National Park Service
U.S. Department of the Interior

Acadia National Park
Maine

Carriage Road Bridges Rehabilitation

Environmental Assessment

February 3, 2003



U.S. Department of the Interior
National Park Service

Environmental Assessment
Carriage Road Bridges Rehabilitation

Acadia National Park
Hancock County, Maine
February 3, 2003

Proposed Action:
The National Park Service proposes to rehabilitate 25 carriage road bridges that are part of the carriage road system at Acadia National Park near Bar Harbor, Maine. Professional engineering studies have found deteriorating conditions at each bridge. The preferred alternative of "Full Rehabilitation" would focus on installing a water-prevention system comprised of several components. These components include installing a waterproof barrier below the road surface, repointing and mortaring masonry joints and capstones, and installing external and internal drainage improvements. Other rehabilitation activities would include repairing and replacing guardrails, repairing erosion and scoured areas, and cleaning. All rehabilitation activities would be consistent with and maintain the cultural integrity of each bridge. Other important objectives include rehabilitating selected scenic vistas and adjacent hiking trails. This Environmental Assessment documents the decision making process that led to the preferred alternative and assesses the potential adverse and beneficial impacts that would result. Very minor, temporary, adverse impacts to natural and cultural resources could result from implementing the preferred alternative. Conversely, numerous long-term beneficial impacts would result from rehabilitating the carriage road bridges.

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Note to Reviewers and Respondents:
If you wish to comment on this Environmental Assessment, you may mail comments by March 4, 2003, to the name and address below. Please note that names and addresses of people who comment become part of the public record. If you wish for us to withhold your name and/or address, you must state this prominently at the beginning of your comment. We will make all submissions from organizations, businesses, and individuals identifying themselves as representatives or officials of organizations or businesses available for public inspection in their entirety.

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Comments submitted via electronic mail may be addressed to judy_hazen_connery@nps.gov and will be accepted through March 4, 2003.

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Executive Summary

This **Environmental Assessment (EA)**[1] provides documentation and solicits public involvement in the decision making process for the rehabilitation of the **carriage road bridges (bridges)** at **Acadia National Park (ANP)**, which include 15 masonry **arch** bridges, 9 steel **stringer** bridges, and 1 concrete **culvert**. The **carriage road system (CRS)** is listed in the National Register of Historic Places. The 25 bridges are an important and integral component of the larger CRS. Each bridge is architecturally unique and an important part of the historic fabric of the Park. Each bridge shows signs of deterioration resulting from natural processes. The basic project purpose is to repair and fully rehabilitate the bridges and to maintain them for current and future generations. This EA examines NPS policies, the Park's **General Management Plan (GMP)**, and other ANP management plans to assess the consistency of the proposed rehabilitation, and has been prepared in accordance with the **National Environmental Policy Act of 1969 (NEPA)**.

Two alternatives are proposed to rehabilitate the bridges: the "No Action" alternative and the preferred "Full Rehabilitation" alternative. Each alternative would have adverse and beneficial impacts, but only the "Full Rehabilitation" alternative meets the project purpose. Several other alternatives were considered, but were rejected because they did not meet the basic project purpose. The potential impacts for the "No Action" and "Full Rehabilitation" alternatives are assessed and compared.

The "No Action" alternative does not meet the basic project purpose of rehabilitating the bridges, but is included to provide a baseline upon which to compare the effects of the "Full Rehabilitation" alternative. This alternative avoids some short-term, temporary impacts to visitor use and experience, but does not address the need for bridge maintenance. Furthermore, continued deterioration of the structural components of the bridges would likely result in future bridge closures that would have moderate long-term adverse impacts on visitor use and experience. Deterioration of the bridges would have an adverse impact on the cultural and historic setting of the CRS. One additional adverse impact involves erosion within and along several stream channels. Under the "No Action" alternative, soil erosion within and along several stream channels would continue and would constitute a long-term, minor adverse impact to water quality and aquatic habitats.

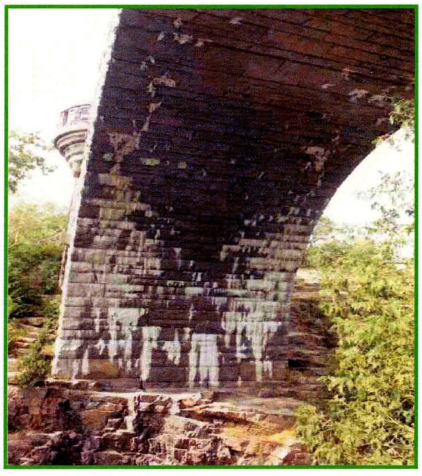
The NPS Preferred Alternative of "Full Rehabilitation" clearly meets the basic project purpose of rehabilitation, which is needed to keep the bridges functional in the long-term. Completing the rehabilitation would have long-term benefits for natural and cultural resources, would enhance visitor use and experience, and would not impair Park resources.

[1] A complete list of acronyms and bridge related terms in **bold** throughout the text is provided in Section 6.0.

1 Introduction: Purpose & Need

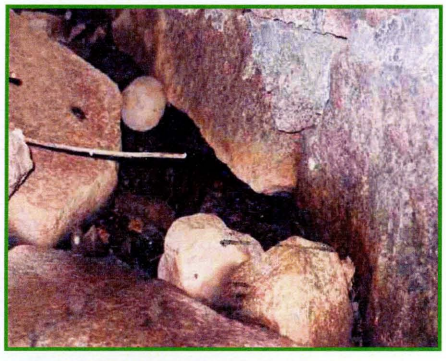
1.1 Purpose & Need for the Action

The **National Park Service (NPS)** is proposing to rehabilitate 24 historic bridges, 1 culvert, certain adjacent sections of historic hiking trails, and elements of the surrounding cultural landscape in a manner that is structurally and environmentally sound, consistent with NPS management policies, and meets the *Secretary of the Interior's Standards for Rehabilitation* (36 **CFR** Part 67) of historic structures. The rehabilitation work has been planned so that it does not produce any major adverse direct, indirect, or cumulative environmental impacts and would not impair Park resources.



Evidence of water seepage and calcium carbonate deposits

Rehabilitating the bridges would address current and long-term problems that threaten to undermine the structural integrity of the bridges and would maintain their historic architectural appearance. Furthermore, rehabilitating these unique features will address minor environmental adverse impacts resulting from continued visitor use and natural ecological processes.



Evidence of scouring



Erosion from social trails along Duck Brook

This EA documents the proposed rehabilitation of 25 bridges and the technical and planning process used to determine the level of rehabilitation and methodology for minimizing adverse environmental effects. This EA describes the alternatives considered in relation to their impacts on the human and natural environment. It was prepared in accordance with NEPA, as amended, regulations of the **Council on Environmental Quality (CEQ)** (40 CFR 1508. 9), and *NPS Director's Order 12: Conservation Planning, Environmental Impact Analysis, and Decision-making* (NPS 2002).

The proposed "Full Rehabilitation" of the bridges documented in this EA includes three main components:

1. rehabilitating structural and architectural features that have deteriorated over time, including a major water prevention process, rectifying scouring and erosion problems underneath and adjacent to some of the bridges;
2. rehabilitating the surrounding landscape and setting; and
3. rehabilitating small portions of trails adjacent to eight of the bridges.

The Historic Bridge Reconnaissance Surveys Reports completed by **Vanasse Hangen Brustlin, Inc. (VHB)** during 1994 and 2001 (VHB 1994 and 2002) provide detailed descriptions of all the bridges, their conditions, and proposed rehabilitation. The reports also provide the technical basis for the proposed work. Field inspections by VHB engineers confirmed that the bridges are structurally sound, but all are experiencing varying levels of deterioration. Natural processes, primarily water infiltration, compromised the condition of the bridges to a point that warrants repair, cleaning, and rehabilitation. Deteriorating conditions include the failure of the original waterproofing system, which is causing cracking in the granite masonry, the displacement of stones, deteriorating mortar joints, undermining of **abutments**, **spalling** and **delamination** of exposed concrete surfaces, and calcium carbonate deposition.



Harbor Brook Bridge, part of the Carriage Road System at ANP

Water seeping through the structures has fueled a freeze/thaw cycle, causing cracks and separations in stone, mortar, and concrete. This action facilitates increased volumes of seepage, furthering the deterioration process. Erosion and scouring are evident along some of the streams and underneath some of the bridges. Erosion and scouring increase turbidity and decrease water quality in downstream areas, which can have adverse effects on aquatic wildlife. If allowed to continue, the deterioration of the bridges will lead to structural deficiencies and potential bridge closures. Without rehabilitation, reconstruction would eventually be necessary.

The carriage road surfaces were rehabilitated in the early 1990's. The Stanley Brook Bridge and Jordan Stream Little Bridges were rehabilitated during 2000 based on the recommendations of the VHB (1994) study. This rehabilitation effort provided a basis to understand and improve the rehabilitation techniques and provided a basis for the proposed rehabilitation.

Public funding has become available for completing the maintenance needs of the bridges. Extensive studies were completed assessing the condition of each bridge and recommending the appropriate rehabilitation (VHB 1994 and 2002). The proposed rehabilitation work would repair damage and rehabilitate the bridges, and would prevent further damage and deterioration.



Steel stringer bridge, Eagle Lake Bridge No. 3

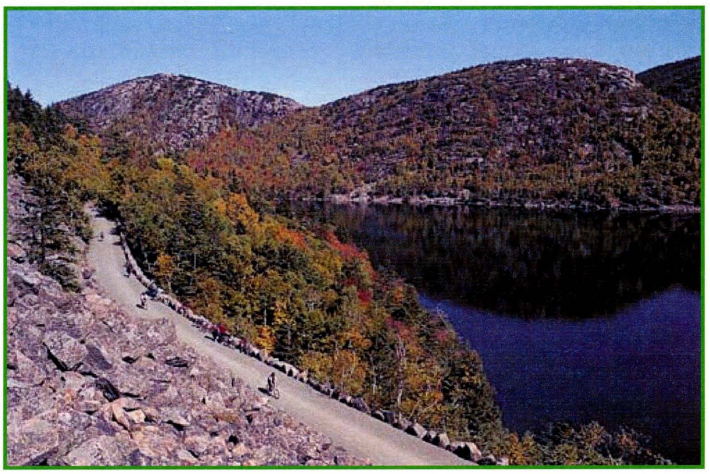
This assessment does not specifically complete the requirements of Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations (36 CFR 800). However, because the bridges are listed in the National Register of Historic Places and their preservation is the overriding concern of the proposed rehabilitation project, this EA includes a thorough evaluation of the affects of the project relative to maintaining the historical and cultural integrity of each

bridge. The consultation process under Section 106 with the Maine State Historic Preservation Officer will be completed concurrently and independently.

1.2 Project Background

1.2.1 History and Significance of Acadia National Park

Acadia National Park (ANP) is home to a unique set of natural and cultural resources that are enjoyed by millions of visitors each year. ANP encompasses a 35,000-acre landscape of rare scenic beauty located in the mid-coastal region of Maine, approximately 45 miles southeast of Bangor (Figure 1) on **Mount Desert Island (MDI)**. ANP is known for its varied and dramatic scenery, including rugged coastline, cobblestone beaches, offshore islands, granite cliffs, glacial lakes, salt marshes, freshwater wetlands and streams, and evergreen and hardwood forests. The Park was established in 1919 and became the first national park east of the Mississippi River.



Bicycling has become the primary type of carriage road use.

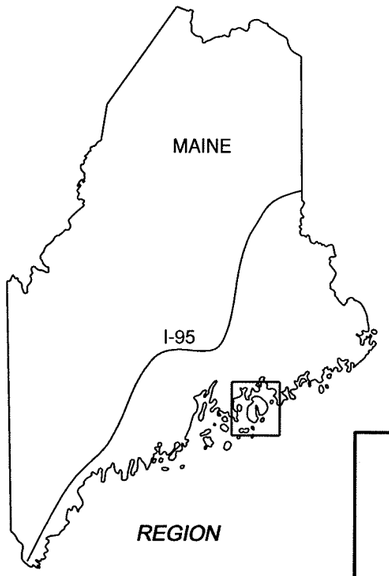
ANP is an important vacation destination, as only 6% of the Maine coast is accessible to the public, with one-quarter of that acreage located in ANP (NPS 1991). The Park receives approximately 2.7 million visitors annually, and some 80% of these visitors eventually use the Park's hiking trails and system of carriage roads. Approximately one-half of the Park's annual visitors are repeat visitors, which stresses the Park's appeal as a destination vacation area.

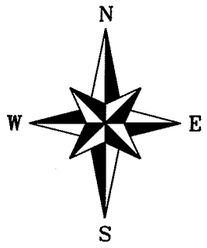
1.2.2 Carriage Road System and Bridges

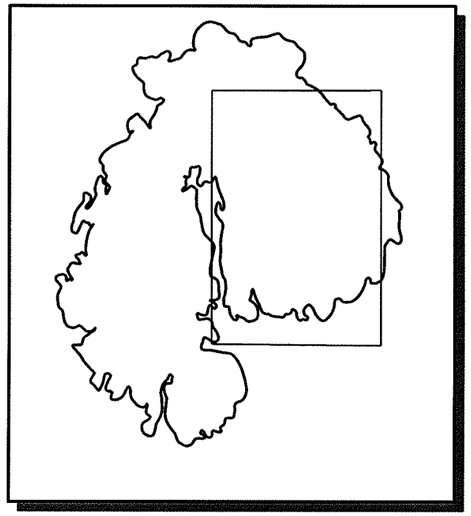
The **carriage road system (CRS)** was conceived and developed by John D. Rockefeller, Jr. He focused on the creation of a circulation system that would allow access to the most scenic and remote sections of the area. This encompassed the establishment of two systems of roads: one for carriages and one to accommodate automobiles. In 1913, Rockefeller began building a system of carriage roads on his Seal Harbor estate and neighboring properties. Two years later, he was granted permission to extend the roads onto the lands controlled by the Hancock County Trustees of Public Reservations. These early roads eventually evolved into the current system of carriage roads and bridges and were donated to ANP.

The carriage roads and 13 of the masonry bridges were listed in the National Register of Historic Places in 1979 as part of the Carriage Paths, Bridges and Gatehouses, ANP Historic District (Krog 1979). The bridges that were not included in the nomination are eligible for listing in the National Register of Historic Places.

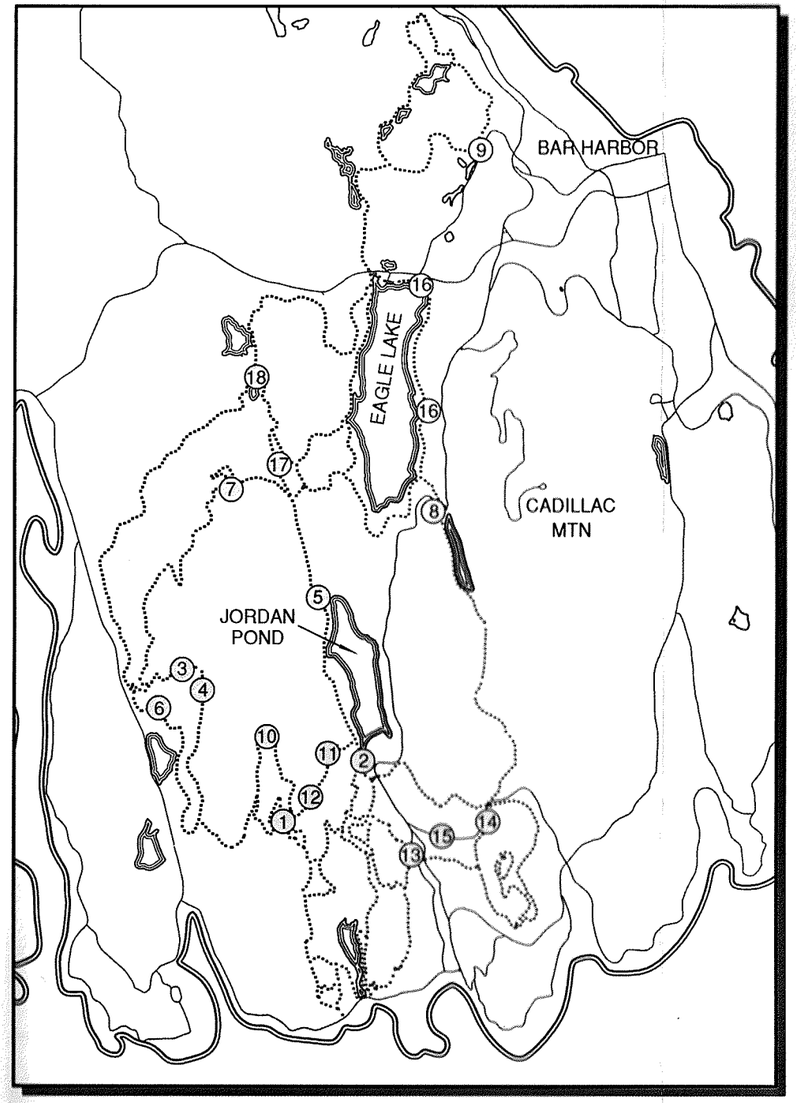
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MOUNT DESERT ISLAND



CARRIAGE ROAD BRIDGE LOCATIONS

1. LITTLE HARBOR BROOK BRIDGE
2. JORDAN POND DAM BRIDGE
3. HEMLOCK BRIDGE
4. WATERFALL BRIDGE
5. DEER BROOK BRIDGE
6. HADLOCK BROOK BRIDGE
7. CHASM BROOK BRIDGE
8. BUBBLE POND BRIDGE
9. DUCK BROOK BRIDGE
10. AMPHITHEATER BRIDGE
11. JORDAN STREAM WEST BRANCH BRIDGE
12. CLIFFSIDE BRIDGE
13. JORDAN POND (SEAL HARBOR) ROAD BRIDGE
14. TRIAD-DAY MOUNTAIN BRIDGE
15. DANE FARM BRIDGE
16. EAGLE LAKE LITTLE BRIDGES (3)*
17. SEVEN SISTERS LITTLE BRIDGES (6)*
18. SEVEN SISTERS GILMORE MEADOW **

* STEEL STRINGER BRIDGES (ALL OTHER BRIDGES ARE MASONARY ARCH BRIDGES)

** CULVERT

CARRIAGE ROAD
SHORELINE
ROAD
LAKE OR POND
(17) BRIDGE LOCATION

NOT TO SCALE

NATIONAL PARK SERVICE

Acadia National Park
Carriage Road Bridge Locations
Figure 1

The CRS allows visitors on foot, bicycle, skis, or horseback an opportunity to enjoy the Park for its quiet beauty, peaceful landscape, and stunning scenery far away from the faster pace of the Park's motor road. There are 45 miles of carriage roads within Park boundaries. The remaining 12 miles of roads are on private lands, but are open to the public. The carriage roads also provide Park maintenance staff and emergency personnel access to the Park without creating additional service roads.

