long-term benefits to archeology.
Geotechnical Slope Stabilization					
Grading	Short term	Moderate	+	3	Short-term, adverse impacts from the ground disturbance during construction. Potential long-term, adverse impacts from changes to the angle of the riverbank. Long-term, beneficial impacts from the use of a technique that preserves important landscape characteristics and is aesthetically pleasing.
Geogrids and geotextiles	Long term	Minor	+	1	Short-term, adverse impacts from the ground disturbance during construction. Long-term, beneficial impacts from the use of a technique that preserves important landscape characteristics and is aesthetically pleasing.
Retaining walls	Long term	Major	Depends on type	0	Short-term, adverse impacts from ground disturbance during construction. Potential long-term, adverse impacts from changes to views and potential alterations of the river hydrology. Long-term benefits to archeology.
Drains		Moderate	Depends on type	1	Short-term, adverse impacts from ground disturbance during construction. Potential long-term, adverse impacts from changes to views and potential alterations of the river hydrology. Long-term benefits to archeology.
Channel Development					
Channel widening	Long term	Major	+	2	Short-term, adverse impacts from ground disturbance during construction. Potential long-term, adverse impacts from changes to the angle of the riverbank and river hydrology. Long-term, beneficial impacts from the use of a technique that preserves important landscape characteristics and is aesthetically pleasing.
High flow diversion channels	Long term	Major	+	2	Short-term, adverse impacts from ground disturbance during construction. Potential long-term adverse impacts from changes to the angle of the riverbank and river hydrology. Long-term, beneficial impacts from the use of a technique that preserves important landscape characteristics and is aesthetically pleasing.

[a] Construction disturbance level can vary depending on current condition of banks and depends on bank slope / angle of repose necessary for structure technique, as well as depth/footprint of grading needed for installation

[b] 0 = No grading / angle of repose ; 1 = minor grading needed / high angle of repose acceptable; 2 = major grading needed / low angle of repose necessary; 3 = major grading needed for structure but angle of repose not applicable or significant

Pocket Gopher Control. Overall, the reduction of pocket gophers would have long-term, beneficial impacts on the cultural landscape. The impacts of these animals on the cultural landscape are described in the no-action alternative. The use of fumigants and trapping to manage pocket gopher populations would have little to no adverse impact on the cultural landscape. These techniques involve little visible ground disturbance or use of materials that would alter the archeology or view characteristics of the cultural landscape. Toxicants do require some ground disturbance when applied with a burrow builder; however, the disturbance would be localized, could be easily masked, and would be less intrusive on the views than the pocket gopher burrows themselves. The burrow builder would not impact intact features of the landscape because it would only be used in areas that have been previously disturbed by plowing. There would be few adverse impacts on the cultural landscape associated with these techniques.

Exclusion fencing and habitat modification would affect the cultural landscape, particularly the archeology, vegetation, and view characteristics. These techniques require changes in the landscape that would affect the natural and cultural environment and views. The installation of fences would be ground disturbing, possibly affecting in situ archeological materials, and would result in the addition of a new, human-made structure into the cultural landscape. This structure would have an adverse impact on the views, particularly if installed at one of the component landscapes.

Habitat modification includes planting a species that is undesirable to pocket gophers in a ring around the gopher community. While this may not involve extensive ground disturbance, the crop itself would stand out as an anomaly from the rest of the cultural landscape and affect views. These impacts would be greatest if the technique was used near the component landscapes. The adverse impacts of this approach would be short term because the vegetation would eventually die. Once the gophers are removed from the site, the area could be replanted with vegetation consistent with the natural landscape.

Overall, many of the adverse impacts of these approaches would be short term and could be avoided or minimized. The beneficial impacts of removing pocket gophers from the cultural landscape outweigh these adverse impacts. The effects of pocket gophers on the cultural landscape are more severe than the methods proposed to reduce their populations. The impacts on archeological materials, topography, and views as described in chapter 3 could lead to permanent impacts on the cultural landscape.

Vegetation Management. Natural resources, and particularly native vegetation, are an important component of the cultural landscape. Vegetation management can play an important role in maintaining the integrity of the cultural landscape. The vegetation management treatments proposed in the adaptive management plan would have largely beneficial impacts on the cultural landscape, particularly in the long term. The majority of the treatments would result in little ground disturbance (e.g., broadcast seeding, chemical treatments to remove undesirable plants, and most biological controls) and would be aimed at establishing native plants in the cultural landscape.

Adverse impacts are likely when vegetation management treatments introduce new elements or visual changes into the cultural landscape. These impacts stem from ground-disturbing activities, such as those associated with manual treatments that cause barren areas or visual changes (e.g., patterns created by seed drilling) and/or treatments such as prescribed fire and hydroseeding, which change the views associated with the cultural landscape. However, these adverse impacts would be short term and the end result of the treatment would have long-term benefits by maintaining or improving on the vegetation associated with the cultural landscape.

Vegetation management treatments are most likely to adversely affect archeology and view characteristics. Treatments that involve ground disturbance, such as those associated with mechanical methods, can displace in situ archeological deposits. These impacts can be avoided or minimized by completing work outside of archeological sites or in areas that have been previously disturbed (such as the plowzone). Additionally, ground disturbance can change the views associated with the cultural landscape, although these impacts are generally temporary. Ground disturbance levels would be similar to those as presented above under archeological resources.

The addition of new elements to the landscape, such as burned areas from prescribed fire, brush piles created during manual removal, or vegetation die-off from chemical or biological treatments also adversely affect views.

Overall, there would be long-term benefits associated with vegetation management for all of the cultural landscape characteristics. Archeological materials would be preserved by removing woody vegetation with root systems that impact in situ deposits. Natural systems and features and vegetation would be improved by removing undesirable vegetation and promoting native vegetation. Views would be maintained or improved by removing woody vegetation that is currently affecting the views between sites and the maintenance or enhancement of native vegetation in the landscape.

The impacts on the cultural landscape from each of the proposed vegetation management treatments are summarized in table 4-6. Vegetation management treatments as part of the adaptive management plan is anticipated to have short-term, adverse impacts on the cultural landscape. These impacts would occur during or shortly after the treatment is complete. In the long term, vegetation management would have beneficial impacts on the cultural landscape.

Impacts of Alternative 2

Under alternative 2, archeological sites, riverbank erosion, pocket gophers, and woody vegetation would be managed under the adaptive management framework discussed in chapter 2. The maintenance facility and museum collections storage would be relocated to another location in the park, and the existing maintenance facility would be removed. Two potential relocation sites in the park have been identified that would meet the necessary criteria outlined in chapter 2:

- Site 1 includes approximately 17,600 square feet located adjacent to the south side of the existing visitor center (figure 2-7). Museum collections storage and supporting administrative offices would be located in an addition to the visitor center. The addition would total approximately 3,000 square feet.
- Site 2 includes approximately 65,600 square feet located south of the existing visitor center (figure 2-7). The maintenance offices, maintenance shop, cold storage, and tractor storage would be located in a new facility of approximately 6,000 square feet built on this site.

As a result of the criteria used to select these locations, neither would have long-term, adverse impacts on the cultural landscape. There would be short-term, adverse impacts during construction as a result of the removal of vegetation and presence of construction materials and equipment in the cultural landscape. These would cause both visual and auditory impacts in the cultural landscape. However, in the long-term, the movement of the maintenance facility would have a beneficial impact because it currently detracts from important views from Big Hidatsa, one of the component landscapes.

TABLE 4-6. POTENTIAL IMPACTS ON THE CULTURAL LANDSCAPE FROM VEGETATION MANAGEMENT TREATMENTS

Vegetation Management Treatment	Description	Ground Disturbance	Long-Term Maintenance	Impacts on the Cultural Landscape
Cultural treatments	Examples include prevention (inspection of equipment, vehicles and materials to prevent the importation on nonnative species) and reseeding of native herbaceous species following woody vegetation removal. Reseeding method includes hand broadcasting, seed drill, hydroseeding, and seed mats.	None to moderate	Requires ongoing prevention practices; periodic spot reseeding and irrigation.	Short-term impacts associated with activities such as seed drilling, hydroseeding, and seed mats that introduce new visual elements into the landscape. The removal of undesirable vegetation and maintenance or enhancement of native vegetation would have long-term, beneficial impacts on the cultural landscape.
Manual treatments	Includes hand pulling or cutting using small hand tools and shovels. Most manual methods need to be used in combination with pesticides, grazing, or prescribed fire to treat resprouts and new seedlings.	Moderate	Requires spot treatments annually.	Pulling or hand cutting would have no adverse impact on the cultural landscape provided that vegetation was removed and not piled on-site. This activity would have long-term, beneficial impacts by removing undesirable vegetation and maintaining or enhancing native vegetation, an important characteristic of the cultural landscape.
Mechanical treatments	Includes pulling, cutting, grubbing, and mowing using weed whippers, mowers, tractor- or all-terrain vehicle-pulled mowers, chainsaws, and shovels. Most mechanical methods need to be used in combination with pesticides, grazing, or prescribed fire to treat resprouts and new seedlings. Heavy equipment could be used for treatment of woody species encroachment.	Minor to moderate	Requires spot treatment annually.	Mechanical treatments are the most likely to cause short-term, adverse impacts on the cultural landscape from the ground disturbance associated with the individual techniques. However, these activities would have long-term, beneficial impacts by removing undesirable vegetation and maintaining or enhancing native vegetation, an important characteristic of the cultural landscape.

Vegetation Management Treatment	Description	Ground Disturbance	Long-Term Maintenance	Impacts on the Cultural Landscape
Chemical treatments	Herbicides applied using portable sprayers, all-terrain vehicles equipped with sprayers, and aerial spraying. Includes spraying, basal bark and stem treatment, cut surface treatment, cut stump treatment, and tree injection.	None to minor	Requires spot treatments the first year; depending on the species requires continuing spot treatments every 1 to 3 years.	Chemical treatments would have minimal adverse impacts on the cultural landscape. Impacts could include plant die-off that mars views in the cultural landscape. However, these impacts would be minimal and short-term. Overall, this technique would have long-term, beneficial impacts by removing undesirable vegetation and maintaining or enhancing native vegetation, an important characteristic of the cultural landscape.
Prescribed fire treatments	Frequency, intensity, and timing of burning are extremely important. Used in the spring to deter woody species germination. Prescribed fire used as treatment of woody species encroachment needs to be used in combination with mowing, herbicide, or reseeding with native grasses to treat resprouts and new seedlings.	Minor to major	Requires ongoing treatment practices every 3 to 5 years. (Snowberry requires annual treatment.)	Prescribed fire would have short-term, adverse impacts on the cultural landscape because it would introduce visual changes (e.g., burned areas) into the landscape. However, these changes are short term; provided the burning is of low intensity and duration, the impacts should be minimal. This method would have long-term, beneficial impacts by removing undesirable vegetation and maintaining or enhancing native vegetation, an important characteristic of the cultural landscape.
Biological controls	Includes the use of insects and microorganisms to reduce the abundance of an exotic plant. Long-term solution for controlling select exotic plant species.	None to minor	Pending reproduction, establishment, and effect of biological control on target vegetation species, more than one release may be necessary for desired level of management.	Biological controls themselves are likely to have no impact on the cultural landscape. Similar to chemical treatments, there may be some impacts from die-off; however, these impacts would be short-term. Overall, this technique would have long-term, beneficial impacts by removing undesirable vegetation from the cultural landscape and maintaining or enhancing native vegetation, an important characteristic of the cultural landscape.
Grazing	Considerations include grazing practice used (i.e., standard grazing, flash grazing, rotational grazing), stocking rate, species of livestock, timing	Minor to moderate	Requires seasonal to ongoing maintenance.	Grazing would have some adverse impacts on the cultural landscape. These impacts include the addition of animals to the cultural landscape that may not be

Vegetation Management Treatment	Description	Ground Disturbance	Long-Term Maintenance	Impacts on the Cultural Landscape
	(i.e., spring, summer, fall), and fencing requirements.			compatible with the landscape as well as impacts from the animals themselves (e.g., ground disturbance). The use of fencing would also introduce new elements into the landscape. However, these impacts would be short term.

As a result of ground disturbance associated with the removal of the existing maintenance facility and the presence of equipment and vehicles, both long- and short-term, adverse impacts could occur. These facilities are located in the Taylor Bluff component of the cultural landscape, and care would need to be taken to ensure that long-term impacts, such as damage to archeological features or native vegetation, do not occur during removal.

Cumulative Impacts. Impacts of past, present, and future actions on cultural landscapes would be the same as those presented under the no-action alternative.

Although alternative 2 is anticipated to have short-term, adverse impacts on the cultural landscape, the adaptive management plan and movement of the maintenance facility would result in long-term benefits. When combined with other past, present, and reasonably foreseeable projects, alternative 2 would result in beneficial, cumulative impacts.

Conclusion. Under alternative 2, an adaptive management approach would be used to preserve cultural resources affected by riverbank erosion, pocket gophers, and vegetation encroachment. Some of the techniques used to address these issues would have short-term, adverse impacts on the cultural landscape as a result of the construction methods, visual changes, and introduction of new elements into the cultural landscape. However, these techniques would also preserve the cultural landscape by proactively addressing current threats and maintaining the integrity of the landscape. There would be long-term beneficial impacts on the cultural landscape under this alternative.

The movement of the maintenance facility and museum collections storage to new buildings in the park would have a beneficial impact on the cultural landscape. In particular, the relocation of the maintenance facility would benefit the views associated with the cultural landscape because the current location of the facility is a visual intrusion. Adverse impacts are not anticipated to be significant.

Impacts of Alternative 3

Under alternative 3, the maintenance facility and museum collections storage would be moved off-site to either a leased facility or a newly constructed facility on leased land. The removal of the existing maintenance facility would have short-term, adverse impacts on the cultural landscape as a result of the ground disturbance associated with the action and the presence of equipment and vehicles during removal. There would be no direct impacts on the cultural landscape from the construction or lease of off-site facilities.

Similar to alternative 2, the movement of the maintenance facility would have a beneficial impact on the cultural landscape by removing the facility from important views from the Big Hidatsa site.

Cumulative Impacts. Cumulative impacts would be the same as those described for alternative 2.

Conclusion. The impacts of alternative 3 on the cultural landscape would be the same as those described for alternative 2. There would be short-term, adverse impacts on the cultural landscape from the removal of the existing facility, but long-term benefits from the improvement of important views, particularly from the Big Hidatsa site. Adverse impacts are not anticipated to be significant.

Impacts of the Preferred Alternative

Under the preferred alternative, the National Park Service would keep the museum collections storage in place provided that efforts to address water infiltration issues were successful. If efforts are ultimately unsuccessful, the museum collections storage would be moved off-site. In addition, under the preferred alternative, the National Park Service would identify land through a General Services Administration build-lease arrangement to build an off-site maintenance facility to suit park needs. However, based on supply and regulatory constraints, this action is currently not feasible. As such, the National Park Service is seeking to relocate and construct the maintenance facility in the park, unless the opportunity to lease or build off-site arises. Under the preferred alternative, the National Park Service would implement all aspects of the adaptive management framework, including a priority list of archeological resources and measures to address riverbank erosion, pocket gopher activities, and vegetation encroachment. Impacts on cultural landscapes would be the same as those described under alternative 3 and would include adverse impacts associated with the demolition of the existing maintenance facility and potential adverse impacts from the construction of a new off-site facility. If suitable land or lease options for an off-site facility cannot be identified, the National Park Service would defer to building a new maintenance facility in the park. Under this scenario, impacts would be the same as those described under alternative 2.

The impacts from bank stabilization techniques, pocket gopher control, and vegetation management would be the same as those presented previously under "Impacts Common to Both Action Alternatives."

Cumulative Impacts. Cumulative impacts are anticipated to be the same as those described under alternative 2 or 3, depending on the new facility considerations discussed previously.

Conclusion. Impacts of the preferred alternative would be the same as those described under alternative 3 and "Impacts Common to Both Action Alternatives." If the water infiltration project being implemented under the no-action alternative proves successful, the museum collections storage would not be relocated unless the park identifies funding or partnership opportunities to relocate the museum collection from the basement to a more suitable location. If the collection is moved, it would be done in consultation with the MHA Nation tribal historic preservation officer and North Dakota state historic preservation officer and comply with NPS museum collection standards. If suitable off-site property or lease arrangements for a new maintenance facility cannot be identified, the National Park Service would defer to building a new maintenance facility on-site, and impacts would be the same as those described under alternative 2. Cumulative impacts would be the same as those described under alternatives 2 or 3, respectively.

IMPACTS OF THE ALTERNATIVES ON ETHNOGRAPHIC RESOURCES

Methods and Assumptions

Ethnographic resources are defined as "cultural and natural features of a park that are of traditional significance to traditionally associated peoples. These peoples are the contemporary park neighbors and ethnic or occupational communities that have been associated with a park for two or more generations (40 years), and whose interest in the park's resources began before the park's establishment" (NPS 2006a). The importance of ethnographic resources is defined by the community that continues to place value in those resources. Identification of these resources and potential impacts are determined through consultation with these communities.

Consultation with the MHA Nation and previous ethnographic research indicates that resources in the park have been considered ethnographic resources. These include the important village sites that not only served as the home for ancestral peoples but also play a prominent role in oral histories, other archeological features that tell the story of village life, and numerous aspects of the natural environment. Important features in the natural environment include the rivers and river banks, terraces, hills, bluffs, coulees, and buttes (Zedeño et al. 2006).

As noted by Zedeño et al., "there are strong associations among places, religious beings, and oral traditions that provide the rationale for ritual belief and behavior" (2006). These include holy places, storied places, and personally experienced places. While some of these places are known, many are not because the information related to them is considered confidential. In general, the park plays a central role in the identity, history, religion, and culture of the MHA Nation (Zedeño et al. 2006).

During consultation, officials from the tribal historic preservation office of the MHA Nation expressed support for the stabilization of riverbanks to prevent the loss of archeological materials. They also expressed a desire to collect traditionally used plants from the park. One of the most important areas for plant collection would be along the bottomlands near the river. Spring flooding of these areas is considered essential for maintaining important plant communities (Zedeño et al. 2006). The MHA Nation has expressed concern that these areas currently are not flooding in the same way they flooded in the past (Zedeño et al. 2006).

Based on the information known about potential ethnographic resources in the park and previous consultation, it is possible to generate several assumptions related to these resources:

- Actions that impact or preserve archeological resources are assumed to also impact or preserve ethnographic resources.
- Activities that change the topography in the park or hydrology of the rivers may adversely affect ethnographic resources.
- The maintenance or enhancement of native vegetation is assumed to have a beneficial impact on ethnographic resources.

Area of Analysis

The area of analysis for ethnographic resources is the park itself.

Impacts of Alternative 1 (No-Action Alternative)

The connection between the MHA Nation and the park has been well documented and ethnographic resources are present (Zedeño et al. 2006). Additionally, the park is treated as a traditional cultural property even though it has not been recorded as such.

Under the no-action alternative, erosion would continue to affect riverbanks in the park, altering the banks themselves and causing the loss of archeological materials.

Park staff would continue to react to these events by trying to preserve archeological materials before they are completely lost to erosion, but these actions would be reactionary, and materials would be irretrievably lost before park staff could respond. The Elbee site and Taylor Bluff Village are particularly at risk from flooding. There would be long-term, adverse impacts on ethnographic resources from the loss of these archeological materials.

Pocket gophers adversely affect intact archeological deposits and have a negative impact on ethnographic resources. Under the no-action alterative, park staff would continue to trap pocket gophers, thereby reducing some of their impacts. But trapping alone is not anticipated to reduce the impacts to the degree necessary to preserve these materials, particularly at the village sites where pocket gophers are abundant.

Ongoing vegetation management aimed at restoring native species to the park would be beneficial to ethnographic resources, particularly if plants important for tribal use (as defined in Zedeño et al. 2006) were incorporated into management actions. As noted in the discussion of cultural landscape, some of the plant communities in the park are considered some of the best in the area. Maintaining these communities would have beneficial impacts on ethnographic resources. However, while current management actions are geared toward maintaining native species, they are not anticipated to correct the issues associated with vegetation encroachment. Vegetation encroachment on the archeological sites not only affects cultural deposits but also makes portions of the site inaccessible, which could affect how the tribes use these sites.

Cumulative Impacts. Past, present, and reasonably foreseeable projects have the potential to have adverse and beneficial impacts on ethnographic resources. Land cultivation; roadway, infrastructure, and energy development; and the operation of Garrison Dam have all adversely affected these resources. Some of these impacts have been minimized through management activities, including the *Fire Management Plan* (NPS 2008c) and the *Exotic Plant Management Plan* (NPS 2005), which assist in restoring or maintaining a more natural environment. Previous bank stabilizations also have beneficial impacts on ethnographic resources.

Under this alternative, ethnographic resources would continue to be affected by erosion, pocket gopher activities, and woody vegetation encroachment. These impacts, combined with past, present, and reasonably foreseeable actions would result in long-term, adverse, cumulative impacts on ethnographic resources.

Conclusion. Overall, the continuation of existing conditions would have some long-term, adverse impacts on ethnographic resources. Ongoing management actions would reduce some of these impacts, but data show that park resources have degraded using this management method and continued loss of resources are anticipated. Adverse impacts are directly associated with the loss of archeological materials to erosion or pocket gopher activity and disturbance from vegetation. Ethnographic resources could also be adversely impacted from vegetation encroachment if the vegetation prevents access to these resources. There would be beneficial impacts on ethnographic resources from continuing vegetation management activities that maintain or promote native plants, which is important for defining the relationships between village life and the natural environment. This alternative, when combined with other past, present, and reasonably foreseeable projects would result in long-term, adverse cumulative impacts. Given that archaeological sites are also ethnographic resources and that significant impacts are expected on archeological resources under this alternative, the impacts on ethnographic resources are also anticipated to be significant.

Impacts Common to Both Action Alternatives

Bank Stabilization Techniques. Bank stabilization techniques have the potential to result in both adverse and beneficial impacts on ethnographic resources. Techniques that require extensive grading or a dramatic change in angle of repose could have long-term, adverse impacts on aspects of the natural environment that may be considered ethnographic resources (e.g., riverbanks) because they could alter the relationship between the tribes and the natural environment. Additionally, techniques that alter the river by changing its velocity and/or seasonal flooding could affect ethnographic resources by making them inaccessible or degrading their condition. Flow diversion, energy reduction, and channel development techniques are the most likely to cause these types of adverse impacts. Archeological materials could also be adversely affected during bank stabilization efforts, but these impacts would be mitigated prior to construction and are not anticipated to be significant.

Alternatively, bank stabilization measures can preserve archeological resources. Because these resources are essential to the culture of the MHA Nation, their preservation would protect ethnographic resources. Continued consultation with the MHA Nation is essential for ensuring that potential adverse impacts are avoided or minimized. Given that the tribes have expressed support for bank stabilization measures, it is anticipated that future stabilizations would have a minimal impact on ethnographic resources.

Pocket Gopher Control. Some of the methods used to remove pocket gophers could impact ethnographic resources. Although unlikely, the use of toxicants or fumigants could make it impossible for the tribes to collect plants from locations where these chemicals have been applied, if the chemicals have been applied to vegetation. However, typically, these chemicals are applied underground, so no effect would be expected. Additionally, exclusion fencing could make accessing certain areas difficult and/or detract from the spiritual and traditional uses of some ethnographic resources. Habitat modification that removes important plants also could affect uses of ethnographic resources and replace plants that are traditionally gathered. This would be particularly problematic if the plants need to come from a specific area or site to be used for traditional practices. Overall, despite the potential impacts of these methods, the removal of pocket gophers is anticipated to have a beneficial impact on ethnographic resources by preserving the natural and cultural environment. Consultation with the tribes to identify the best methods and locations to employ pocket gopher removal activities without disrupting traditional uses would allow for many of these impacts to be avoided or minimized.

Vegetation Management. The implementation of an adaptive management plan for vegetation management would have beneficial impacts on ethnographic resources. Any practice aimed at reducing undesirable plants and maintaining or encouraging native species would preserve ethnographic resources. Particularly important would be the ability for the MHA Nation to potentially collect traditional plants from in the park. There may be some die-off of native vegetation from the use of several of the vegetation management treatments (i.e., chemical methods, prescribed fire, and grazing) because these approaches are less targeted. However, these impacts could be avoided and/or minimized by reseeding native plants after the removal of vegetation, excluding actions in certain areas (e.g., no chemical use or grazing on native prairie), or ensuring the prescribed fire conditions are appropriate for the plants the park wants to maintain. However, chemical use may make it impossible for tribes to collect certain plants because of concerns over residual chemicals.

Impacts of Alternative 2

Under this alternative, an adaptive management plan would be implemented, the maintenance facility and museum collections storage would be moved to identified locations in the park, and the existing maintenance facility would be removed. Alternative 2 would have a beneficial impact on ethnographic resources. In particular, the removal of the maintenance facility would be beneficial for the nearby Big Hidatsa site. The site is not landscaped for visitors, and many plants and animals that are considered important to the tribes grow or live there or near the Big Hidatsa site (Zedeño et al. 2006). The removal of the building would improve the views from the site, which could increase feelings of connection with the land and the past. Additionally, the removal of the maintenance facility from its location in a village site, considered to be an ethnographic resource, would be beneficial.

Because of the criteria used to select the locations for the maintenance facility and museum collections storage, neither location is anticipated to have adverse impacts on ethnographic resources.

Cumulative Impacts. Past, present, and reasonably foreseeable projects could have adverse and beneficial impacts on ethnographic resources. Land cultivation; roadway, infrastructure, and energy development; and the operation of Garrison Dam have all adversely affected these resources. Some of these impacts have been minimized through management activities, including the *Fire Management Plan* (NPS 2008c) and the *Exotic Plant Management Plan* (NPS 2005), which assist in restoring or maintaining a more natural environment. Previous bank stabilizations had beneficial impacts on ethnographic resources.

The adaptive management framework, in combination with other management plans, and the movement of the maintenance facility would have long-term, beneficial impacts on ethnographic resources and would counteract past adverse impacts on these resources. Therefore, long-term, beneficial, cumulative impacts are anticipated under this alternative.

Conclusion. Under alternative 2, management actions would be implemented to preserve cultural resources affected by riverbank erosion, pocket gopher activity, and vegetation encroachment through an adaptive management framework. Although potential adverse impacts are associated with some of the proposed methods, consultation with the MHA Nation on the timing and location of use of ethnographic resources should allow the park to avoid or minimize these impacts. Overall, the alternative is anticipated to have beneficial impacts by preserving archeological resources in situ. The removal of the maintenance facility would be have a beneficial impact on ethnographic resources.

Impacts of Alternative 3

Under alternative 3, an adaptive management plan would be implemented and the maintenance facility and museum collections storage would be moved off-site to a newly constructed or leased facility where no ethnographic concerns exist. The impacts on ethnographic resources are anticipated to be the same as those described for alternative 2. Impacts on ethnographic resources from the removal of the maintenance facility from the vicinity of the Big Hidatsa site would be beneficial.

Cumulative Impacts. Cumulative impacts are anticipated to be the same as those described for alternative 2.