In addition to funding the construction of the bridges, Rockefeller supervised their design and placement, paying particular attention to the setting in which the bridges were constructed. The natural topography and opportunity for creating dramatic vistas figured prominently in the design of the bridges. The use of native granite facing materials and the distinct asymmetry, curvature, and **skew** of some of the bridges to follow land contours are indicators that Rockefeller desired the bridges to blend with the rustic landscape. The settings in which the bridges are situated are important character-defining features of the cultural landscape. The rehabilitation of these features is an important component of the proposed project.

The bridges that were necessary to traverse streams and gaps received particular attention from Rockefeller. Rockefeller supervised the completion of the first ten bridges of the CRS between 1917 and 1929. The Cobblestone Bridge was the first, and stands out architecturally for the use of cobblestone instead of granite as the primary facing material.

Masonry bridges added during the second phase of construction were Little Harbor Brook Bridge (1919), Jordan Pond Dam Bridge (1920), Hemlock Bridge (1924), Waterfall Bridge (1925), Deer Brook Bridge (1925), Hadlock Brook Bridge (1926), Chasm Brook Bridge (1926), Bubble Pond Bridge (1927), and Duck Brook Bridge (1929). These bridges were constructed with poured concrete structural systems and utilized native granite quarried on MDI as the facing material.

The final phase of construction of the CRS occurred between 1931 and 1940 and consisted of the addition of several connector roads that joined with larger segments. Masonry bridges constructed during this period were the Jordan Stream West Branch Bridge (1931), Amphitheater Bridge (1931), Cliffside Bridge (1932), Jordan Pond (Seal Harbor) Road Bridge (1932); Stanley Brook Bridge (1933), Triad-Day Mountain Bridge (1938), and Dane Farm Bridge (1939).

In addition to the prominent masonry bridges, Rockefeller constructed three groups of small, rustic, steel stringer bridges to cross narrow streams. Known as the Jordan Stream (1919), Eagle Lake (1929), and Seven Sisters (1931) little bridges, these bridges were said to have received as much of Rockefeller's attention as the major masonry bridges. They originally had wood plank **decks** and simple wood rail and post guardrails. The wood plank decking on the Eagle Lake and Seven Sisters bridges was replaced sometime in the 1940s with poured concrete.

Rockefeller's crews maintained the system and bridges until his death in 1960. Thereafter, maintenance became the responsibility of the NPS. In 1991, a historic agreement was reached between the federal government and private donors to rehabilitate and maintain the CRS. This agreement only focused on the roads and no attention was given to maintaining the bridges. The following year, Congress allocated four million dollars for the carriage road rehabilitation with a matching private endowment for perpetual maintenance. However, none of these funds were allocated for the rehabilitation of the bridges.

Funding for the proposed project was secured in 2002. The project represents the first major publicly sponsored effort aimed specifically at addressing the critical need to rehabilitate the historic bridges of the CRS in order to preserve them for future generations. Recent efforts rehabilitated the Stanley Brook Bridge and Jordan Stream Little Bridges as pilot studies. Knowledge gained from these rehabilitation

efforts can be used to improve the techniques and approaches to the proposed rehabilitation of the remaining bridges.

1.2.3 Historic Hiking Trails

The historic hiking trail system is a legacy of the work performed largely by the **Village Improvement Associations (VIA)** and **Societies (VIS)** and the Civilian Conservation Corps. There are currently 115 miles of trails that are marked and maintained within the Park boundaries. An additional 110 miles of trails within the Park are not marked or maintained. The VIA/VIS were founded in a number of locations throughout MDI in the late nineteenth and early twentieth centuries as volunteer organizations, consisting primarily of summer residents. The VIA/VIS addressed the number of issues such as sanitation, road maintenance, finances, entertainment, and beautification that confronted the growing villages of the island. These organizations also established numerous miles of trails to accommodate the extremely popular pastime among summer residents of hiking to the mountain summits or along the coastline. In 1900 the various VIA/VIS formed the Joint Path Committee to oversee what by then had become an island-wide system of trails.

The VIA/VIS trails exhibit superior craftsmanship in their use of iron for climbing rungs and footbridges, and local stone for the construction of steps, retaining walls, bridges, and archways. These trails are important elements of the ANP circulation system and are eligible for listing in the National Register of Historic Places.

1.2.4 Supporting Plans and Studies

Acadia National Park General Management Plan

ANP's mission is based on NPS legislation and the *Acadia National Park GMP* (NPS 1992):

> "The National Park Service at Acadia National Park protects and preserves outstanding scenic, natural, scientific, and cultural values for present and future generations. These resources include a glaciated coastal and island landscape, biological diversity, clean air and water, and a rich cultural heritage. Acadia National Park also offers opportunities for high-quality non-consumptive recreation, education, and scientific research."

This mission statement was formally adopted in the *Acadia National Park Strategic Management Plan* (NPS 1997), which identifies three primary purposes for the Park:

- to protect and conserve the land and water resources, the scenery, the natural and historic objects, the wildlife, and the wild character of the Park;
- to promote and regulate the use of the Park for the benefit and enjoyment of the public in such a manner and by such means as will leave Park resources unimpaired for the enjoyment of future generations; and
- to protect and preserve the scenic, ecological, historical, archeological, and cultural resources of the Acadian archipelago and to limit development of the islands and conserve their natural qualities and traditional resource-based uses.

The GMP articulates a series of specific management goals for the Park, many of which are particularly relevant to this project. Included goals are:

- to provide for a variety of high quality, resource-related visitor experiences while ensuring a safe and positive social environment;

- to protect, preserve, and rehabilitate, as appropriate, the cultural heritage of ANP, including archeological, historical, curatorial, and cultural landscape resources; and
- to manage visitor impacts by limiting parking to the capacity of the existing lots.

In addition to the GMP, the ***Statement for Management Planning Implementation Report*** (NPS 1999), an implementing document for the GMP, reiterated the goals of the GMP, including maintaining the existing capacity of parking lots. The overall intent is to retain current use levels and the existing natural condition and solitude of the Park, especially as relevant to the carriage roads and bridges.

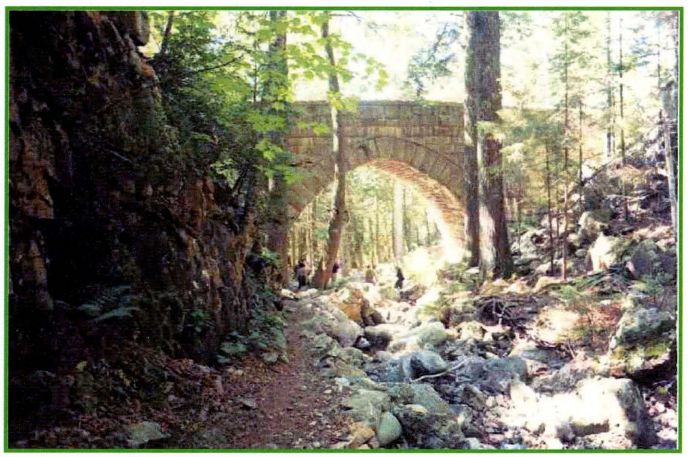
Carriage Road Studies

ANP staff initiated several planning studies during the 1990s to address issues relating to visitor experience, resource protection, and rehabilitation of the CRS. Studies specifically relating to visitor use and experience were prepared by Manning *et al.* (1997a, 1997b, 1997c). Specific studies were also completed concerning rehabilitation of the carriage roads and the scenic vistas that were an original feature of the system (Pressley Assoc. 1995, Rieley Assoc. 1988 and 1989). These studies helped ANP undertake the rehabilitation of the carriage roads, understand and make informed decisions about visitor capacity on the CRS (Jacobi and Manning 1997) and the careful thinning of vegetation over time to rehabilitate certain scenic vistas.

The overall plan for the rehabilitation of the CRS includes three main components: road rehabilitation, scenic vista rehabilitation, and bridge rehabilitation. The first two components, road and scenic vista rehabilitation, have been partially completed. Only a very small portion of the bridge rehabilitation has been completed, namely rehabilitation of the Stanley Brook and Jordan Pond Little Bridges. Because the bridges are integral to the overall CRS, the rehabilitation of the bridges directly ties into the overall rehabilitation plan of the CRS, and is consistent with the GMP (NPS 1992).

Hiking Trail Management Plan

The *Hiking Trail Management Plan* (NPS 2002) was developed to guide the rehabilitation of the hiking trail system. The trail system is eligible for the National Register of Historic Places. Trail rehabilitation would adhere to the *Hiking Trail Management Plan* and the *Secretary of the Interior's Standards for Rehabilitation*. ANP staff determined which trails need rehabilitation and to what level of intensity such maintenance is needed. This assessment was completed by a through on-site review by maintenance, engineering, cultural, and natural resources staff. This detailed assessment documented that trails in the vicinity of eight bridges would need some level of rehabilitation.

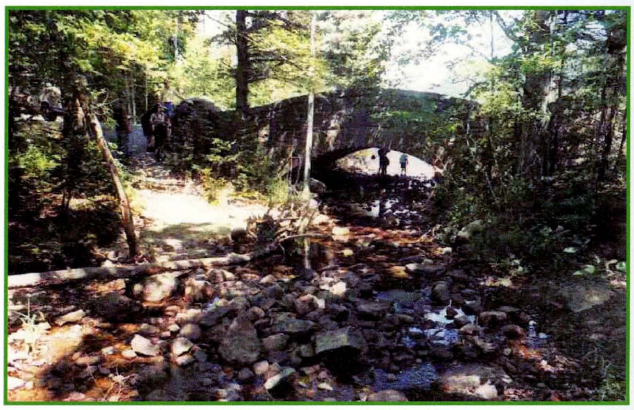


Hiking trail adjacent to Hemlock Bridge

Several trails approach and cross over and under the bridges. In some cases, bridges were designed to accommodate trail crossings, such as Stanley Brook Bridge and Duck Brook Bridge. The rehabilitation of these trails immediately adjacent to the bridges is part of the overall trail management plan, and represents an important part of trail maintenance in terms of preventing erosion and allowing hikers to enjoy the bridges and corresponding scenic vistas.

Social Trail Management

In addition to the formal, designated hiking trails, many unauthorized "**social trails**" exist near the bridges. In many cases these trails have been initiated by water draining from the roadways and bridges, around the **wing walls**, down towards the streams. Visitors often use these eroded areas as "shortcuts" to stream banks and areas under or along the bridges. These social trails typically occur along the wing walls of bridges and adjacent to the streams. Frequent use of these trails exacerbates the erosion problems. Eliminating and formalizing some of the social trails near the bridges is included as part of the water prevention plan and trail maintenance plan, respectively.



Social trail adjacent to Jordan Pond Dam Bridge

1.3 Planning Issues & Process

The following issues were identified during internal and external scoping meetings and site reviews. The impact issues include: Protecting Water Quality, Streams, Floodplains, Wetlands, and Soils; Protecting Wildlife and Natural Communities; Protecting Historic Structures and Cultural Landscapes; Maintaining Visitor and Staff Safety; and Maintaining Recreational Resources, Visitor Use, and Quality Experiences. Each of these issues is comprised of several closely related topics that were considered for determining the impact topics.

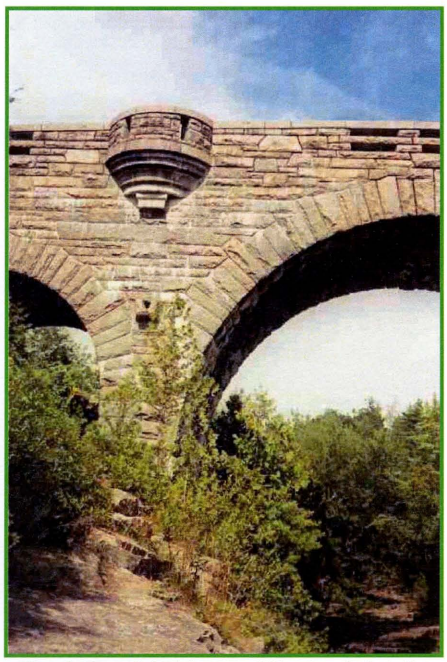
1. ***Protecting Water Quality, Streams, Floodplains, Wetlands, and Soils.*** Most of the bridges cross streams or drainage channels, and in some cases the streams have small wetland fringes. Temporary impacts would be necessary to install cofferdams or other control structures to manage the water levels while repairing scour and erosion. Minor and temporary drainage or flooding problems could occur as a result. Erosion of stream bank sediments is a potential adverse impact, even with minor construction projects. Water quality issues need to be addressed, including potential erosion and sedimentation that could enter the watershed during the rehabilitation process.



Stream at Eagle Lake Bridges No. 1 and 2

2. ***Protecting Vegetation, Wildlife and Natural Communities.*** Minor earthwork could impact adjacent native vegetation or could create conditions that favor the spread of exotic and invasive plant species. A list of plant species observed adjacent to the bridges is provided in Appendix B.

3. ***Protecting Historic Structures and Cultural Landscapes.*** Cultural resource issues center on the long-term physical impacts of the alternative actions on the bridges, historic hiking trails, and cultural landscape, including the setting of the bridges and their scenic vistas. As these resources are part of a significant cultural landscape, all activities that have the potential to impact them must be carried out in accordance with the guidelines contained in the *Secretary of the Interior's Standards for Rehabilitation* in order to avoid adverse effects on their historic and architectural integrity. Rehabilitation techniques and materials must be consistent with the composition and architecture of the resources and meet the appropriate materials specifications.



Duck Brook Bridge architectural details

4. ***Maintaining Visitor and Staff Safety.*** Minimizing safety hazards is a priority for the rehabilitation project. Long-term concerns include maintaining the structural integrity of the bridges. Short-term safety issues include construction worker safety, following Occupational Safety and Health Administration guidelines, and protecting visitors and employees during construction.

5. ***Recreational Resources, Visitor Use, and Experience.*** Timing and phasing of the project must be managed, as closing portions of the carriage roads could create inconveniences to visitors and ANP staff. Road closures are inevitable, but emergency access must be maintained. Construction may be possible "out of season," i.e., from late October through early June, but only for some rehabilitation efforts.

1.4 Impact Topics

The following impact topics were chosen for detailed evaluation based on the CEQ's NEPA regulations and *NPS Director's Order 12: Conservation Planning, Environmental Impact Analysis, and Decision-making* (NPS 2002), by assessing the issues and concerns raised during project planning meetings, and by observing the potentially impacted resources at each bridge site. The impact topics were derived from the planning issues as well. Several topics were considered and dismissed from the detailed EA analysis and are discussed in Section 1.6. Those topics analyzed in this EA are as follows:

- Soils: There is some potential for soil disturbance that could result in runoff and erosion. Major losses of soils are not expected, but minor erosion could contribute to water quality degradation.
- Water quality: Potential impacts could occur during construction from erosion and runoff. Currently erosion occurs along several bridges and streams, which can affect water quality downstream.
- Wetlands: Most of the bridges cross over streams and other wetland areas and could lead to potential impacts to these resources. Furthermore, federal and state regulations protect

streams and wetlands and permits could be required before commencing and construction. Hereafter, there is no distinction made between the streams and wetlands and such areas will be addressed as wetlands.

- Wildlife: Potential impacts could occur to common wildlife species and their habitat occurring along or within the vicinity of the bridges.
- Vegetation: Rehabilitation could impact vegetation and natural communities adjacent to the bridges and trails during construction.
- Historic structures: Each bridge is a historic structure and Park resource. Federal regulations and NPS policies protect such resources. Rehabilitation could affect the cultural integrity of each bridge; conversely, rehabilitation could provide long-term beneficial affects.
- Cultural landscape: Each bridge exists in a larger cultural setting that includes the CRS, scenic vistas, historical context, and the actual landscape. Rehabilitation efforts must consider the effects that could occur to this broader topic.
- Visitor and staff safety: This topic considers short-term and long-term safety issues. Short-term safety issues include those relating to the actual construction activity associated with the rehabilitation. Long-term issues include those that relate to maintaining the structural integrity of the bridges and any safety devices built into each, such as guardrails.
- Visitor use and experience: Rehabilitation could affect visitor use of the bridges, as some temporary bridge closures would likely be needed.

Several of the above referenced natural resource issues are closely related in regard to adverse and beneficial impacts. Under the discussion of Environmental Consequences, Section 4.0, several of these topics, such as soils, water quality, and wildlife habitat, that relate to the effects of erosion, are presented together.

1.5 Impairment of Park Resources

The NPS's *Management Policies, 2001* (2000) require analysis of potential effects to determine whether or not actions would impair Park resources. The fundamental purpose of the National Park system, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve Park resources and values. NPS managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adversely impacting Park resources and values. However, the laws do give the NPS the management discretion to allow impacts to Park resources and values when necessary and appropriate to fulfill the purposes of a Park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the NPS the management discretion to allow certain impacts within a Park, that discretion is limited by the statutory requirement that the NPS must leave Park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of Park resources or values. An impact to any Park resource or value may constitute an impairment, but an impact would be more likely to constitute an impairment to the extent that it has a major or severe adverse effect upon 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
- identified as a goal in the Park's general management plan or other relevant NPS planning documents.

Impairment may result from NPS activities in managing the Park, visitor activities, or activities undertaken by concessionaires, contractors, and others operating in the Park. A determination on impairment is made in the *Environmental Consequences* section for water quality, wetlands, wildlife, vegetation, historic structures, cultural landscapes, and visitor and staff safety. The Visitor Use and Experience topic is not included in the impairment determination, since the primary object of the NPS is to protect and manage Park resources. It is possible that extensive or excessive visitor use could adversely affect or impair Park resources.

1.6 Impact Topics Considered but Dismissed from Further Analysis

The following impact topics would not be affected by the proposed rehabilitation activity and were eliminated from further evaluation. They are briefly discussed below, but are not analyzed in detail in this EA.

1.6.1 Ethnographic Resources

Ethnographic resources are defined by the NPS 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 Director's Order 28: Cultural Resource Management Guideline*). ANP, in partnership and through consultation with the federally recognized tribes in Maine, will be conducting ethnographic research over the next two years to identify ethnographic resources and places of religious or cultural importance within the Park. These groups include the Passamaquoddy Tribe – Indian Township, Passamaquoddy Tribe – Pleasant Point; Penobscot Nation; Houlton Band of Maliseet Indians; and Aroostook Band of Micmacs. The proposed project would not affect any known ethnographic resources, given the specific focus of the rehabilitation effort.

1.6.2 Indian Trust Resources

Secretarial Order 3175 requires that any anticipated impacts to Indian trust resources from a proposed project or action by Department of Interior agencies be explicitly addressed in environmental documents. The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal law with respect to American Indian and Alaska native tribes.

There are no Indian trust resources in ANP. The CRS and bridges are not considered an Indian Trust Resource, and the proposed rehabilitation does not conflict with American Indian interests.

1.6.3 Archeological Resources

In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, an archeological survey was conducted in the proposed project area during the fall of 2002 to identify potentially significant archeological properties within the proposed project's area of potential effect. The survey found that no archeological properties would be affected by the proposed project (Lee Terzis personnel communication). Once it is completed, the final report will be submitted as part of the Section 106 compliance process.

1.6.4 Floodplains

The bridges are not located within areas subject to normal flooding from a 100-year flooding event, and the rehabilitation would not affect floodplain functions or values.

1.6.5 Prime or Unique Farmland

The Natural Resource Conservation Service (1998) defines prime farmland as soil that produces general crops such as common foods, forage, fiber, and oil seed. Unique farmland is defined as soil that produces specialty crops such as fruits, vegetables, and nuts. There are twelve soil types in the Hancock County area that support prime farmland based on these definitions. The project area consists of Schoodic-rock outcrop-Naskeag complex soils that are on steep slopes and are not prime or unique farmland.

1.6.6 Geology

ANP is host to a variety of outstanding geological features with unusual intrinsic value or uniqueness. Examples of such features include extensive bedrock exposures of complexly intermixed igneous rocks, raised cobble beaches on hillsides 200 feet about current sea levels, and the only example of a fjord-like embayment on the east coast of the United States. Many of these geological features are regularly viewed and studied by a wide range of visitors, educators, and scientists and are considered a valuable natural resource.

The proposed rehabilitation project will not affect local or regional geology, and it will not involve the excavation, disturbance, or removal of geologic features or subsurface components. The project will not require the quarrying of any stone for bridge rehabilitation.

1.6.7 Wild and Scenic Rivers

There are no federal wild and/or scenic rivers located within or near the CRS.

1.6.8 Endangered, Threatened, Candidate Species, and Species of Special Concern

There is little, if any, potential for occurrence of federal or state listed Endangered, Threatened, Candidate Species, and Species of Special Concern. There have not been any reports or sightings of any listed species at any of the bridge sites based on consultation with ANP biologists, and those with the **Maine Department of Inland Fisheries and Wildlife (MDIFW)** and the **U.S. Fish and Wildlife Service (USFWS)**. No adverse impacts to federal or state listed species would be expected; therefore this impact topic is dismissed from the analysis.

1.6.9 Air Quality

The Clean Air Act of 1973, as amended, and associated NPS policies require the NPS to protect air quality in Parks. ANP is downwind from large urban and industrial areas in states to the south and west. High concentrations of air pollutants periodically blow into the Park from these areas. ANP is classified as a Class I area per the Clean Air Act of 1973, which provides the highest level of air-quality protection. Summer ozone levels occasionally exceed federal health standards, and the effects of atmospheric depositions are a major concern at the Park. For example, acid precipitation can be a major influence on lake and stream chemistry, cause excessive nutrient enrichment in estuaries, and affect sensitive vegetation. Much of the rehabilitation work would involve the use of hand tools and manual labor, with a

minimal amount of machinery needed. A minimal amount of exhaust and dust would be expected. Therefore, air quality was dismissed as an impact topic.

1.6.10 Soundscape

In accordance with *NPS Management Policies* (2001) and *Director's Order 47: Sound Preservation and Noise Management*, an important part of the NPS mission is preservation of natural soundscapes associated with National Park units. Natural soundscapes exist in the absence of human-caused sound. The natural ambient soundscape is the aggregate of all the natural sounds that occur in Park units, together with the physical capacity for transmitting natural sounds. Natural sounds occur within and beyond the range of sounds that humans can perceive and can be transmitted through air, water, or solid materials. The frequencies, magnitudes, and durations of human-caused sound considered acceptable varies among NPS units, as well as potentially throughout each Park unit, being generally greater in developed areas and less in undeveloped areas.



Workers repointing mortar joints and bedding stones on Stanley Brook Bridge

Hauling material, operating equipment, and other construction activities could result in dissonant, human-caused sounds. Any dissonant sounds associated with construction, however, would be temporary, lasting only as long as the construction activity generating the sound, and would negligibly impact visitor enjoyment of the Park. Much of the rehabilitation work would involve the use of hand tools and manual labor. Therefore, soundscape management was dismissed as an impact topic.

1.6.11 Socioeconomic Resources

The proposed action would neither change local and regional land use nor appreciably impact local businesses or other agencies. Implementation of the proposed action could provide a negligible beneficial impact to the economies of nearby towns such as Bar Harbor and Mount Desert, as well as Hancock County (e.g., minimal increases in employment opportunities for the construction workforce and revenues for local businesses and government generated from construction activities and workers). Any increase, however, would be temporary and negligible, lasting only as long as construction.

Visitors to ANP have a large fiscal impact on these surrounding communities. Visitation at the Park peaks during the summer with a steady flow through foliage season. The CRS will not be closed during the proposed project, although some portions would require re-routing visitors around construction areas. Short-term, temporary closure of portions of the CRS would not adversely affect tourism in the Park and surrounding areas. The rehabilitation work should not cause visitors to leave the Park or not visit the Park; therefore, impacts to socioeconomic resources of the area are not anticipated. In fact maintaining the bridges is an important component of ensuring the integrity of the CRS, which maintains and enhances future visitor opportunities. Socioeconomic environment was dismissed as an impact topic.

1.6.10 Environmental Justice

According to the Environmental Protection Agency, environmental justice is the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations and policies. Fair treatment means that no group of people, including a racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies.

Presidential Executive Order 12898, "General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing the disproportionately high and/or adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. The proposed action would not have adverse health or environmental effects on minorities or low-income populations or communities as defined in the Environmental Protection Agency's Draft Environmental Justice Guidance (July 1996). Therefore, environmental justice was dismissed as an impact topic.

2 Alternatives

2.1 Introduction

The purpose of the proposed project is to implement rehabilitation and repair measures in order to stop deterioration and to protect the integrity of the carriage road bridges and their surrounding environment. Extensive inspections and studies completed by VHB (1994 and 2002) document the deteriorating conditions of the bridges and make recommendations for appropriate rehabilitation. The rehabilitation must maintain the historical and cultural integrity of the bridges and their surrounding landscapes and minimize environmental impacts.

This EA considers two alternatives for the bridges rehabilitation:

- Alternative A – "No Action."
- Alternative B – "Full Rehabilitation"(NPS preferred alternative).

NEPA requires that the "No Action" alternative be considered in this EA for baseline comparisons, although it is not a viable alternative, as it does not achieve the project objectives.

Three other alternatives were initially considered, but each was ultimately rejected as not meeting the basic project purpose. These alternatives are discussed further in Section 2.4 of this document.

2.2 Alternative A – "No Action" Alternative

This alternative would retain the bridges in their current condition and would not proceed with any rehabilitation measures. No substantive changes would be made to the bridges for structural repair. The slow deterioration, as documented in the VHB (1994 and 2002) reports, would continue.

2.3 Alternative B – Full Rehabilitation Alternative (NPS Preferred)

Overview: Alternative B, as based on the VHB studies (1994 and 2002), would rehabilitate all the bridges and would provide for the long-term stability and visitor enjoyment of the CRS. The proposed project would include full stabilization, cleaning, and repointing of all stone and capstone work, installing a system to prevent water infiltration into the bridges, and minor adjacent site work. The proposed work would bring each bridge up to its original condition and would lay the groundwork for long-term maintenance. Public funding makes the opportunity for the rehabilitation a possibility at this time. The NPS plans to complete the rehabilitation during 2003 – 2004.

Proposed rehabilitation can be roughly categorized into six general actions:

1. installing a system to prevent water from infiltrating through the road surface and the bridge structure;
2. cleaning calcium carbonate and other surface deposits, but leaving the patina where feasible;
3. repairing and/or replacing, in-kind, displaced masonry and rotted wood railings, and repointing and repairing mortar joints, masonry, and other materials;
4. repairing erosion and scouring within stream channels and along banks;
5. rehabilitating the surrounding landscape and setting;
6. rehabilitating small portions of trails adjacent to eight of the bridges.

The main cause of deterioration is water seeping through the bridge structure from several different sources. This project would install a bentonite membrane on the deck of each bridge to prevent water from infiltrating into the structural components of the bridge. Repointing mortar joints and replacing capstones is needed to close those gaps in the mortar that allows rainwater to drain into the bridge interior. Failed mortar joints allow water to seep into the inner portions of the bridge, which deteriorates the concrete arch support or steel stringer support of each bridge. Furthermore, as mortar deteriorates, the stone facings fall apart and the visual integrity of the bridge is lost. Providing minor external drainage improvements would intercept surface and groundwater from the bridge surface and subsurface alleviating a source of water seepage. Internal drainage system improvements are needed to hasten the flow of any water that manages to infiltrate the bridges.



Example of un-repaired (top) and repaired mortar joints

This construction phase primarily includes the water prevention and drainage improvements needed on most of the bridges. This construction process would be implemented on a phased basis and would likely take up to nine months to complete. The road system can be divided into three loops: priority loop; inside loop; and outside loop (Appendix E). The priority loop includes the Deer Brook and Jordan Pond Dam bridges and is a heavily used section, especially for horse concessions. The inside and outside loops each encompass numerous bridges. Only one loop would be taken out of service at a time, and the priority loop would be closed only during the off-season (between Columbus Day and June 15, excluding Memorial Day). The priority loop construction would be completed in two shifts based on this schedule.

The bridges would be cleaned to remove surface deposits. This process is relatively simple and would be performed without the use of chemicals. Dry aggregate blasting, a method successfully employed during the rehabilitation of the Stanley Brook Bridge, would be used for surface cleaning. Most of the cleaning would be conducted to remove calcium carbonate deposits, although in a few instances, cleaning the entire surface of the exterior walls is recommended. The careful and expertly controlled application of the blast cleaning system can minimize the otherwise stark color differences between cleaned and uncleaned masonry. Patina coloration would remain where feasible. This approach would improve the

aesthetic condition of each bridge without eroding the surface materials or adversely altering their natural appearance. Some cleaning would be completed using hand tools.

Displaced or shifted stones and rotted wood railings represent safety hazards for ANP visitors and staff. Repairing or replacing displaced or shifted capstones and rotted railings, would improve the long-term safety of each bridge.

Improving drainage along the bridges will remove sources of water that contribute to erosion and scouring along banks. Drainage improvements would reduce erosion adjacent to the bridges, and reduce the subsequent development of social trails often initiated by water draining from the bridge. Scouring under the bridge abutments was documented at several of the bridges. Repairs include replacing and mortaring loose and displaced stones and stabilizing the banks to stop the loss of soil, prevent scouring, and stop the degradation of water quality downstream. If left untreated, the continued under-scouring of the bridge abutments could also compromise the structural integrity of the bridges.

Revegetation work is proposed, but not detailed at this time, because the exact techniques and species proposed are yet to be determined. All revegetation work would use native species consistent with the original historic setting. Major revegetation, erosion control, social trail elimination and fencing would be completed at Duck Brook Bridge. Social trails would be eliminated at Chasm Brook Bridge, Jordan Pond (Seal Harbor) Road Bridge, Dane Farm Bridge, Cliffside Bridge, Bubble Pond Bridge, and Jordan Stream West Branch Bridge; otherwise, no other trail rehabilitation is needed.

Minor to moderate revegetation, erosion control, slope stabilization and social trail elimination would be completed at Triad-Day Mountain Bridge, Jordan Pond Dam Bridge, Amphitheater Bridge, Deer Brook Bridge, Little Harbor Brook Bridge, Hadlock Brook Bridge, Hemlock Bridge, and Waterfall Bridge. Proposed vista improvements are limited to minor tree removal at two bridges: Bubble Pond Bridge (conifers in old road way); and Jordan Pond West Branch Bridge (five birches for vista improvement).

No site work, including trail maintenance, revegetating, or clearing vegetation, would be required at Seven Sisters Bridges and Eagle Lake Bridges.