Conclusion. The impacts of alternative 3 would be the same as those described for alternative 2.

Impacts of the Preferred Alternative

Under the preferred alternative, the National Park Service would implement alternative 3 (options 1 or 2), including the actions common to both action alternatives. Under the preferred alternative, impacts on ethnographic resources would be the same as those described under alternative 3 and would include adverse impacts associated with the demolition of the existing maintenance facility and potential adverse impacts from the construction of a new off-site facility.

If current efforts to address water infiltration issues under the no-action alternative were successful, the museum collections storage would remain in its current location, ideally with an increase in staff and curation abilities, while all other aspects of alternative 3 would be implemented. The impacts from bank stabilization techniques, pocket gopher control, and vegetation management, would be the same as those presented under “Impacts Common to Both Action Alternatives.” If suitable land or lease options for an off-site facility cannot be identified, the National Park Service would defer to building a new maintenance facility in the park. Under this scenario, impacts would be the same as those described under alternative 2.

Cumulative Impacts. The cumulative impacts are anticipated to be the same as those described under alternative 2 or 3, depending on the new facility considerations discussed previously.

Conclusion. Impacts of the preferred alternative would be the same as those described for alternative 3 and the impacts common to both action alternatives. If the water infiltration project being implemented under the no-action alternative proves successful, the museum collections storage would not be relocated unless the park identifies funding or partnership opportunities to relocate the museum collection from the basement to a more suitable location. If the collection is moved, it would be done in consultation with the MHA Nation tribal historic preservation officer and North Dakota state historic preservation officer and comply with NPS museum collection standards. If suitable off-site property or lease arrangements for a new maintenance facility cannot be identified, the National Park Service would defer to building a new facility on-site and impacts would be the same as those described under alternative 2. Cumulative impacts would be the same as those described under alternatives 2 or 3, respectively.

IMPACTS OF THE ALTERNATIVES ON MUSEUM COLLECTIONS

Methods and Assumptions

The following assumptions guided the analysis of museum collections:

- Adherence to NPS policies would ensure that the movement of the collections storage to another facility or within the facility itself would have no effect on museum objects.
- Without successful waterproof storage, ongoing water infiltration issues in the visitor center have the potential to affect museum collections storage.
- The National Park Service would consult with the tribes prior to moving any collections off-site to ensure that tribal access is not affected.

Impacts of Alternative 1 (No-Action Alternative)

Under the no-action alternative, management of the museum collections at the park would continue to comply with NPS policies, including NPS *Management Policies 2006*, Director’s Order 24, and Director’s Order 28, and procedures set forth in the NPS *Museum Handbook* and NPS-28: *Cultural Resource Management Guidelines*. The park would continue to manage the museum collections as described in chapter 2. Water infiltration into the museum collections storage is a major threat to the long-term preservation of artifacts. Water infiltration could destroy some materials, particularly organic materials or pieces in the ethnographic collection that are made of delicate materials such as leather or fur. The National Park Service is in the process of addressing water infiltration and will include modifications to the museum structure and surroundings to prevent water ingress. The installation of waterproof storage would mitigate the potential adverse impacts associated with water infiltration, assuming the waterproofing is successful. If water infiltration occurs in the future, the park would identify a site in North Dakota to house the museum collections storage. This facility would need to meet NPS standards, and the park would consult with the MHA Nation on potential locations.

In the event that the collections continue to grow as a result of ongoing erosion issues and disturbance from pocket gophers (and park policy to collect artifacts that are disturbed), existing facilities may encounter issues with space. Although unlikely, as current archeological materials are collected from erosion areas, the size of the collection could increase and result in the existing museum collections becoming overcrowded and materials being stored in areas that may not meet standards.

Cumulative Impacts. Past, present, and reasonably foreseeable projects considered for cumulative impacts do not pertain to the museum collections; therefore, no potential for cumulative impacts exists.

Conclusion. Under the no-action alternative, museum collections could be adversely affected if ongoing water infiltration issues are not resolved. These impacts would be mitigated through the installation of waterproof storage, which would preserve the materials and would not result in significant impacts. The size of the collections could increase, creating additional stress on limited storage space. No cumulative impacts to museum collections are anticipated under this alternative.

Impacts Common to Both Action Alternatives

Under both action alternatives, an adaptive management plan would be employed to manage riverbank erosion, pocket gopher activity, and vegetation encroachment. This plan would not have direct impacts on the museum collections. However, many of the actions proposed under the plan may require archeological excavations or research prior to their implementation. This would result in the collection of additional archeological materials that would need to be curated and stored in the collections.

The museum collections storage would be moved to new locations, either on-site or off-site, under each of the action alternatives. This would have beneficial impacts on both existing and future museum collections because (1) the space would be waterproof and (2) the items would be housed in a facility with enough curation space for increasing collections. Therefore, museum collections would be better preserved than in their current location. Additionally, relocation to a new facility would allow the park to ensure that it has the space to curate additional materials that may be recovered during activities undertaken as part of the adaptive management plan.

Impacts of Alternative 2

Under alternative 2, a facility for the museum collections storage would be constructed in the park. A new location would benefit the collection because it would provide a facility that likely would not have the water infiltration issues associated with the current basement location. The materials, particularly those made of organic materials, would be better preserved in a new facility. Additionally, the new facility would likely have additional space to allow for the future expansion of collections. The collections would remain in the park, which would benefit researchers interested in the area who would only have to visit one location to see both the sites and associated materials.

Cumulative Impacts. Cumulative impacts are anticipated to be the same as those described under the no-action alternative; therefore, no cumulative impacts are anticipated under this alternative.

Conclusion. This alternative would have long-term benefits for the museum collections housed at the park because the museum collections storage would be moved to a facility without water infiltration issues and could be better preserved. This alternative would ultimately have beneficial impacts on museum collections. No cumulative impacts are anticipated under this alternative.

Impacts of Alternative 3

Under this alternative, the museum collections storage would be moved off-site to a newly constructed facility. In general, this would have a positive impact on the museum collections because a new facility would not likely suffer from water intrusions, and as a result, the collections would be better preserved. However, depending on the location of the new space, the movement of collections storage off-site would make it more difficult for the park to manage those collections and use them for interpretation. Additionally, researchers interested in the park and its collections would have to visit two different and possibly distant locations. Moving the museum collections storage would be accomplished in conjunction with consultation with the MHA Nation tribal historic preservation officer and the North Dakota state historic preservation officer.

Cumulative Impacts. Cumulative impacts would be the same as those described under the no-action alternative; therefore, be no cumulative impacts are anticipated under this alternative.

Conclusion. Alternative 3 would have beneficial impacts on the museum collections because museum collections storage would be housed in a facility that would ensure its preservation. However, if the facility is moved to a distant location (e.g., outside of the Stanton area), it would be more difficult for park staff to manage and use the collections. This alternative would ultimately have beneficial impacts on museum collections. No cumulative impacts are anticipated under this alternative.

Impacts of the Preferred Alternative

Under the preferred alternative, the National Park Service would keep the museum collections storage in place provided that efforts to address water infiltration issues prove successful. In the event efforts are ultimately unsuccessful, the museum collections storage would be moved off-site. In addition, under the preferred alternative, the National Park Service would identify land through a General Services Administration build-lease arrangement to build an off-site maintenance facility to suit park needs. However, based on supply and regulatory constraints, this action is currently not feasible. As such, the National Park Service is seeking to relocate and construct the maintenance facility in the park, unless the opportunity to lease or build off-site arises. Under the preferred alternative, the National Park Service would implement all aspects of the adaptive management framework, including a priority list of archeological resources and measures to address riverbank erosion, pocket gopher activity, and vegetation encroachment. Under this scenario, impacts on the museum collections would be the same as those described under alternative 3 and would include beneficial impacts associated with housing the museum collections storage in a facility that would ensure its preservation.

Cumulative Impacts. Cumulative impacts are anticipated to be the same as those described under alternative 2 or 3, depending on the new facility considerations discussed previously.

Conclusion. Impacts of the preferred alternative would be the same as those described for alternative 3 and under "Impacts Common to Both Alternatives." If the water infiltration project being implemented under the no-action alternative proves successful, the museum collections storage would not be relocated unless the park identifies funding or partnership opportunities to relocate the museum collection from the basement to a more suitable location. If the collection is moved, it would be done in consultation with the MHA Nation tribal historic preservation officer and North Dakota state historic preservation officer and comply with NPS museum collection standards. Cumulative impacts would be the same as those described for alternatives 2 or 3, respectively.

IMPACTS OF THE ALTERNATIVES ON FISH AND WILDLIFE RESOURCES

Guiding Regulations and Policies

NPS regulations and policies, including the Organic Act of 1916, NPS *Management Policies 2006*, and the NPS *Natural Resource Management Manual #77* (NPS 2004b), direct national parks to provide for the protection of park resources. The Organic Act directs national parks to conserve wildlife unimpaired for future generations and is interpreted to mean that native animal life is to be protected and perpetuated as part of a park unit's natural ecosystem. Furthermore, the NPS *Management Policies 2006* states, "natural processes will be relied upon to maintain native plant and animal species and influence natural fluctuations in populations of these species. The Service may intervene to manage individuals or populations of native species only when such intervention will not cause unacceptable impact to the populations of the species or to other components and processes of the ecosystems that support them" (NPS 2006a). The National Park Service may further intervene in the management of native plants and animals "to protect specific cultural resources of parks" (NPS 2006a).

Methods and Assumptions

Scientific literature was reviewed and used to describe the effects of archeological resource preservation and resource management on fish and wildlife resources. Literature and applicable studies that could provide information on proposed activities under the alternatives and the impacts they could have on fish and wildlife resources in the park were reviewed. This information was used to augment the on-site observations and documentation gathered by NPS personnel at the park and the best professional judgment of internal and external resource specialists to support the qualitative and quantitative statements presented in this impact analysis section. When applicable, GIS analysis also contributed to the assessment of impacts for fish and wildlife resources. It is assumed that the pocket gopher abundance observed through trapping efforts at the three main village sites is representative of the rest of the park and surrounding area.

Area of Analysis

The geographic study area for this plan is the park. Specifically, this includes all areas in the park, including the portion of Knife River that exists in the park.

Impacts of Alternative 1 (No-Action Alternative)

Under the no-action alternative, bank stabilization activities would be implemented in reaction to or as an emergency response to large erosion events. Installation and construction of bank stabilization projects would result in disturbance to wildlife habitat associated with the riparian area at the location of each individual project. Disturbances associated with bank stabilization activities would affect aquatic species, including any of the 18 fish species and 26 mollusk species documented in the Knife River, along with frogs, toads, salamanders, and snakes. Mammals that forage near the river or on its banks may also be temporarily affected by bank stabilization actions as a result of disturbance and temporary displacement from these habitats. Bats species that are present in the park may use trees along the river for roosting and foraging may be temporarily affected by disturbance during construction activities or if tree removal is required or necessary. Disturbed areas would be revegetated following construction; therefore, adverse impacts would be short term. Bank stabilization projects may require construction activities to occur in the river channel. Construction would be temporary but could result in short-term loss of habitat availability and increased turbidity and sedimentation, which could adversely impact fish and mollusks in the Knife River. Turbidity and sedimentation could interfere with fish respiratory function, reduce visibility resulting in missed feeding opportunities, and disrupt spawning behavior. These impacts would be short term and localized. Changes in flow and turbidity could also adversely affect mollusks such as freshwater mussels. Because these species have minimal mobility, they would not be able to relocate to nearby habitats. When implementing bank stabilization, special consideration would be given to the impacts of specific techniques on river flow and velocity characteristics as well as mitigation measures to reduce turbidity in an effort to minimize impacts on fish species (NPS 2014a; USFWS 2001). Seasonal restrictions on construction activities may be implemented to avoid potential impacts on fish spawning, depending on the timing and intensity of the project.

Lethal trapping operations as part of ongoing pocket gopher control management actions would continue on the three main village sites under the no-action alternative. Pocket gopher trapping has not resulted in any documented declines in pocket gopher populations. Pocket gophers are widespread throughout the park and surrounding area (Macdonald 2009). Although high numbers of pocket gophers have been trapped on the three main village sites in the past (e.g., 113 trapped in 2009), this level of trapping is not anticipated to have a noticeable effect on the pocket gopher population in surrounding areas or regionally. Based on observations of burrows in surrounding areas, it is assumed that pocket gopher densities are likely similar to those documented on the village sites. Mortality of nontarget species as a result of pocket gopher trapping has not been documented and is not expected to occur under the no-action alternative.

Cumulative Impacts. Past, present, and future activities have the potential to affect fish and wildlife resources, both adversely and/or beneficially. Past land cultivation, livestock grazing, introduction of nonnative species, timber harvesting, and gravel and quarry operations have contributed to adverse impacts on fish and wildlife resources in the park. Land cultivation included ground disturbance from plows over a large portion of the area, which would have disturbed vegetative communities, displaced terrestrial wildlife, and degraded water quality as a result of erosion and agricultural runoff. The operation of Garrison Dam has also resulted in adverse impacts on fish and wildlife resources at the park. Adverse impacts from these activities include loss of or decline in quality of foraging habitat for fish and wildlife resources, loss of riparian areas, a reduction in cottonwood regeneration along the river, and loss of habitat for ground-dwelling or tree-roosting species. The construction and operation of Garrison Dam upstream of Knife River on the Missouri River altered the natural hydrology and erosion/deposition and flooding regimes. The flow regulation of the dam altered the riparian vegetation of the park along the Missouri River by reducing overbank flooding and moisture availability in downstream riparian-adapted woodlands, which in turn reduced the regeneration of cottonwoods. Land cultivation, livestock grazing, the introduction of exotic species, timber harvesting, and gravel and quarry operations have removed or altered native plants and reduced native species habitat. The operation of Garrison Dam has and will continue to restrict downstream overbank flooding, limiting the ability for cottonwood stands to regenerate and reducing riparian habitat along the river.

However, beneficial impacts on fish and wildlife resources have occurred and would continue to occur in the future from the implementation of the following plans:

- *Exotic Plant Management Plan* (NPS 2005)
- *Fire Management Plan* (NPS 2008c)

Under the *Exotic Plant Management Plan* (NPS 2005), part staff manage exotic plants, using a suite of management actions and techniques, to reduce their negative effects on native plant communities that provide habitat for wildlife at the park. The *Fire Management Plan* (NPS 2008c) benefits fish and wildlife resources species by restoring native vegetation and natural ecosystem processes at the park, in accordance with the plan's objectives.

Overall, past, present, and future activities actions have long-term, adverse and beneficial, cumulative impacts on fish and wildlife resources. The no-action alternative would have short-term, localized, adverse impacts on fish and wildlife resources and contribute slightly to adverse, cumulative effects.

Conclusion. Impacts from the no-action alternative are anticipated to be short term and localized for most fish and wildlife species. Although a noticeable decline in pocket gopher abundance on the three main village sites would be expected, pocket gophers are a common and widespread species in the area and in North Dakota, and trapping is not anticipated to have a noticeable effect on the pocket gopher population in surrounding areas or regionally.

Impacts Common to Both Action Alternatives

Bank Stabilization Techniques. Bank stabilization techniques include soil bioengineering, bank armoring, flow diversion, energy reduction, geotechnical slope stabilization, and channel reconfiguration. These actions have the potential to alter the flow and velocity of the river and the physical structure of the river bank and adjacent area. Impacts associated with bank stabilization techniques would be both short and long term and range from minor to major intensity (see table 4-2). Changes in flow and velocity modify conditions in the river such as turbidity, depth, sedimentation, deposition, or other ecological factors that contribute to the river ecosystem. Mammals that forage near the river or on its banks may be temporarily affected by disturbance associated with bank stabilization actions and could be temporarily displaced from these habitats. Bat species that are present in the park may use trees along the river for roosting and foraging on insects and may be temporality disturbed during construction activities or if tree removal is required or necessary. Impacts include the loss of roosting areas and daytime bat disturbance and loss or avoidance of foraging areas. Impacts on bats could be avoided or minimized by implementing procedures or precautions to ensure construction or tree removal does not occur when bats may be using trees in the riparian corridor for roosting (e.g., bats are typically present in the park during summer and mate in early fall). Adverse impacts on mammal species would be short term because species are expected to return after construction activities are complete.

Birds such as waterfowl may use the Knife River for food, shelter, and breeding habitat. Alterations to the river bank or its flow and velocity through bank stabilization activities could decrease foraging and breeding habitat availability in the short term. In addition, waterfowl species are sometimes prey to larger raptor species such as bald eagles. If bank stabilization actions decrease the number of waterfowl on the river, larger raptor species may be affected by reduced availability of prey. Bank stabilization may also affect fish and mollusk populations through changes to river flow and velocity. Decreases in fish populations could affect the availability of prey to larger raptor species. Many birds present at the park nest in the trees in the riparian area adjacent to the river, and some use the river bank for nesting and foraging on small invertebrates. Bank stabilization techniques that include grading or adding structures to the river bank would decrease the amount of available habitat for birds that nest or forage on the banks. Adverse impacts would be short term. Construction would be temporary but could result in short- and long-term loss of habitat and foraging availability. Changes in flow or velocity could shape the channel bed through degradation and other erosive processes, which would further alter the depths and turbidity of the water.

Species of fish present in the portion of Knife River in the park have different habitat requirements such as specific water depths, turbidity, flow, and velocity that may be altered by bank stabilization actions. Changes to flow and velocity characteristics of the river may alter the prey and forage base of fish species in the park. Large erosion events affect the flow and velocity of the river and may cause impacts on fish species and their forage base by altering the depth, width, and turbidity of the river. Changes in river hydrology or turbidity may also affect mollusks, such as freshwater mussels.

Disturbed areas would be revegetated following construction; therefore, adverse impacts would be short term, with the exception of impacts associated with bank armoring, which are anticipated to occur over the long term. Bank stabilization projects could require construction activities to occur in the river channel. Construction would be temporary but could result in short- and long-term loss of habitat availability and increased turbidity, which could adversely impact fish and mollusks in the Knife River. These impacts would be localized and confined to small areas. When implementing bank stabilization, special consideration would be given to the impacts that specific techniques would have on river flow and velocity characteristics as well as mitigation measures to reduce turbidity to minimize impacts on fish and mollusk species (NPS 2014a; USFWS 2001).

Pocket Gopher Control. Pocket gopher management techniques include exclusion, habitat modification, repellents, toxicants, fumigants, or trapping. Some of these techniques have the potential to affect mammals, birds, reptiles, and amphibians. Repellents and toxicants must be applied by hand or through the use of burrow builders, which can result in ground disturbance. Unintentional mortality is possible when large mechanical equipment is used to administer the toxicants, especially to chicks or nesting birds. Some wildlife such as coyotes, raptors, and other scavengers may be negatively impacted through secondary or tertiary consumption of toxicants or poisons through the carcasses of poisoned gophers. However, the likelihood of secondary poisoning is low because pocket gophers spend the majority of their time underground and the carcass would remain underground where it would not likely be encountered by nontarget species (USDA-APHIS, Paulson, pers. comm. 2014; USDA-APHIS, Shellie, pers. comm. 2015). Following standard protocols and regulations for applying toxicants would minimize adverse effects on nontarget species. The desired condition under this alternative is to use a combination of pocket gopher control techniques that would remove pocket gophers from archeological sites in the park. As a result, the pocket gopher population in the park is anticipated to decline noticeably. However, pocket gophers are widespread throughout the surrounding area and North Dakota (Macdonald 2009), and impacts on the pocket gopher populations in the surrounding area or in the context of their range in North Dakota are not anticipated. Nontarget species could enter traps and unintentional mortality could occur; however, because traps are placed underground in existing pocket gopher burrows, the potential for nontarget species mortality would be low. Following standard protocols for placing pocket gopher traps would minimize adverse effects on nontarget species. Impacts on aquatic species are not anticipated to result from pocket gopher management activities because applied toxicants are not anticipated to contact water resources.

Vegetation Management. Vegetation control methods such as prescribed fire, chemical and biological controls, grazing, or mechanical removal would result in ground and habitat disturbance. The use of vegetation management treatments, including reseeding and grazing, could result in beneficial impacts on fish and wildlife resources. Fire could result in unintentional mortality of individuals that are unable to avoid the burn area. Application of chemicals may also impact wildlife through exposure or secondary consumption. All application regulations and chemical label requirements would be followed to minimize harmful effects to wildlife and only those approved by the National Park Service that have minimal ecological effects would be approved. Mechanical removal of vegetation is also associated with ground disturbance. Disruptions and disturbances to the ground, soil, and vegetation would result in short-term, localized impacts on wildlife habitat. These activities would primarily affect terrestrial species, including birds, mammals, and reptiles. If large mechanical apparatus were used to remove vegetation, a risk of unintentional mortality coincides with its use. Impacts on aquatic species are not anticipated to result from prescribed fires, mechanical vegetation removal, or biological controls. Chemicals that are applied to vegetation as a means of vegetation control, would not be applied directly to water resources. If runoff potential is high, or application is occurring near the river, nonselective herbicides that meet aquatic use standards would be used. Furthermore, if chemicals applied for vegetation control were to runoff into the river, impacts are not anticipated; the life cycle of many of the chemicals that would be approved for use is short and the chemicals have a rapid degradation rate in water.

Impacts of Alternative 2

Under this alternative, the maintenance facility and museum collections storage would be relocated to another location in the park, and the existing maintenance facility would be removed. Two potential relocation sites have been identified. Approximately 98% of site 1 is categorized as undifferentiated urban area with the remaining 2% consisting of a planted grass-forb mix. The previously disturbed nature of site 1 limits its value as wildlife habitat. Site 2 is composed entirely of a planted grass-forb mix, which currently provides wildlife habitat. Construction of the new facilities under alternative 2 would result in a loss of habitat for terrestrial wildlife species at the park such as birds, mammals, reptiles, and insects, which would be an adverse impact; however, the permanent conversion of wildlife habitat to developed areas would be less than 1 acre between the two sites. This impact would be small in comparison to the amount of similar habitat available throughout the park. Mixed grass prairie vegetation and other herbaceous vegetation types cover approximately 52% of the park and is found throughout the park. The most recently available vegetation mapping indicates that 23.6 acres of planted grass-forb mix exist in the park (Nadeau et al. 2014). Disturbance to wildlife from construction activities would be localized and temporary and occur in an area currently characterized by higher levels of human activity relative to other areas throughout the park. Demolition of the existing maintenance structures are not anticipated to result in any impacts on wildlife or associated habitat.

Cumulative Impacts. The same past, present, and reasonably foreseeable projects discussed for the no-action alternative would continue to have adverse and beneficial impacts on fish and wildlife resources. Some of the adverse impacts have been minimized through management activities, including the *Exotic Plant Management Plan* and the *Fire Management Plan*, which help to restore and preserve native plants and fish and wildlife habitat. Alternative 2 would contribute both short-and long-term, adverse, cumulative impacts resulting from implementation of bank stabilization techniques and vegetation management treatments as described under "Actions Common to Both Action Alternatives." In addition, the construction of new facilities in the park would contribute to these adverse impacts from the long-term conversion of less than 1 acre of wildlife habitat to developed area for construction of new facilities within the park. The contribution of these adverse impacts under alternative 2 to the cumulative impact would be small relative to the widespread modifications to the native landscape that occurred from past actions such as land cultivation and the introduction of nonnative species.

Conclusion. Beneficial and adverse impacts to fish and wildlife resources are anticipated as a result of bank stabilization techniques, vegetation management, and pocket gopher control activities. Adverse impacts on wildlife habitat from relocation of facilities under alternative 2 would occur; however, they would be small in scale. Less than 1 acre of impact is anticipated, only a portion of which would affect previously disturbed area. In addition, the amount of habitat that would be affected under alternative 2 is small in comparison to the amount of similar habitat available within the park.

Impacts of Alternative 3

Option 1 under alternative 3 would result in impacts similar to those described under alternative 2. The amount of area disturbed for construction of new facilities would be the same (i.e., less than 1 acre); however, because an off-site location has not been identified it is not known what type, if any, of existing wildlife habitat would be affected. Option 1 could result in less intense wildlife habitat impacts than alternative 2 because the National Park Service would have more flexibility in identifying an off-site location that would contain less wildlife habitat than the on-site options included under alternative 2. Because the area surrounding the park is largely composed of agricultural areas or urban/developed areas within the town of Stanton, it is anticipated that impacts on fish and wildlife habitat for option 1 would not exceed that described for alternative 2. Under option 2, the National Park Service would lease existing space for relocation of facilities, which is not anticipated to affect fish and wildlife resources and associated habitat. Disturbance to wildlife from construction activities would be localized and temporary. Demolition of the existing maintenance structures are not anticipated to result in any impacts on wildlife or associated habitat.

Cumulative Impacts. Cumulative impacts as a result of alternative 3, option 1, are anticipated to be the same as those described for alternative 2. Cumulative impacts under alternative 3, option 2, would be less intense than those described for alternative 2.

Conclusion. Impacts caused by building new facilities off-site are anticipated to be equal to or slightly less than those described in alternative 2. The maintenance structures in the park would be removed, and the site restored. The size of impact would be relatively small compared to habitat in the surrounding area. Under option 2, impacts caused by leasing facilities off-site are anticipated to be less than those described for alternative 2 because new structures would not be built.

Impacts of the Preferred Alternative

Under the preferred alternative, the National Park Service would keep the museum collections storage in place if efforts to address water infiltration issues are successful. In the event efforts are ultimately unsuccessful, the museum collections storage would be moved off-site. In addition, under the preferred alternative, the National Park Service would identify land through a General Services Administration build-lease arrangement to build an off-site maintenance facility to suit park needs. However, based on supply and regulatory constraints, this action is currently not feasible. As such, the National Park Service is seeking to relocate and construct the maintenance facility in the parks, unless the opportunity to lease or build off-site arises. Under the preferred alternative, the National Park Service would implement all aspects of the adaptive management framework including a priority list of archeological resources and measures to address riverbank erosion, pocket gopher activity, and vegetation encroachment. Under the preferred alternative, impacts on fish and wildlife resources would be the same as those described under alternative 3 and would include adverse impacts associated with the demolition of the existing maintenance facility and potential adverse impacts from the construction of a new off-site facility.

Impacts from bank stabilization techniques, pocket gopher control, and vegetation management would be the same as those presented under "Impacts Common to Both Action Alternatives." As described above, if suitable land or lease options for an off-site facility cannot be identified, the National Park Service would defer to building a new maintenance facility in the park, and under this scenario, impacts would be the same as those described under alternative 2.

Cumulative Impacts. Cumulative impacts are anticipated to be the same as those described under alternative 2 or 3, depending on the new facility considerations discussed previously.

Conclusion. Impacts of the preferred alternative would be the same as those described under alternative 3 and "Impacts Common to Both Alternatives." If the water infiltration project being implemented under the no-action alternative proves successful, the museum collections storage would not be relocated unless the park identifies funding or partnership opportunities to relocate the museum collection from the basement to a more suitable location. If the collection is moved, it would be done in consultation with the MHA Nation tribal historic preservation officer and North Dakota state historic preservation officer and comply with NPS museum collection standards. If suitable off-site property or lease arrangements for a new maintenance facility cannot be identified, the National Park Service would defer to building a facility on-site, and impacts would be the same as those described under alternative 2. Cumulative impacts would be the same as those described under alternatives 2 or 3, respectively.