Minimization of Adverse Impacts: An important component of Alternative B, "Full Rehabilitation," is the avoidance and minimization of potentially adverse impacts. Through prior planning, almost all impacts can virtually be avoided or substantially minimized (Tables 1 and 2). For example, although potential erosion could result from diverting water during rehabilitation of scouring, completing the repairs during the dry season will avoid most impacts. In the case of a perennial stream, using erosion control methods such as staked hay bales and a small portable temporary dam will minimize erosion. Impacts to visitor experiences should be minimized by scheduling bridge closures during off-peak times, preparing a road loop closure plan, completing the construction for all the bridges on that closed road loop, and through signage and information postings (Appendix E).



Workers re-setting stone on Stanley Brook Bridge

The following tables outline minimization measures that will avoid or minimize the potential impacts to natural and cultural resources (Table 1) and visitor use and experience (Table 2). These minimization

activities have been well planned and consider diverse factors such as a phased bridge and road closure plan, phasing of heavy construction (bridge closure needed) verses the masonry rehabilitation (bridge closure not needed), **Best Management Practices (BMPs)**, stockpiling materials on the carriage road surface instead of in natural resource areas, delineating construction vehicle traffic routes, and using sandblasting instead of chemicals. ANP previously rehabilitated the Stanley Brook Bridge, providing insight to the rehabilitation process and methods for minimizing impacts. For example, the use of scaffolding eliminated the potential for erosion within streams. This rehabilitation was very successful. Techniques that proved beneficial there would be used on the impending bridge rehabilitations, while techniques that were less satisfactory can be modified to reduce the potential for adverse effects to the environment.

Table 1 Minimization Activities to Reduce Impacts on Natural and Cultural Resources

Section	Minimization Effort
Contracting Methodology	• Restricting critical site work to NPS crews or NPS supervised contract labor only. Examples of critical or sensitive work includes revegetation, trail rehabilitation, necessary vegetation pruning or clearing. • Providing a greater level of oversight from ANP resource management specialists. • Planning and arrangement of any selective tree, shrub, and branch pruning to be done by ANP staff arborist and botanist. • Providing an individual to serve as rehabilitation coordinator to this project with dedicated on-site time.
Use of Site	• Prohibiting material storage and equipment traffic in vegetated areas; using road surface only. • Identifying centralized staging areas. • Prohibiting stream crossings. • Requiring equipment to be typed and sized with landscape conditions to prevent damage.
Construction Aids	• Requiring the use of ladders, platforms, fencing, and footbridges to protect streams and slopes adjacent to bridges. • Fencing site limits and critical resource areas. • Requiring tenting to enclose all debris generating activities. • Inspecting erosion control measures daily • Requiring daily removal of trash that would attract animals and pests. • Requiring use of containment basins for potentially hazardous materials and refueling restrictions.
Phasing of Work	• Placing seasonal and moisture condition restrictions on earth and streambed work.
Design and Best Management Practices	• Preserving patina and lichen colonies on stone. Restricting cleaning to calcium carbonate deposits (efflorescence) and masonry joints. • Using minimally invasive water prevention and drainage techniques. • Strictly evaluating the necessity of all excavation activities. • Covering new non-historic features and materials. • Identifying sources for native materials. • Requiring use of erosion control measures, including silt fencing, straw bales, turbidity barriers, fabric blankets, and careful construction. Using water-filled temporary dams to divert or control water when working within the streambed. Completing as much of the scouring and erosion repairs during the "dry season" such as August and September, to virtually avoid any temporary erosion impacts.
Education	• ANP resource management personnel are to brief contractor and consultant personnel about: sensitive resources on-site and recommend practices for their protection; visitor use and how to best handle interaction with construction activities; and visitor safety.

Table 2 Minimization Activities to Reduce Adverse Impacts on Visitor Experience, Activities, Recreation, and Aesthetics

Section	Minimization Effort
Contracting Methodology	• Separating the contracts for drainage/water prevention, masonry repairs, and site work would allow for more flexibility and efficiency. Drainage and water prevention work could be let to a contractor with better construction capabilities who could move faster unburdened by masonry tasks. Drainage and water prevention work will have a shorter performance period (12 – 18 months total) and be conducted in more marginal seasons, whereas masonry work has a longer performance period (24 – 36 months). • Planning road closures carefully to reduce impacts on visitor use and keep highly used roads open during the busy season.
Phasing of Work	• Sequencing of work by road segments to allow for detours. • Restricting in-season work involving road closures and programming a blackout for select critical bridges. • Identifying critical connections and developing special timing specifications. • Closing key bridges would need to be planned and timed to minimize loss of concession business. Certain key bridges, such as Deer Brook Bridge, have heavy summer use and indirectly effect concessions.
Design	• ANP undertook the rehabilitation of Stanley Brook Bridge. The knowledge and experience gained from this effort would be used to minimize impacts and insure that the rehabilitation effort is consistent with the Secretary of the Interior's Standards for Rehabilitation for historic properties. • Selecting water prevention and drainage techniques that require minimum road surface excavation. • Selecting materials that are cold weather and rain tolerant during application. • Selecting materials that provide shorter preparation, installation, and curing periods.
Traffic Management	• Developing specific routes and restrictions for construction traffic. • Developing specifications to allow safe passage for visitor traffic during non-closure periods. • Identifying detours with consideration to the modes of transportation, such as emergency vehicles, horseback and carriages, bicycle, pedestrian, and winter modes, at each segment and locally for more determined pedestrians.
Public Information	• Installing road head and detour signage (contractor). • Making maps available to the public that reflect specific road closures and restriction information for each phase of work. • Providing the public with information, including periodic press releases, frequent briefings of visitor contact staff, briefings and feedback sessions with local government and interest groups. • Placing or adding additional visitor contact and enforcement staff on the CRS at critical locations and times.

2.4 Alternatives Considered but Rejected

ANP staff completed an analysis of five alternatives for the proposed bridges rehabilitation, including the two alternatives referenced above: "No Action" and "Full Rehabilitation." The three other alternatives considered were: "Immediate Maintenance" (point and capstone work), "Stabilization" (water prevention, storm water redirection, and minimal repointing), and "Partial Rehabilitation" (full stabilization, cleaning, repointing, and capstone work without adjacent site work).

Of the alternatives analyzed, only the "Full Rehabilitation" alternative met the project purpose. The "Immediate Maintenance" alternative was considered only to be a minimal fix and did not address water-preventing and long-term maintenance. The "Stabilization" alternative addressed water preventing with minimal rehabilitation, but also required continued surface repairs and could lead to permanent damage. The "Rehabilitation" option addressed all the water prevention, surface cleaning, and maintenance issues, but did not consider the adjacent landscape. Only the "Full Rehabilitation" option considered all of the repair maintenance, water prevention, and landscape issues and completely fulfilled the basic project purpose. Therefore, the "Immediate Maintenance," "Stabilization," and "Rehabilitation" alternatives were rejected and are not analyzed further in this EA.

2.5 NPS Preferred Alternative

Alternative B, "Full Rehabilitation," is the NPS preferred alternative because it meets the basic project purpose while minimizing adverse impacts to cultural and natural resources and to the visitor experience. The bridges are part of a unique, irreplaceable, and valuable natural and cultural resource and should be managed as such. "Full Rehabilitation" would eliminate short-term and long-term structural and aesthetic deterioration, and control erosion. This alternative is fully consistent with the GMP, scenic vista rehabilitation, carriage road rehabilitation, and hiking trails rehabilitation, and is essentially one element of Park stewardship. The bridges require maintenance activities that may be on a longer rotation and require more construction effort than many other types of maintenance. "Full Rehabilitation" reduces or eliminates potential safety hazards and deficiencies. The work is technically feasible and appropriately funded. Eliminating portions of the rehabilitation work would leave the bridges vulnerable to further structural deterioration, increase the likelihood of safety hazards, and adversely affect the historic and architectural integrity of the bridges.

Alternative A, "No Action," would not meet the basic project purpose because no rehabilitation of the bridges would occur. The uncorrected deficiencies will lead to structural deterioration, further loss of aesthetic appeal, and an increased potential for injury to Park visitors and staff. Structural deterioration could lead to the closure of deficient bridges and portions of the CRS. While short-term adverse impacts generated by the rehabilitation may be eliminated by the "No Action" alternative, long-term adverse impacts to natural and cultural resources and the visitor experience would likely occur.

2.6 Environmentally Preferred Alternative

The Environmentally Preferred Alternative is defined by the CEQ as "the alternative that will promote the national environmental policy as expressed in the National Environmental Policy Act [Section 101 (b)]." This section states that the Environmentally Preferred Alternative should:

- "Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.
- Ensure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings.
- Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences.
- Preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice.
- Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities.
- Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources."

Alternative B, "Full Rehabilitation," has been identified as the Environmentally Preferred Alternative, based on the analysis of impacts of each alternative. Alternative B is the only alternative that completely meets the project purpose by rehabilitating the bridges for cultural and aesthetic qualities and preventing possible structural deterioration. The "Full Rehabilitation" effort has been designed to avoid or minimize adverse impacts to cultural and natural resources and to the quality of visitor experiences at the Park. The rehabilitation process for each bridge and for the entire collection of bridges is being well planned by ANP staff to avoid and minimize adverse impacts. The potential adverse impacts are minor, short-term and temporary in nature and all can be controlled and minimized. There are no permanent adverse environmental effects that would result from the rehabilitation. Numerous beneficial effects are anticipated by completing the "Full Rehabilitation":

- protection of an important cultural resource from decay and loss;
- reduces quantities of materials, calcium carbonate, road.surface mix, and disturbed topsoil, from running off the bridges into adjacent forests and streams;
- control and elimination of erosion within several stream channels and along trails adjacent to the bridges;
- rehabilitates adjacent hiking trails;
- maintains the cultural landscape of the bridges and CRS.

The "No Action" alternative would allow erosion to continue within the stream channels under several bridges and on worn trails adjacent to the bridges. The rehabilitation would repair scouring and eliminate sources of erosions, including social trails. The "No Action" alternative would allow the continued seepage of water into the bridges, which would accelerate the deterioration process and likely lead to a significant loss to the cultural resource and visitor experience. The rehabilitation would install a water prevention membrane under the road surface that eliminates water seepage and would improve drainage and repair cracks that allow water to seep into the bridge. The "No Action" alternative would not improve the cultural landscape. The rehabilitation would re-vegetate the surrounding areas, formalize, repair, or remove social trails, and repair adjacent hiking trails, thus restoring the cultural landscape. The

"No Action" alternative would not clean, repair, replace, or improve the stone and mortar structure of the bridges. The rehabilitation would remove calcium carbonate deposits and other stains, repair loose and displaced stones, re-mortar loose joints, and maintain the historic appearance of each bridge. The "No Action" alternative would not repair guardrails or loose stones that compromise safety. The rehabilitation would repair these safety concerns. The "No Action" alternative is not consistent with the Park's GMP, CRS rehabilitation plans (Pressley Assoc. 1995, Rieley Assoc. 1988 and 1989), or hiking trail rehabilitation plan and is not a viable alternative.

2.7 Alternatives Comparison

The following briefly summarizes the differences between the two alternatives, which are primarily the difference of not completing the rehabilitation verses completing all rehabilitation measures.

- Alternative A would continue to use the same water proofing system that leaks. Alternative B, rehabilitation would install a new system to prevent water infiltration.
- No drainage improvements would be conducted based on Alternative A. Alternative B would improve the drainage from the road surface and along bridge walls.
- Alternative A would not repair scouring under the bridge footers. Alternative B would repair scouring under all portions of the bridges.
- Alternative A would not clean or remove calcium carbonate deposits. Alternative B would remove calcium carbonate and cleans bridges as needed.
- Alternative A does not repoint or repair mortar joints or loose and displaced stones. Alternative B would repoint all deteriorating mortar joints and repair loose or fallen capstones.
- Alternative A does not formalize or eliminate social trails. Alternative B would formalize some social trails and eliminate others.
- Alternative A does not establish any plantings. Alternative B would use native species to establish understory and shrub vegetation.
- Alternative A does not repair loose guardrails. Alternative B would repair the wooden guardrails.
- Alternative A would not rehabilitate formal trails near the bridges. Alternative B would complete rehabilitation of those trails that are adjacent to or cross over or under any of the bridges.
- Alternative A would not address any of the deteriorating features of the cultural landscape. Alternative B would rehabilitate the cultural landscape surrounding the bridges, including rehabilitating trails, improving drainage, repairing erosions, re-vegetating the adjacent areas, minor vista improvement, and overall rehabilitating the bridges.

3 Affected Environment

3.1 Introduction

This chapter describes the existing environmental conditions adjacent to each of the bridges. An interdisciplinary team of biologists and cultural resource specialists completed a thorough review of each bridge site. Biologists completed an inventory of wetlands and streams, documented the vegetative communities, made observations on water resources, noted wetland functions and values, obtained Global Positioning System locations on the wetlands, streams and corners of the bridges, conducted searches for rare plants and wildlife, and made wildlife observations at each bridge site. Cultural resource specialists made notes on the current architectural appearance and condition of the bridges. A review of potential archeological issues and the cultural landscape was completed. Background research was completed by reviewing existing information and by meeting with knowledgeable Park staff relative to visitor use and experience. An assessment of impacts that may result from Alternatives A and B for each resource area is presented in Section 4 of this EA.

3.2 Natural Resources

3.2.1 Soils

Soils within the vicinity of the CRS, based on the Natural Resource Conservation Service (1998) soil survey of Hancock County, Maine, are listed in Table 3. These soils are generally derived from and are locally underlain by glacial till. Bedrock typically occurs on peaks and crests of ridges on the steeper hillsides. Many of the steepest hillsides have highly erodible soils with evidence of past avalanches and scarring. Muck soils dominate the lowlands along the wetlands where the more level terrain allows the appropriate conditions for developing these soils. The remaining soils are generally well-draining to excessively well-draining, supporting numerous intermittent streams that drain the upper slopes.

Table 3 Soils in the Vicinity of the Carriage Roads in Acadia National Park

Lowland Soils
Wonsquek and Bucksport mucks.
Colton, gravelly, loamy sand 0-8% slopes.
Moderate and Rolling Slopes
Lyman-Brayton-Schoodic complex, rolling, very stony.
Lyman-Tunbridge-Schoodic complex, rolling, very stony.
Schoodic rock outcrop-Naskeag complex, rolling.
Lyman-Brayton complex, 0-15% slopes, very stony.

Table 3 Soils in the Vicinity of the Carriage Roads in Acadia National Park (Cont'd.)
Lyman-Tunbridge complex, 0-15% slopes, very stony.
Herman-Monadnock complex, 8-15% slopes, very stony.
Herman-Colton rock outcrop complex, 3-15% slopes.
Naskeag-Schoodic-Lyman complex, undulating, very stony.
Steep Slopes
Schoodic rock outcrop-Lyman complex, very steep.
Herman-Monadnock-Dixfield complex, steep, very stony.
Lyman-Schoodic rock outcrop complex, steep, very stony.
Schoodic rock outcrop complex, 15-65% slopes (highly erodible).

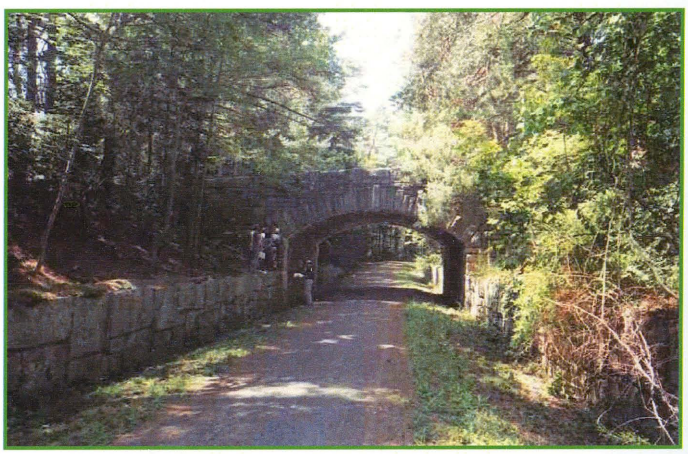
3.2.2 Water Quality

Most of the streams that exist within the CRS are unnamed and there is little if any data available in regards to their water quality. In general small point sources of erosion occur adjacent to many of the bridges. Much of this erosion has been created by poorly managed drainage. In many instances, this erosion is worsened as water and pedestrian traffic scour the soils adjacent to the streams. Furthermore, scouring and undercutting has occurred at several bridges from the force of water flowing through the bridge channel. This action creates erosion and contributes to water quality degradation. While the impacts on water quality have not been quantified, any sources of erosion that could degrade water quality should be investigated and repaired.

3.2.3 Natural Communities (Vegetation), Streams, and Wetlands

Natural Communities

Table 4 provides a brief description of the natural communities, and wetland that are located adjacent to the bridges. The natural community designations used here are based on those descriptions presented in the *Natural Landscapes of Maine: A Classification of Vegetated Natural Communities and Ecosystems* (Gawler 2001). Using this classification system, a natural community is defined as "an assemblage of interacting plants and animals and their common environment recurring across the landscape, in which the effects of human intervention are minimal." Dominant species observed in the communities at each bridge were used to classify each system and were included with the natural community designation to appropriately describe each area. Wetlands associated with each bridge have been given an alphanumeric code that follows the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin *et al.* 1979).



Jordan Pond (Seal Harbor) Road Bridge

Areas such as roadsides that are maintained by human activity are not considered natural communities; therefore, for the purposes of this report, community descriptions represent areas located beyond the immediate roadside. In addition, areas heavily fragmented by development, such as that surrounding Jordan Pond (Seal Harbor) Road Bridge, are difficult to categorize, because very little of the original natural community remains. These heavily fragmented areas were not given natural community designations.



Stream and hardwood-spruce-pine forest adjacent to Seven Sisters Stream

It is important to note that areas with the same community classification may not have the same complement of species, because the composition of a natural community can vary. For example, a hemlock forest can vary from strongly coniferous, with eastern hemlock, spruce, or pine as the dominant species, to a mixed community of eastern hemlock and northern hardwoods.

Each bridge site was reviewed and field checked for the occurrence of rare animals and plants. ANP staff biologists were also consulted to determine if known occurrences of such species exist near any of the bridge sites. It was determined that no such occurrences of rare animals or plants exist at any of the bridge sites. Wetlands upstream of Duck Brook Bridge are considered a Significant Wildlife Habitat for wading birds by the MDIFW, but this area is not within the project site. A list of all plant species observed with both common and scientific names is provided in Appendix B.

Table 4 Natural Communities and Dominant Vegetation Adjacent to the Carriage Road Bridges

	Upland Community and Dominant Species	Wetland Community and Dominant Species
Concrete Arch Bridges (15)		
Little Harbor Brook Bridge	Spruce – Northern Hardwoods Forest: yellow birch, red spruce, striped maple.	Intermittent stream (R4SB3) with a rock and cobble substrate. No associated wetlands.
Jordan Pond Dam Bridge	Spruce – Northern Hardwoods Forest: red spruce, northern white cedar, red maple, and yellow birch.	Perennial stream (R2UB1) with a rock and cobble substrate with essentially no associated wetland.
Hemlock Bridge	Spruce – Northern Hardwoods Forest: red spruce, eastern hemlock, yellow birch, hobblebush, striped maple, interrupted fern.	Intermittent stream (R4SB3) with a rock and cobble substrate. No associated wetlands.
Waterfall Bridge	Community on the upstream side of the bridge is Spruce – Northern Hardwoods Forest: yellow birch, red spruce, hobblebush, large-leaved aster. Community on the downstream side of the bridge is White Pine – Mixed Coniferous Forest: white pine, red spruce, striped maple, common lowbush blueberry.	Intermittent stream (R4SB2) with a ledge, rock, and cobble substrate. No associated wetlands.
Deer Brook Bridge	Hemlock Forest: eastern hemlock, red spruce, sugar maple, striped maple, mountain maple, whorled aster.	Intermittent stream (R4SB2) with a ledge, rock, and cobble substrate. No associated wetlands.
Hadlock Brook Bridge	Hemlock Forest: eastern hemlock, yellow birch, white pine, and red maple.	Upstream side of the bridge includes two perennial streams (R2UB1) with very limited summer-time flows and a small intermittent (R4SB3) stream. In addition, there is a small wetland drainage flowing into this area from the east. Vegetation in this drainage includes tall meadow rue, New York fern, cinnamon fern, interrupted fern, and starflower.
Chasm Brook Bridge	Beyond the rock slopes adjacent to the stream, community is Red Oak – Northern Hardwoods – White Pine Forest: red oak, paper birch, mountain maple.	Intermittent stream with bedrock, rock and cobble substrate (R4SB1). No associated wetlands.
Bubble Pond Bridge	Beyond the abandoned roadway under the bridge, the natural community most closely resembles a White Pine – Mixed Coniferous Forest: white pine, white birch, red spruce, and eastern hemlock.	No associated streams or wetland communities.
Amphitheater Bridge	Upland community most closely resembles a Spruce – Northern Hardwoods Forest: sugar maple, red spruce, yellow birch, white birch, eastern hemlock, and striped maple.	Intermittent stream (R4SB2) with a ledge, rock, and cobble substrate. No associated wetlands.
Jordan Pond (Seal Harbor) Road Bridge	Surrounding area is primarily residential with remnant wooded areas that include white pine, red pine, red maple, red spruce, striped maple, and witch hazel.	No associated streams or wetland communities.

Table 4 Natural Communities and Dominant Vegetation Adjacent to the Carriage Road Bridges (Cont'd.)

	Upland Community and Dominant Species	Wetland Community and Dominant Species
Duck Brook Bridge	Red Oak – Northern Hardwoods – White Pine Forest: red oak, red maple, white pine, white birch, and gray birch.	Perennial stream (R2RB1) with narrow scrub-shrub wetland fringe (PSS1E). This wetland fringe most closely represents an Alder Shrub Thicket, but its small size make categorization difficult. Speckled alder, winterberry, black chokeberry, and red maple.
Jordan Stream West Branch Bridge	Immediately adjacent to stream, the community is Spruce – Northern Hardwoods Forest: yellow birch, red spruce, white ash, and American beech. On the slopes above the stream, the community is White Pine – Mixed Coniferous Forest: red spruce, white pine, and red pine.	Intermittent stream (R4SB3) with a rock, cobble, and gravel substrate. No associated wetlands.
Cliffside Bridge	Steep slope above the bridge most closely matches the Spruce Talus Woodland community in vegetative composition, with red spruce dominant and white birch and beech also present. However, the slope is exposed bedrock, not talus. The down slope community includes sugar maple, white ash, white pine, mountain maple, and striped maple.	No associated wetland, stream or water resource communities.
Triad-Day Mountain Bridge	Upland communities beyond the paved road include American beech, sugar maple, yellow birch, and red spruce, which most closely resemble a Beech – Birch – Maple Forest.	No associated wetland, stream or water resource communities.
Dane Farm Bridge	Upland communities beyond the abandoned road most closely resemble a White Pine – Mixed Coniferous forest, and include red spruce, white pine, big-toothed aspen, and white birch.	No associated wetland, stream or water resource communities.
Steel Stringer Bridges (9) and Concrete Culvert (1)		
Eagle Lake No. 1 and 2 Bridges	White Pine – Mixed Coniferous Forest: red spruce, white pine, red maple, and red oak.	Perennial stream (R2UB1) with an associated floodplain forest (PFO 4/1E). Northern White Cedar Swamp: Northern white cedar, red maple, yellow birch.
Eagle Lake No. 3 Bridge	Beech – Birch – Maple Forest: American beech, yellow birch, paper birch, and green ash.	Intermittent stream (R4SB3) with a rock and cobble substrate. No associated wetlands.
Seven Sisters Culvert (Gilmore Meadow)	Spruce – Northern Hardwood Forest: red spruce, white pine, and white birch.	Tussock Sedge Meadow (PEM1E) with areas of open water. Tussock sedge, bluejoint, rattlesnake mannagrass, smooth goldenrod, speckled alder, and meadowsweet.
Seven Sisters No. 1, 2, 3, 4, 5, & 6 Bridges	Spruce – Northern Hardwood Forest: red spruce, white pine, eastern hemlock, yellow birch, red maple, and striped maple.	Intermittent stream with cobble-gravel substrate (R4SB3). No associated wetlands.

Wetland Functions and Values Assessment

A wetland function and value assessment was completed for those wetlands adjacent to the bridges. Wetland functions and values were assessed using *The Highway Methodology Workbook Supplement: Wetland Function and Value, A Descriptive Approach* (ACOE 1995). The purpose of this evaluation is to provide a rating of the relative value of each wetland system that can be used to assess the severity of proposed wetland impacts. This method bases function and value determinations on the presence or absence of specific criteria for each of the 13 wetland functions and values. The criteria are assessed through direct field observation during on-site wetland determinations and during office review of existing resource maps and databases.



Eagle Lake dam



Beaver Dam at Seven Sisters Culvert (Gilmore Meadow)

Of the 24 bridges and 1 culvert assessed, five bridges are not associated with a wetland community. Fifteen of the remaining bridges are associated with a stream, but are not adjacent to other wetland areas. Jordan Pond Dam Bridge crosses a perennial stream at the outlet to Jordan Pond. This stream provides some fisheries habitat, based on observations of unidentified fish in this area, although the dam would likely limit the movement of fish between the pond and stream. The remaining streams are intermittent and would provide only limited habitat to fish that may move into these channels from more permanent water bodies during periods of high flow. Although the intermittent streams offer limited habitat to fish, they do maintain isolated pools of water that are used by amphibians. For example, pickerel frogs (*Rana palustris*) and green frogs (*Rana clamitans*) were observed in pools within many of these streams, including all six of the Seven Sisters Little Bridges. Duck Brook is known to provide habitat for brook trout (*Salvelinus fontinalis*).

The remaining four bridges span streams with associated wetland communities, and the Seven Sisters-Gilmore Meadow culvert is associated with a large wetland community. Table 5 summarizes the functions and values provided by these wetlands and their associated streams.

3.2.4 Wildlife

Numerous wildlife species were observed within the habitats adjacent to the bridges and along the carriage roads. Habitats are described in detailed within the *Natural Communities* section. Many songbird species were observed within the hardwood and coniferous-forested communities, which are extensive and common within the Park. These species include black-throated green warbler (*Dendroica virens*), red-eyed vireo (*Vireo olivaceus*), yellow-rumped warbler (*Dendroica coronata*), scarlet tanager (*Piranga olivacea*), American robin (*Turdus migratorius*), hermit thrush (*Catharus guttatus*), cedar waxwing (*Bombycilla cedrorum*), winter wren (*Troglodytes troglodytes*), black-and-white warbler (*Mniotilta varia*), red-breasted nuthatch (*Sitta canadensis*), black-capped chickadee (*Poecile atricapillus*), northern parula (*Parula americana*), and brown creeper (*Certhia americana*). Mammalian species

observed in the forested uplands include white-tailed deer (*Odocoileus virginianus*), eastern gray squirrel (*Sciurus carolinensis*), red squirrel (*Tamiasciurus hudsonicus*), eastern chipmunk (*Tamias striatus*), and porcupine (*Erethizon dorsatum*).

Gilmore marsh represents the best example of a wetland community and likely provides excellent habitat for wetland and aquatic dependent species, as evidenced by recent beaver (*Castor canadensis*) activity. Several amphibian species were observed in the stream areas in the upper portion of the Seven Sisters Little Bridges including, bullfrog (*Rana catesbeiana*), green frog, wood frog (*Rana sylvatica*), and pickerel frog (*Rana palustris*). An eastern phoebe (*Sayornis phoebe*) nest was observed on one of these bridges. Bullfrogs were also observed at other bridge sites.

Table 5 Wetland Functions and Values for Wetlands Adjacent to the Carriage Road Bridges

Function/Value	Hadlock Brook Bridge	Duck Brook Bridge	Eagle Lake No. 1 and 2 Bridges	Seven Sisters Culvert (Gilmore Meadow)	Comments
Groundwater recharge/discharge	–	–	+	+	Rocky substrate limits this function at Hadlock Brook and Duck Brook.
Floodflow alteration	+	+	P	P	Larger wetland areas are better able to slow flood waters.
Fish and shellfish habitat	+	+	+	+	Fisheries use is limited by shallow water and dry conditions during summer months. Brook trout habitat occurs in Duck Brook.
Sediment/toxicant/ pathogen retention	+	+	+	+	Limited sources of excess sediment in the area. Minimal function provided.
Nutrient removal, retention, and transformation	+	+	+	+	Limited sources of excess nutrients in the area. Minimal function provided.
Production export	+	+	+	+	More likely to occur at Gilmore Meadow than at other locations.
Sediment/shoreline stabilization	+	+	+	+	Wetlands are associated with streams or areas of open water.
Wildlife habitat	+	+	P	P	The larger streams and wetlands at the Eagle Lake bridges and Gilmore Meadow provide better wildlife use opportunities.
Recreation	+	+	+	+	Gilmore Meadow provides wildlife watching opportunities as well as canoeing.
Education/scientific value	+	+	+	+	Location within the National Park would allow any of these areas to be used for educational purposes.
Uniqueness/heritage	+	+	+	+	Available access within the National Park would allow these areas to provide this value. Particularly true of Gilmore Meadow.
Visual quality/aesthetics	P	P	P	P	All of these areas provide opportunity to view natural areas, but Gilmore Meadow provides views of the wetlands and surrounding mountains.
Endangered species habitat	–	–	–	–	No rare or endangered species known to occur in these areas.

P = principal function/value.
+ = function/value occurs in the wetland or stream.
- = function/value does not occur in the wetland or stream
? = Unknown

3.3 Cultural Resources

3.3.1 Historic Structures – Carriage Road Bridges

The bridges are contributing resources in the Carriage Paths, Bridges and Gatehouses, ANP Historic District, which was listed in the National Register of Historic Places in 1971 (Krog 1979). The district is listed under National Register criteria A, B, and C and is significant in the areas of engineering, landscape architecture, and transportation. The bridges are integral and highly visible elements of the designed historic landscape and retain a high degree of their architectural integrity. Appendix D provides a summary of the history and significant engineering and architectural features of each bridge. A full description of the current condition and work proposed for each of the bridges is found in the VHB reports (1994 and 2002).

3.3.2 Cultural Landscape

Overview

According to the *NPS Director's Order 28: Cultural Resource Management Guideline*, 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 landscape surrounding the bridges is an important element of their historical significance. The rustic setting provides the backdrop for the bridges and the vistas to and from the bridges are designed elements of the cultural landscape. Numerous scenic vistas can be found along the carriage roads and hiking trials. Some of the carriage roads and trails were specifically designed to take advantage of the vistas and enhance visitor's enjoyment of the natural beauty of the area.

Historic Hiking Trails

The proposed work at six of the bridges would be completed on hiking trails that are eligible for listing in the National Register of Historic Places as part of the historic circulation system of the Park. These consist of the Deer Brook Trail, #51 (Deer Brook Bridge); Harbor Brook Trail, #55 (Little Harbor Brook Bridge); Amphitheater Trail, #56 (Amphitheater Bridge and Little Harbor Brook Bridge); Hadlock Brook Trail, #57 (Waterfall Bridge); and Maple Spring Trail, #58 (Hemlock Bridge); and Hadlock Trail, upper, #501 (Hadlock Brook Bridge). These trails connect to the Park trail system and are an integrated part of the trail system.

Numerous hiking trails cross the CRS and pass through the bridges underneath the roads. These are strictly footpaths that have been improved by clearing vegetation and installing steps, railings, drainage, stone paving, and retaining walls. The trail system that extends through the CRS connects to the remaining trails and allows access to most interior portions of the Park. Hikers can travel to selected vista points and points of interest, and they can traverse shorter segments between carriage or auto roads. Often the ground surface of the trails becomes sufficiently compacted to resist indentations and causes water to sheet flow off the trails. Erosion from poor or excessive drainage, natural freeze and thaw cycles, and extensive use can lead to deterioration of the trials.

Social Trails

Numerous erosion gullies have been created by water draining around the bridge wing walls and into the forests and streams adjacent to the bridges, creating the appearance of social trails. Visitors now use these areas as informal trails to access areas underneath the bridges and streams. Furthermore, these unauthorized social trails exacerbate the erosion and alter the vegetative composition adjacent to some of the bridges, which requires revegetation to restore the setting. Soil erosion leads to siltation in the streams.

Vegetation

Much of the shrub and groundcover vegetation directly adjacent to the bridges has been denuded by human activity or has succumbed to shading effects. As a result, many of these areas are bare except for the overhanging canopy of conifers and hardwoods. Landscaping established during the construction of the bridges has largely vanished. Furthermore, some of those species were not native plants, but rather exotic nursery varieties.

Canopy trees often cover and exclude the original vistas that were cleared for visitor enjoyment. The lack of vegetation detracts from the landscaped appearance that probably existed when the bridges were new.

3.4 Visitor and Staff Safety

The CRS provides access for emergency vehicles into the interior of the Park in otherwise remote locations, including areas traversed by the hiking trail system, where trails often cross the roads. In emergency situations, hikers and trail workers have easier access to emergency services, than they would if the CRS did not exist. Emergency vehicles have relatively quick access via the carriage roads to much of the eastern portion of Mount Desert Island.