IMPACTS OF THE ALTERNATIVES ON SPECIAL-STATUS SPECIES

Guiding Regulations and Policies

The National Park Service has a responsibility to meet its obligations under the Organic Act and the federal Endangered Species Act of 1973 to conserve listed species and prevent detrimental effects on listed, threatened, or candidate species as a result of any proposed action. The Endangered Species Act mandates that all federal agencies consider the potential effects of their actions on threatened and endangered species and species of special concern. If the National Park Service determines that an action may adversely affect a federally listed species, consultation with the US Fish and Wildlife Service is required to ensure that the action would not jeopardize the species' continued existence or result in the destruction or adverse modification of critical habitat. NPS *Management Policies 2006* state that the potential effects of agency actions will also be considered on state or locally listed species.

Methods and Assumptions

Scientific literature was reviewed and used to describe the effects of archeological resource preservation and resource management on special-status species, including the least tern and the northern long-eared bat. In addition, literature and applicable studies that could provide information on the proposed actions and the impacts they could present special-status species in the park were reviewed. This information was used to augment the on-site observations and documentation gathered by NPS personnel at the park and the advice of internal, external, and USFWS resource management experts to support the qualitative and quantitative statements presented in this impact analysis section. When applicable, GIS analysis also contributed to the assessment of impacts for special-status species.

Area of Analysis

The geographic study area for this plan is the park. Specifically, this includes all areas in the park boundary, including the portion of Knife River in the park.

Impacts of Alternative 1 (No-Action Alternative)

The no-action alternative includes actions that are currently in use at the park to manage and protect archeological resources. Management actions under this alternative that have the potential to affect species of special-status include bank stabilization and vegetation management actions.

Least Tern. Least terns nesting and living on the Missouri River may use the Knife River in the park for foraging. Installation and construction of bank stabilization projects would result in disturbance to the Knife River at the location of each individual project. Individual bank stabilization techniques are described in table 4-2. Impacts associated with bank stabilization techniques would be short- and long-term, ranging minor to major intensity. Disturbed areas would be revegetated following construction; therefore, adverse impacts would be short term. In addition, bank stabilization projects may require construction activities to occur in the river channel. Construction would be temporary but could result in short-term loss of foraging habitat for least terns. However, least tern populations are not expected to be affected because of the size of available foraging habitat in the Missouri River. Impacts would be short term and localized.

Ongoing pocket gopher trapping and vegetation management activities would not have an effect on least terns or their foraging habitat.

Northern Long-eared Bat. Northern long-eared bats use trees that are at least 3 to 5 inches in diameter for roosting, especially in riparian areas. Under alternative 1, bank stabilization techniques have the potential to affect the northern long-eared bat if tree removal is necessary or required. North Dakota is in northern long-eared bat range, but not within the white-nose syndrome buffer zone, and under the 4(d) rule, incidental take is exempted from Endangered Species Act prohibitions (USFWS 2016b). Under the no-action alternative, bank stabilization activities would be implemented in reaction to or as an emergency response to a large erosion event. Installation and construction of bank stabilization projects would disturb trees in the riparian area at the location of each individual project. Disturbed areas would be revegetated following construction. As a result, adverse impacts would be temporary, with the exception of the loss of mature trees used for northern long-eared bat roosting, where impacts would be long term. Because bank stabilization activities would be implemented in reaction to or as an emergency response to a large erosion event, exact timing and duration of construction activities cannot be predicted. However, construction would be temporary but could result in both short- and long-term loss of trees and habitat availability along the Knife River.

Ongoing gopher trapping and vegetation management activities would not have an effect on northern long-eared bats or their habitat.

Cumulative Impacts. Past, present, and future activities have the potential to affect special-status species, both adversely and/or beneficially. Adverse impacts have accrued to special-status species from past land cultivation, livestock grazing, introduction of nonnative species, timber harvesting, and gravel and quarry operations. The operation of Garrison Dam has also resulted in adverse impacts on special-status species. Direct and indirect, adverse impacts from these activities include loss of or decline in quality of native prairie habitat, loss of forested riparian areas, and reduction in cottonwood regeneration along the river. Land cultivation, livestock grazing, the introduction of exotic species, timber harvesting, and gravel and quarry operations have removed or altered native prairie habitat. The operation of Garrison Dam has and will continue to restrict overbank flooding, limiting the ability for cottonwood stands to regenerate and reducing riparian habitat along the river.

Beneficial impacts on special-status species have occurred would continue to occur into the future from the implementation of the following plans:

- *Exotic Plant Management Plan* (NPS 2005)
- *Fire Management Plan* (NPS 2008c)

Overall, these actions contribute to long-term, adverse and beneficial, cumulative impacts on special-status species. The no-action alternative would have potential for short-term, adverse impacts on special-status species and would contribute to long-term, adverse, cumulative effects.

Conclusion. The no-action alternative would result in short- and long-term, adverse impacts on special-status species and as such would contribute to adverse, cumulative effects. Adverse impacts on special-status species are not anticipated to be significant because of the relatively low probability that least terns are using the Knife River for forage. In accordance with section 7 of the Endangered Species Act, alternative 1 may affect but would not likely adversely affect least terns, but could adversely affect northern long-eared bats if tree removal is required for bank stabilization activities. However, because park is located outside of the white-nose syndrome zone, there are no incidental take prohibitions for the northern long-eared bat.

Impacts Common to Both Action Alternatives

Bank Stabilization Techniques. Bank stabilization techniques under this alternative include soil bioengineering, bank armoring, flow diversion, energy reduction, geotechnical slope stabilization, and channel reconfiguration. Installation and construction of bank stabilization projects would result in disturbance to the Knife River at the location of each individual project. Bank stabilization projects may require construction activities to occur in the river channel, and while construction would be temporary, it could result in short-term loss of foraging habitat for least terns. It is not anticipated that least tern populations would be affected considering the size of available foraging habitat in the Missouri River. Impacts on the northern long-eared bat could occur if tree removal is necessary or required, but disturbed areas would be revegetated following construction. Impacts would be both short and long term and localized.

Pocket Gopher Control. Least terns would not be affected by pocket gopher control techniques.

Northern long-eared bats would not be affected by the pocket gopher control techniques included in the action alternatives.

Vegetation Management. Potential least tern foraging habitat that occurs in the Knife River in the park would not be affected by vegetation management actions.

Possible roosting trees in the park are found in the riparian corridor along the Knife and Missouri Rivers. Vegetation management for the purposes of archeological resources protection would not occur in these areas. As a result, northern long-eared bats would not be affected by vegetation management actions.

Impacts of Alternative 2

Alternative 2 includes the construction of a visitor center addition to accommodate museum collections storage, construction of a new maintenance facility at a site near the existing visitor center, and demolition of the existing maintenance facility. These actions would have no impact on least terns because least terns would not occur in the areas that would be affected. No impacts on northern long-eared bats are anticipated from demolition of the existing maintenance facility because no tree removal would be required. Likewise, no tree removal is anticipated in site 2 where the new maintenance facility would be constructed. Tree removal would likely be necessary for development in site 1, potentially resulting in short-term, direct, adverse impacts on northern long-eared bats, which have been documented in the vicinity of the visitor center (NPS 2016a). Impacts would likely be minimal because the trees that would be removed under alternative 2 are not in a riparian area and thus are not likely suitable roosting trees. Adverse impacts would occur primarily as a result of noise and visual disturbances during construction activities. Northern long-eared bats temporarily displaced by construction activities under alternative 2 would likely use adjacent areas of the park for foraging.

Cumulative Impacts. Alternative 2 would not result in significant impacts on least terns. Thus, there would be no significant cumulative impact on least terns. Adverse impacts of alternative 2 on northern long-eared bats from bank stabilization activities would represent a small contribution to overall cumulative impacts to the species. Past and ongoing actions such as land cultivation, timber harvesting, gravel and quarry operations, and the influence of the operation of Garrison Dam on cottonwood forest regeneration have had a much larger contribution to the overall cumulative impact on the species.

Conclusion. Alternative 2 has the potential for adverse impacts on least terns if bank stabilization projects, including those implemented under the adaptive management plan, disrupt least tern foraging habitat. These impacts would be temporary during construction, and other foraging habitat is located nearby on the Missouri River. The exact timing and location of adaptive management measures cannot be predicted at this time. In addition, although least terns are known to nest and forage on the Missouri River adjacent to the park, their use of the Knife River upstream of its confluence with the Missouri River has not been documented. Under the requirements of section 7 of the Endangered Species Act, it is anticipated that alternative 2 may affect, but would not likely adversely affect least terns.

Tree removal and construction activities associated with the new visitor center under alternative 2 would result in short-term, direct, adverse impacts on northern long-eared bats. Long-term, adverse impacts may occur if bank stabilization projects require the removal of roosting trees. Northern long-eared bats are known to occur at the park (NPS 2016a) and an abundance of suitable roosting trees exist in the peninsula area of the park and near the park. As stated previously, the US Fish and Wildlife Service's final 4(d) rule indicates that there are no prohibitions on incidental take for areas of the country not affected by white-nose syndrome. The US Fish and Wildlife Service states that regulating incidental take outside the white-nose syndrome zone will not influence the future impact of the disease throughout the species' range or the status of the species (USFWS 2016b). The park is located outside of the white-nose syndrome zone. In accordance with section 7 of the Endangered Species Act, alternative 2 may adversely affect northern long-eared bat but would comply with the Endangered Species Act because there are no incidental take prohibitions. Therefore adverse impacts on the northern long-eared bat would not be significant.

Impacts of Alternative 3

Impacts on special-status species under alternative 3 would be the same as those described for alternative 2. Although off-site locations for construction of new facilities have not been identified, the National Park Service would not select an off-site location that would have a significant, adverse impact on special-status species.

Cumulative Impacts. Cumulative impacts under alternative 3 would be the same as those described under alternative 2.

Conclusion. Impacts on special-status species under alternative 3 would be the same as those described for alternative 2 and are not anticipated to be significant. Section 7 Endangered Species Act determinations would be the same as those described for alternative 2.

Impacts of the Preferred Alternative

Under the preferred alternative, the National Park Service would keep the museum collections storage in place provided that efforts to address water infiltration issues are successful. In the event efforts are ultimately unsuccessful, the museum collections storage would be moved off-site. In addition, under the preferred alternative, the National Park Service would identify land through a General Services Administration build-lease arrangement to build an off-site maintenance facility to suit park needs. However, based on supply and regulatory constraints, this action is currently not feasible. As such, the National Park Service is seeking to relocate and construct the maintenance facility in the park, unless the opportunity to lease or build off-site arises. Under the preferred alternative, the National Park Service would implement all aspects of the adaptive management framework including a priority list of archeological resources and measures to address riverbank erosion, pocket gopher activity, and vegetation encroachment. Under the preferred alternative, impacts on special-status species would be the same as those described under alternative 3 and would include adverse impacts associated with the demolition of the existing maintenance facility and potential adverse impacts from the construction of a new off-site facility.

The impacts from bank stabilization techniques, pocket gopher control, and vegetation management would be the same as those presented under "Impacts Common to Both Action Alternatives." As described above, if suitable land or lease options for an off-site facility cannot be identified, the National Park Service would defer to building a new maintenance facility in the park. Under this scenario, impacts would be the same as those described for alternative 2.

Cumulative Impacts. Cumulative impacts are anticipated to be the same as those described under alternative 2 or 3, depending on the new facility considerations discussed previously.

Conclusion. Impacts of the preferred alternative would be the same as those described for alternative 3 and the impacts common to both action alternatives. If the water infiltration project being implemented under the no-action alternative proves successful, the museum collections storage would not be relocated unless the park identifies funding or partnership opportunities to relocate the museum collection from the basement to a more suitable location. If the collection is moved, it would be done in consultation with the MHA Nation tribal historic preservation officer and North Dakota state historic preservation officer and comply with NPS museum collection standards. If suitable off-site property or lease arrangements for a new maintenance facility cannot be identified, the National Park Service would defer to building a new facility on-site and impacts would be the same as those described for alternative 2. Cumulative impacts would be the same as those described for alternatives 2 or 3, respectively.

IMPACTS OF THE ALTERNATIVES ON WATER QUALITY, WATER RESOURCES, AND WETLANDS

Guiding Regulations and Policies

NPS *Management Policies 2006*, specifically, "Chapter 4: Natural Resources," states that "the National Park Service will strive to understand, maintain, restore, and protect the inherent integrity of the natural resources, processes, systems, and values of the parks while providing meaningful and appropriate opportunities to enjoy them" (NPS 2006a). This includes surface waters and water quality. NPS *Management Policies 2006* also direct the National Park Service to manage watersheds as complete hydrologic systems and manage stream processes, such as erosion and deposition. Director's Order 77-1 requires that the National Park Service avoid adverse impacts on wetlands to the extent practicable, minimize any impacts that could not be avoided, and compensate for any remaining unavoidable adverse impacts (NPS 2012). Bank stabilization techniques that may be implemented along the Knife River could affect wetlands associated with the riverbed and banks. Further evaluation of wetland impacts through a statement of findings for wetlands would be required at the time that specific projects are implemented. Any necessary permits associated with the work would also have to be completed during the planning and design of specific projects.

Construction activities would be guided by state and federal laws, including the Clean Water Act (sections 401 and 404), the Rivers and Harbors Act, and regulations associated with the North Dakota Pollutant Discharge Elimination System program and permit. According to the North Dakota Century Code 61-33 and the North Dakota Administrative Code article 89-10, work within the ordinary high water mark of navigable streams or sovereign lands is administered by the state engineer and requires a permit. North Dakota Century Code (chapter 61-16) also regulates projects that affect a floodway.

Methods and Assumptions

The analysis of potential impacts on water quality, water resources, and wetlands focused on the expected extent of effects on stream flows and velocity, disturbance to the stream bed and banks, wetlands, and water quality. Existing data, studies, reports, water quality standards, and information provided by NPS staff and other agencies on river flow, bank erosion, local geomorphological conditions, wetlands and water quality of the Knife River and surrounding water resources were analyzed.

Area of Analysis

The area of analysis includes the Knife River in the boundaries of the park and portions of the Knife and Missouri Rivers that are upstream and downstream from the park. Water quality issues for smaller wetlands and water resources affected by construction and management actions outside the park were also considered. The cumulative impact analysis considers projects that could affect bank erosion, water movement, and water quality of the Knife and Missouri Rivers as well as associated wetlands.

Impacts of Alternative 1 (No-Action Alternative)

Under the no-action alternative, current factors affecting water quality, water resources, and wetlands and management of water resources and wetlands in the area of analysis would continue. Natural riverbank erosion and associated changes to river flow, channel morphology, riverine wetlands, and sediment loading would continue to occur. Bank repair and stabilization actions would be implemented when necessary and when identified as a necessary emergency action to protect archeological resources. Riverbank erosion is a natural process that promotes river health; implementation of bank stabilization projects that would alter or prevent this process would represent a long-term, adverse impact on water quality, water resources, and wetlands. Bank stabilization projects would also result in adverse impacts on turbidity, water chemistry, channel morphology, and sediment transport that would be short term during the implementation of the project and, in some cases, long term, lasting for the life of the project. Informal and opportunistic monitoring of the condition of the river and banks would occur with specific annual monitoring only on active riverbank erosion sites. Erosion and associated sediment loading would persist in unstabilized areas of active erosion. The continuation of current park management, including reactive park emergency response, would result in further deterioration of channel morphology, river flows, riverbank conditions, riverine wetlands, and water quality and result in long-term, adverse impacts on water quality, water resources, and wetlands.

Cumulative Impacts. Several past, present, and reasonably foreseeable future actions have the potential to affect hydrology, bank erosion and river movement, and water quality of the Knife River in and near the park.

Past, present, and reasonably foreseeable future operation of Garrison Dam affect the hydrologic regime of the Knife River. Prior to the construction of the dam, the Missouri River transported large suspended sediment loads. Construction of Garrison Dam was completed in 1953, and the dam began to trap and store sediment, resulting in degradation in downstream reaches of the Missouri River, including at the confluence of the Knife River. Over time, rates of erosion and deposition have declined from the maximum levels observed immediately after construction. Reduced sediment loads and modified hydrogeomorphic processes resulted in an increase in riverbed degradation (channel incision) and channel widening, and a decrease in island and sandbar formation. The system adjusted to this degradation by lowering the baseflow of the Knife River (Ellis 2005). The lower base level allowed peak flows from the Missouri River to backup into the Knife River, further altering the hydrologic regime and wetlands in the floodplain resources and riparian areas. Additionally, this backup flow changed channel morphology and the erosion processes acting on the lower Knife River and the associated riverine wetlands. Flow velocity and sediment concentration are greater in the Knife River at its confluence with the Missouri River, which has resulted in sediment deposition and the formation of an island (Ellis 2005). The operation of Garrison Dam will continue to have similar regional impacts.

The past actions of land cultivation, livestock grazing, timber harvesting, and gravel and quarry operations disturbed land and removed vegetation throughout the park, including on the river bottoms. These actions resulted in adverse impacts on the water quality of the Knife River. Land cultivation for the production of agricultural crops disturbed soils and removed native floodplain, wetland, and riparian vegetation leading to the increased potential for sediment loading into the Knife River and eliminated wetland functions. Livestock grazing on floodplain resources, river bottoms, and associated wetlands modified the native woodland and wetland vegetation, allowing for increased erosion and sedimentation. Additionally, the presence of livestock on the river bottoms upstream of the park likely increased bacteria loading to water resources from the direct deposition or indirect runoff of manure. Past timber harvesting operations in the park removed trees and increased the potential for soil erosion and sediment loading into the river and associated wetlands.

Bank stabilization projects implemented at the Sakakawea site and Taylor Bluff Village in 1979, 1984–1985, and 2009 affected Knife River hydrology, bank erosion, river movement, and riverine wetlands. These projects minimized or eliminated unnatural bank erosion and movement at these sites, resulting in beneficial impacts on bank erosion. The project also altered the river channel and banks, which modified the wetlands in these areas. Bank stabilization measures can alter hydrologic regimes and lead to erosion upstream and downstream of the stabilized areas.

Past, present, and reasonably foreseeable future land management actions in the Knife River watershed upstream of the park have affected and likely will continue to affect water quality. These actions include pesticide use, development, cultivation, and livestock feeding operations. Each upstream land use disturbs soil and contributes sediment and other pollutants (e.g., pesticides) to the river either through direct inputs or indirect loads associated with stormwater runoff. Cultivation and livestock feeding operations degrade water quality by contributing nutrient and bacteria loads. Impervious surfaces associated with upstream development increase the volume and velocity of stormwater runoff. Altering the runoff entering the river can affect natural hydrogeomorphological processes and result in increased potential for riverbed and bank erosion and changes in channel morphology and riverine wetlands.

Overall, the no-action alternative would contribute adversely to cumulative impacts. This contribution would be appreciable because of the potential for natural river processes to be altered.

Conclusion. Under the no-action alternative, natural riverbank erosion from flooding and ice jams and unnatural erosion from the altered riverine systems would continue, especially in unstabilized areas, as would associated effects on channel morphology and sediment loading. Emergency bank stabilization projects to protect archeological resources may be taken in reaction to an erosion event and would adversely impact hydrology and water resources of the Knife River. The operation of Garrison Dam would continue to affect the flow regime in the lower reaches of the Knife River. The no-action alternative would contribute adverse impacts to the impacts of past, present, and reasonably foreseeable actions. This contribution would be appreciable because of the potential alteration of natural river processes upstream, downstream, and in the park. Appreciable adverse impacts on water quality, water resources, and wetlands in the park would occur and could be significant, depending on the type and scale of river alteration.

Impacts Common to Both Action Alternatives

Bank Stabilization Techniques. Bank stabilization techniques can impact water quality, surface elevation, flow velocity, slope, erosion and deposition processes, riverbed and banks and associated riverine and riparian palustrine wetlands, and channel morphology across various riverine spatial scales (Fischenich 2001). The magnitude and direction of the impacts depend on the watershed, the site-specific characteristics of the river, and the location and type of other bank stabilization measures and control features (Fischenich 2001). Depending on the specific bank stabilization technique, construction activities would directly affect riverbed and banks and riverine and riparian palustrine wetlands. Although bank stabilization techniques provide protection for the treated area, the interaction of stream flows with the stabilized area could transfer energy and high water volumes to an unprotected area and cause bank and wetland degradation in areas (typically downstream) that would not have experienced these high flows if not for the presence of the stabilized area. The hydrogeomorphic processes that erode riverbeds, banks, and wetlands; transport sediment; and reform river channels and riparian areas are natural mechanisms that allow the riverine ecosystem to adapt and adjust to changing conditions. These processes are necessary to maintain riverine ecological functions and habitat and the natural evolution of the system. However, as a result of the anthropogenic influence on the local watersheds, many of the natural processes affecting the park area have been altered, resulting in instability. In general, using an adaptive management framework would minimize these negative effects and provide beneficial impacts on water quality, water resources, and wetlands in the unnaturally modified system by allowing for site-specific design and implementation of treatment techniques for bank stabilization based on a predetermined system-wide outcome rather than performed on an emergency basis on a local scale. Bank stabilization processes that are implemented as part of the site-specific design and system approach would minimize or eliminate unnatural erosive processes, resulting in beneficial impacts on bank erosion. This approach also allows the long-term scale of hydrogeomorphic processes to be considered. The ability for revisions and adjustments throughout the adaptive management process would allow the stabilization techniques to perform more effectively in the frequently unstable environment of the existing river system and ensure that the techniques are successful at meeting objectives. Bank stabilization techniques that may be implemented along the Knife River could affect both riverine and palustrine wetlands associated with the riverbed and banks and associated riparian areas. The specific impacts, either adverse or beneficial, would depend on the type of technique used, location, and the existing condition of the wetland. At this time, enough information is not available concerning the type and location of bank stabilization techniques that would be implemented. Therefore, further evaluation of wetland impacts through a statement of findings for wetlands would be required at the time that specific projects are implemented.

Soil bioengineering — Soil bioengineering incorporates engineering techniques and ecological processes that use natural and living materials to protect riverbanks and riverine wetlands from erosion and stabilize and restore degraded banks. These techniques use "softer" materials (e.g., vegetation) compared to bank armoring (e.g., where hard materials such as rock is sometimes used as protective measures while vegetation becomes established). Frequently, multiple bioengineering techniques are used together. The hard materials protect the toe of the bank and the vegetation helps to stabilize the upper portion of the bank, resulting in beneficial impacts on unnatural bank erosion. During construction activities, the banks and associated wetlands would be disturbed, resulting in increased potential for sediment or other construction-related pollutant loading into the river. In addition, some measures require more modifications or excavation of the bank, thereby disturbing the bank and associated wetlands to a greater extent. Soil bioengineering would result in direct, short-term, adverse impacts on water quality and riverine and potential riparian palustrine wetlands during construction from added sedimentation. Best management practices would be used to minimize and prevent sediment and other pollutants from entering the surface water.

Bioengineering techniques using large woody vegetation could create roughness and increase water surface elevation and decrease velocity on localized scales resulting in long-term impacts on hydrology. Techniques that narrow the cross section of the river, such as tree revetments and live cribwalls, would result in more impacts on surface elevation, velocity, and riverine wetlands. Until the plantings become established, the lack of a natural riparian buffer would have adverse impacts on water quality and riparian palustrine wetlands. Riverine wetland and riparian buffer functions such as filtering sediment and nutrients from overland surface water runoff, shading and moderating river water temperature, and attenuating flood waters would be limited. If any existing riverine or riparian palustrine wetlands are degraded, the soil bioengineering technique could provide benefits in the form of improved infiltration capacity, flood flow storage and attenuation, and contaminant filtration.

Overall, soil bioengineering would have direct short-term, adverse impacts on water quality from sediment loading during construction and indirect, short-term, adverse impacts from the loss of riverine wetland and riparian buffer functions until vegetation is reestablished. Indirect long-term, adverse impacts on hydrology would result from the modified flow velocity. Overall, impacts on unnatural bank erosion and potentially on riverine and/or palustrine wetlands would be long term and beneficial.

Bank armoring — Bank armoring places hardened materials on riverbanks for protection. Using this technique would deviate from the NPS *Management Policies 2006* that recommend "visually nonobtrusive" techniques that "protect natural processes to the greatest extent practicable" (NPS 2006a). However, the impacts of shear stress and ice scour on the riverbanks may necessitate using bank armoring in place of other bank stabilization techniques to successfully protect and preserve the banks under these conditions. The use of this technique would be determined on a project by project basis. During construction activities, banks and associated wetlands would be disturbed, resulting in an increased potential for sediment or other construction-related pollutant loading into the river. Bank armoring would result in direct, short-term, adverse impacts on water quality and riverine wetlands during construction from added sedimentation. Best management practices would be used to minimize and prevent sediment and other pollutants from entering the surface water.

Armoring protects riverbanks from local erosive forces and prevents riverbank-based sediment loading. Additionally, diverting erosive flows tends to scour the riverbed and bank at the toe of the armoring structure. Downstream and local toe erosion could be minimized through appropriate design, construction, and placement of the structure and would have beneficial impacts on bank erosion. The lack of a natural riverine wetland and riparian buffer would also have long-term, adverse impacts on water quality because wetland and buffer functions, including filtering sediment and nutrients from overland surface water runoff, shading and moderating river water temperature, and attenuating flood waters would not be performed. Bank armoring typically does not affect water surface elevation and velocity and has minimal impacts on hydrology (Fischenich 2001).

Overall, bank armoring would have direct, short-term, adverse impacts on water quality from sediment loading during construction, direct, long-term, adverse impacts from the loss of riverine wetland, and potentially direct, long-term, adverse impacts from the loss of riparian wetland functions. Overall impacts on unnatural bank erosion would be long term and beneficial.

Flow diversion — Flow diversion techniques attempt to redirect flows away from eroding banks by placing structures in the river channel to reduce bank erosion. The structures usually constrict the channel width. During construction activities, the river channel and banks and riverine wetlands would be disturbed, resulting in increased potential for sediment or other construction-related pollutant loading into the river. Bank disturbance is usually less than that associated with other bank stabilization techniques. Impacts on water quality would be direct, short-term, and adverse during construction from added sedimentation. Best management practices would be used to minimize and prevent sediment and other pollutants from entering the surface water.

Diversion structures that create roughness and/or decrease the channel cross-section lead to an increase in water surface elevation and velocity as well as changes to secondary currents. The narrowed channel width results in an increase in local flow velocity as water passes the structure; however, upstream velocity is reduced. Riverine wetlands would experience the same impacts as the river channel. Changes in water surface elevation and flow regimes from diversion structures typically result in bed scouring and deepening as well as sediment deposition (Fischenich 2001). Scouring could occur close to the ends of the structure, whereas deposition could occur downstream of the structure as the velocity diminishes. Scouring processes and impacts could be minimized through appropriate design, construction, and placement of the flow diversion structure, resulting in beneficial impacts on unnatural bank erosion. Depending on the changes to flow, the impacts from diversion structures can occur both upstream and downstream of the structure. Changes in turbidity, water chemistry, riverine wetlands, channel morphology, and sediment transport as a result of flow diversion techniques may last the life of the project and would result in long-term, adverse impacts.