The CRS is generally a safe environment for visitors. Some visitor actions create unsafe conditions. For example, some bikers travel too fast for road conditions and create hazards for equestrians and pedestrians. Wooden guardrails are present on the Seven Sisters Little Bridges and the Eagle Lake Bridges and help keep carriage road users, especially bicyclists and equestrians, on the roads. Several of these guardrails show signs of deterioration.

3.5 Visitor Use and Experience

The CRS and bridges provide controlled visitor access to the Park's interior via non-motorized means. The roads are used for driving horse-drawn carriages, horseback riding, hiking, jogging, bicycling, skiing, and leisurely walking. The CRS offers visitors peace and quiet away from the more heavily traveled auto roads, and many unique scenic vistas.

Manning *et al.* (1997a, 1997b, and 1997c) completed an intensive three-phase visitor study of carriage road users and residents. The focus of that research was to document carriage road visitor characteristics, uses, and experiences, as well as opinions and perceptions about management, conflicts, and use patterns. The following provides a summary of visitor characteristics, use, and experience based on that study.

Carriage Road User Characteristics

Most of the respondents to the survey were between the ages of 30 and 49 and were equally divided between men and women. In general, the majority of carriage road users were from out-of-state with a very small portion being local residents. Despite the low overall percentage that locals make up of the total carriage road user population, nearly all residents of MDI use or have used the carriage roads. Many MDI residents are very active users of the carriage roads, visiting the area 10 times per year on average. Most carriage road visitors use the road system in small groups consisting of family and friends, and most have visited the road system before.

Levels of Visitor Use

Visitor use of the carriage roads increased greatly in the 1980's and early 1990's. Bicycling has become the primary type of carriage road use, especially for visitors from out-of-state. Walking and hiking comprise just over 25% of use, while equestrian activities comprise 3% of use; conversely, most MDI residents that use the road system walk or hike. Visitors generally spend an average of just over two hours using the carriage roads. The entire CRS is used, but use is generally concentrated in two locations, the Witch Hole Pond/Eagle Lake/Visitor Center area and the Jordan Pond area. The Jordan Pond area is an important equestrian destination area, with equestrian concessions being located at the Wildwood Stables. Numerous bike rental shops have been established in local towns to support visitors who want to ride bicycles on the CRS.



Bicyclist crossing Deer Brook Bridge.

Quality of Visitor Experiences

Visitors using the CRS generally report high quality experiences, although occasional conflicts arise, and the visitor experience can suffer as a result. Problem behaviors include bicyclists startling visitors from behind by passing without warning, bicyclists traveling at excessive speeds, dogs off leashes, visitors obstructing or blocking the road, large groups of visitors (usually of six or more), and visitors walking or biking off the carriage roads into undesignated areas. In general, the frequency of these problem behaviors has not exceeded visitor tolerances. Some behaviors, such as blocking or obstructing roads and bicyclists traveling at excessive speeds, are approaching the frequency that could violate visitor tolerances for such annoyances. Improved enforcement of the carriage road rules and information and education programs should help reduce these negative experiences and help maintain a high quality experience for all visitors.

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4 Environmental Consequences

4.1 Introduction

The environmental consequences of rehabilitating the carriage road bridges are presented in this chapter. These include a description of the expected impacts for each impact topic. Impacts are presented in three categories: direct, indirect, and cumulative.

4.2 Methodology for Assessing Impacts

4.2.1 Definitions

Levels of Intensity

Levels of intensity refers to significance of the impact; for example, it is negligible or major, or somewhere in between. The gradient of this grading system can be general or very detailed, but ultimately the assumptions and subjectivity of the system affect its sensitivity. A simple and subjective rating system is proposed for the impact topics, which includes a rating scale of "negligible, minor, moderate, and major effects" and are described below. The authors of this EA based the rating system score on professional opinion and review.

- For natural resource impacts:
  - *Negligible:* Impacts would not be detectable, measurable, or observable.
  - *Minor:* Impacts would be detectable, but not expected to have an overall effect on the natural community. Impacts generally affect less than one-half acre of the resource or would not be expected to be outside the natural range of variability for that resource.
  - *Moderate:* Impacts would be clearly detectable, but could have short-term appreciable effects on the local ecology. Impacts may affect up to one-acre of the resource, but would not threaten the continued existence of that resource.
  - *Major:* Long-term or permanent, highly noticeable effects on individual species, community ecology, or natural processes. Impacts may affect over one-acre of resource area or may affect the continued existence of that resource.

- For cultural resource impacts:
  - *Negligible:* Impacts would not be detectable, measurable, or perceptible, essentially a determination of *no adverse effect.*
  - *Minor:* Negligible effects with limited change to the structure or landscape. Impact would not affect the character defining features of the structure or landscape, essentially a determination of *no adverse effect.*

- *Moderate:* Noticeable changes to the character defining features of the structure or landscape, but does not diminish the integrity or change the essence of either. A finding of *no adverse effect* would be appropriate.
- *Major:* Significant changes to the structure or the landscape thereof, that affects the character defining features and integrity of either. A determination that would result in an *adverse effect* would be made.

- For safety impacts:
  - *Negligible:* Impacts would not be detectable, measurable, or perceptible.
  - *Minor:* Effects would be limited to a small number of visitors and could be avoided or minimized through planning.
  - *Moderate:* Safety concerns, resulting in permanently increased accident rates, would still exist despite implementing all minimization efforts.
  - *Major:* Significant safety issues that would warrant the closing of some bridges and possibly portions of the carriage roads for a long-term period or permanently.

- For visitor use and experience impacts:
  - *Negligible:* Impacts would not be detectable, hence visitors would not be aware of any effects of the rehabilitation.
  - *Minor:* Visitors would be aware of effects, but this would be short-term and could be avoided or minimized through planning.
  - *Moderate:* Very noticeable long-term effects resulting in some negative visitor experiences, despite implementing minimization efforts.
  - *Major:* Very noticeable long-term effects with the loss of use of a resource during a peak time creating a widespread negative visitor experience or may result in a permanent loss of use of a resource.

Duration

Duration describes how long an impact would be expected to last. In this EA, impacts are described as either being short-term or long-term. Short-term is an impact that would last no more than one or two years. Long-term would be an impact that would last for more than two years.

Context

Context refers to the geographical area that the impact would affect, thus consideration is given to the geographic extent and location that the impact affects. Some impacts could be spatially restricted to the structure or immediate site. Other impacts could be spatially broader and encompass a larger geographical area, such as a watershed. Furthermore, impacts could extend to an even broader extent such as the Park or region, especially when considering cumulative impacts.

Direct and Indirect Impacts

Direct impacts include effects on the resource actually caused by the proposed action, generally at the immediate site of the action and at the time of the action. Direct impacts can extend into the future and are often permanent, but can be temporary. An example of a direct impact would be habitat loss from the filling of a portion of a wetland.

Indirect impacts generally occur as a result of a "side-effect" of a direct impact, but occur later in time or further in distance than the action. An indirect impact could result from silt flowing downstream, creating turbid conditions, and negatively affecting water quality.

Cumulative Impacts

The CEQ's regulations, which implement the National Environmental Policy Act of 1969 (42 USC 4321 *et seq.*), require assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are 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 non-federal) or person undertakes such other actions (40 CFR 1508.7)". Cumulative impacts are considered for both the no-action and preferred alternatives.

Cumulative impacts were determined by combining the impacts of the preferred alternative—rehabilitating the carriage road bridges—with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects at ANP and, if applicable, the surrounding region. Completed, ongoing, and reasonably foreseeable projects both inside and outside the Park include the rehabilitation of the Park entrance station (ongoing); rehabilitation scheduled to start in 2003, including work on Seawall Campground, Duck Brook Road, and the visitor facilities at Sand Beach; and projects scheduled for 2004, including rehabilitating Blackwoods Campground and Echo Lake Beach, Bear Brook waterline, and numerous small projects that qualify as categorical exclusions.

4.2.2 Impact Matrix Comparisons

Comparisons of potential adverse and beneficial impacts are made between the "No Action" and "Full Rehabilitation" alternatives in order to determine if the proposed project would impair Park resources. Impairment of Park resources is prohibited per NPS policy. The preferred alternative must not produce any significant impacts and must not impair Park resources in order to be approved as an EA as documented through a Finding of No Significant Impact. If the project does not meet the criteria for issuance of a Finding of No Significant Impact, then an Environmental Impact Statement would be required. A prohibited impairment is an impact that, in the professional judgment of the responsible Park management, would harm the integrity of Park resources and values, including the opportunity to enjoy those resources and values.

4.3 Impact Assessment

4.3.1 Alternative A (No Action)

Overview

The "No Action" alternative is included in this EA to provide a baseline upon which to compare the effects of Alternative B, "Full Rehabilitation." The "No Action" alternative would not repair any of the deteriorating conditions on any of the bridges. Damage and deterioration would continue unabated. Over time, the continued deterioration of the bridges would require reconstruction and generate safety concerns for visitors and Park staff. The costs of reconstruction are exponentially higher than the costs of rehabilitation and maintenance. Therefore, the "No Action" alternative does not meet the basic project purpose and would require much more extensive and expensive repairs in the long-term. A summary of impacts is provided in Table 6.

Table 6 Impacts Summary for Alternatives A and B

Category	Adverse Impacts		Beneficial Impacts	
	Alternative A "No Action"	Alternative B "Full Rehabilitation"	Alternative A "No Action"	Alternative B "Full Rehabilitation"
NATURAL RESOURCES:				
Soils, water quality, streams, wetlands, & wildlife habitat	Long-term turbidity and will continue. Degraded water quality will adversely affect adjacent stream and wetland habitats. Long-term negligible to minor indirect and cumulative impacts would be limited to the watershed.	No direct impacts would be expected. Indirect and cumulative impacts include negligible, short-term turbidity spread out over several months that would be limited to the affected streams and watershed. BMPs used to avoid and minimize impacts.	No benefits expected.	Stabilization of bridge abutments and social trails would correct erosion problems and improve water quality at several sites which results in minor, indirect and cumulative long-term, local and watershed benefits.
Vegetation	Vegetation clearing issues are not applicable.	Negligible loss of some habitat structure.	No loss of habitat structure.	Prevents inadvertent damage to existing vegetation and minimizes visual impact.
CULTURAL RESOURCES:				
Historic Structures	Structural deterioration will have a moderate impact on the use and aesthetic values of the bridges. Impacts would be moderate, long-term, local, and regional.	Negligible, short-term, local impacts on the historic appearance of the bridges due to potential discoloration resulting from the cleaning of calcium carbonate deposits.	No benefits expected.	Preserves the historic integrity of the bridges by resolving water seepage problems. These moderate, direct, indirect, and cumulative benefits would occur on a regional basis.
Cultural Landscape	The cultural landscape will deteriorate. These direct, indirect, and cumulative impacts would be moderate and occur on a regional basis.	No adverse effects expected.	No benefits expected.	Rehabilitates elements of the cultural landscape through the rehabilitation of historic trails, revegetation of social trails, and vista restoration. These moderate, direct, indirect, and cumulative benefits would occur on a regional basis.

Table 6 Impacts Summary for Alternatives A and B (Cont'd.)

Category	Adverse Impacts		Beneficial Impacts	
	Alternative A "No Action"	**Alternative B "Full Rehabilitation"**	**Alternative A "No Action"**	**Alternative B "Full Rehabilitation"**
VISITOR and STAFF SAFETY:	Safety rails falling into disrepair would lead to minor, long-term, local safety issues on the steel bridges. Structural integrity of all bridges would be compromised leading to moderate, long-term safety issues. Moderate safety issues would result, as emergency vehicles access would be reduced. Cumulative impacts would be considered negligible.	Minor short-term safety issues that can be avoided with planning. Long-term safety issues are not applicable.	No benefits expected.	Rehabilitation will keep the bridges in safe and functional condition, providing safe conditions for visitor use. This is a minor to moderate, long-term, local benefit.
VISITOR USE and EXPERIENCE:	Possible long-term loss of use of portions and/or the entire road system should structural problems arise. Closure of bridges for structural repairs would result in direct and indirect moderate, long-term, regional impacts. Cumulative impacts would be considered minor to moderate.	Minor, short-term loss of use of portions of the CRS. At least two-thirds of the roads would remain open at all times. Some disruption of visitors' plans and expectations.	No loss of use of the roads in the short-term near future.	Provides long-term use of the entire CRS. Provides for the long-term maintenance of the bridges and full enjoyment of the CRS by the visiting public. Benefits would be considered moderate, long-term, and regional.

Natural Resources – Soils, Water Quality, Wetlands, and Wildlife

Direct and Indirect Impacts: The natural resource topics relating to the effects of erosion, soils, water quality, wetlands, and wildlife, are analyzed together, because the interactions of the effects of erosion often lead to impacts on all of these resources. Alternative A would not likely generate any direct impacts to natural resource topics, including soils, water quality, streams and wetlands, wildlife, and vegetation. There would not be any rehabilitation activities and, therefore, deterioration of the bridges would continue. Long-term, direct impacts are not anticipated.

Long-term negligible to minor indirect impacts to soils and water quality would continue through erosion and scouring of silt along some of the bridges. This erosion derives from two sources: foot traffic along social paths and stream flow scouring loose rocks and soil. Lowering the water quality would have negligible to minor impacts on the wetlands and associated wildlife habitat. Given the small amount of eroded areas along the bridges, impacts should be small and often restricted to the spring thaw and rainy season. This erosion would continue unabated, and could worsen, if the bridges were to be closed and new crossings established. Erosion would continue along the wetlands or adjacent to several bridges, including the Deer Brook Bridge, Hadlock Brook Bridge, Waterfall Bridge, Hemlock Bridge, Jordan Pond Dam Bridge, and Duck Brook Bridge. Scouring would continue within the stream channels underneath Hemlock Bridge, Waterfall Bridge, Deer Brook Bridge, all three of the Eagle Lake stringer bridges, and all six of the Seven Sisters stringer bridges. Eroded silt would continue to increase turbidity downstream, although it would likely be a minor occurrence. Wetland functions would continue to be adversely impacted including degraded water quality, degraded aquatic wildlife habitat, and reduced food chain production. These adverse impacts would be of low intensity, but would be long-term and would not be remedied unless some rehabilitation activity took place. The effects of turbidity on each of the 15 bridges should be considered when combined with the effects from other projects in the watershed over time. The long-term effects of continued erosion would be magnified somewhat because the erosion would become more extensive. Again, water quality, aquatic wildlife, and food chain production would be adversely affected by the turbidity, although this would still be a negligible to minor impact (Table 6).



Example of social trail erosion from drainage at Seven Sisters Bridge No. 4

Cumulative Impacts: The combined effects of the "No Action" alternative and other ANP and private projects would likely not have any moderate or major cumulative impacts on natural resources within the Park and vicinity. Cumulative adverse impacts from water quality degradation could result, but would likely be negligible to minor. BMPs should be employed on any active construction projects, thereby minimizing turbidity from other sources. BMPs as generally accepted include various erosion control measures, culvert sizing and placement, seeding and re-grading disturbed areas, and sediment barriers. Other ANP and private projects will be required to obtain natural resource-based regulatory permits, which would provide additional protection to these resources, reducing the potential for cumulative impacts.

Summary: Direct and indirect impacts to natural resource topics are expected to be minimal. They are largely related to ongoing erosion issues, which can lower water quality and adversely impact streams and wetlands and wildlife habitat as well. These impacts are expected to be negligible to minor, long-term,

and restricted to watershed areas. Cumulative impacts to natural resource elements are generally considered negligible to minor, but are long-term and restricted to the local watersheds.

Natural Resources – Vegetation

Direct and Indirect Impacts and Cumulative Impacts: There would be no direct, indirect, or cumulative impacts to vegetation and other aspects of the wetland vegetation, natural communities, and wildlife habitat not directly tied to water quality.

Cultural Resources – Historic Structures and Cultural Landscape

Direct and Indirect Impacts: The implementation of Alternative A would result in moderate direct adverse long-term impacts on the historic integrity of the bridges, including the cultural landscape. As defined by the National Register of Historic Places, historic integrity is the authenticity of a property's historic identity, evidenced by the survival of physical characteristics that existed during the period when property achieved significance. The seven qualities of historic integrity are location, design, setting, materials, workmanship, feeling, and association. Alternative A would not address damage caused by water seepage and scour, which threaten the structural integrity of the masonry arches, abutments, **piers**, **parapets**, and facades of the bridges. The failure of any of these components would impact the qualities of the bridge's historic design, setting, materials, and workmanship.