Overall, flow diversion would have direct, short- and long-term, adverse impacts on water quality from sediment loading during construction and direct, long-term, adverse impacts on riverine wetlands and local hydrology from altering the river cross section. Overall impacts on unnatural bank erosion would be long term and beneficial.

Energy reduction — Energy reduction methods place structures in the stream channel to reduce the kinetic energy and erosive forces of the water flow. During construction activities, the river channel and riverine wetlands would be disturbed, resulting in increased potential for sediment or other construction-related pollutant loading into the river. Impacts on water quality during construction would be direct, short term, and adverse as a result of added sedimentation. Best management practices would be used to minimize and prevent sediment and other pollutants from entering the surface water flow. Examples of best management practices include general erosion and sediment control practices (e.g., sediment basins, silt fences or curtains, vegetative buffers, erosion control blankets) and instream construction techniques (i.e., temporary flow diversions and dams or barriers) (NDDH 2015b; VADCR 2004).

As kinetic energy is reduced, it is converted to potential energy that can manifest in elevated water surfaces. Grade control structures and channel blocks can increase water elevation and reduce flow velocity upstream of the treatment structure, thereby resulting in indirect, long-term impacts on hydrology (Fischenich 2001). Upstream alterations to water elevation and velocity cause sediment to settle out of the flow, while changes to elevation and velocity can create scour pools downstream from the energy reduction structures (Fischenich 2001; Florsheim et al. 2008). Scouring processes and impacts could be minimized through appropriate design, construction, and placement of the energy reduction structure.

Overall, energy reduction techniques have direct, short-term, adverse impacts on water quality and riverine wetlands from sediment loading during construction and direct, long-term, adverse impacts on local hydrology and riverine wetlands from the alteration of river cross section. Overall impacts on unnatural bank erosion would be long term and beneficial.

Geotechnical slope stabilization — Geotechnical slope stabilization methods modify the riverbank to prevent slope failures and bank instability and protect the toe of the bank from erosion by regrading, soil reinforcement, and drainage measures. During construction activities, most slope stabilization techniques disturb riverbanks and associated riverine and riparian wetlands. This disturbance would result in increased potential for sediment or other construction-related pollutant loading into the river. Slope stabilization would result in direct, short-term, adverse impacts on water quality during construction from added sedimentation. Best management practices would be used to minimize and prevent sediment and other pollutants from entering the surface water.

Any slope stabilization technique that provides enough bank roughness could change local water surface elevations or velocity. However these changes would be minimal, resulting in negligible impacts on hydrology. Slope stabilization would protect the bank from erosion, but it would redirect the energy to scour the toe of the structure. Bank grading can alter secondary currents leading to sediment deposition, the formation of point bars, and changes to bed depth. Upstream or downstream erosion as a result of slope stabilization is usually minimal, and these processes and toe scouring could be prevented through appropriate design, construction, and placement of the structure. Additionally, the lack of a natural riverine wetland and riparian buffer would have adverse impacts on water quality. Wetland and riparian buffer functions such as filtering sediment and nutrients from overland surface water runoff, shading and moderating river water temperature, and attenuating flood waters would be limited or eliminated depending on the amount of planting incorporated into the design. If riverine or riparian palustrine wetlands are present, the geotechnical slope stabilization technique could result in direct, adverse impacts on wetlands from disturbance and disruption of wetland functions such as infiltration capacity, flood flow storage and attenuation, and contaminant filtration.

Overall, slope stabilization techniques have direct, short-term, adverse impacts on water quality because of sediment loading during construction and direct, long-term, adverse impacts from the loss of riverine and potential riparian wetland functions during vegetation establishment. Overall impacts on unnatural bank erosion would be long term and beneficial.

Channel development — Channel development uses large-scale modification of existing channel morphology to alter and ameliorate erosive flow regimes. During construction activities, the river channel and banks and riverine wetlands would be disturbed and the potential for sediment or other construction-related pollutant loading into the river would be increased. Channel development would result in direct, short-term, adverse impacts on water quality during construction from added sedimentation. Best management practices (i.e., general erosion and sediment control practices such as sediment basins, silt fences or curtains, vegetative buffers, erosion control blankets, as well as instream construction techniques such as temporary flow diversions and dams or barriers) would be used to minimize and prevent sediment and other pollutants from entering the surface water (NDDH 2015b; VADCR 2004).

Channel development techniques are based on the general principles of water movement in relation to channel morphology to alleviate the erosive force of the existing flow regime on riverbanks, especially those that are actively eroding. Although the techniques likely would allow for more rapid movement of river flow past areas of active bank erosion and reduce high river levels, they may not prevent future bank erosion and movement or modification of riverine wetlands. Changing the channel slope or cross section width would typically result in changes to the water surface elevation and flow velocity (Fischenich 2001) and would alter riverine wetlands. Channel widening could reduce the flow velocity and associated erosion, whereas the creation of a side diversion channel could provide additional capacity for high water events. Hydrology would be altered considerably. Channel development techniques could also reconnect a river channel to its floodplain resource and associated riparian wetlands, which could minimize flood flows and associated erosion. Channel development techniques have the potential to create both riverine and riparian palustrine wetlands that result in wetland benefits in the form of additional infiltration capacity, flood flow storage and attenuation, and contaminant filtration. If any existing riverine or riparian palustrine wetlands are degraded, the technique could result in beneficial impacts by restoring or improving wetland functions.

Overall, channel development would have direct, short-term, adverse impacts on water quality from sediment loading during construction and indirect, long-term, adverse impacts on hydrology from the alteration of the river flows. Over the long-term, impacts on riverbanks and riverine wetlands would be adverse as a result of bank stabilization and channel reconfiguration that alters natural geomorphic processes. Depending on the channel development techniques, location, and condition of any existing wetlands, impacts on wetlands could potentially be long term and adverse as a result of wetland destruction or long-term and beneficial as a result of the creation of wetlands and restoration of wetland functions.

Table 4-7 summarizes impacts on water quality, water resources, and wetlands from each category of bank stabilization technique.

TABLE 4-7. IMPACTS ON WATER QUALITY, WATER RESOURCES, AND WETLANDS ASSOCIATED WITH BANK STABILIZATION TECHNIQUES

Stabilization Techniques	Stabilization Technique Life Span	Construction Disturbance Level[a]	Impacts on Water Quality and Water Resources
Soil bioengineering	Long term, with root wad having a short-term impact	Ranging from minor to moderate	Potential short-term, adverse impacts on water quality from sediment loading during construction and from the loss of riparian and riverine wetlands functions until the reestablishment of vegetation. Potential adverse impacts on hydrology from the modification of flow velocity. Potential long-term, beneficial impacts on riverine and riparian wetlands from improved wetland functions.
Bank armoring	Long term	Ranging from minor to major	Potential adverse impacts on water quality during construction from added sedimentation and long-term adverse impacts from the loss of riparian and riverine wetlands. Potential long-term, beneficial impacts on river banks from unnatural erosion.
Flow diversion	Both short and long term	Ranging from moderate to major	Potential adverse impacts on water quality during construction from added sedimentation and long-term adverse impacts on riverine wetlands and hydrology from the alteration of the river cross section. Potential long-term, beneficial impacts on river banks from unnatural erosion.
Energy reduction	Long term	Ranging from moderate to major	Potential adverse impacts on water quality during construction from added sedimentation and long-term adverse impacts on riverine wetlands and hydrology from the alteration of the river cross section. Potential long-term, beneficial impacts on river banks from unnatural erosion.
Geotechnical slope stabilization	Both short and long term	Ranging from minor to major	Potential adverse impacts on water quality during construction from added sedimentation and long-term, adverse impacts from the loss of riparian and riverine wetlands. Potential long-term, beneficial impacts on river banks from unnatural erosion.
Channel development	Long term	Major	Potential adverse impacts on water quality during construction from added sedimentation and long-term, adverse impacts on hydrology from river flow alteration. Potential long-term, adverse impacts from riverine and riparian wetland alteration or long-term, beneficial impacts from the creation or restoration of wetland functions.

[a] Construction disturbance level can vary depending on current condition of banks and depends on bank slope / angle of repose necessary for structure technique, as well as depth/footprint of grading needed for installation.

Pocket Gopher Control. Table 4-8 summarizes the impacts of proposed pocket gopher control techniques on water quality, water resources, and wetlands. Chemical toxicants have the potential to adversely impact the water quality of surrounding water resources and wetlands by introducing pollutants into the hydrologic system. Fumigants and gas can also enter water resources and wetlands by diffusion through damp soil; however, the risk of contamination to water sources is low. Aluminum phosphide degrades rapidly in most soil conditions and has a low likelihood of contaminating water resources and wetlands (USEPA 1998). The use of certified applicators, application, and chemicals and fumigants under the direction and regulation of the USDA-APHIS toxicant label and placement of toxicants and fumigants underground and in locations away from surface waters, shallow groundwater resources, or wetlands would prevent and minimize potential adverse impacts on these resources. Several control techniques require temporary soil disturbance, including exclusion fencing, buffer strips, and burrow builder systems. These techniques could increase sedimentation of surrounding surface waters and alter palustrine wetlands. Trapping would have no impacts on water quality, water resources, and wetlands. Pocket gopher control techniques would not affect hydrology or bank erosion and movement. Appropriate application practices and best management practices in the use of pocket gopher techniques would not affect water quality, water resources, and wetlands.

TABLE 4-8. IMPACTS ON WATER QUALITY, WATER RESOURCES, AND WETLANDS ASSOCIATED WITH POCKET GOPHER CONTROL TECHNIQUES

<table>
<tr><th>Management Techniques</th><th>Description</th><th>Efficacy Timeline</th><th>Ground Disturbance Level</th><th>Long-Term Maintenance</th><th>Impacts on Water Resources</th></tr>
<tr><td>Exclusion</td><td>The installation of subsurface and surface fencing to exclude animals from areas</td><td>Immediate</td><td>Minor to major</td><td>Requires ongoing maintenance/replacement.</td><td rowspan="2">Potential adverse impacts as a result of increased sedimentation or water resources and wetland disturbance.</td></tr>
<tr><td>Habitat modification</td><td>Vegetation control and flood irrigation</td><td>Long term</td><td>Minor to major</td><td>Requires ongoing maintenance/replacement.</td></tr>
<tr><td>Toxicants</td><td>Zinc phosphide, chlorophacinone, diphacinone, and strychnine milo</td><td>Long term</td><td>Minor to major</td><td>May require frequent maintenance and reapplication depending on size of gopher population and area.</td><td rowspan="2">Potential adverse impacts as a result of the introduction of pollutants into the hydrologic system.</td></tr>
<tr><td>Fumigants</td><td>Aluminum phosphate and various gas cartridges</td><td>Long term</td><td>Minor</td><td>May require frequent application depending on size of gopher population and area.</td></tr>
<tr><td>Trapping</td><td>Live and lethal trapping</td><td>Immediate to long term</td><td>Moderate</td><td>May require frequent trapping events, depending on size of gopher population and area.</td><td>No impacts on water quality, water resources, and wetlands.</td></tr>
</table>

Vegetation Management. Table 4-9 summarizes the impacts of proposed vegetation management treatments on water quality, water resources, and wetlands. All vegetation management treatments involve the initial clearing of vegetation, which could temporarily increase the potential for soil erosion and associated sedimentation of surrounding surface waters and palustrine wetlands. Depending on the amount of clearing and the remaining vegetation, clearance of all vegetation would have the potential for greater impacts. Reseeding methods associated with cultural treatments would have no impact on surface waters and palustrine wetlands. Application of herbicides have the potential to adversely affect the water quality of surrounding surface waters and palustrine wetlands, by introducing pollutants to the hydrologic system. The use of appropriate herbicide application methods would prevent and minimize the degradation of surface water quality. Grazing practices could introduce bacteria (e.g., *E.coli*) and nutrients into surface waters and palustrine wetlands via nonpoint sources runoff. Prescribed fires can affect both water quality and the local surface runoff regime, depending on the severity of the fire and the local fire regime (USFWS 2009). Prescribed fire removes vegetation and organic matter on the surface and exposes the soil to erosive processes. Fire can reduce the infiltration capacity of soil leading to more surface water runoff during precipitation events.

TABLE 4-9. IMPACTS ON WATER QUALITY, WATER RESOURCES, AND WETLANDS ASSOCIATED WITH VEGETATION MANAGEMENT TREATMENTS

Vegetation Management Treatment	Description	Ground Disturbance	Long-Term Maintenance	Impacts on Water Resources
Cultural treatments	Examples include prevention and reseeding of native herbaceous species following woody vegetation removal. Reseeding method includes hand broadcasting, seed drill, hydroseeding, and seed mats.	Minor to moderate	Requires ongoing prevention practices; periodic spot reseeding and irrigation.	Potential for short-term adverse impacts on water quality as a result of vegetation clearing.
Manual treatments	Includes hand pulling or cutting using small hand tools and shovels. Most manual methods need to be used in combination with pesticides, grazing, or prescribed fire to treat resprouts and new seedlings.	Minor to moderate	Requires spot treatments annually.	Potential for adverse impacts on water quality and palustrine wetlands as a result of vegetation clearing as well as from the introduction of pollutants into the hydrologic system.
Mechanical treatments	Includes pulling, cutting, grubbing, and mowing using weed whippers, mowers, tractor or all-terrain vehicle-pulled mowers, chainsaws, and shovels. Most mechanical methods need to be used in combination with pesticides, grazing, or prescribed fire to treat resprouts and new seedlings. Heavy equipment could be used for treatment	Minor to moderate	Requires spot treatment annually.	

Vegetation Management Treatment	Description	Ground Disturbance	Long-Term Maintenance	Impacts on Water Resources
	of woody species encroachment.			
Chemical treatment	Herbicides applied using portable sprayers, all-terrain vehicles equipped with sprayers, and aerial spraying. Includes spraying, basal bark and stem treatment, cut surface treatment, cut stump treatment, and tree injection.	Minor	Spot treatments the first year; depending on the species requires ongoing spot treatments every 1 to 3 years.	
Prescribed fire treatments	Frequency, intensity, and timing of burning are extremely important. Used in the spring to deter woody species germination. Prescribed fire used as treatment of woody species encroachment needs to be used in combination with mowing, herbicide, or reseeding with native grasses to treat resprouts and new seedlings.	Minor to moderate	Requires continuing treatment practices every 3 to 5 years. (Snowberry requires annual treatment.)	Potential for adverse impacts on water quality as a result of vegetation clearing as well as from the introduction of pollutants into the hydrologic system. Potential adverse impacts on local hydrology as a result of fire impacts on soil properties.
Biological controls	Includes the use of insects and microorganisms to reduce the abundance of an exotic plant. Long-term solution for controlling select exotic plant species.	Minor	Pending reproduction, establishment, and effect of biological control on target vegetation species, more than one release may be necessary for desired level of management.	No Impacts on water quality.
Grazing	Considerations include grazing practice used (i.e., standard grazing, flash grazing, rotational grazing), stocking rate, species of livestock, timing (i.e., spring, summer, fall), and fencing requirements.	Minor	Requires seasonal to continual maintenance.	Potential for adverse impacts on water quality and palustrine wetlands as a result of vegetation clearing and waste from grazing animals.

These effects can lead to short-term increases in sediment loading in local surface waters and long-term alteration to the patterns of local surface water runoff. Fire management techniques that would minimize impacts include consideration of weather; season, and fuel conditions; using qualified crews; avoiding steep slopes; retaining vegetative buffers adjacent to surface waters; use of appropriate firelines; and the use of the lowest-intensity fire necessary (USEPA 2005). Vegetation management treatments would affect water quality; however, they would not affect hydrology, bank erosion and movement, or riverine wetlands. Overall, vegetation management practices would result in indirect, short-term, adverse impacts on water quality, water resources, and wetlands.

Impacts of Alternative 2

The proposed relocation sites for facilities are not located close to any existing surface waters or wetlands. As a result, there would be no impacts on surface waters and wetlands, including water quality from the relocation and construction of new facilities and the removal of the existing facilities. Removal of the existing building would temporarily contribute to soil disturbance. The area of disturbance would be less than 1 acre and would not require a construction general permit or stormwater pollution prevention plan unless the construction could contribute significant pollutants to surface waters or to a violation of the state water quality standard. Construction activities would implement best management practices such as silt fences to minimize and prevent impacts from stormwater runoff and associated erosion. Impervious surface would increase following the relocation of the maintenance facility and museum collections storage. However, the additional impervious surface would be relatively small.

Management actions to address riverbank erosion would be individualized to each active erosion site using the adaptive management process. An adaptive management process would allow for ongoing examination of and potential revisions to the bank stabilization process, if necessary, which would provide the most effective and beneficial actions for each erosion site. The implementation of bank stabilization techniques, pocket gopher control, and vegetation management would result in short- and long-term, adverse and beneficial impacts on water quality, water resources, and wetlands.

Cumulative Impacts. The same past, present, and reasonably foreseeable projects that are discussed for the no-action alternative are considered under alternative 2, and the impacts on water quality, water resources, and wetlands in the Knife River in the vicinity of the park and upstream from these projects would be the same. Alternative 2 would contribute short- and long-term, adverse impacts on water quality to the beneficial and adverse impacts from other past, present, and reasonably foreseeable future projects. The cumulative impact of dam operations and bank stabilization techniques would provide similar adverse impacts on water quality, water resources, and wetlands as those described under "Impacts Common to Both Action Alternatives." The contribution of adverse impacts from alternative 2 would be noticeable because alternative 2 would affect hydrology, riverbanks, wetlands, channel movement, and water quality over the entire area of the park depending on the scale and type of project.

Conclusion. Under alternative 2, management techniques would be implemented using an adaptive management approach that would consider the riverine ecosystem as a whole as well as site-specific issues. There would be long-term, adverse impacts on hydrology following implementation of bank stabilization techniques. Short-term, adverse impacts would result from implementation of the vegetation management treatments and localized, long-term, adverse impacts on water quality and wetlands would be possible following implementation. Depending on the condition of existing wetlands and the type and location of bank stabilization techniques, beneficial impacts to wetlands are possible. Impacts on water quality, water resources, and wetlands from alternative 2 would have the potential to be significant depending on the ultimate scale and number of bank stabilization projects implemented for archeological resources protection. Adverse impacts would occur in the park as a result of modifications to natural river processes, riverbanks, and wetlands. Other bank stabilization projects have already altered the Knife River in the park, and any new impacts associated new bank stabilization projects would be as a result of projects implemented for the preservation of archeological resources, which are central to the purpose and significance of the park.

Impacts of Alternative 3

Alternative 3 would require the construction of new facilities outside the park. Clearing, grading, and other construction activities would disturb and expose soil, resulting in increased potential for soil erosion, sedimentation of surrounding surface waters or wetlands, and accidental release of hazardous materials. Construction would temporarily alter existing stormwater infiltration and drainage patterns. If options 1 or 2 were selected and the new facilities were sited in a previously undisturbed area, there would be an increase in impervious surface. The small area of the disturbance would not require a construction general permit or stormwater pollution prevention plan unless the construction could contribute significant pollutants to surface waters or to a violation of the state water quality standard. However, a stormwater pollution prevention plan would be recommended. Alternative 3 would remove the existing maintenance facility in the park, which would temporarily contribute to soil disturbance. Construction activities would follow best management practices such as silt fences to minimize and prevent impacts from stormwater runoff and associated erosion. Therefore, no impacts on water quality, water resources, and wetlands would occur as a result of the off-site relocation and construction of new facilities because the area of disturbance would be small and best management practices would be followed.

Impacts on water quality, water resources, and wetlands from management techniques described in “Impacts Common to Both Action Alternatives” would occur. Management actions to address riverbank erosion would be individualized to each active erosion site using the site prioritization process. An adaptive management process would allow for ongoing examination of and potential revisions to the bank stabilization process, if necessary, which would provide the most effective and beneficial actions for each erosion site. The implementation of bank stabilization techniques, pocket gopher control, and vegetation management would result in short- and long-term, adverse impacts on water quality, water resources, and wetlands.

Cumulative Impacts. Cumulative impacts for alternative 3 would be the same as those discussed for alternative 2.

Conclusion. Under alternative 3, management techniques would be implemented using an adaptive management approach that would consider both the riverine ecosystem and site-specific issues. There would be long-term, adverse impacts on hydrology until the river stabilizes following bank stabilization projects. Short-term, adverse impacts would result from implementation of the vegetation management treatments and localized long-term, adverse impacts on water quality and wetlands would be possible following implementation. Depending on the condition of existing wetlands and the type and location of bank stabilization techniques, beneficial impacts on wetlands are possible. Impacts on water quality, water resources, and wetlands from alternative 3 would have the potential to be significant depending on the ultimate scale and number of bank stabilization projects implemented for archeological resources protection. Adverse impacts would occur in the park as a result of modifications to natural river processes, riverbanks, and wetlands.

Other bank stabilization projects have already altered the Knife River in the park, and any impacts associated with new bank stabilization projects would be as a result of bank stabilization projects implemented for preservation of archeological resources, which are central to the purpose and significance of the park.

Impacts of the Preferred Alternative

Under the preferred alternative, the National Park Service would keep the museum collections storage in place provided that efforts to address water infiltration issues are successful. In the event efforts are ultimately unsuccessful, the museum collections storage would be moved off-site. In addition, under the preferred alternative, the National Park Service would identify land through a General Services Administration build-lease arrangement to build an off-site maintenance facility to suit park needs. However, based on supply and regulatory constraints, this action is currently not feasible. As such, the National Park Service is seeking to relocate and construct the maintenance facility in the park, unless the opportunity to lease or build off-site arises. Under the preferred alternative, the National Park Service would implement all aspects of the adaptive management framework including a priority list of archeological resources and measures to address riverbank erosion, pocket gopher activity, and vegetation encroachment. Under the preferred alternative, impacts on water resources would be the same as those described under alternative 3 and would include adverse impacts associated with the demolition of the existing maintenance facility and potential adverse impacts from the construction of a new off-site facility.

The impacts from bank stabilization techniques, pocket gopher control, and vegetation management would be the same as those described under "Impacts Common to Both Action Alternatives." As described above, if suitable land or lease options for an off-site facility cannot be identified, the National Park Service would defer to building the new maintenance facility in the park. Under this scenario, impacts would be the same as those described under alternative 2.

Cumulative Impacts. Cumulative impacts are anticipated to be the same as those described under alternative 2 or 3, depending on the new facility considerations discussed previously.

Conclusion. Impacts of the preferred alternative would be the same as those described for alternative 3 and the impacts common to both alternatives. If the water infiltration project being implemented under the no-action alternatives proves successful, the museum collections storage would not be relocated unless the park identifies funding or partnership opportunities to relocate the museum collection from the basement to a more suitable location. If the collection is moved, it would be done in consultation with the MHA Nation tribal historic preservation officer and North Dakota state historic preservation officer and comply with NPS museum collection standards. If suitable off-site property or lease arrangements for a new maintenance facility cannot be identified, the National Park Service would defer to building a new facility on-site, and impacts would be the same as those described under alternative 2. Cumulative impacts would be the same as those described for alternatives 2 or 3, respectively.

IMPACTS OF THE ALTERNATIVES ON FLOODPLAIN RESOURCES

Guiding Regulations and Policies

Executive Order 11988, "Floodplain Management" requires federal agencies such as the National Park Service to assess the likely impacts of actions within floodplain resources and to avoid floodplain resource development and any adverse impacts from the use or modification of floodplain resources when a feasible alternative exists. Specifically, section 1 of the executive order states that an agency is required "to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities." To comply with Executive Order 11988, Director's Order 77-2 and NPS *Management Policies 2006* highlight National Park Service policies on floodplain management, including to protect and restore floodplain values and functions; avoid and minimize floodplain resource development; and minimize impacts that could increase flood risks, hazards, and other environmental issues. Procedures to comply with Executive Order 11988 and NPS floodplain policies are provided in Procedural Manual 77-2. NPS *Management Policies 2006* also guides NPS actions to protect natural stream processes that create floodplains and other habitat features.

Additionally, floodplain development in North Dakota is guided by the North Dakota Century Code 9 (chapter 61-16.2 Floodplain Management) to protect human life and property and reduce impacts from flood events. A development project in a regulatory floodway must obtain a floodway permit or authorization from the local floodplain coordinator.

Methods and Assumptions

The analysis of potential impacts on floodplain resources focused on the expected extent of impacts on floodplain resource functions and values and disturbance to floodplain resource areas. Analysis was based on review of existing published literature and information provided by the National Park Service and other agencies on floodplain resources and flooding conditions of the Knife River and surrounding water resources.

Area of Analysis

The area of analysis includes Knife and Missouri River floodplains in the park. Floodplain resources affected by proposed construction and management actions outside the park were also considered.

Impacts of Alternative 1 (No-Action Alternative)

Under the no-action alternative, current management policies would remain in effect, and factors affecting floodplain resources and management of floodplain resources in the park would continue. Flood flows on the Knife River would occur during snowmelt and ice breakup in spring and during rain events in early summer. Ice jams would also create overbank flows. Channel incision on portions of the river could restrict access to the floodplain resource except during very high flows and lead to localized impacts. Natural processes such as meandering and bank erosion would continue to modify adjacent floodplains in unstabilized areas. The Knife River would have access to most of its floodplain resource during high flows except where existing bank stabilization measures or incision would impede access. The implementation of bank repair and stabilization measures would result in long-term, adverse impacts on floodplain resources by modifying the hydrology in the Knife River, which would affect the floodplain resource. The no-action alternative would result in adverse impacts on floodplain resources and associated functions and values.

Cumulative Impacts. Several past actions have the potential to affect floodplain resource functions and values in the park. Timber harvesting for agricultural and firewood purposes removed native tree species from the park, including in the river bottomlands, converting the habitat to an open woodland and resulting in a long-term, adverse impact. Disturbance to floodplain vegetation increases the potential for fluvial erosion and limits the ability of riparian and floodway areas to function naturally. Bank stabilization projects at the Sakakawea site and Taylor Bluff Village were implemented in response to active bank erosion that was threatening archeological resource sites. The bank stabilization techniques used (i.e., riprap and tri-lock) are considered bank armoring methods that disturb the riparian area of the river, resulting in a long-term, adverse impact.

The tri-lock method covers the banks with hardened interlocking material that eliminates the natural bank and portions of the adjacent floodway. Riprap functions similarly by using stone or rock materials. Although these techniques allow for some porosity, the riparian zone has limited ability to attenuate flood flows, store floodwaters, and encourage vegetation growth. The operation of Garrison Dam has altered the flood regime of the Knife and Missouri Rivers, which has resulted in minimal changes to the floodplain resources. The no-action alternative would contribute adverse impacts from additional bank stabilization projects. When combined with the other projects in the area of analysis, an overall adverse, cumulative impact would be expected. The no-action alternative would make a small but perceptible contribution to the overall cumulative impact.

Conclusion. Implementation of bank stabilization projects as emergency actions to protect archeological resources would result in adverse impacts on floodplain resources. The no-action alternative would have long-term, adverse impacts as a result of hydrology modification; however, this alternative would not impede floodplain resource functioning.

Impacts Common to Both Action Alternatives

Bank Stabilization Techniques. Many bank stabilization techniques are designed to eliminate the natural riverine processes of bank erosion and meandering (Florsheim et al. 2008). These processes are necessary for an adaptable and sustainable riverine ecosystem that includes the formation and maintenance of floodplain resources. Bank erosion and sediment transport are important for the formation of point bars and eventually floodplain resources. Bank stabilization techniques can affect floodplain resources through direct modification in floodplain size and by altering their ability to store water, reduce peak flood flows, and infiltrate water. Bank stabilization techniques that trap the river flow within the banks both reduce and eliminate the ability of the river to access the floodplain resource and minimize its beneficial values (Ellis 2002; USDA-NRCS n.d.). Many stabilization techniques affect water surface elevation and velocity upstream and downstream of the stabilized area and lead to riverine instability and an increased risk of flooding (Fischenich 2001; Florsheim et al. 2008). The placement of some types of stabilization techniques in an incised channel prevents the river from naturally developing a new functioning floodplain resource, which results in adverse impacts. However, bank stabilization techniques that enhance or restore riverine-floodplain connectivity, the riparian vegetation community, or bankfull benches in the unnaturally altered system are the most beneficial to floodplain resources. An adaptive management framework would provide beneficial impacts on floodplain resources in the unnatural altered riverine system by implementing treatment techniques that consider the overall condition of the riverine and riparian ecosystems. The framework could allow for dynamic equilibrium and natural processes such as the creation of new active floodplains. Table 4-10 summarizes the impacts of bank stabilization techniques on floodplain resources.

TABLE 4-10. IMPACTS ON FLOODPLAIN RESOURCES ASSOCIATED WITH BANK STABILIZATION TECHNIQUES

Stabilization Techniques	Stabilization Technique Life Span	Construction Disturbance Level[a]	Impacts on Floodplain Resources
Soil bioengineering	Both short and long term	Ranging from minor to moderate	Potential short-term, adverse impacts as a result of construction activities and long-term, adverse impacts from the loss of floodplain resource functions until the reestablishment of vegetation. Long-term, beneficial impacts from the restoration of floodplain resource functions.
Bank armoring	Long term	Ranging from minor to major	Potential short-term, adverse impacts as a result of construction activities and long-term, adverse impacts as a result of a reduction in floodplain resource function and interruption in the river and floodplain connection (Baird et al. 2015; FEMA n.d.).
Flow diversion	Both short and long term	Ranging from moderate to major	Potential adverse impacts from the placement of flow diversion structures could indirectly result in channelization and floodplain resource impacts elsewhere (Baird et al. 2015; Ellis 2005). In comparison to other bank stabilization measure the disturbance to banks typically would be less and the placement of diversion structures would not directly impact floodplain resources.
Energy reduction	Long term	Ranging from moderate to major	Potential indirect, adverse impacts as a result of channelization and subsequent floodplain resource impacts downstream.
Geotechnical slope stabilization	Both short and long term	Ranging from minor to major	Potential adverse impacts as a result of construction activities and the disconnection of the river and floodplain. Potential long-term, beneficial impacts as a result of improved riverine-floodplain connections (Baird et al. 2015).
Channel development	Long term	Major	Potential adverse impacts as a result of construction activities. Potential beneficial impacts as a result of a reduction of flood risks and an increase in floodplain area (Baird et al. 2015).

[a] Construction disturbance level can vary depending on current condition of banks and would depend on the bank slope / angle of repose necessary for structure technique, as well as the depth/footprint of grading needed for installation.

Soil bioengineering — Soil bioengineering uses living vegetative and natural materials to protect riverbanks from erosion and restore degraded banks. This technique typically results in the establishment of vegetation on the banks for stabilization and occasionally a new floodplain bench. During construction activities, the banks and small portions of the adjacent floodplain resource would be disturbed, resulting in increased direct, short-term, adverse impacts on floodplain resource functioning; some measures require greater bank modification, and as a result, disturb the bank and floodplain resource to a greater extent. Until the plantings become established, the lack of vegetation would have adverse impacts on the floodplain resource because of its limited capacity to slow flood waters and allow water infiltration. Establishment of vegetation would benefit the river-floodplain connection and support natural floodplain resource functioning. Overall, soil bioengineering has direct, short-term, adverse impacts on floodplain resources from the loss of floodplain resource functioning during construction and long-term, adverse impacts from the loss of floodplain functions until the reestablishment of vegetation. Long-term, beneficial impacts on floodplain resources would result from the restoration of floodplain resource functioning.

Bank armoring — Bank armoring places hardened materials on riverbanks for protection. During construction activities, the banks and small portions of the adjacent floodplain resource would be disturbed, resulting in increased direct, adverse impacts on floodplain resource functioning. Following construction, the riverbank would be covered with armoring material to varying degrees. The lack of a natural bank and floodplain resource directly adjacent to the river would have long-term, adverse impacts by reducing floodplain resource functions and the connection between the river and floodplain resource (Baird et al. 2015; FEMA n.d.). Overall, bank armoring has direct, short-term and long-term, adverse impacts during and after construction from the loss of floodplain resource functions and values.

Flow diversion — Flow diversion techniques place structures in the river channel to redirect flow away from banks. Although these structures would allow the river to connect to adjacent floodplains, they could indirectly result in channelization and floodplain impacts elsewhere (Baird et al. 2015; Ellis 2002). The placement of diversion structures would result in indirect impacts on floodplain resources.

Energy reduction — Energy reduction methods work to reduce the kinetic energy and erosive forces of the flow through the construction of in-channel structures. Because these structures would be located in the channel, physical disturbance from construction to the bank and floodplain resource would be limited and the river would still have the ability to access the adjacent floodplains. These structures could indirectly result in channelization and floodplain resource impacts downstream (Ellis 2002), which could result in long-term impacts. However, the placement of energy reduction structures would not directly impact floodplain resources.

Geotechnical slope stabilization — Geotechnical slope stabilization methods modify the riverbank through regrading, soil reinforcement, drains, and retaining walls. During construction activities, most slope stabilization techniques would have moderate to major disturbance on the riverbank and small portions of the adjacent floodplain resource. This disturbance would interrupt typical floodplain resource functions by slowing flood waters and capturing water through infiltration. Depending on the slope stabilization technique used and the existing conditions at the site of the stabilization, there would be long-term, adverse or beneficial impacts following construction as described below. If the river and its' floodplain are disconnected, bank regrading would benefit floodplain resources by allowing for improved riverine-floodplain connections after implementation (Baird et al. 2015). Geotextiles and geogrids would provide limited floodplain functioning until the reestablishment of vegetation. Construction of a retaining wall would completely disconnect the river from the floodplain except during very high flow conditions. Installation of drains would not adversely impact floodplain resource functions and, if the current infiltration conditions are poor, could aid the infiltration of flood waters. Overall, slope stabilization techniques would have direct, short-term, adverse impacts on floodplain resources during construction and direct, long-term, adverse and beneficial impacts after construction. Adverse impacts would result from the disconnection of the river and floodplain resources. Beneficial impacts would result from the improvement of vegetation and infiltration capabilities.

Channel development — Channel development consists of large-scale modification of the existing channel morphology through widening or creation of diversion channels. During construction activities, there would be temporary disturbance to the river channel, banks, and portions of the adjacent floodplain. Reconfiguration in the form of channel widening and creation of additional channels would increase the river's operational capacity for high water events and allow the river discharge to move through the area, resulting in a reduction in human-associated flood risks. Reestablishment of a riverine-floodplain connection would increase floodplain area, improve natural beneficial floodplain functions, and decrease the potential for flooding damages and associated human hazards (Baird et al. 2015). Overall, channel development would have direct, short-term, adverse impacts on floodplain resources from disturbance during construction. Over the long-term, beneficial impacts on the unnaturally altered systems could occur from an increase in floodplain area.

Pocket Gopher Control. Table 4-11 summarizes the impacts of pocket gopher control techniques on floodplain resources. Habitat modification in the form of buffer strips would convert existing vegetation to planted grains but would have no impact on the functioning of the floodplain resource. Mechanical burrow builder systems and exclusion fencing would disturb the soil but would not prevent the natural and beneficial functions of floodplain resources nor would it increase risk to humans from floods. Toxicant and fumigant use and trapping would have no impacts on floodplain resources. The implementation of pocket gopher control techniques would result in no impacts on floodplain resources.

Vegetation Management. Table 4-12 summarizes the impacts of vegetation management treatments on floodplain resources. A large portion of the park occurs in the 100-year (1% occurrence) floodplain. All vegetation management treatments involve the initial clearing of vegetation that could temporarily degrade floodplain functioning depending on the amount of clearing and the vegetation remaining (USDA-NRCS 1996). Substantial vegetation clearing as a result of some vegetation management treatments, including controlled burns, would have the potential for greater impacts. Without vegetation, the capacities of a floodplain to infiltrate and slow floodwaters are reduced, thereby increasing the potential impacts of a flood event (Wright 2007). Mechanical treatment involves some soil disturbance, which would enhance the water infiltration and water storage functions of the floodplain resource. Adding vegetation through the reseeding methods associated with cultural treatments would benefit floodplain resources over the long term. The application of herbicides would temporarily remove vegetation, resulting in short-term, adverse impacts on floodplain resources. Vegetation management practices would result in indirect, short-term, adverse impacts on floodplain resources from vegetation removal; there would be no long-term impacts because of revegetation.

TABLE 4-11. IMPACTS ON FLOODPLAIN RESOURCES ASSOCIATED WITH POCKET GOPHER CONTROL TECHNIQUES

Management Techniques	Description	Efficacy Timeline	Ground Disturbance Level	Long-Term Maintenance	Impacts on Floodplain Resources
Exclusion	Installation of subsurface and surface fencing to exclude animals from areas	Immediate	Minor to major	Requires ongoing maintenance/ replacement	Although soil disruption would occur, the magnitude of impacts would not impact floodplain resource functions nor increase floodplain risk, resulting in no impacts.
Habitat modification	Vegetation control and flood irrigation	Long term	Minor to major	Requires ongoing maintenance/ replacement	No impacts on floodplain resources.

Management Techniques	Description	Efficacy Timeline	Ground Disturbance Level	Long-Term Maintenance	Impacts on Floodplain Resources
Toxicants	Zinc phosphide, chlorophacinone, diphacinone, and strychnine milo	Long term	Minor to major	May require frequent maintenance and reapplication depending on size of gopher population and area.	
Fumigants	Aluminum phosphate and various gas cartridges	Long term	Minor	May require frequent application depending on size of gopher population and area.	
Trapping	Live and lethal trapping	Immediate to long term	Moderate	May require frequent trapping events, depending on size of gopher population and area.	

TABLE 4-12. IMPACTS ON FLOODPLAIN RESOURCES ASSOCIATED WITH VEGETATION MANAGEMENT TREATMENTS

Vegetation Management Treatment	Description	Ground Disturbance	Long-Term Maintenance	Impacts on Floodplain Resources
Cultural treatments	Examples include prevention and reseeding of native herbaceous species following woody vegetation removal. Reseeding method includes hand broadcasting, seed drill, hydroseeding, and seed mats.	Minor to moderate	Requires ongoing prevention practices; periodic spot reseeding, and irrigation.	Potential for short-term, adverse impacts as a result of woody vegetation clearing (USDA-NRCS 1996).
Manual treatments	Includes hand pulling or cutting using small hand tools and shovels. Most manual methods need to be used in combination with pesticides, grazing, or prescribed fire to treat resprouts and new seedlings.	Minor to moderate	Requires spot treatments annually.	Potential for short-term, adverse impacts as a result of vegetation clearing (USDA-NRCS 1996).
Mechanical treatments	Includes pulling, cutting, grubbing, and mowing using weed whippers, mowers, tractor or all-terrain vehicle-pulled mowers, chainsaws, and shovels. Most mechanical methods need to be used in combination with pesticides, grazing, or prescribed fire to treat resprouts and new seedlings. Heavy equipment could be used for treatment of woody species encroachment.	Minor to moderate	Requires spot treatment annually.	
Chemical treatment	Herbicides are applied using portable sprayers, all-terrain vehicles equipped with sprayers, and aerial spraying. Includes spraying, basal bark and stem treatment, cut surface treatment, cut stump treatment, and tree injection.	Minor	Requires spot treatments the first year; depending on the species requires ongoing spot treatments every 1 to 3 years.	Potential for short-term, adverse impacts as a result of vegetation clearing.

Vegetation Management Treatment	Description	Ground Disturbance	Long-Term Maintenance	Impacts on Floodplain Resources
Prescribed fire treatments	Frequency, intensity, and timing of burning are extremely important. Used in the spring to deter woody species germination. Prescribed fire used as treatment of woody species encroachment needs to be used in combination with mowing, herbicide, or reseeding with native grasses to treat resprouts and new seedlings.	Minor to moderate	Requires ongoing treatment practices every 3 to 5 years. (Snowberry requires annual treatment.)	Potential adverse impacts as a result of vegetation clearing. Potential impacts on floodplain resources as a result of controlled burns would be more pronounced than other vegetation management treatments as a result of larger amounts of cleared vegetation (USFWS 2009).
Biological controls	Includes the use of insects and microorganisms to reduce the abundance of an exotic plant. Long-term solution for controlling select exotic plant species.	Minor	Pending reproduction, establishment, and effect of biological control on target vegetation species, more than one release may be necessary for desired level of management.	No impacts on floodplain resources.
Grazing	Considerations include grazing practice used (i.e., standard grazing, flash grazing, rotational grazing), stocking rate, species of livestock, timing (i.e., spring, summer, fall), and fencing requirements.	Minor	Requires seasonal to ongoing maintenance.	Minimal potential for adverse impacts as a result of vegetation clearing.

Impacts of Alternative 2

All proposed clearing, grading, and other construction activities would be located outside of the 100-year floodplain in accordance with Executive Order 11988. There would be no impacts on floodplain resources, human safety, or welfare from the relocation and construction of new facilities and the removal of the existing facilities under alternative 2.

There would be adverse and beneficial impacts on floodplain resources from management techniques as described in "Impacts Common to Both Action Alternatives." The implementation of bank stabilization techniques and vegetation management treatments could result in short-term, adverse impacts on floodplain resource functioning during construction. Depending on the method of bank stabilization, direct, long-term, adverse impacts would result from modifications to upstream and downstream floodplain resources or direct, long-term, beneficial impacts would result from an increase in floodplain area and a decrease in flood risks.

Cumulative Impacts. The same past actions that are discussed under the no-action alternative are considered under alternative 2, and the impacts on floodplain resources in the park would be the same. Alternative 2 would contribute short- and long-term, adverse impacts and long-term, beneficial impacts on floodplain resources to the adverse impacts from the past projects. The short-term contributions of the adverse impacts from alternative 2 to the impacts from the past actions would be imperceptible because of their localized effect. The long-term, adverse impacts from alternative 2 would be limited and localized. When the long-term, beneficial impacts on floodplain functions and values are combined with other past actions, both adverse and beneficial cumulative impacts would occur, with the predominant impacts being beneficial. The contribution would be somewhat noticeable because alternative 2 affects floodplain functions and values over the entire park as a result of the adaptive management strategy, whereas most of the past impacts were localized.

Conclusion. Under alternative 2, management techniques would be implemented using an adaptive management approach that considers the riverine ecosystem. Implementation of management techniques would temporarily disturb streambanks and associated floodplain resources and remove floodplain vegetation, resulting in short-term, adverse impacts on floodplain structure and functions until vegetation is reestablished. Some management actions would permanently remove floodplain resources, eliminate riverine-floodplain connectivity, or alter river hydrology and hydraulics that influence floodplain resources and result in long-term, adverse impacts. Therefore, short-term, adverse impacts would result from implementation of the management techniques and localized long-term, adverse impacts on upstream or downstream floodplain resource would be possible following implementation. Parkwide long-term, beneficial impacts on floodplain functions and values would result from implementation of management techniques.

Alternative 2 would contribute beneficial impacts on floodplain resources in the park to the adverse impacts from other past actions. The contribution would be somewhat noticeable because most of the cumulative impacts from other actions were localized and had a limited effect on floodplain functions and values in the park.

Impacts of Alternative 3

Alternative 3 would require the construction of new facilities. If options 1 or 2 are selected and the new facilities are sited in a previously undisturbed floodplain resource, there would be a limited increase in impervious surface and adverse impacts on floodplain functions. However, using guidelines provided in Executive Order 11988 and Director's Order 77-2, the construction would likely occur outside of a floodplain and would not affect floodplain functions and values. Therefore, there would be no impacts on floodplain resources, human safety, or welfare from the relocation and off-site construction of new facilities and the removal of the existing facilities under alternative 3.

There would be adverse and beneficial impacts on floodplain resources from management techniques as described in "Impacts Common to Both Action Alternatives." The implementation of bank stabilization techniques and vegetation management treatments could result in short-term, adverse impacts on floodplain functioning during construction. Depending on the method of bank stabilization, direct, long-term, adverse impacts would result from modifications to upstream and downstream floodplain resources or direct, long-term, beneficial impacts would result from an increase in floodplain area and a decrease in flood risks.

Cumulative Impacts. The same past projects that are discussed under the no-action alternative are considered under alternative 3, and the impacts on floodplain resources in the park would be the same. Alternative 3 would contribute short-term and long-term, adverse impacts and long-term, beneficial impacts on floodplain resources to the adverse impacts from the past projects. The short-term contributions of the adverse impacts from alternative 3 to the impacts from the past actions would be imperceptible because of their localized effect. The long-term, adverse impacts from alternative 3 would be limited and localized. When the long-term, beneficial impacts on floodplain functions and values as a result of alternative 3 are combined with other past projects, an overall beneficial, cumulative impact would be expected. The contribution would be somewhat noticeable because alternative 3 would affect floodplain functions and values over the entire park as a result of the adaptive management strategy whereas most of the past impacts were localized.

Conclusion. Under alternative 3, management techniques would be implemented using an adaptive management approach that would consider the riverine ecosystem. Implementation of management techniques would temporarily disturb streambanks and associated floodplain resources and remove floodplain vegetation, resulting in short-term, adverse impacts on floodplain structure and functions until vegetation is reestablished. Some management actions would permanently remove floodplain resources, eliminate riverine-floodplain connectivity, or alter river hydrology and hydraulics that influence floodplain resources and result in long-term, adverse impacts. Therefore, short-term, adverse impacts would result from implementation of the management techniques, and localized long-term, adverse impacts on upstream or downstream floodplain resource would be possible following implementation. Parkwide long-term, beneficial impacts on floodplain functions and values would result from implementation of management techniques.

Alternative 3 would contribute beneficial impacts on floodplain resources in the park to the adverse impacts from other past projects. The contribution would be somewhat noticeable because most of the cumulative impacts from other actions were localized and had a limited effect on floodplain functions and values in the park.

Impacts of the Preferred Alternative

Under the preferred alternative, the National Park Service would keep the museum collections storage in place provided that efforts to address water infiltration issues are successful. In the event efforts are ultimately unsuccessful, the museum collections storage would be moved off-site. In addition, under the preferred alternative, the National Park Service would identify land through a General Services Administration build-lease arrangement to build an off-site maintenance facility to suit park needs. However, based on supply and regulatory constraints, this action is currently not feasible. As such, the National Park Service is seeking to relocate and construct the maintenance facility in the park, unless the opportunity to lease or build off-site arises. Under the preferred alternative, the National Park Service would implement all aspects of the adaptive management framework including a priority list of archeological resources and measures to address riverbank erosion, pocket gopher activity, and vegetation encroachment. Under the preferred alternative, impacts on floodplain resources would be the same as those described under alternative 3 and would include adverse impacts associated with the demolition of the existing maintenance facility and potential adverse impacts from the construction of a new off-site facility.

The impacts from bank stabilization techniques, pocket gopher control, and vegetation management would be the same as those described under “Impacts Common to Both Action Alternatives.” As described above, if suitable land or lease options for an off-site facility cannot be identified, the National Park Service would defer to building a new maintenance facility in the park. Under this scenario, impacts would be the same as those described for alternative 2.

Cumulative Impacts. Cumulative impacts are anticipated to be the same as those described under alternative 2 or 3, depending on the new facility considerations discussed previously.

Conclusion. Impacts of the preferred alternative would be the same as those described for alternative 3 and under “Impacts Common to Both Action Alternatives.” If the water infiltration project being implemented under the no-action alternative proves successful, the museum collections storage would not be relocated unless the park identifies funding or partnership opportunities to relocate the museum collection from the basement to a more suitable location. If the collection is moved, it would be done in consultation with the MHA Nation tribal historic preservation officer and North Dakota state historic preservation officer and comply with NPS museum collection standards. If suitable off-site property or lease arrangements for a new maintenance facility cannot be identified, the National Park Service would defer to building a new facility on-site, and impacts would be the same as those described for alternative 2. Cumulative impacts would be the same as those described for alternatives 2 or 3, respectively.

IMPACTS OF THE ALTERNATIVES ON VISITOR USE AND EXPERIENCE

Guiding Regulations and Policies

The fundamental purpose of all national parks is to allow the people of the United States to enjoy park resources and values, and the National Park Service is committed to providing appropriate, high-quality opportunities to make this happen. Because not all recreational activities are appropriate for each park, the National Park Service encourages activities that are appropriate to the purposes for which the park was established, are appropriate to the unique park environment, promote enjoyment through direct association with park resources, and can be sustained without causing unacceptable impacts on park resources or values (NPS 2006a).

Overall, the management of visitor use and experience, like all management decisions affecting the resources of a national park, is subject to the Organic Act. The act is this foundational law that requires the National Park Service to “provide for the enjoyment” of the national parks while also leaving them “unimpaired for future generations.” Where a conflict between the public enjoyment of a park area and the conservation of a park value or resource occurs, then “conservation is to be predominant” (NPS 2006a).

Methods and Assumptions

This assessment considers the availability of existing recreational opportunities and accessible areas to assess the level of impact for each alternative. Data used in this analysis, including visitor statistics, historic use patterns, and visitor use observations obtained from park rangers, are presented in chapter 3. When available, quantitative information was used to assess the overall change to any existing visitor use patterns or satisfaction levels.

Area of Analysis

The area of analysis for visitor use and experience is limited to the park.

Impacts of Alternative 1 (No-Action Alternative)

Under the no-action alternative, management of archeological resources at the park would continue as currently implemented. Impacts on visitor use and experience would occur as a result of measures to manage riverbank erosion, pocket gopher activity, vegetation encroachment, and infrastructure. Under the no-action alternative, the park would react to riverbank erosion events after they occur, and this may include emergency bank stabilization work. In such cases, visitor use may experience short-term, adverse impacts because access would be restricted during construction. Lethal pocket gopher trapping would continue to occur in May, June, and July—months with high visitation at the park. Based on the nature of current pocket gopher management activities (i.e., many management actions occur outside of the sight of visitors), current impacts on visitor use would be minimal and short term during the above mentioned months. Under the no-action alternative, existing management actions to control vegetation encroachment would continue, including prescribed burns, mowing, and exotic vegetation management. Activities conducted under the auspices of the *Exotic Plant Management Plan* (NPS 2005) would continue to rehabilitate native plant species. Current vegetation management would have a long-term, beneficial impact on visitor use by returning the park to a more natural state (NPS 2005). However, visitor experience would likely experience short-term, adverse impacts while disturbances and management actions are taking place. The no-action alternative includes maintenance related to infrastructure at the park. Repairs and rehabilitation to existing facilities and to the visitor center to address water infiltration issues would continue, and the museum collections storage would remain housed at the existing visitor center. Repairs to facilities would result in a short-term, adverse impact on visitor use and experience during rehabilitation activities. However, visitor use and experience conditions would improve when facilities are repaired and rehabilitated, resulting in a long-term, beneficial impact. In addition, the presence of the maintenance facility at the Big Hidatsa site would result in ongoing, long-term, adverse impacts on visitor use and experience as a result of reduced accessibility and continued intrusion to the Big Hidatsa site.

Cumulative Impacts. Past, present, and future activities have the potential to affect visitor use and experience, both adversely and/or beneficially. Depending on the proximity of activities, adverse impacts have accrued to visitor use and experience from the implementation of activities under the *Fire Management Plan* (NPS 2008c). Direct and indirect adverse impacts from these activities include loss of access to areas of the park and manipulation of the natural landscape.

Long-term, beneficial impacts on visitor use and experience have occurred and would continue to occur into the future from the implementation of the following actions:

- Knife River Indian Villages Comprehensive Interpretive Plan (in development, 2016)
- *Exotic Plant Management Plan* (NPS 2005)
- *Cultural Resources Management Plan* (NPS 1983)

- bank stabilization projects at the Sakakawea site and Taylor Bluff Village
- roadway, infrastructure, and energy development

Overall, these actions contribute to long-term, adverse and beneficial, cumulative impacts on visitor use and experience by preserving the natural and cultural state of the park while increasing accessibility. The no-action alternative would have both long-term, beneficial impacts and short and long-term, adverse impacts on visitor use and experience and would contribute both to identified beneficial and adverse, cumulative impacts. Overall impacts would be predominately beneficial.

Conclusion. Under the no-action alternative, adverse impacts on visitor use and experience would be primarily temporary and could be minimized through development of procedures and precautions that would guide implementation of any management action that has the potential to adversely impact the visitor use and experience at the park. Long-term, beneficial impacts on visitor use and experience would continue under the no-action alternative.

Impacts Common to Both Action Alternatives

Bank Stabilization Techniques. Bank stabilization techniques common to both action alternatives include soil bioengineering, bank armoring, flow diversion, energy reduction, geotechnical slope stabilization, and channel widening. Soil bioengineering, bank armoring, and geotechnical slope stabilization all involve construction along the banks of the Knife River and could limit access to those areas during that time, resulting in a short-term, adverse impact. Flow diversion, channel reconfiguration, and energy reduction involve construction in the river waters and could result in a short-term, adverse impact during construction activities, when recreational users may have limited access to the river. All of the riverbank stabilization methods would limit riverbank erosion and preserve existing views around the river, resulting in a long-term, beneficial impact. Depending on the bank stabilization technique chosen, visitor experience may be affected differently. Some visitors' experience may be adversely affected by the use of hard material such as riprap as opposed to the "softer" aesthetic of soil bioengineering techniques. It such cases, adverse impacts on visitor experience along the Knife River in the park could occur; however, these impacts would be subjective for each visitor.

Pocket Gopher Control. Pocket gopher population techniques involve exclusion, habitat modification, toxicants, fumigants, and trapping. Exclusion techniques require construction of a fence that is at least 18 inches deep. This pocket gopher control technique has potential for short- and long-term impacts. During construction activities, visitor use could experience a short-term, adverse impact from disturbances caused by equipment or staff members. Long-term, adverse impacts are possible if the fences obstruct views. Additionally, gopher control measures and signage could have long-term, adverse impacts on visitor use and experience as a result of direct knowledge of gopher culling.