The adoption of Alternative A would also impact aesthetic qualities and cultural landscape characteristics of the bridges by not addressing the need to clean calcium carbonate deposits, which detract from the historic appearance of the bridges. In addition, adverse impacts on the setting of the bridges, including the loss of vegetation caused by erosion and the continued use of unauthorized social trails alongside some of the bridges and overgrown vegetation that has obscured historic vistas at the Bubble Pond and Jordan Stream West Branch bridges, would not be mitigated. Therefore, the overall appearance of each bridge, the surrounding landscape, and associated hiking trials would be degraded and moderate long-term impacts could result.



Architectural details at Deer Brook Bridge

Cumulative Impacts: Alternative A would have an adverse cumulative impact on integrity of the historic circulation system of the Park, extending beyond the carriage road and hiking trail systems. The failure of bridges would force the closure of segments of the circulation system, thereby having an adverse impact on its historic function as an integrated transportation system. When combined with other rehabilitation projects, which are implemented, cumulative impacts would be minor. The adverse effects would generally be confined to the CRS and adjacent or connected circulation system.

Summary: Impacts to historic structures would be of moderate intensity, restricted to the bridges, and of long-term duration. It may take many years of continued deterioration to adversely affect the structural components of the bridges, but deterioration already affects the integrity of the bridges. The cultural landscape is compromised by the deterioration of the bridges reducing the original historic appearance, setting, and potential enjoyment by Park visitors. Cumulative impacts could result from a closing of the

bridges, should deterioration extend to that level. These impacts relate to the overall traffic circulation in the Park.

Visitor and Staff Safety

Direct and Indirect Impacts: Alternative A does not implement any rehabilitation activities that would address short-term safety issues, such as repairing guard rails, especially those on the Seven Sisters Little Bridges. This would be considered a minor impact to safety issues. Furthermore, this alternative does not address potential long-term moderate adverse impacts to the structural integrity of the bridges. Water infiltration would continue and lead to further deterioration of the structural components of the bridges, which could lead to moderate safety hazards. Safety of Park employees and visitors would be compromised and emergency vehicle access would be limited if not eliminated, but these effects would be fairly localized and would probably not create a regional safety issue.

Cumulative impacts: Considering safety hazards that would occur through this alternative combined with other safety issues from projects in the vicinity, suggests negligible cumulative impacts. Some potential would exist for a negligible increase in traffic in the immediate area.

Summary: Safety impacts would result if the condition of the bridges became structurally unsound. Current safety concerns include deteriorating guardrails on some of the smaller bridges. Cumulative impacts would be negligible.

Visitor Use and Experience

Direct and Indirect Impacts: Alternative A would have direct and indirect adverse impacts of moderate intensity on visitor use and experience of the CRS (Table 6). The aesthetic and structural conditions of each bridge would continue to deteriorate. While all the bridges are currently structurally sound, gradual deterioration would likely lead to structural deficiencies. The continued infiltration of water into the interior of the bridges would compromise their structural integrity. These adverse impacts are a long-term consequence of the "No Action" alternative that could lead to the need for structural rehabilitation. Bridge closures would necessitate the closure of entire portions of the road system until repairs could be made, hence an indirect result of No Action. If deterioration of this magnitude occurred, road closures would be lengthy with no opportunity to avoid and minimize adverse impacts to Park visitors. Use of the CRS would then be severely limited and the visitor use and experience would be degraded. Furthermore, costs for extensive structural rehabilitation would be substantial, as c revenue loss from decreased numbers of visitors and concessions.

Cumulative Impacts: When combined with other implemented rehabilitation projects, minor to moderate cumulative effects could result. Local concessions would be adversely effected. The entire hiking trail system could become divided and separated by the bridge closures. Individuals using the CRS would have to look elsewhere for their recreational outlets, which would increase roadway traffic and lower the quality of the visitor experience across the Park.

Summary: Moderate impacts to visitor use and experience would likely result without rehabilitation. These impacts would be of long-term duration and could extend beyond the immediate CRS area. Cumulative effects could relate to loss of hiking trail use, traffic congestion, and a general drop in visitor enjoyment of the Park.

4.3.2 Alternative B ("Full Rehabilitation")

Overview

The "Full Rehabilitation" alternative would repair the structural and architectural features that have deteriorated over time, and would include installing a major water prevention system, rectifying scouring and erosion problems underneath and adjacent to some of the bridges, rehabilitating the surrounding landscape and setting, and rehabilitating small portions of trails adjacent to eight of the bridges. The "Full Rehabilitation" would have numerous beneficial effects and are discussed in detail below. Important minimization steps would be taken by ANP to protect Park resources.

Natural Resources – Soils, Water Quality, Wetlands, and Wildlife

Direct and Indirect Impacts: The natural resource topics relating to the effects of erosion, soils, water quality, wetlands, and wildlife, are analyzed together. With minimization efforts implemented as proposed, full bridge rehabilitation would have a negligible level of impacts on natural resources, including soils, water quality, streams and wetlands, and wildlife habitat. Table 6 provides a summary impact matrix. The potential for erosion during some bridge rehabilitation processes is the only anticipated. The minimization processes mentioned above would avoid and minimize erosion and possible downstream turbidity, which offers only a temporary, short-term potential for negligible impacts to soils, water quality, streams and wetlands, and wildlife habitat. These potential effects would be restricted to the local watershed. Erosion control is the key to avoiding such impacts, as erosion would lead to lowered water quality, which in turn would affect the ecology of the streams and wetlands and the habitat that they provide. Much of the proposed in-stream work focuses on repairing scouring and adjacent erosion sources; therefore, despite potential short-term erosion, a long-term erosion problem would be repaired and controlled. A net minor environmental benefit is anticipated for water quality and aquatic habitat, generally of a long-term duration within the local watershed.

Cumulative Impacts: The combined effects of potential temporary erosion during construction across the 25 bridges should produce negligible levels of adverse impacts to soils, water quality, streams and wetlands, and aquatic habitat within the watershed, when considered with other projects in the vicinity. Most other projects in the region, as listed above, do not influence or connect to the streams within the CRS. One exception is Duck Brook for which associated roadway improvements should also have minor adverse impacts to wetlands and water resources. Any impacts from other projects are expected to be negligible to minor and generally of short-term duration, especially by implementing BMPs. Implementing the minimization practices listed in Table 7 will reduce the potential for short-term erosion to negligible or minor levels for the bridges. Repairing in-stream scouring and erosion along the banks will reduce downstream turbidity and have a minor net ecological benefit to water quality and aquatic habitat. These benefits are minimal when considered in a watershed context, but still contribute a benefit to the natural resources of the Park and adjacent areas. There should be no adverse cumulative effects on vegetation, given the lack of direct and indirect adverse impacts.

Summary: Impacts to natural resource topics should be negligible, temporary, and local and largely relate to erosion and water quality parameters. Implementing minimization would virtually eliminate adverse impacts. Beneficial effects would likely be minor, long-term, and local relating to improving drainage and reducing erosion. Cumulative impacts, both adverse and beneficial, are likely to be negligible to minor.

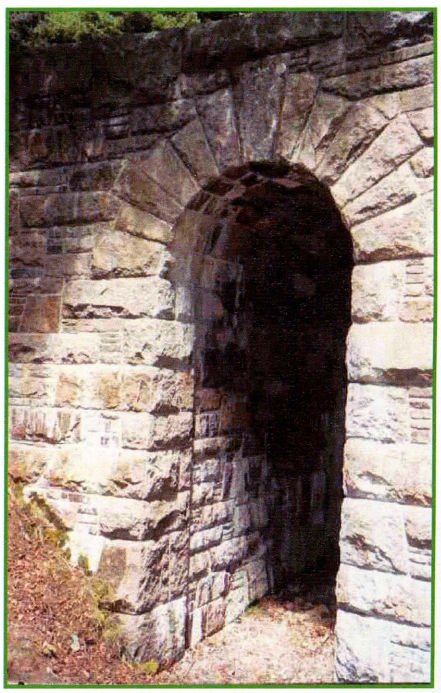
Natural Resources – Vegetation

Direct, Indirect, and Cumulative Impacts: Minor pruning of trees and shrubs would occur along the Chasm Brook Bridge, Bubble Pond Bridge, and Triad-Day Mountain Bridge to allow construction vehicle access. Pruning overhanging vegetation would prevent inadvertent damage to branches and tree trunks. Construction workers will coordinate the pruning with the ANP arborist to minimize removal. This effort should result in negligible, short-term, localized adverse impacts to vegetation. No other impacts to the natural communities adjacent to the bridges are expected. No cumulative impacts are expected given the low level of vegetation removal that is expected.

Cultural Resources – Historic Structures

Direct and Indirect Impacts: Negligible direct adverse impacts of the preferred alternative are limited to the potential for uneven coloration of masonry bridge walls after the cleaning of calcium carbonate deposits. These impacts would be considered short-term and minor and would be restricted to the bridges. Potentially stark differences between cleaned and uncleaned masonry can be minimized by careful and expert application of the proposed dry aggregate blasting method, which was successfully employed during the rehabilitation of Stanley Brook Bridge in 2000. Any resulting uneven coloration will fade in time.

The long-term effects of the preferred alternative would have a moderate beneficial impact on the bridges. The alternative represents a sound strategy for ensuring the long-term preservation of the bridges and meets the *Secretary of the Interior's Standards for Rehabilitation* for the preservation of historic structures. By arresting ongoing deterioration, repairing masonry and other structural materials that have deteriorated over time, and developing a long-term maintenance plan, the proposed project would preserve the structural integrity of the bridges.



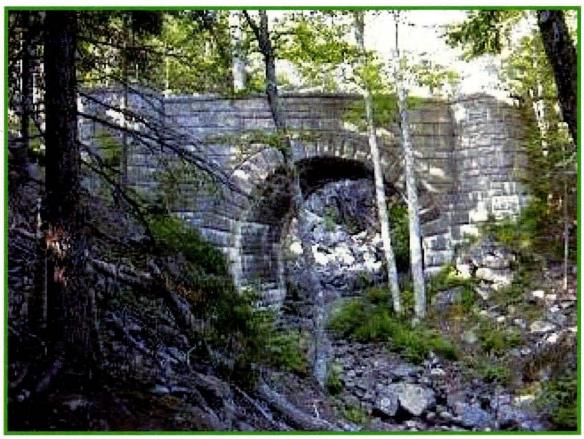
Hiking trail passage and architectural detail at Jordan Stream West Branch

Cumulative Impacts: The preferred alternative would have cumulative beneficial effects on the Carriage Paths, Bridges, Gatehouse, ANP Historic District and the historic circulation system of ANP as a whole. When considered in combination with previous projects to rehabilitate carriage roadbeds and scenic vistas and other visitor attractions, the proposed project represents the final component of a major system-wide rehabilitation effort that will allow the CRS to continue to function as originally designed. No adverse cumulative effects are anticipated from completion of the rehabilitation relative to other projects in the vicinity. The proposed project would insure the preservation of these valuable cultural resources as unique, tangible links to the history of ANP.

Summary: Rehabilitation will have long-term, moderate beneficial effects to the structure and appearance of the bridges. These benefits also relate to the overall stewardship of the Park, which is the focus of many projects in the vicinity. Adverse impacts relating to the appearance of the bridges after cleaning would be negligible, short-term, and localized.

Cultural Resources – Cultural Landscape

Direct and Indirect Impacts: Revegetating, rehabilitating the historic hiking trails, formalizing or removing selected social trails, and rehabilitating selected vistas will have moderate benefits to the cultural landscape. These efforts will improve the aesthetic appeal of the bridges and adjacent landscape and improve the hiking access to and from the bridges. Adverse impacts are not expected as completing this work would improve conditions at and adjacent to the bridges. The proposed rehabilitation of sections of historic hiking trails and surrounding landscape would also constitute a moderate beneficial effect. The work on the adjacent sections of the six historic hiking trails would improve safety and accessibility without adverse effects on the integrity of their design. The elimination of erosion through the revegetation of social trails and the removal of overgrown vegetation that obscures historic vistas would re-establish aspects of the historic cultural landscape of the bridges.



Example of a cultural setting: Waterfall Bridge blends in with the landscape features

Cumulative Impacts: The proposed improvements to the cultural landscape would have beneficial cumulative impacts on the overall cultural landscape in the Park. This project, combined with other rehabilitation and Park improvement projects, will improve the appearance and cultural integrity of the Park. No adverse cumulative effects are expected when considering other rehabilitation and Park improvement projects.

Summary: Rehabilitation of the bridges should not have any adverse impacts on the cultural landscape, except for the temporary closure of each bridge. Long-term benefits include improvements to the cultural landscape through revegetation and the rehabilitation of the bridges and adjacent hiking trails. Cumulative effects are likely to be beneficial when considered in conjunction with other Park improvement projects in the area.

Visitor and Staff Safety

Direct and Indirect Impacts: Implementing Alternative B could have minor direct impacts on visitor and staff safety due to the presence of construction equipment on the carriage roads and during the operation of equipment at each bridge site. These impacts are considered short-term and restricted to the immediate area. The presence of signage, Park staff directing traffic, and the temporary closing of portions of the CRS will prevent more intensive safety concerns. Maintaining open loops will allow emergency vehicles and law enforcement personnel access to the CRS and minimize potential safety concerns.

Cumulative Impacts: The direct and indirect adverse impacts on safety should not extend beyond the CRS and should not increase adverse effects within the Park and vicinity when considered in relation to other projects. These safety issues are temporary and should not extend beyond the immediate project area.

Summary: Adverse impacts to safety topics should be minor, short-term, and local, especially after implementing the minimization features of the project. Minor and moderate long-term benefits are expected immediately by repairing guardrails and maintaining the structural integrity of the bridges. Cumulative adverse effects are not expected.

Visitor Use and Experience

Direct and Indirect Impacts: For Park visitors that use the CRS, "Full Rehabilitation" would create some minor, short-term, temporary impacts because the roads would be closed during the construction phase. These impacts would largely be restricted to the CRS and immediate vicinity. Most visitors are expected to follow the signage and stay on the open loops with no adverse effects to their enjoyment of the CRS.

Bridges would not be closed for most surficial work, namely repointing, cleaning, and replacing fallen rocks; this work is done by hand with minimal space needed for the workers. Traffic might be restricted to a smaller width for crossing each bridge, but the bridges will not be closed. Visitors will have open access across the bridges; therefore, adverse impacts to visitors would likely be minor and temporary.

Even though this work schedule would minimize the adverse effects on visitor use of the carriage roads and bridges, some minor impacts are expected. For example, the closure of an individual bridge would require that some roads be closed for a very short duration. The construction process is more efficient if work is completed on loop areas or sections of the CRS at one time. Planning requires proper pre-identification of stockpile locations and understanding of the sequence of work activities in order to prevent unnecessary rerouting of construction traffic once construction work has been initiated.



Finished repointing and cleaning is done by hand: note the wet mortar

The "Full Rehabilitation" alternative should result in moderate, long-term benefits through the re-establishment of bridge integrity and continued enjoyment by Park visitors. The long-term benefits should outweigh any short-term adverse effects that result from the rehabilitation. Many Park visitors may actually appreciate the effort made to rehabilitate the bridges and perceive that the NPS is taking appropriate action to maintain valuable resources held in the public trust. Local residents or other repeat visitors who may already have some knowledge of the need for the bridge rehabilitation may appreciate the efforts more than first-time visitors.

Cumulative Impacts: Bridge rehabilitation would require the closure of loops of the CRS. These closures would create a situation of partial use of the carriage roads leaving the open loops to share the full burden of traffic. This situation would put more bicyclists, walkers, hikers, and equestrians on the remaining open carriage roads, motor roads, and might create greater potential for conflict. The quality of the visitor experience would likely be diminished for short periods during the busy season (Table 2). Visitors would be made aware of the rehabilitation work and the need for it, in order to minimize adverse effects. Appropriate education and signage would help prevent surprise and frustration among visitors, and may induce more cooperation and understanding. With these minimization aspects in place, temporary, short-term adverse impacts should be minimal and insignificant. Given these conditions and the short-term extent of impacts, it appears unlikely that any moderate or major cumulative impacts would result. The temporary closure of the campgrounds for rehabilitation combined with bridge and carriage road closures could have a minor adverse effect on visitor use. The masonry work should also produce only low-level, insignificant adverse impacts to the visitor experience, as roads would remain open and visitors should not be inconvenienced; therefore, no cumulative impacts would be expected.

Summary: Adverse effects to visitor use and experience would occur during the heavy construction, i.e., installing the water prevention system, phase of the rehabilitation. These effects are minor, short-term and localized. They can be minimized through signage, staff communication, and education. Long-term moderate benefits to visitors would result, directly relating to their enjoyment of the bridges and CRS and cumulatively within the Park and vicinity as other improvements are made to Park attractions and facilities.