Vegetation Management. Vegetation encroachment management treatments include cultural, biological, manual/mechanical, and chemical techniques and prescribed fire. Vegetation encroachment is usually best handled through a combination of methods. Cultural techniques involve prevention, reseeding, and grazing, while biological techniques include the use of insects or microorganisms to reduce the abundance of targeted species. Manual and mechanical methods involve pulling or cutting stems at the base and then applying an herbicide. Chemical treatments involving pesticides must be registered with the US Environmental Protection Agency. Prescribed fire can be used to control woody vegetation. All prescribed fires would be implemented in accordance to the *Fire Management Plan* (NPS 2008c). All vegetation management methods under both action alternatives would result in possible short-term, adverse impacts on visitor use and experience during the implementation phase when certain portions of the park would have limited access or when implementation actions such as the presence of work crews and haze and smoke would detract from the visitor experience. However, many visitors complain about invasive exotic plants, and vegetation management would have a long-term, beneficial impact on visitor use by returning the park to a more natural state (NPS 2005).

Impacts of Alternative 2

Under alternative 2, the maintenance facility and museum collections storage would be relocated to another location in the park. Two potential sites have been identified as meeting the site criteria (described in chapter 2). Both sites would add additional space to the visitor center and maintenance facility. The visitor center would add more storage room and improve accessibility for qualified researchers and those accessing the museum collections storage in accordance with access requirements found in the park's Collection Access Policy (NPS 2016b), resulting in a long-term, beneficial impact. Disturbances from construction activities would result in a short-term, adverse impact.

Cumulative Impacts. Under alternative 2, the same past, present, and reasonably foreseeable projects discussed for the no-action alternative would continue to have adverse and beneficial impacts on visitor use and experience. The implementation of adaptive management activities that preserve and prevent the loss of cultural resources or accessibility would have long-term, beneficial impacts on visitor use and experience and likely would offset any adverse impacts from the conversion of undeveloped land in the park to developed infrastructure. Adaptive management activities would also offset adverse impacts associated with bank stabilization, pocket gopher control, and vegetation management. These actions would contribute to long-term, adverse and beneficial, cumulative impacts on visitor use and experience. Overall, alternative 2 would contribute both to identified beneficial and adverse, cumulative impacts. Overall impacts would be predominately beneficial

Conclusion. Under alternative 2, impacts on visitor use and experience would be both short and long term and adverse, as well as long term and beneficial with overall adverse impacts. Overall, alternative 2 would contribute both to identified beneficial and adverse cumulative impacts; however, overall impacts would be predominantly beneficial under alternative 2.

Impacts of Alternative 3

Alternative 3 would relocate facilities out of the park land. Options 1 and 2 would result in the same short-term impacts described under alternative 2; however, the facilities would be located outside of the park. Under options 1 and 2 the existing maintenance facility would be removed and the disturbance during construction would result in a short-term, adverse impact. Under alternative 3, museum collections storage would be relocated off-site and ease of accessibility for qualified researchers and those accessing the storage in accordance with the park's Collection Access Policy would be reduced (NPS 2016b). This would have a long-term, adverse impact on visitor use and experience.

Cumulative Impacts. Cumulative effects are anticipated to be the same as those described for alternative 2.

Conclusion. Under alternative 3, adverse impacts on visitor use and experience would be both temporary and long-term; however, some impacts could be minimized if procedures and precautions are developed to guide implementation of any management action with the potential to harm visitor use and experience. Overall, long-term, adverse impacts would be expected to visitor use and experience under alternative 3.

Impacts of the Preferred Alternative

Under the preferred alternative, the National Park Service would keep the museum collections storage in place provided that efforts to address water infiltration issues are successful. In the event efforts are ultimately unsuccessful, the museum collections storage would be moved off-site. In addition, under the preferred alternative, the National Park Service would identify land through a General Services Administration build-lease arrangement to build an off-site maintenance facility to suit park needs. However, based on supply and regulatory constraints, this action is currently not feasible. As such, the National Park Service is seeking to relocate and construct the maintenance facility in the park, unless the opportunity to lease or build off-site arises. Under the preferred alternative, the National Park Service would implement all aspects of the adaptive management framework, including a priority list of archeological resources and measures to address riverbank erosion, pocket gopher activity, and vegetation encroachment. Under the preferred alternative, impacts on visitor use and experience would be the same as those described under alternative 3 and would include adverse impacts associated with the demolition of the existing maintenance facility.

The impacts from bank stabilization techniques, pocket gopher control and vegetation management would be the same as those provided under "Impacts Common to Both Action Alternatives." As described above, if suitable land or lease options for an off-site facility cannot be identified, the National Park Service would defer to building a new maintenance facility in the park. Under this scenario, impacts would be the same as those described under alternative 2.

Cumulative Impacts. Cumulative impacts are anticipated to be the same as those described under alternative 2 or 3, depending on the new facility considerations discussed previously.

Conclusion. Impacts of the preferred alternative would be the same as those described for alternative 3 and the impacts common to both alternatives. If the water infiltration project being implemented under the no-action alternative s proves successful, the museum collections storage would not be relocated unless the park identifies funding or partnership opportunities to relocate the museum collection from the basement to a more suitable location. If the collection is moved, it would be done in consultation with the MHA Nation tribal historic preservation officer and North Dakota state historic preservation officer and comply with NPS museum collection standards. If suitable off-site property or lease arrangements for a new maintenance facility cannot be identified, the National Park Service would defer to building a new facility on-site and impacts would be the same as those described for alternative 2. Cumulative impacts would be the same as those described under alternatives 2 or 3, respectively.

UNAVOIDABLE ADVERSE IMPACTS

The National Park Service is required to consider whether the alternative actions would result in impacts that could not be fully mitigated or avoided (National Environmental Policy Act, section 101(c)(ii)).

Alternative 1 (No-Action Alternative)

Under the no-action alternative, there would be long-term, unavoidable, adverse impacts on archeological resources, cultural landscapes, ethnographic resources, and museum collections from the reduced access, loss, degradation, and/or displacement of resources as a result of ongoing riverbank erosion, pocket gopher activity, vegetation encroachment, and facility inefficiencies. Some of the sites most at risk and important to the park (Big Hidatsa, Sakakawea, Lower Hidatsa, Stanton Mound Group, and Elbee) would see ongoing impacts that would continue to affect the integrity of the sites and, over time, could reduce their eligibility to the national register.

Unavoidable adverse impacts on fish and wildlife resources and special-status species would occur primarily in the form of the loss of individuals of a species. Impacts on water resources and floodplain resources would occur as a result of bank stabilization projects that would alter the natural riverine processes occurring in the park.

Alternative 2

Alternative 2 would result in unavoidable adverse impacts on archeological resources, cultural landscapes, and ethnographic resources as a result of bank stabilization and pocket gopher management activities (e.g., grading and ground disturbance) and from vegetation management activities through removal of resources by mechanical operations. However, when compared with the no-action alternative, unavoidable adverse impacts under alternative 2 would be reduced because deficiencies related to protection of archeological resources would be addressed.

Unavoidable adverse impacts on fish and wildlife resources and special-status species under alternative 2 could occur in the form of individuals of a species and habitat loss as a result of bank stabilization and pocket gopher and vegetation management tools. Adverse impacts on water quality and local hydrology could occur as a result of bank stabilization measures. Similarly, modifications to upstream and downstream floodplain resources from bank stabilization activities could affect floodplain resources.

Alternative 3

Unavoidable adverse impacts as a result of the implementation of alternative 3 would be similar to those described for alternative 2. When compared with the no-action alternative, unavoidable adverse impacts under alternative 3 would be reduced as result of the ability to mitigate adverse impacts on park resources.

Preferred Alternative

Unavoidable adverse impacts as a result of the implementation of preferred alternative would be similar to those described for alternative 3. When compared with the no-action alternative, unavoidable adverse impacts under alternative 3 would be reduced as result of the ability to mitigate adverse impacts on park resources.

SUSTAINABILITY AND LONG-TERM MANAGEMENT

In accordance with the National Environmental Policy Act, and as further explained in Director's Order 12, consideration of long-term impacts and the effects of foreclosing future options should be included throughout any NEPA document. According to Director's Order 12, and as defined by the World Commission on Environment and Development, "sustainable development is that which meets the needs of the present without compromising the ability of future generations to meet their needs" (NPS 2011). For each alternative considered in a NEPA document, considerations of sustainability must demonstrate the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity. This is described below for each alternative. The National Park Service must consider whether the effects of the alternatives involve tradeoffs of the long-term productivity and sustainability of park resources for the immediate short-term use of those resources. It must also consider whether the effects of the alternatives are sustainable over the long term without causing adverse environmental effects for future generations (National Environmental Policy Act, section 102(c)(iv)).

Alternative 1 (No-Action Alternative)

Under the no-action alternative, cultural resources management would continue as currently implemented—management actions would be primarily reactionary to cultural resources threats as risks are identified. This management approach offers some long-term considerations for the sustainability of these resources; however, it would not adequately address many of the current threats to these resources, including bank erosion, pocket gopher activity, vegetation encroachment, and facility deficiencies.

Similarly, ongoing management of riverbank erosion, pocket gophers, and vegetation would offer some long-term support and protection of fish and wildlife resources, special-status species, water resources, and visitor use and experience. However, ongoing threats would persist and threaten the long-term management and sustainability of these resources. The no-action alternative would not ensure archeological resources persist for future generations.

Alternative 2

Cultural resources in the park would be preserved and restored under alternative 2 by identifying and using an adaptive management framework and bank stabilization, pocket gopher, and vegetation management techniques. Identified efforts to maintain, enhance, and restore cultural and natural resources would improve the long-term sustainability of cultural resources and sustainability and productivity of natural resources. Sustainable improvements to existing infrastructure are expected to improve both access to and conditions of cultural resources. Alternative 2 would provide for protection of archeological resources for future generations.

Alternative 3

Sustainable actions for the long-term management of cultural resources under alternative 3 would be similar to those described for alternative 2.

Preferred Alternative

Sustainable actions for the long-term management of cultural resources under the preferred alternative would be similar to those described for alternative 2.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

The National Park Service must consider whether the effects of the alternatives cannot be changed or are permanent (that is, the impacts are irreversible). The National Park Service must also consider whether the impacts on park resources would mean that once gone, the resource could not be replaced; in other words, the resource could not be restored, replaced, or otherwise retrieved (National Environmental Policy Act, section 102(c)(v)). An irreversible commitment of resources is defined as the loss of future options. The term applies primarily to the effects of using nonrenewable resources, such as minerals or cultural resources, or to those factors such as soil productivity that are renewable only over long periods. It could also apply to the loss of an experience as an indirect effect of a "permanent" change in the nature or character of the land. An irretrievable commitment of resources is defined as the loss of production, harvest, or use of natural resources.

Alternative 1 (No-Action Alternative)

Under the no-action alternative, impacts on archeological sites, cultural landscapes, and ethnographic resources would continue as a result of erosion, pocket gophers, and vegetation encroachment and could result in the loss of archeological deposits, the displacement of artifacts and ethnographic resources, damage to archeological and ethnographic features, and the interruption and intrusion into cultural landscapes. Some of the sites most at risk and important to the park (Big Hidatsa, Sakakawea, Lower Hidatsa, Stanton Mound Group, and Elbee) would see ongoing impacts that would continue to affect the integrity of the sites and over time could reduce their eligibility to the national register. In addition, ongoing water infiltration issues could adversely affect museum collections.

Riverbank erosion would continue to affect water resources through impacts on channel morphology and sediment loading. A management approach that is reactive to future riverbank erosion events would result in the irretrievable loss of some amount of archeological material. Ongoing pocket gopher and vegetation encroachment activity at present levels would also result in permanent disruption to the soil stratigraphy at archeological sites and would irreversibly impede the ability of archeologists to obtain information through research.

Alternative 2

Alternative 2 would reduce the potential for irreversible impacts on archeological resources, cultural landscapes, ethnographic resources, and museum collections when compared to the no-action alternative. The implementation of the archeological resources management plan and adaptive management approach and the construction of a new facility are intended to provide long-term support and protection of these resources. Although the potential exists for the irretrievable loss of archeological material from the impacts of riverbank erosion, pocket gopher activity, and vegetation encroachment, a proactive management approach would reduce this potential. Conducting data recovery prior to implementation of management actions would reduce the likelihood of irreversible or irretrievable loss of archeological resources compared to the no-action alternative.

Irreversible impacts on fish and wildlife resources and special-status species under alternative 2 could occur in the form of individuals of a species loss as a result of pocket gopher and vegetation management tools.

Alternative 3

Irreversible and irretrievable impacts under alternative 3 would be similar to those presented above for alternative 2; however, the potential for irretrievable loss of archeological resources may be less than that described for alternative 2 because no new ground disturbance would occur in the park.

National Park Service Preferred Alternative

Irreversible and irretrievable impacts under the preferred alternative would be similar to those described above for alternative 3; however, the potential for the irretrievable loss of archeological resources may be less than that described for alternative 2 because no new ground disturbance would occur in the park.

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CHAPTER 5: CONSULTATION AND COORDINATION

The National Environmental Policy Act requires public involvement, including the engagement of interested and affected members of the public and potentially affected federal, state, and local agencies and tribal governments throughout the EIS process. This section describes the public involvement process that occurred during development of this plan, including consultation with the public, stakeholders, and involved agencies. This chapter also includes a description of the public involvement process and a list of the recipients of the draft document. The public involvement activities for this plan fulfill the requirements of the National Environmental Policy Act and the 2015 NPS *NEPA Handbook* (NPS 2015a).

THE SCOPING PROCESS

The National Park Service divides the scoping process into two parts: internal scoping and external or public scoping. Internal scoping involves discussions among NPS personnel regarding the purpose of and need for taking action, perceived issues, management alternatives, mitigation measures, and other related topics. Public scoping is the early involvement of the interested and affected members of the public in the environmental analysis process. The public scoping process helps ensure that individuals have an opportunity to comment and contribute early in the decision-making process.

Internal Scoping

The National Park Service held an internal scoping meeting on December 10, 11, and 12, 2013. Participants included NPS staff from the Denver Service Center, Midwest Archeological Center, Midwest Regional Office, and Knife River Indian Villages National Historic Site. The internal scoping participants worked to define the purpose, need, and objectives of the plan, discuss preliminary alternatives, identify impact topics for analysis, and define data needs. Representatives from the North Dakota state historic preservation office participated in portions of the internal scoping meeting.

The National Park Service held an internal agency meeting on March 5, 2014, with project team members and personnel from the NPS' Northern Great Plains Inventory and Monitoring staff and Northern Great Plains Exotic Plant Management team to discuss information from ongoing inventory and monitoring efforts at the park and how they may relate to development of management actions to address resource threats, including riverbank stabilization, pocket gopher activity, and vegetation management.

A desired conditions and alternative concepts workshop was held with NPS staff in April and May 2014 to further identify and define the desired conditions and alternatives for the plan. Preliminary alternative concepts developed during the workshop were presented to the public during public scoping meetings in August 2014. The National Park Service further refined the alternatives during another alternatives workshop held in December 2014.

Public Scoping

The public scoping process began on February 13, 2014, with the publication of a notice of intent in the *Federal Register* (72 *Federal Register* 169). The National Park Service issued a public scoping newsletter on August 7, 2014. The newsletter was sent to the park's mailing list and posted on the park's PEPC website. The newsletter described the plan process and the preliminary purpose, need, objectives, and alternatives. In addition to the newsletter, the plan was also announced through local media outlets and the park's website.

In support of the public scoping effort, the National Park Service hosted three public scoping meetings intended to obtain public input on the initial purpose, need, and objective statements for archeological resources management at the park. Meeting announcements were mailed to interested parties, and public notices announcing the public scoping period and meetings were published in state newspapers at the end of July 2014. The meetings were held on:

- Wednesday, August 13, 2014, from 2:00 p.m. to 4:00 p.m. at the MHA Nation Museum, New Town, North Dakota—this meeting was advertised as a special meeting for tribal elders
- Wednesday, August 13, 2014, from 6:00 p.m. to 8:00 p.m. at the MHA Nation Museum, New Town, North Dakota
- Thursday, August 14, 2014, from 6:00 p.m. to 8:00 p.m. at the Knife River Indian Villages National Historic Site Visitor Center, Stanton, North Dakota

The meetings were held in an open house format. Posters and handouts provided information about the plan's purpose and need for taking action, plan objectives, and preliminary alternative concepts. NPS staff members were on hand to answer questions, provide additional information about the plan, and describe how to submit comments.

The public comment period extended through September 30, 2014. During the comment period, four pieces of correspondence were received. The correspondences received during the public scoping period contained a total of 70 comments. Comments received focused on management actions that could possibly be used to address riverbank erosion, pocket gophers, and vegetation encroachment. Discussion focused on clarifying the nature of the threats to archeological resources at the park.

TRIBAL COORDINATION AND CONSULTATION

The park initiated formal tribal consultation with the MHA Nation in November 2013. The park invited the MHA Nation tribal historic preservation officer to the internal scoping meeting held in December 2013. Formal consultation was initiated with the Apsaalooke Nation and Northern Cheyenne Tribe in February 2014. As described previously, an elders meeting was held in New Town, North Dakota, on August 13, 2014, to familiarize tribal elders with the project and solicit input on the plan going forward. In response to comments received during the public scoping meeting held in New Town, a follow-up tour of the park was offered by NPS staff on September 12, 2014. Park staff have been in regular contact with the MHA Nation tribal historic preservation officer and provided updates on the development of the plan.

In addition, as noted below, under "National Historic Preservation Act Consultation" in accordance with section 106 of the National Historic Preservation Act, the National Park Service initiated formal consultation with the North Dakota state historic preservation office and the advisory council concerning impacts on cultural resources in early 2014. The park sent letters to the North Dakota state historic preservation office, the advisory council, the MHA Nation, and the Northern Cheyenne Tribe, and Apsaalooke Nation initiating formal consultation for the plan, inviting representatives to participate in the planning process, and requesting input on the plan.

AGENCY COORDINATION AND CONSULTATION

The park sent letters to numerous agencies announcing the scoping period and requesting input on the plan, including the draft purpose and need and preliminary alternative concepts. Agencies and officials contacted and solicited for comment include:

- Congressional delegates
- American Indian Tribes
- US Environmental Protection Agency
- US Army Corps of Engineers
- US Geological Survey

- US Fish and Wildlife Service
- US Forest Service
- State of North Dakota
  - North Dakota Parks and Recreation
  - North Dakota State Water Commission
  - State Historical Society of North Dakota - North Dakota state historic preservation office
  - North Dakota Department of Health
  - North Dakota Game and Fish Department
  - North Dakota Department of Transportation

Government Partner Calls

In February 2014, the National Park Service initiated and conducted three government partner webinars to leverage technical expertise and identify best practices or lessons learned to consider when developing alternatives to address the threats to archeological resources at the park. Webinars were held between February 24 and 26, 2014, and covered the topics of river management, vegetation management and burrowing mammal management, and infrastructure. Each webinar provided participants with an overview of the purpose and need for the plan, draft objectives, and background on the archeological resources at the park. An additional call focused on archeological resources management was held on March 10, 2014, and similarly provided project and resource background.

The river management call was held on February 24, 2014, and included representatives from the US Army Corps of Engineers, the USGS North Dakota Water Services Center, North Dakota Parks and Recreation, North Dakota State Water Commission, North Dakota state historic preservation office, and North Dakota Department of Health. Representatives were asked to share similar experiences, potential ideas, or research being conducted on the topic of riverbank stabilization. Solicited input on riverbank stabilization included a discussion on the hardening of banks, the use of a “technical toolbox” of stabilization techniques allowing for flexibility in management, as well as the challenges presented by the proximity of archeological sites to riverbanks.

The vegetation and burrowing mammal management call was held on February 25, 2014, and included representatives from the USGS Northern Plains Prairie Wildlife Research Center, North Dakota Game and Fish Department, North Dakota state historic preservation office, and North Dakota Department of Transportation. Representatives were asked to share similar experiences, potential ideas, or research being conducted on vegetation management and burrowing mammals near archeological sites. Solicited input on vegetation management included the use of prescribed burns, removal of woody vegetation, mowing, and supplementing native vegetation elsewhere in the park away from the village sites. Suggestions and comments on burrowing mammal management focused on the use of predator management, trapping, poison, and the use of tools, including burrow builders and repellents.

The infrastructure call was held on February 26, 2014, and included representatives from the US Army Corps of Engineers, North Dakota Department of Health, and North Dakota Department of Transportation. A representative of the NPS Midwest Regional Office also participated. Solicited input focused on bridge, structure and road design, infrastructure funding, the challenges of ice flows or bends, and the potential relocation of existing park facilities and infrastructure.

An archeological resources management call was held on March 10, 2014. It was attended by representatives from the US Army Corps of Engineers, the Northern Great Plains Exotic Plant Management Team, and the US Forest Service Dakota National Grasslands, in addition to NPS staff working on the plan. The call covered background information similar to the previous three calls and included a discussion of archeological resources and applicable research, treatments for addressing archeological resource issues, prescribed burns, and the prioritization of archeological sites.

National Historic Preservation Act Consultation

In accordance with section 106 of the National Historic Preservation Act, the National Park Service initiated formal consultation with the North Dakota state historic preservation office and the Advisory Council on Historic Preservation concerning impacts on cultural resources in early 2014. The National Park Service is coordinating the consultation for section 106 of the National Historic Preservation Act with the National Environmental Policy Act and using the NEPA process for section 106 purposes as provided in 36 CFR 800.8.

The park sent letters were sent to the North Dakota state historic preservation office, the Advisory Council on Historic Preservation, the MHA Nation, the Northern Cheyenne Tribe, and Apsaalooke Nation initiating formal consultation for the plan, inviting representatives to participate in the planning process, and requesting input on the plan. Consultation with these organizations will continue through the distribution of this draft plan for comment as well as for concurrence of the National Park Service assessment of effect.

US Fish and Wildlife Service

In initiating compliance with the Endangered Species Act, the park obtained a list of federally listed threatened or endangered species with potential to occur in Mercer County from the USFWS Information, Planning, and Conservation System in November 2014. Follow-up conversations were held with staff from the USFWS North Dakota Ecological Services Office to gather additional information on species from that list with potential to be affected by the plan alternatives. Information regarding the species carried forward for detailed analysis is included in chapters 3 and 4. Consultation with the US Fish and Wildlife Service will continue through the distribution of this draft plan for comment as well as for concurrence of the National Park Service assessment of effect.

LIST OF RECIPIENTS OF THE DRAFT PLAN

Notification of the availability of this plan will be sent to the following agencies, organizations, and businesses, as well as to other entities and individuals who have submitted comments during scoping. In addition, hard copies of the document will be available for review at park headquarters.

FEDERAL AGENCIES

US Army Corps of Engineers
US Fish and Wildlife Service
US Department of Agriculture – Natural Resources Conservation Service
US Geological Survey

US SENATORS AND REPRESENTATIVES

Honorable Heidi Heitkamp, Senator
Honorable John Hoeven, Senator
Honorable Kevin Cramer, House of Representatives

STATE AGENCIES

North Dakota Department of Health
North Dakota Department of Transportation
North Dakota Game and Fish Department
North Dakota Geologic Survey
North Dakota Parks and Recreation
North Dakota State Water Commission
State Historical Society of North Dakota - State Historic Preservation Office

AMERICAN INDIAN TRIBES TRADITIONALLY ASSOCIATED WITH PARKLANDS

Mandan, Hidatsa, Arikara Nation (Three Affiliated Tribes)

LOCAL AND REGIONAL GOVERNMENT AGENCIES

City of Stanton, North Dakota
Mercer County, North Dakota

ORGANIZATIONS AND BUSINESSES

Dunn County Historical Society and Museum
Knife River Indian Heritage Foundation (Knife River National Historic Site – Friends Group)
Lewis and Clark Fort Mandan Foundation
Metcalf Archaeological Consultants, Inc.

INDIVIDUALS

The list of individuals is available from park headquarters.

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APPENDIXES, ACRONYMS AND ABBREVIATIONS, REFERENCES, LIST OF PREPARERS

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APPENDIX A: APPLICABLE LAWS, POLICIES AND CONSTRAINTS, AND RELATED PLANS FOR KNIFE RIVER INDIAN VILLAGES NATIONAL HISTORIC SITE

Laws and policies, as well as plans by the National Park Service (NPS), state governments, or agencies with neighboring land or relevant management authority, are described in this section to show the framework and constraints under which this plan will need to operate and the goals and policies that will be considered. These related laws, policies, plans, and constraints will guide the development and implementation of this plan.

National Environmental Policy Act. Pursuant to section 102(2)(C) of the National Environmental Policy Act of 1969, as amended (42 United States Code [USC] 4341 et seq.) (NEPA), the National Park Service has prepared an environmental impact statement for the Knife River Indian Villages National Historic Site Archeological Resources Management Plan. Regulations governing NEPA compliance are set by the President's Council on Environmental Quality (CEQ) (40 Code of Federal Regulations [CFR] parts 1500–1508), and Department of the Interior NEPA regulations (43 CFR 46). CEQ regulations establish requirements and the process for agencies to fulfill their obligations under the National Environmental Policy Act. This environmental impact statement documents compliance with NEPA requirements, including the following fundamental requirements: (1) to make careful, complete, and analytical study of the impacts of any proposal, and alternatives to that proposal, if it has the potential to significantly affect the human environment, well before decisions are made; and (2) to be diligent in involving any interested or affected members of the public in the planning process. The NEPA process is also used to coordinate compliance with other federal laws and regulations applicable to the decisions to be made as part of this plan.

Section 106 of the National Historic Preservation Act. Section 106 directs federal agencies to take into account the effect of any undertaking (a federally funded or assisted project) on historic properties. A historic property is any district, building, structure, site, or object (including resources considered by American Indians to have cultural and religious significance) that is eligible for listing in the National Register of Historic Places because the property is significant at the national, state, or local level in US history, architecture, archeology, engineering, or culture. Section 106 provides the Advisory Council on Historic Preservation (advisory council), the North Dakota state historic preservation office (SHPO), and federally recognized American Indian tribes a reasonable opportunity to comment on assessment of effects by the undertaking. In this document, the undertaking is the implementation of the actions outlined in this plan's preferred alternative. The historic preservation review process mandated by section 106 is outlined in regulations issued by the advisory council. Revised regulations (Protection of Historic Properties [36 CFR 800]) became effective January 11, 2001.

National Park Service Organic Act and General Authorities Act. By enacting the NPS Organic Act of 1916, Congress directed the US Department of the Interior and the National Park Service to manage units of the national park system "to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (16 USC 1).

The NPS General Authorities Act of 1970 supplemented the Organic Act, providing (as codified at 16 USC 1a–1):

> Congress declares that the National Park Service, which began with establishment of Yellowstone National Park in 1872, has since grown to include superlative natural, historic, and recreation areas in every major region of the United States, its territories and island possessions; that these areas, though distinct in character, are united through their inter-related purposes and resources into one national park system as cumulative expressions of a single national heritage; that, individually and collectively, these areas derive increased national dignity and recognition of their superb environmental quality through their inclusion jointly with each other in one national park system preserved and managed for the benefit and inspiration of all the people of the United States; and that it is the purpose of this Act to include all such areas in the System and to clarify the authorities applicable to the system.

Congress thus required the entire national park system to be managed as a whole, and not as constituent parts.

The 1978 Redwood Amendment reiterates these mandates by stating that the National Park Service must conduct its actions in a manner that will ensure no "derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress" (16 USC 1a–1). Congress intended the language of the 1978 Amendment (which was included in language expanding Redwood National Park) to reiterate the provisions of the Organic Act, not to create a substantively different management standard. The House committee report described the 1978 Amendment as a "declaration by Congress" that the promotion and regulation of the national park system is to be consistent with the Organic Act (NPS 2006a). The Senate committee report stated that under the 1978 Amendment, "The Secretary has an absolute duty, which is not to be compromised, to fulfill the mandate of the 1916 Organic Act to take whatever actions and seek whatever relief as will safeguard the units of the national park system" (NPS 2006a). Although the Organic Act and the 1978 Amendment use different wording ("unimpaired" and "derogation") to describe what the National Park Service must avoid, both acts define a single standard for the management of the national park system—not two different standards. For simplicity, the NPS *Management Policies 2006* uses "impairment," not both statutory phrases, to refer to that single standard.

Despite these mandates, the Organic Act and its amendments afford the National Park Service latitude when making resource decisions to allow appropriate visitor use, while preserving resources. Because conservation remains predominant, the National Park Service seeks to avoid or to minimize adverse impacts on park resources and values. The National Park Service does, however, have discretion to allow negative impacts when necessary (NPS 2006a, section 1.4.3, 10). Although some actions and activities cause impacts, the National Park Service cannot allow an adverse impact that impairs resources or values (NPS 2006a, section 1.4.3, 10). In the administration of authorized uses, park managers have the discretionary authority to allow and manage uses, provided that the uses will not cause impairment or unacceptable impacts. The Organic Act and the 1978 Amendment prohibit actions that impair park resources unless a law directly and specifically allows for the action (16 USC 1a-1) (NPS 2006a, section 1.4.3.1).

Pursuant to the NPS Guidance for Non-Impairment Determinations and the NPS NEPA Process, a non-impairment determination for the selected alternative will be appended to the Record of Decision.

National Parks Omnibus Management Act of 1998. The National Parks Omnibus Management Act of 1998 (16 USC 5931 et seq.) provides direction for considering and using appropriate technical and scientific information in park management decisions.

Archaeological Resources Protection Act of 1979, 16 USC 470 et seq. This act, as amended, defines archeological resources as any material remains of past human life that are at least 100 years old; requires federal permits for their excavation or removal and sets penalties for violators; provides for preservation and custody of excavated materials, records, and data; provides for confidentiality of archeological site locations; and encourages cooperation with other parties to improve protection of archeological resources. The act was amended in 1988 to require development of plans for surveying public lands for archeological resources, and systems for reporting incidents of suspected violations.

Native American Graves Protection and Repatriation Act of 1990. The Native American Graves Protection and Repatriation Act of 1990 provides for the treatment, repatriation, and disposition of Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony from federally funded institutions and federal lands to culturally affiliated Indian tribes and Native Hawaiian organizations. The law also provides greater protection for Native American burial sites and greater controls over their removal. In addition, the Native American Graves Protection and Repatriation Act makes trafficking human remains and cultural items illegal.

The Clean Water Act of 1972 (33 USC 1344 et seq.), as amended. The Clean Water Act is the primary federal law in the United States governing water integrity. The goal of the Clean Water Act is to "restore and maintain the chemical, physical, and biological integrity of the nation's waters." Waters of the United States generally include tidal waters, lakes, ponds, rivers, streams (including intermittent streams), and wetlands.

Section 404 of the Clean Water Act authorizes the US Army Corps of Engineers (USACE) to issue permits to project applicants for the "discharge of dredged and/or fill material in waters of the U.S." and is the primary federal authority for the protection of wetlands. The USACE jurisdiction for waters of the United States is based on the definitions and limits contained in 33 CFR 328, which encompasses all navigable waters, their tributaries, and adjacent wetlands, and includes ocean waters within 3 nautical miles of the coastline. Projects involving the discharge of dredged and/or fill material into waters of the United States require authorization from the US Army Corps of Engineers.

Section 401 of the Clean Water Act requires that any applicant for a section 404 permit also obtain a water quality certification from the state. The purpose of the certification is to confirm that the discharge of fill materials will comply with the state's applicable water quality standards. Section 401 gives the authority to the State of North Dakota either to concur with USACE approval of a section 404 permit or to place special conditions on the approval, or deny the activity by not issuing section 401 certification. States were granted this authority to ensure that federally approved projects are in the best interests of the state. The section 404 permit is not valid without section 401 certification or waiver of the certification by the state.

Endangered Species Act of 1973. The Endangered Species Act of 1973 provides for the conservation of ecosystems on which threatened and endangered species of fish, wildlife, and plants depend. Section 7 requires all federal agencies to consult with the Secretary of the Interior on all projects and proposals with the potential to impact federally endangered or threatened plants and animals. It also requires federal agencies to use their authorities in furtherance of the purposes of the Endangered Species Act by carrying out programs for the conservation of endangered and threatened species. Federal agencies are also responsible for ensuring that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of designated critical habitat. Section 9 of the act makes it unlawful for a person to "take" a listed animal without a permit. The term "take" is defined in the act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." Through regulations, the term "harm" is defined as "an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering." Listed plants are not protected from take; however, it is illegal to collect or maliciously harm them on federal land. The act also imposes civil and criminal penalties for violations of any provisions of the act.

Executive Order 11593, "Protection and Enhancement of the Cultural Environment." This executive order directs federal agencies to inventory cultural properties under their jurisdiction, to nominate to the national register all federally owned properties that meet the criteria, to use due caution until the inventory and nomination processes are completed, and also to assure that federal plans and programs contribute to preservation and enhancement of nonfederal properties. Some of the provisions of the executive order were turned into section 110 of the National Historic Preservation Act.

Executive Order 11990, "Protection of Wetlands." Executive Order 11990 directs federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative. Director's Order 77-1: *Wetland Protection* (NPS 2012) and its companion document, Procedural Manual 77-1: *Wetland Protection* (NPS 2002b), provide NPS policies and procedures for complying with Executive Order 11990. Most actions associated with riverbank management will require a site-specific statement of findings for wetlands at the time that specific projects are implemented within the ordinary high water mark of the Knife River.

Executive Order 11988, "Floodplain Management." Executive Order 11988 requires the National Park Service to evaluate the likely impacts of actions in floodplains, avoid adverse impacts associated with the occupancy and modification of floodplains, and avoid support of floodplain development wherever a practicable alternative exists. Director's Order 77-2: *Floodplain Management* (NPS 2003) and its companion document, Procedural Manual 77-2: *Floodplain Management* (NPS 2002c), provide NPS policies and procedures for complying with Executive Order 11988. Pursuant to Director's Order 77-2, the National Park Service must strive to preserve floodplain values and minimize hazardous floodplain conditions (NPS 2003). Appendix F includes the Floodplain Management Statement of Findings. NPS Management Policy 28 4.6.6 also requires that the National Park Service manage streams to protect stream processes that create habitat features such as floodplains. Additionally, floodplain development in North Dakota is guided by the North Dakota Century Code 9 (chapter 61-16.2, Floodplain Management) to protect human life and property and reduce impacts from flood events. A development project in a regulatory floodway must obtain a floodway permit or authorization from the local floodplain coordinator.

Executive Order 13007, "Indian Sacred Sites." In managing federal lands, this executive order directs federal agencies, to the extent practicable, permitted by law, and consistent with essential agency functions, (1) to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners, (2) to avoid adversely affecting the physical integrity of such sacred sites, and (3) where appropriate, maintain the confidentiality of such sites. If a federal action may affect the physical integrity of, the ceremonial use of, or the access to these sites by American Indian religious practitioners in federally recognized tribes, then consultations are required with the associated tribe as part of the planning and approval process.

Executive Order 13175, "Consultation and Coordination with Indian Tribal Governments." Executive Order 13175 states that to the extent practicable and permitted by law, federal agencies cannot promulgate two types of rules unless they meet certain conditions. The two types of rules are: (1) rules with tribal implications, substantial direct compliance costs on Indian tribal governments, and not required by statute, and (2) rules with tribal implications and that preempt tribal law. Tribal implications are defined as having substantial direct effects on one or more Indian tribes, on the relationship between the federal government and Indian tribes, or on the distribution of power and responsibilities between the federal government and Indian tribes. Federal agencies cannot promulgate the first type of rule unless they provide funds necessary to pay direct compliance costs of the tribal governments, or early in the process before promulgation, consult with tribal officials. Consultation with tribal officials is required for the second type of rule.

Historic Sites, Buildings, and Antiquities Act, 1935. This act declares as national policy the preservation for public use of historic sites, buildings, objects, and properties of national significance. It authorizes the Secretary of the Interior and NPS director to restore, reconstruct, rehabilitate, preserve, and maintain historic or prehistoric sites, buildings, objects, and properties of national historical or archeological significance.

NPS *Management Policies 2006*. NPS *Management Policies* 2006 addresses management of cultural resources under section 5.0. This section states (NPS 2006a):

The National Park Service's cultural resource management program involves

- research to identify, evaluate, document, register, and establish basic information about cultural resources and traditionally associated peoples;
- planning to ensure that management processes for making decisions and setting priorities integrate information about cultural resources and provide for consultation and collaboration with outside entities;
- and stewardship to ensure that cultural resources are preserved and protected, receive appropriate treatments (including maintenance) to achieve desired conditions, and are made available for public understanding and enjoyment.

NPS Director's Order 28: *Cultural Resource Management*. This director's order (NPS 1998a) sets forth the guidelines for management of cultural resources, including cultural landscapes, archeological resources, historic and prehistoric structures, museum objects, and ethnographic resources. This order calls for the NPS staff to protect and manage cultural resources in its custody through effective research, planning, and stewardship in accordance with the policies and principles contained in the NPS *Management Policies 2006*.

Programmatic Agreement among the National Park Service (U.S. Department of Interior), The Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers for Compliance with Section 106 of the National Historic Preservation Act. In 2008, the National Park Service entered into a

Programmatic Agreement with the Advisory Council on Historic Preservation and the National Conference of State Historic Preservation Officers (2008 Programmatic Agreement) that covers all parks and entities within the NPS system (NPS 2008b). This agreement defines roles, qualifications, responsibilities, training requirements, and the general review process for signatories of the agreement. The agreement also includes a list of various undertakings that are eligible for streamlined review if they meet the required criteria. Generally, actions that fall within the streamlined review process are frequent with minimal to no impacts that require no additional consultation with each state historic preservation office if the criteria for streamlined review can be met. Nothing in this plan will supersede elements of the 2008 Programmatic Agreement. The 2008 Programmatic Agreement forms the basis for continued consultation with the North Dakota state historic preservation office for undertakings that qualify for section 106 review.

NPS Director's Order 12: *Conservation Planning, Environmental Impact Analysis, and Decision-making* and Handbook. NPS Director's Order 12 (NPS 2011), and its accompanying handbook (NPS 2001, NPS 2015a) lay the groundwork for how the National Park Service complies with the National Environmental Policy Act. During the development of this document, the handbook was updated and guidance from the update incorporated. Director's Order 12 and the handbook set forth a planning process for incorporating scientific and technical information and establishing a solid decision file for NPS projects. Director's Order 12 requires that impacts on park resources be analyzed in terms of their context, duration, and intensity. It is crucial for the public and decision makers to understand the implications of those impacts in the short and long term, cumulatively, and within context, based on an understanding and interpretation by resource professionals and specialists.

NPS Director's Order 77: *Natural Resource Protection*. Director's Order 77 addresses natural resource protection, with specific guidance provided in the Natural Resource Management Reference Manual #77. Reference Manual #77 (NPS 2004b) offers comprehensive guidance to NPS employees responsible for managing, conserving, and protecting the natural resources found in national park system units. The manual serves as the primary guidance on natural resource management in units of the national park system. Reference manual chapters that are particularly relevant to this plan include endangered, threatened, and rare species management; native animal management; and air resources management.

North Dakota Stream Bank Modification. North Dakota Century Code 61-33 gives the state engineer administrative authority over state sovereign land, which are defined as those areas, including beds and islands, lying within the ordinary high watermark of navigable lakes and streams. Rules for administration and management of sovereign lands were promulgated in North Dakota Administrative Code article 89-10 and require all projects occurring on state sovereign lands to obtain a permit for such activity.

Knife River Indian Villages Comprehensive Interpretive Plan. The Knife River Indian Villages Comprehensive Interpretive Plan (in development, 2016) defines the overall vision and long-term (7 to 10 years) interpretive goals of the park. The process that develops the plan defines realistic strategies and actions that work toward achievement of the interpretive goals. The plan consists of two phases. First, the foundation phase articulates significance, themes, and target audiences. The foundation document (NPS 2013) addresses those elements of the plan and includes a review of existing conditions. The second phase of the plan process involves recommendations for interpretive services, media, and partnerships for the park, over the next 7 to 10 years. This plan would be implemented in fiscal year 2016.

Knife River Indian Villages National Historic Site Foundation Document. In 2013, the park completed a foundation document that confirmed the park's purpose and significance, as noted above (NPS 2013). The foundation document also details the fundamental resources and values of the park as well as other important resources and values and interpretive themes. Additionally, the foundation document outlines the planning and data needs to support the park, assesses the importance of each of the fundamental resources and values, and outlines existing and desired conditions for each of them.

Knife River Indian Villages Fire Management Plan. The park completed a *Fire Management Plan* in 2008 (NPS 2008c). The plan was mandated by and complies with NPS Director's Order 18: *Wildland Fire Management*, which outlines NPS fire management policy that requires that "every park area with burnable vegetation must have a fire management plan approved by the Superintendent." The *Fire Management Plan* was prepared to serve as a detailed program of action, which provides specific guidance and procedures for accomplishing park fire management objectives. The plan defines levels of protection necessary to ensure both firefighter and public safety, protection of facilities, protection of cultural and natural resources, and minimizes undesirable environmental impacts of fire management. The *Fire Management Plan* also defines proper use of fire to restore and perpetuate natural processes given current understanding of the complex relationships in natural ecosystems.

Northern Great Plains Exotic Plant Management Plan. In 2005, the National Park Service completed an exotic plant management plan for the entire Northern Great Plains region (NPS 2005). The plan outlines methods to control exotic (nonnative) plants at 13 parks in order to reduce their negative effects on native plant communities and natural and cultural resources.

Knife River Indian Villages National Historic Site Cultural Resources Management Plan. A cultural resources management plan was completed for the park in 1983 (NPS 1983). The plan summarized the cultural resources present at the site, addressed specific problems that have a bearing on the management of those resources, and proposed solutions. All proposed activities involving cultural resources are expected to conform to this plan except in emergency situations. The 1983 plan currently guides management of resources, but it is out of date. This plan supersedes the 1983 plan and updates the park's management guidance.

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APPENDIX B: STANDARD OPERATING PROCEDURES FOR ARTIFACTS IN SITU

Knife River Indian Villages, NHS
National Park Service
PO Box 9
Stanton, ND 58571

Standard Operating Procedure

Submitted:	John Moeykens, LE Park Ranger	Date: ____________
Approved:	___________________________ KNRI Superintendent	Date: ____________

Effective Date:
Revision Date:

Subject: Property
Sub-Activity: Artifacts In Situ
Type of Directive: Policy
Distribution: All Personnel
Duration: Permanent
Amends: None
Rescinds: All Others
Supplements: None
Index: 109 File: (A)

I.PURPOSE
To provide a standard policy for the disposition of artifacts In situ.

II. DEFINITIONS
In Situ: An object's original position.

III. SCOPE
All park personnel.

IV. PROCEDURE
Under ordinary circumstances, no artifact to be removed from any location within the park. If you find an artifact, leave it in place, do NOT handle it. Note its description and precise location. As soon as possible, give the information to the Law Enforcement Chief Ranger or the Chief or Interpretation and Cultural Resources. In consultation with the Superintendent and Resource Management Specialist, a determination will be made on what will provide the best protection for the artifact.

If a visitor brings you an artifact they "found" in the park, politely return with them to the exact location found and return the artifact In situ. En route you have an excellent opportunity to interpret the reasons for not disturbing artifacts and the significance of our resource. If necessary, you're welcome to advise them of the rules and regulations that protect archeological artifacts: 16 USC, ARPA and 36 CFR 2.1(a) (1) and 36 CFR 2.1(a) (6)

If an item is so unique (not currently in the collection, or of a different type then we have) then it is advisable to document the item with photography, a global positioning system location should be obtained or at the least, mark the location using a blue or yellow golf tee; (which are available at the front desk). Notify your supervisor to determine if it needs to be removed and added into the park's collections. Finally, if a found item is commonplace, it should be returned to its original location by gently placing the item back into the location it was found. (i.e., under the loosen soil).

Advise your supervisor as soon as possible.

If you have any further questions, please consult with your supervisor.

Structure	Primary Use	Square Footage	Current Deferred Maintenance ($)	Construction Cost ($)[a]	Anticipated RM ($)[b]	Anticipated PM ($)[b]	Anticipated OPS ($)[b]	CR ($)[b]	Projected UM ($)[b]	Total TCFO (50 years) ($)[c]
Existing Maintenance Facility										
Maintenance shop	Houses tools and equipment used in all park operations, the majority of project work takes place here	1,581	7,476	0	123,691	98,844	758,176	320,028	378,857	1,679,596
Maintenance office	Office space for maintenance, resource management, break room, and fire truck storage	1,488	5,373	0	157,656	99,271	806,344	334,362	398,048	1,795,680
Cold storage	Storage area used by all park divisions for equipment, lumber, interpretive tools, fire cache, etc.	1,985	0	0	243,170	1,514	317,562	110,162	11,503	683,911
Tractor storage building	Area for tools and small equipment storage, minor project work, skid steer storage in winter for snow removal	240	0	0	59,471	236	81,706	488,83	1,797	192,093
Total:		5,294	12,849	0	583,989	199,864	1,963,788	813,435	790,205	4,351,281

Structure	Primary Use	Square Footage	Current Deferred Maintenance ($)	Construction Cost ($)[a]	Anticipated RM ($)[b]	Anticipated PM ($)[b]	Anticipated OPS ($)[b]	CR ($)[b]	Projected UM ($)[b]	Total TCFO (50 years) ($)[c]
New Maintenance Facility										
New maintenance facility	Incorporates functions of maintenance shop, office, cold storage, and tractor storage as described for the existing facilities	6,000	0	2,136,560	383,273	95,925	1,448,243	381,597	367,293	4,812,891
New maintenance facility built to Leadership in Energy and Environmental Design (LEED) standards with a solar array	Incorporates functions of maintenance shop, office, cold storage, and tractor storage as described for the existing facilities. Built to LEED standards with a solar array	6,000	0	2,898,032	400,636	100,271	1,513,851	398,884	383,932	5,520,543
Savings with New Consolidated Facility										
New maintenance facility		-706	0	- 2,136,560	200,716	103,939	515,545	431,838	422,912	- 461,610
New maintenance facility built to LEED standards with a solar array		-706	0	-2,898,032	183,353	99,594	449,937	414,551	406,273	-1,169,263
Existing Visitor Center										
Visitor Center	Where historic, cultural, and/or natural objects are stored and exhibited/interpreted for the public	8,100	276,301	0	761,699	99,271	3,266,682	479,041	398,048	5,004,741
Proposed Visitor Center Addition (to accommodate museum collection storage)										
Museum Collections Storage and	Dedicated space for storing museum objects,	3,000	0	3,170,880	1,015,204	99,271	4,358,989	534,082	398,048	9,576,474

Structure	Primary Use	Square Footage	Current Deferred Maintenance ($)	Construction Cost ($)[a]	Anticipated RM ($)[b]	Anticipated PM ($)[b]	Anticipated OPS ($)[b]	CR ($)[b]	Projected UM ($)[b]	Total TCFO (50 years) ($)[c]
Administrative Space	natural history specimens, and archival materials; designed or upgraded to meet the standards and requirements for the preservation, protection, and accessibility of the collections									
Additional Requirements of Expanded Visitor Center										
				-3,170,880	-253,505	0	-1,092,307	-55,041	0	-4,571,733

[a] All construction estimates include a gross markup of 35% and an escalation of 60% to account for cost premium in this area of North Dakota

[b] RM = Recurring maintenance, PM = preventative maintenance, OPS = facility operations, CR = component renewal, UM = unscheduled maintenance

[c] TCFO = Total Cost of Facility Ownership. Estimates life-cycle costs of facilities over 50 years accounting for operations and maintenance as well as construction costs.

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APPENDIX D: NATIONAL REGISTER STATUS, CONDITION, AND THREATS FOR ARCHEOLOGICAL SITES AT KNIFE RIVER INDIAN VILLAGES NATIONAL HISTORIC SITE

Resource Name	National Register Status	Condition	Threats and Needs
32ME00008	Listed/Documented	Unknown	Burrowing mammals
32ME00009	Listed/Documented	Good	Burrowing mammals
32ME00010	Listed/Documented	Fair	Burrowing mammals, vegetation, unauthorized collecting
32ME00011	Listed/Documented	Fair	Burrowing mammals, vegetation, bank erosion, stabilization maintenance, unauthorized collecting
32ME00012	Listed/Documented as a national historic landmark	Fair	Burrowing mammals, vegetation, cultural viewshed, unauthorized collecting
32ME00104	Unevaluated	Fair	Burrowing mammals, vegetation, cultural viewshed
32ME00298	Unevaluated	Good	Burrowing mammals, vegetation
32ME00299	Unevaluated	Good	Burrowing mammals, vegetation
32ME00310	Listed/Documented	Good	Burrowing mammals, infrastructure, erosion
32ME00311	Listed/Documented	Good	Burrowing mammals, vegetation, erosion
32ME00312	Listed/Documented	Good	Burrowing mammals, vegetation, erosion, infrastructure
32ME00348	Unknown	Unknown	
32ME00366	Listed/Documented	Good	Erosion, infrastructure, cultural viewshed
32ME00383	Listed/Documented	Good	Burrowing mammals, vegetation, infrastructure
32ME00407	Listed/Documented	Good	Burrowing mammals, vegetation
32ME00408	Listed/Documented	Poor	Erosion, burrowing mammals, vegetation, infrastructure
32ME00409	Listed/Documented	Good	Burrowing mammals, vegetation
32ME00410	Unevaluated	Good	Infrastructure, erosion
32ME00411	Listed/Documented	Good	Burrowing mammals
32ME00412	Listed/Documented	Good	Burrowing mammals, vegetation
32ME00413	Listed/Documented	Good	Burrowing mammals, vegetation

Resource Name	National Register Status	Condition	Threats and Needs
32ME00414	Listed/Documented	Good	Burrowing mammals, vegetation, erosion
32ME00415	Listed/Documented	Good	Burrowing mammals, vegetation, Erosion
32ME00416	Listed/Documented	Good	Burrowing mammals, vegetation, erosion
32ME00417	Listed/Documented	Good	Burrowing mammals
32ME01420	Listed/Documented	Good	Burrowing mammals
32ME01421	Listed/Documented	Good	Burrowing mammals
32ME01422	Listed/Documented	Good	Burrowing mammals, erosion
32ME01423	Listed/Documented	Good	Burrowing mammals, erosion
32ME00464	Listed/Documented	Good	Burrowing mammals
32ME00465	Listed/Documented	Good	Burrowing mammals
32ME00466	Listed/Documented	Good	Erosion, burrowing mammals, vegetation, infrastructure
32ME00467	Listed/Documented	Inundated-Uncertain	Erosion
32ME00468	Determined Ineligible	NA	NA
32ME00469	Determined Ineligible	NA	NA
32ME00470	Determined Ineligible	NA	NA
32ME00471	Determined Ineligible	NA	NA
32ME00472	Determined Ineligible	NA	NA
32ME00473	Listed/Documented	Good	Burrowing mammals, erosion, vegetation, infrastructure
32ME00474	Listed/Documented	Good	Burrowing mammals, vegetation
32ME00475	Listed/Documented	Good	Vegetation
32ME00476	Listed/Documented	Unknown	Vegetation
32ME00477	Listed/Documented	Good	Burrowing mammals, vegetation
32ME00478	Listed/Documented	Good	Burrowing mammals, vegetation, infrastructure
32ME00479	Listed/Documented	Good	Burrowing mammals, vegetation
32ME00480	Listed/Documented	Good	Burrowing mammals, vegetation
32ME00481	Listed/Documented	Good	Burrowing mammals, vegetation
32ME00482	Determined Ineligible	NA	NA
32ME00483	Determined Ineligible	NA	NA
32ME00484	Determined Ineligible	NA	NA
32ME00485	Determined Ineligible	NA	NA
32ME00486	Determined Ineligible	NA	NA
32ME00487	Listed/Documented	Good	Burrowing mammals, vegetation
32ME00488	Listed/Documented	Good	Burrowing mammals, vegetation

Resource Name	National Register Status	Condition	Threats and Needs
32ME00489	Listed/Documented	Good	Burrowing mammals, vegetation
32ME00490	Listed/Documented	Good	Burrowing mammals, vegetation
32ME00491	Listed/Documented	Good	Burrowing mammals, vegetation, erosion, stabilization maintenance
32ME00492	Listed/Documented	Good	Burrowing mammals, vegetation
32ME00493	Listed/Documented	Good	Burrowing mammals, vegetation, infrastructure
32ME00494	Listed/Documented	Good	Burrowing mammals, vegetation
32ME00495	Listed/Documented	Unknown	Burrowing mammals, vegetation, infrastructure
32ME00496	Listed/Documented	Good	Burrowing mammals, vegetation, infrastructure
32ME00497	Determined Eligible	NA	NA
32ME00498	Determined Eligible	NA	NA
32ME00499	Listed/Documented	Good	Burrowing mammals, infrastructure
32ME00787	Listed/Documented	Good	Infrastructure, burrowing mammals

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APPENDIX E: COMMON AND SCIENTIFIC NAMES FOR PLANTS, FISH, AND WILDLIFE

Common Names	Scientific Name
Birds	
American crow	*Corvus brachyrhynchos*
Bald eagle	*Haliaeetus leucocephalus*
Barn swallow	*Hirundo rustica*
Black-billed magpie	*Pica hudsonia*
Brown thrasher	*Toxostoma rufum*
Canada goose	*Branta canadensis*
Cliff swallow	*Petrochelidon pyrrhonota*
Common grackle	*Quiscalus quiscula*
Common nighthawk	*Chordeleis vociferous*
Downy woodpecker	*Picoides pubescens*
Great horned owl	*Bubo virginianus*
House wren	*Troglodytes aedon*
Killdeer	*Charadrius vociferous*
Lark sparrow	*Chondestes grammacus*
Lazuli bunting	*Passerina amoena*
Least tern	*Sterna antillarum*
Mallard	*Anas platyrhynchos*
Red-tailed hawk	*Buteo jamaicensis*
Red-winged blackbird	*Agelaius phoeniceus*
Ring-necked pheasant	*Phasianus colchicus*
Spotted sandpiper	*Actitis macularius*
Sprague's pipit	*Anthus spragueii*
Western meadowlark	*Sturnella neglecta*
Wild turkey	*Meleagris gallapavo*
Wood duck	*Aix sponsa*

Common Names	Scientific Name
Fish	
Blue sucker	*Cycleptus elongates*
Channel catfish	*Ictalurus punctatus*
Fathead minnow	*Pimephales promelas*
Northern pike	*Esox lucius*
Red shiner	*Cyprinella lutrensis*
Shovelnose sturgeon	*Scaphirhynchus platorynchus*
Sauger	*Sander canadensis*
Walleye	*Sander vitreus*
White sucker	*Catostomus aommersonii*
Mammals	
Badger	*Taxidea taxus*
Big hoary bat	*Lasiurus cinereus*
Coyote	*Canis latrans*
Deer mouse	*Peromyscus maniculatus*
Long-tailed weasel	*Mustela frenata*
Little brown bat	*Myotis lucifugus*
Meadow jumping mouse	*Zapus hudsonius*
Mule deer	*Odocoileus heminus*
Northern long-eared bat	*Myotis septentrionalis*
Northern pocket gopher	*Thomomys talpoides*
Pronghorn	*Antilocapra americana*
Red fox	*Vulpes*
Silver-haired bat	*Lasionycteris noctivagans*
Southern red-backed vole	*Clethrinomys gapperi*
Thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*
White-footed mouse	*Peromuscus leucopus*
White-tailed deer	*Odocoileus virginianus*
Plants	
Absinth wormwood	*Artemisia absinthium*
American elm	*Ulmus americana*
Black medic	*Medicago lupulina*
Boxelder	*Acer negundo*
Canada thistle	*Cirsium arvense*
Chinese elm	*Ulmus parvifolia*

Common Names	Scientific Name
Coyote willow	*Salix exigua*
Crested wheatgrass	*Agropyron cristatum*
Eastern cottonwood	*Populus deltoides*
Field bindweed	*Convolvulus arvensis*
Field mustard	*Brassica kaber*
Grape	*Vitis* spp.
Green ash	*Fraxinus pennsylvanica*
Honeysuckle	*Lonicera* spp.
Kentucky bluegrass	*Poa pratensis*
Kochia	*Kochia scoparia*
Leafy spurge	*Euphorbia esula*
Milkweed	*Asclepias* spp.
Peachleaf willow	*Salix amygdaloides*
Russian olive	*Eleagnus angustifolia*
Siberian elm	*Ulmus pumila*
Smooth brome	*Bromus inermis*
Strawberry	*Fragaria* spp.
Sweet clover	*Melilotus* spp.
Virginia wild rye	*Elymus virginicus*
Wild licorice	*Galium* spp.
Reptiles and Amphibians	
Bullsnake	*Pituophis catenifer*
Boreal chorus frog	*Pseudacris maculate*
Great plains toad	*Bufo cognatus*
Northern leopard frog	*Rana pipiens*
Plains garter snake	*Thamnophis radix*
Plains spadefoot toad	*Spea bombifrons*
Racer	*Coluber constrictor*
Red-sided garter snake	*Thamnophis sirtalis*
Rocky mountain toad	*Bufo woodhousii*
Tiger salamander	*Ambystoma tigrinum*

Note: A further listing of all plant, fish, and wildlife species at Knife River Indian Villages National Historic Site can be accessed at https://irma.nos.gov/NPSpecies/

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APPENDIX F: FLOODPLAIN MANAGEMENT STATEMENT OF FINDINGS

STATEMENT OF FINDING FOR EXECUTIVE ORDER 11988: FLOODPLAIN MANAGEMENT, EXECUTIVE ORDER 13690: ESTABLISHING A FEDERAL FLOOD RISK MANAGEMENT STANDARD AND A PROCESS FOR FURTHER SOLICITING AND CONSIDERING STAKEHOLDER INPUT, AND NPS DIRECTORS ORDER 77-2: FLOODPLAIN MANAGEMENT

ARCHEOLOGICAL RESOURCES MANAGEMENT PLAN ENVIRONMENTAL IMPACT STATEMENT

Knife River Indian Villages National Historic Site

RECOMMEND:
____
SUPERINTENDENT, KNIFE RIVER INDIAN VILLAGES NATIONAL HISTORIC SITE DATE

TECHNICAL
ADEQUACY:____
CHIEF, WATER RESOURCES DIVISION DATE

CONCURRED:____
REGIONAL DIRECTOR, MIDWEST REGION DATE

INTRODUCTION

Knife River Indian Villages National Historic Site (park) is preparing an environmental impact statement for proposed archeological resource management at the park. Proposed archeological resource management would consist of using numerous bank stabilization techniques to address Knife River bank erosion through an adaptive management framework and vegetation management treatments.

Policy Introduction

Executive Order 11988, “Floodplain Management” and the newly issued Executive Order 13690, “Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input” require the National Park Service and other federal agencies to evaluate the potential impacts of their actions on floodplain resources. The evaluation is intended to reduce the risk of flood damage to park resources, preserve floodplain values, and minimize the impact of floods on human safety, health and welfare. This statement of findings has been prepared according to NPS Floodplain Director’s Order 77-2 (NPS 2003) and Procedural Manual 77-2 (NPS 2002c) to comply with Executive Order 11988 and Executive Order 13690.

PROPOSED ACTION

The preferred alternative would include impacts from implementation of bank stabilization techniques and vegetation management treatments as described below. The actions under this alternative are Class 1 and subject to floodplain review because they are located within the 100-year floodplain.

Bank stabilization techniques can affect floodplain resources through direct modification in floodplain size and by altering their ability to store water, reduce peak flood flows, and infiltrate water. Bank stabilization techniques that trap the river flow within the banks both reduce and eliminate the ability of the river to access the floodplain resources and minimize the beneficial values of the floodplain resource (Ellis 2002; USDA-NRCS n.d.). Many stabilization techniques affect water surface elevation and velocity upstream and downstream of the stabilized area leading to riverine instability and potentially to an increased risk of flooding (Fischenich 2001; Florsheim et al. 2008). The placement of some types of stabilization techniques in an incised channel prevents the river from naturally developing a new functioning floodplain. Bank stabilization techniques that enhance or restore riverine-floodplain connectivity, the riparian vegetation community, or bankfull benches are the most beneficial to floodplain resources. The use of an adaptive management framework would provide beneficial impacts on floodplain resources by implementing treatment techniques that consider the overall condition of the riverine and riparian ecosystems. The framework would allow for dynamic equilibrium and natural processes such as the creation of new, active floodplains. During construction, implementation of bank stabilization projects could result in short-term, adverse impacts on floodplain functioning as a result of disturbance of banks and floodplain lands. Depending on the method of bank stabilization, direct, long-term, adverse impacts would result from modifications to upstream and downstream floodplain resources or direct, long-term, beneficial impacts would result from an increase in floodplain area and a decrease in flood risks. Table F-1 summarizes the impacts of bank stabilization techniques on floodplain resources:

TABLE F-1. IMPACTS ON FLOODPLAIN RESOURCES ASSOCIATED WITH BANK STABILIZATION TECHNIQUES

Stabilization Techniques	Stabilization Technique Life Span	Construction Disturbance Level[a]	Impacts on Floodplain Resources
Soil bioengineering	Both short and long term	Ranging from minor to moderate	Potential short-term, adverse impacts as a result of construction activities and long-term, adverse impacts from the loss of floodplain resource functions until the reestablishment of vegetation. Long-term, beneficial impacts from the restoration of floodplain resource functions.
Bank armoring	Long term	Ranging from minor to major	Potential short-term, adverse impacts as a result of construction activities and long-term, adverse impacts as a result of a reduction in floodplain resource function and interruption in the river and floodplain resource connection (Baird et al. 2015; FEMA n.d.).
Flow diversion	Both short and long term	Ranging from moderate to major	Potential adverse impacts from the placement of flow diversion structures could indirectly result in channelization and floodplain resource impacts elsewhere (Baird et al. 2015; Ellis 2005). In comparison to other bank stabilization measure, the disturbance to banks typically would be less and the placement of diversion structures would not directly impact floodplain resources.

Stabilization Techniques	Stabilization Technique Life Span	Construction Disturbance Level[a]	Impacts on Floodplain Resources
Energy reduction	Long term	Ranging from moderate to major	Potential indirect, adverse impacts as a result of channelization and subsequent floodplain resource impacts downstream.
Geotechnical slope stabilization	Both short and long term	Ranging from minor to major	Potential adverse impacts as a result of construction activities and the disconnection of the river and floodplain resources. Potential long-term, beneficial impacts as a result of improved riverine-floodplain connections (Baird et al. 2015).
Channel development	Long term	Major	Potential adverse impacts as a result of construction activities. Potential beneficial impacts as a result of a reduction of flood risks and an increase in floodplain area (Baird et al. 2015).

[a] Construction disturbance level can vary depending on current condition of banks and will be dependent on bank slope/angle of repose necessary for structure technique, as well as depth/footprint of grading needed for installation

Vegetation management treatments can temporarily affect floodplain resources by altering their ability to store water, reduce peak flood flows, and infiltrate water. All vegetation management treatments involve the initial clearing of vegetation that could temporarily degrade floodplain resource functioning depending on the amount of clearing and the vegetation remaining (USDA-NRCS 1996). Clearance of substantial amounts of vegetation as a result of some vegetation management treatments, including controlled burns would have the potential for greater impacts. Without vegetation, the capacities of a floodplain resource to infiltrate and slow floodwaters are reduced, thereby increasing the potential impacts of a flood event (Wright 2007). Mechanical treatment involves some soil disturbance, which would enhance the water infiltration and water storage functions of the floodplain resources. The addition of vegetation through reseeding methods associated with cultural treatments would benefit floodplain resources over the long term. The application of herbicides would have short-term, adverse impacts on floodplain resources from temporary vegetation removal. Vegetation management practices would result in indirect, short-term, adverse impacts on floodplains from vegetation removal; there would be no adverse long-term impacts because of revegetation. Table F-2 summarizes the impacts of vegetation management treatments on floodplain resources:

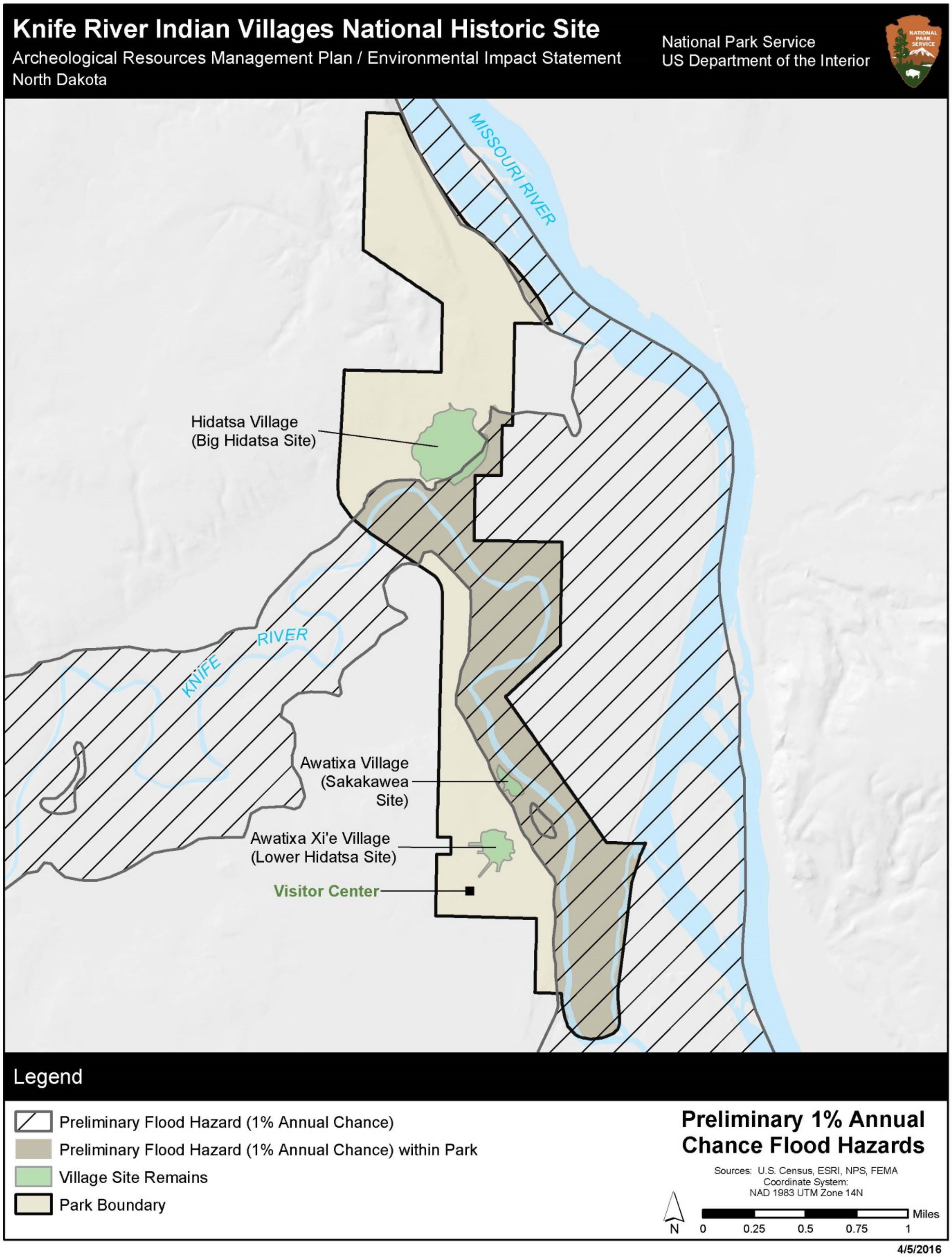
TABLE F-2 IMPACTS ON FLOODPLAIN RESOURCES ASSOCIATED WITH VEGETATION MANAGEMENT TREATMENTS

Vegetation Management Treatment	Description	Ground Disturbance	Long-Term Maintenance	Impacts on Floodplain Resources
Cultural treatments	Examples include prevention and reseeding of native herbaceous species following woody vegetation removal. Reseeding method includes hand broadcasting, seed drill, hydroseeding, and seed mats.	Minor to moderate	Requires ongoing prevention practices; periodic spot reseeding and irrigation.	Potential for short-term, adverse impacts as a result of woody vegetation clearing (USDA-NRCS 1996).
Manual treatments	Includes hand pulling or cutting using small hand tools and shovels. Most manual methods need to be used in combination with pesticides, grazing, or prescribed fire to treat resprouts and new seedlings.	Minor to moderate	Requires spot treatments annually.	Potential for short-term, adverse impacts as a result of vegetation clearing (USDA-NRCS 1996).
Mechanical treatments	Includes pulling, cutting, grubbing, and mowing using weed whippers, mowers, tractor or all-terrain vehicle-pulled mowers, chainsaws, and shovels. Most mechanical methods need to be used in combination with pesticides, grazing, or prescribed fire to treat resprouts and new seedlings. Heavy equipment could be used for treatment of woody species encroachment.	Minor to moderate	Requires spot treatment annually.	
Chemical treatment	Herbicides applied using portable sprayers, all-terrain vehicles equipped with sprayers, and aerial spraying. Includes spraying; basal bark and stem treatment; cut surface treatment; cut stump treatment; tree injection.	Minor	Spot treatments the first year; depending on the species requires continuing spot treatments every 1 to 3 years.	Potential for short-term, adverse impacts as a result of vegetation clearing.

Vegetation Management Treatment	Description	Ground Disturbance	Long-Term Maintenance	Impacts on Floodplain Resources
Prescribed fire treatments	Frequency, intensity, and timing of burning are extremely important. Used in the spring to deter woody species germination. Prescribed fire used as treatment of woody species encroachment needs to be used in combination with mowing, herbicide, or reseeding with native grasses to treat resprouts and new seedlings.	Minor to moderate	Requires ongoing treatment practices every 3 to 5 years. (Snowberry requires annual treatment.)	Potential adverse impacts as a result of vegetation clearing. Potential impacts on floodplain resources as a result of controlled burns would be more pronounced than other vegetation management treatments as a result of larger amounts of cleared vegetation (USFWS 2009).
Biological controls	Includes the use of insects and microorganisms to reduce the abundance of an exotic plant. Long-term solution for controlling select exotic plant species.	Minor	Pending reproduction, establishment, and effect of biological control on target vegetation species, more than one release may be necessary for desired level of management.	No impacts on floodplain resources.
Grazing	Considerations include grazing practice used (i.e., standard grazing, flash grazing, rotational grazing), stocking rate, species of livestock, timing (i.e., spring, summer, fall), and fencing requirements.	Minor	Requires seasonal to continual maintenance.	Minimal potential for adverse impacts as a result of vegetation clearing (Machtinger 2007).

SITE DESCRIPTION

The Federal Emergency Management Agency (FEMA) preliminary data and floodplain mapping includes approximately 747 acres of the park's 1,748.8 acres are within the 100-year floodplain with a 1% chance of annual flood hazard (figure F-1) (FEMA 2007). No 500-year floodplains (0.2% annual chance floodplain) are located in the park (FEMA 2015a, b).



Source: FEMA 2007

FIGURE F-1: PRELIMINARY 1% ANNUAL CHANCE FLOOD HAZARD

Historically, the floodplain areas in the park consisted of forest cover. However most of these areas have been intensely affected and altered since the earliest human occupation and are now known as "Missouri River bottomlands." The bottomlands comprise riparian forest communities with various portions of the floodplain resources in different successional stages, including some planted with a mixture of native and exotic grasses and large areas dominated by grasses.

Most of the land in the park is in the base floodplain of either the Knife or Missouri Rivers (figure F-1).

Flood flows on the Knife River still occur during the spring snowmelt and ice breakup phase and in early summer during rain events. Recent flooding events and overbank flow occurred in 1997, 2003, 2009, and 2011. Major flooding and overland flow occurred in March 1997 as a result of ice melt (Ellis 2005; Nadeau et al. 2014). During the 1997 flood event, flood stages were high for weeks, and the event removed 86 feet of riverbank downstream of Elbee Bend and damaged the trail along the river terrace (Ellis 2005; Nadeau et al. 2014). High water and some overbank flow occurred in March 2003 as a result of an ice jam at Noname Bend (Ellis 2005). Spring flooding occurred in 2009 and 2011 for an extended period (Nadeau et al. 2014). Each of these flooding events resulted in river bank degradation, erosion, and soil loss close to or at archeological sites (Nadeau et al. 2014).

JUSTIFICATION FOR USE OF THE FLOODPLAIN

Project actions associated with the preferred alternative will be located in the 100-year floodplain and floodways. All bank stabilization measures would need to be located in the floodplain. The proposed bank stabilization improvements are functionally dependent on locations near water and for which non-floodplain sites are not practicable alternatives. Alternative locations for the siting of bank stabilization do not exist. The siting of bank stabilization measures depends on the location of archeological resources, particularly those located in the floodplain. Although all bank stabilization projects must occur in the floodplain, the extent of stabilization structures, placement of structures, and types of structures would be selected to minimize floodplain impacts especially through the use of the adaptive management framework.

Some vegetation management may occur in the floodplain. After invasive vegetation is cleared and before new vegetation is reestablished, a minimal amount of disturbance to floodplain resource functions could occur. Without vegetation, the floodplain resource could have reduced capacity to infiltrate high flows and slow floodwaters. However, no alternative locations for vegetation management exist. The siting of vegetation management depends on the location of archeological resources, and implementation of management measures are necessary to protect these resources. If invasive plants in a floodplain resource have the potential to harm archeological resources, then vegetation management must occur in the floodplain resource, but the extent and type of management treatments would be short term and could be selected to minimize impacts on the floodplain resource. Following reestablishment of vegetation, natural floodplain values would be restored.

DESCRIPTION OF SITE-SPECIFIC FLOOD RISK

The Knife and Missouri Rivers flow through portions of the park. The Knife River meanders through the southern three-quarters of the site, while the Missouri River flows through the extreme southeast boundary. Floodplains comprise 60% of the parklands and are found immediately adjacent to the rivers. Historically, both the Knife and Missouri Rivers were subject to inundation during spring runoff and excessive rain storms. Today, as a result of the operation of Garrison Dam, much of the flooding associated with the Missouri River has been eliminated in the vicinity of the park. However, the Knife River still retains its historic potential for flooding (NPS 1985). Bank stabilization projects could include in-river structures and the potential for channel realignment, which could affect floodplain resources and floodways.

Not only will the bank stabilization structures be located in the 100-year floodplain, by necessity they will be located in the floodway, that portion of the channel that experiences the greatest velocities during high flow conditions. The stabilization structures should be designed to allow them to withstand flood velocities to varying degrees.

Flood flows along the Knife River, including in the park, occur regularly during spring as snow melts and ice on the river breaks up. Major floods have occurred in 1997, 2003, 2009, and 2011. Overbank flooding is typically short whereas flood flow can last for several weeks (Ellis 2005; Nadeau et al. 2014). The location of the bank stabilization structures would place them in a zone that experiences very frequent flooding.

HOW THE ACTION WILL BE DESIGNED OR MODIFIED TO MINIMIZE HARM TO PROPERTY AND LIFE

No buildings would be constructed in the floodplain resource; therefore, no impacts on human health and safety are anticipated. Although floods occur regularly, the flood waters would likely be observable and predictable well in advance of bank overtopping.

The proposed bank stabilization structures have the potential to alter localized flood elevations. However, appropriate design, siting, and type of structure would prevent significant increases in flood elevation. These designs and siting options would be specific to each potential site of bank stabilization. Existing hydrologic and hydraulic conditions, including shear stress, channel morphology (including angle of repose), bed and bank materials, and climate are typically considered. The use of an adaptive management plan would help in the consideration of the overall condition of the riverine and riparian ecosystems. Additionally, the potential exists for the loss of capital investment associated with future impacts on implemented bank stabilization techniques. These impacts could be minimized by use of site-specific designs, adaptive management, and use of the site prioritization tool. The selection of a bank stabilization type and location should be aided by the attributes of each stabilization technique described in table 2-4 of chapter 2 of the Knife River Indian Villages National Historic Site Archeological Resources Management Plan / Environmental Impact Statement.

MITIGATION ACTIONS

During the project development process and construction, minimization and mitigation measures would be applied to reduce impacts on sensitive resources. As mentioned previously, an adaptive management framework would minimize negative effects and provide beneficial impacts on floodplain resources by implementing management techniques that consider the overall condition of the riverine and riparian ecosystems. The framework would allow for dynamic equilibrium and natural processes such as the creation of new active floodplains. Additionally, revisions and adjustments throughout the adaptive management process would allow the management techniques to perform more effectively in the frequently unstable environment of the existing river system.

Erosion and sediment control measures would be designed in accordance with state regulations and the specifications of best management practices. Examples include sediment basins, silt fences or curtains, vegetative buffers, erosion control blankets, and instream construction techniques (i.e., temporary flow diversions and dams or barriers) (NDDH 2015b; VADCR 2004).

During initial bank stabilization site preparation and vegetation management, existing vegetation would be removed only as required and to the limits necessary to complete the proposed project. Bank stabilization measures would use living vegetative and natural materials as much as practicable. Revegetation would occur in all disturbed areas. For both bank stabilization and vegetation management, only native plant seed mixtures approved by park staff would be used. No structures would be constructed in the floodplain resource.

NATURAL FLOODPLAIN VALUES

Floodplain resources provide benefits to human and natural environments. The floodplains of rivers can temporarily store floodwaters and attenuate flood flows, resulting in protection for people and property. Floodplain lands provide habitat for plants, fish and mollusks, and wildlife, and thus are ecologically important because they sustain ecosystem integrity and biodiversity. Undisturbed floodplains provide scenic value and can be used for educational and recreational activities. They provide groundwater recharge or discharge and can improve water quality.

Impacts on floodplain resources and floodplain values would result from the continued presence of bank stabilization measures and new installation of stabilization techniques, as well as vegetation management treatments in the 100-year floodplain. No existing structures in the park would be susceptible to flooding and damage, and any new facilities would be constructed outside the floodplain resource. Several roads cross the floodplain in the park; however, the bank stabilization measures would protect these roads and existing archeological resources.

The park is tasked with the preservation and interpretation of the existing archeological and cultural resources for the public. These resources are threatened by riverbank erosion and invasive vegetation. Proposed bank stabilization and vegetative management treatments would benefit these resources and would prevent or minimize the threats, even though floodplain values would be adversely impacted.

CONCLUSION

Activities associated with the preferred alternative would be located in the floodplain resource and would potentially result in impacts on floodplain resource functions or values. Bank stabilization measures would be designed and placed to allow natural process to continue to the extent possible while minimizing impacts on archeological resources to the extent reasonable. The use of the adaptive management framework would allow for management that adjusts to the resource conditions and minimizes the disturbance to floodplain resources and alterations to upstream or downstream flooding. Compliance with applicable regulations and policies to minimize impacts on floodplain resources and loss of property or human life would be strictly adhered to during and after the construction. As a result, impacts on floodplain resource functions or values from the proposed project would be limited and localized.

The National Park Service finds the preferred alternative to be consistent with Executive Order 11988 and Director's Order 77-2.

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ACRONYMS AND ABBREVIATIONS

2008 Programmatic Agreement	"Programmatic Agreement among the National Park Service (US Department of the Interior), the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers for Compliance with section 106 of the National Historic Preservation Act"
advisory council	Advisory Council on Historic Preservation
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
Cultural Resources Management Plan	*Knife River Indian Villages National Historic Site Cultural Resources Management Plan.*
Exotic Plant Management Plan	*Northern Great Plains Exotic Plant Management Plan*
E. coli	*Escherichia coli*
EIFS	exterior insulation finishing system
EIS	environmental impact statement
°F	degrees Fahrenheit
Fire Management Plan	*Knife River Indian Villages National Historic Site Fire Management Plan*
GIS	geographic information system
Interior	US Department of the Interior
LEED	Leadership in Energy and Environmental Design
mg/L	milligrams per liter
MHA Nation	Mandan, Hidatsa, and Arikara Nation
MWAC	Midwest Archeological Center
NAGPRA	Native American Graves Protection and Repatriation Act
NDGF	North Dakota Game and Fish Department
NMFS	National Marine Fisheries Service
NPS	National Park Service

NTU	nephelometric turbidity units
Park	Knife River Indian Village National Historic Site
PEPC	Planning, Environment, and Public Comment
Plan	Knife River Indian Villages National Historic Site Archeological Resources Management Plan / Environmental Impact Statement
SHPO	state historic preservation office(r)
THPO	tribal historic preservation office(r)
USACE	US Army Corps of Engineers
USC	United States Code
USDA-APHIS	US Department of Agriculture Animal and Plant Health Inspection Service
USEPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service

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