4.4 Impact and Impairment Summary

4.4.1 Impact Matrix

Table 6 provides a summary of adverse and beneficial impacts and compares the two alternatives. Comparing these impacts strongly suggests that the "No Action" alternative would have moderate, long-term, regional adverse impacts in the future. The timeframe is difficult to predict as deterioration continues, but adverse impacts appear likely to occur. There would be some minor short-term benefits from the "No Action" alternative, but these are clearly outweighed by the long-term adverse impacts.

The "Full Rehabilitation" alternative has numerous moderate, long-term, regional benefits with some negligible to minor short-term, localized adverse impacts. The rehabilitation of Park resources would be completed in an environmentally sound manner with careful planning will avoid and minimize adverse impacts. Benefits would result from the rehabilitation that would maintain Park resources for years to come.

4.4.2 Impairment Summary "No Action" Alternative

The negligible and minor impacts to natural resource topics would not impair Park natural resources if the "No Action" alternative were implemented. Natural resource elements would still function at nearly full levels and any minor effects would be restricted to local areas. The deterioration of the bridges would lead to moderate long-term adverse impacts to the bridges and CRS and could have effects beyond the local area. Despite these impacts the "No Action" alternative would not impair Park cultural resources. The deterioration of some safety factors would lead to minor impacts on safety concerns. These impacts would not impair Park resources if the "No Action" alternative were implemented. Park

4.4.3 Impairment Summary "Full Rehabilitation" Alternative

Implementing the "Full Rehabilitation" alternative would not impair Park resources. In fact, Park resources would be benefited. The "Full Rehabilitation" alternative would result in beneficial effects on the bridges and associated cultural landscape. The short-term minor, adverse impacts that could result would be out-weighed by the moderate, long-term beneficial effects of the rehabilitation efforts. Therefore implementing the rehabilitation would not impair Park cultural resources. Visitor and staff safety will be improved by the rehabilitation efforts. These short-term safety benefits are minor, while long-term benefits would be moderate. The rehabilitation would not impair Park resources relating to visitor and Park staff safety.

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5 Consultation & Coordination

5.1 Introduction

NEPA requires federal agencies preparing EAs to consult with stakeholders, including the general public and appropriate federal, state, and local regulatory agencies, early in the planning process to identify issues and concerns. The steps taken towards meeting these compliance goals thus far are documented below. The necessary permits are discussed by the regulatory authority. Public input is being sought by issuing this EA for a 30-day public review and commenting period.

5.2 Regulatory, Management, and Legislative Considerations

This EA considers federal, state, and local agencies that may have some regulatory jurisdiction over the rehabilitation activities that are proposed, and provides a discussion of regulatory permitting that must be completed before the rehabilitation work can begin. Consultation was completed with numerous agencies and public interest groups to facilitate permitting and to inform them of the project. Copies of this EA will be submitted to these agencies and public interest groups, as well as to private individuals, for a 30-day review and commenting period. The NPS Development Advisory Board conceptually approved the bridge rehabilitation during the quarterly spring meeting, April 30 – May 2, 2002. All rehabilitation work will be completed in adherence to the *Secretary of the Interior Standards for Rehabilitation.*

5.3 Interagency Consultation

Federal, state, and local agencies that have jurisdiction over the project area were contacted to determine permitting and other compliance requirements. In addition, copies of this EA will be provided to each agency and other individuals listed in Section 5.5. The following agencies have been contacted to date or will be contacted as part of this consultation:

- U.S. Army Corps of Engineers (ACOE)
- U.S. Fish and Wildlife Service (USFWS)
- Maine Department of Environmental Protection (MDEP)
- Maine Department of Inland Fisheries and Wildlife (MDIFW)
- State Historic Preservation Commission
- Coastal Program, Maine State Planning Office
- Town of Bar Harbor
- Town of Mount Desert

5.4 Compliance

5.4.1 Federal

Clean Water Act of 1972

The purpose of the Clean Water Act is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." As part of this legislation, the **U.S. Army Corps of Engineers (ACOE)** regulates fill impacts to "Waters of the United States", including wetlands, which could potentially degrade waters of the U.S. The streams, associated wetlands, and the Gilmore Meadow area would be considered jurisdictional wetlands by the ACOE; therefore, any permanent or temporary fill impacts or other activities that alter water levels in the wetlands will require permitting through either the Programmatic or Individual permitting process.

Mark Christopher contacted Mr. Jay Clement of the ACOE on January 16, 2003. A permit will be required from the ACOE for the work that involves water level alteration or de-watering. Hand work that does not require water level alteration, fill, dredging, or other temporary structures would be considered routine repairs and not require an ACOE permit. The proposed rehabilitation does not require the placement of fill within the streams. However, the placement of temporary water diversion structures will impact a total of 600 square feet of headwater streams. A permit application will be submitted to the ACOE detailing the work that will require review and approval by the ACOE. Rehabilitation work will not begin until all necessary permits have been obtained. All work will be subject to permit conditions and requirements.

Endangered Species Act of 1973, as Amended (16 USC 1531 et seq.)

The USFWS regulates the taking and incidental taking of wildlife and plant species listed as endangered and threatened as per the Federal Register. Section 7 of the Endangered Species Act requires that federal agencies consult with the USFWS on any action that may affect a listed species. The USFWS was consulted through correspondence to biologists in the Old Town office and will be provided a copy of this report. Correspondence from the USFWS indicates that there are no federally listed species known to occur in the project area, except for the potential for occasional transient bald eagle (*Haliaetus leucocephalus*) (Appendix F). Correspondence indicates that no other consultation is required under Section 7 of the Endangered Species Act. There does not appear to be any suitable habitat of federally listed species and none have been observed in the vicinity of the CRS so it is unlikely that the rehabilitation will impact any federally listed species.

Section 106 of the National Historic Preservation Act of 1966 as amended (16 USC 470 et seq.)

Section 106 of the National Historic Preservation Act of 1966, as amended (36 CFR 800), requires federal agencies to consider the affects of projects they fund, permit, or license on historic properties that are listed or eligible for listing in the National Register of Historic Places. Compliance with Section 106 requires agencies to initiate consultation during the project's early planning stages with appropriate parties, including the pertinent State and/or Tribal Historic Preservation Officer(s); identify historic properties within the project's area of potential effect; and determine what impact, if any, the project will have on those resources. If the agency, in consultation with the other consulting parties, determines that the project has the potential to have an adverse impact on historic properties, further consultation must occur to seek ways to avoid, minimize, or mitigate the effects. Consultation and compliance under Section 106 will be completed prior to project commencement.

While this EA identifies historic properties and provides information about the potential effects of the project, it does not satisfy the NPS's obligations under Section 106. No rehabilitation activities can begin until the NPS initiates consultation with the State Historic Preservation Commission/State Historic Preservation Officer and a mutual accord is reached concerning the potential effects. Consultations with the Historic Preservation Officer are ongoing and expected to be completed prior to commencement of the project.

Coastal Zone Management Act of 1972

The Consistency Determination through the Maine State Planning Office, Coastal Program under the Coastal Zone Management Act, Section 307 (c) and 15 CFR Part 930, sub-part C, will be obtained when all required regulatory permits are issued for the full rehabilitation of the bridges. This determination is made to ensure compliance with the Coastal Zone Management Act and that coastal resources would not be adversely affected by the project. The NPS believes that the full rehabilitation work is consistent to the maximum extent practicable with the enforceable policies of the Maine Coastal Program based on the information and analysis contained herein. The NPS will obtain all necessary permits to complete work within the coastal zone. The Coastal Zone Management Act concurrence will not be effective and rehabilitation work will not begin until all coastal zone permits are obtained, if required.

5.4.2 State

Natural Resources Protection Act (38 M.R.S.A. Section 480)

The **Maine Department of Environmental Protection (MDEP)** implements this legislation, which protects wetland and waterbodies from impacts and water quality degradation. The MDEP was contacted to determine a permitting course for the proposed rehabilitation. Temporary work to repair scouring and erosion problems and complete other rehabilitation may not require permitting through the MDEP, based on an informal discussion with Mr. James Beyer of the MDEP, Bangor field office, with Mark Christopher on January 17, 2003. Should a permit be required, the appropriate submittal will be made to the MDEP and rehabilitation work will not begin until all necessary permits have been obtained.

State Endangered Species Act

The State of Maine Endangered Species Act protects state listed endangered and threatened species. The MDIFW was contacted to determine if any significant wildlife or fisheries habitat exists in the project area. Mr. Scott Lindsay indicated that habitat for state-listed endangered and threatened species and other significant wildlife habitat does not occur adjacent to any of the bridges, based on correspondence from the MDIFW (personal communication with Mark Christopher on December 23, 2002).

Mandatory Shoreline Zoning Act

The Maine Mandatory Shoreline Zoning Act (Title 38 MRSA Sections 435-449) applies to all lands within 250 feet of lakes, ponds, rivers, tidal areas, and freshwater wetlands, and at least 75 feet from the portions of streams that are downstream of two intermittent or perennial confluences. These regulations are implemented at the local level through the towns of Bar Harbor and Mt. Desert. Waterbodies within the project area include Eagle Lake and Jordan Pond. That portion of Duck Brook adjacent to the bridge does not appear to be within the Shoreland Zone. The Code Enforcement Officers of Bar Harbor and Mt. Desert Island indicated that review or permitting relative to shoreland zoning is not needed in either township (personal communications with Mark Christopher on January 17, 2003).

5.4.3 Local

The CRS lies within the townships of Bar Harbor and Mount Desert. The Code Enforcement Officer for each township was contacted and indicated that, unless shoreland zoning regulations apply, permitting should not be required. At this time, it does not appear that shoreland zoning regulations apply to the rehabilitation.

5.5 List of Recipients

This EA is available for public review and comment until the closure of the 30-day public review and commenting period, expected to close on March 4, 2003. As indicated below, it has been distributed to a number of interested individuals, agencies, organizations, including those agencies referenced in Section 5.1 of this EA. This EA is available on the Internet at http://www.nps.gov/acad/management.htm and is being made available in local libraries for the review period.

State, Federal, and Local Agencies
Maine Department of Environmental Protection, James Beyer
Maine Coastal Program, Todd Burrows
U.S. Army Corps of Engineers, Jay Clement
Maine House of Representatives
U.S. Fish and Wildlife Service, Mark McCollough
Town of Bar Harbor, Kim Keene, Code Enforcement Officer
Town of Mount Desert, Brent Hamor, Code Enforcement Officer
U.S. Senator
U.S. Representative

Community Organizations and Interested Individuals
Acadia Bike
Acadia Corporation
ANP Advisory Commission
Aquaterra Adventures
Bangor Daily News
Bar Harbor Bicycle Shop
Bar Harbor Chamber of Commerce
Bar Harbor Historical Society
Bar Harbor Times
Bicycle Coalition of Maine
Downeast Transportation
Ellsworth American
Footloose Friends
Friends of Acadia
Mount Desert Island Chamber of Commerce
Mount Desert Island Historical Society
Mount Desert Islander
Northeast Harbor Chamber of Commerce
Southwest Cycle
Southwest Harbor Chamber of Commerce
Wildwood Stables

Federally Recognized Tribes in Maine
Aroostook Band of Micmacs
Houlton Band of Maliseet Indians
Passamaquoddy Tribe-Indian Township
Passamaquoddy Tribe-Pleasant Point
Penobscot Nation

Libraries
Bangor City Library
Bass Harbor Library
Ellsworth Public Library
Jesup Memorial Library
Northeast Harbor Library
Seal Harbor Library
Somesville Public Library
Southwest Harbor Public Library
Thorndike Library

The following were sent a press release announcing the availability of this EA:

Bangor Daily News
Greg Fish, Bar Harbor Times
Castine Patriot
Dobbs Productions
Downeast Coastal Press
Ellsworth American
Maine Coast Reporter
Maine Publicity Bureau
Maine Times
WABI Television Station
WERU Radio Station
WKSQ Radio Station
WLBZ Television Station
WQCB-FM Radio Station
WVII-TV
WWFX Radio Station

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6 Acronyms, Glossary, Bibliography, & List of Preparers

Acronyms

ACOE	U.S. Army Corps of Engineers
ANP	Acadia National Park
BMPs	Best Management Practices
bridges	carriage road bridges
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CRS	carriage road system
EA	Environmental Assessment
GMP	General Management Plan, Acadia National Park
MDEP	Maine Department of Environmental Protection
MDI	Mount Desert Island
MDIFW	Maine Department of Inland Fisheries and Wildlife
NEPA	National Environmental Policy Act of 1969
NPS	National Park Service
USFWS	U.S. Fish and Wildlife Service
VHB	Vanasse Hangen Brustlin, Inc.
VIA	Village Improvement Associations
VIS	Village Improvement Societies

Glossary

Abutment	Part of a structure that supports the end of a span or accepts the thrust of an arch; often supports and retains the approach embankment.
Arch	A curved structure that supports a vertical load mainly by axial compression.
Beam	A horizontal structure member supporting vertical loads by resisting bending. A girder is a larger beam, especially when made of multiple plates. Deeper, longer members are created by using trusses.
Best Management Practices	Construction techniques that prevent or control erosion or other harmful impacts that result from the construction. These practices include silt fencing, netting, seeding, or straw to hold soil together, and proper drainage and stormwater management and many other related techniques.
Bridge	A raised structure built to carry vehicles or pedestrians over an obstacle.
Cantilever	A structural member that projects beyond a supporting column or wall and is counterbalanced and/or supported at only one end.
Castellated girder	A steel beam fabricated by making a zig-zag cut along its web, then welding the two sides together at their peaks. This creates a beam that has increased depth, and therefore, greater strength, but is not increased in weight.
Column	A vertical structural member used to support compressive loads. Also see pier and pile.
Coping	A course of stone capping and forming the topmost portion of a wall
Culvert	A drain, pipe or channel that allows water to pass under a road or embankment.
Deck	The top surface of a bridge that carries the traffic.
Delamination	The separation of constituent layers of stone, mortar, or other structural materials.
Elliptical arch	An arch formed by multiple arcs each of which is drawn from its own center. Compare to a roman arch that is a semi-circular arc drawn from a single centerpoint.
Embankment	Angled grading of the ground.
End post	The outward most vertical or angled compression member of a truss.
Fill	Earth, stone or other material used to raise the ground level, form an embankment or fill the inside of an abutment, pier or closed spandrel.
Girder	A horizontal structure member supporting vertical loads by resisting bending. A girder is a larger beam, especially when made of multiple metal plates. The plates are usually riveted or welded together.
Impost	The surface which receives the vertical weight at the bottom of an arch.
Member	One of many parts of a structure, especially one of the parts of a truss.

Parapet	A low wall along the outside edge of a bridge deck used to protect vehicles and pedestrians.
Pier	A vertical structure which supports the ends of a multi-span superstructure at a location between abutments. Also see column and pile.
Pile	A long column driven deep into the ground to form part of a foundation or substructure. Also see column and pier.
Post	One of the vertical compression members of a truss that is perpendicular to the bottom chord.
Scupper	An opening in the floor portion of a bridge to provide means for rain or other water accumulated on the roadway surface to drain through it into the space under the bridge
Segmental arch	An arch formed along an arc that is drawn from a point below its spring line, thus forming a less than semicircular arch. The intrados of a Roman arch follows an arc drawn from a point on its spring line, thus forming a semi-circle.
Skew	When the superstructure is not perpendicular to the substructure, a skew angle is created. The skew angle is the acute angle between the alignment of the superstructure and the alignment of the substructure.
Social Trail	A trail that develops by continuous human use or erosive forces rather than by design and construction and is not officially designated or maintained.
Spalling	When chips, scales, or slabs are broken off from stones or mortared areas.
Span	The horizontal space between two supports of a structure. Also refers to the structure itself. May be used as a noun or a verb. The clear span is the space between the inside surfaces of piers or other vertical supports. The effective span is the distance between the centers of two supports.
Spandrel	The roughly triangular area above an arch and below a horizontal bridge deck. A closed spandrel encloses fill material. An open spandrel carries its load using interior walls or columns.
Spring line	The place where an arch rises from its support; a line drawn from the impost.
Stringer	A beam aligned with the length of a span that supports the deck.
Substructure	The portion of a bridge structure including abutments and piers that supports the superstructure.
Superstructure	The portion of a bridge structure that carries the traffic load and passes that load to the substructure.
Truss	A structural form which is used in the same way as a beam, but because it is made of a web-like assembly of smaller members it can be made longer, deeper, and therefore, stronger than a beam or girder while being lighter than a beam of similar dimensions.

Voussoir	Any one of the wedge shaped blocks used to form an arch.
Web	The system of members connecting the top and bottom chords of a truss. Or the vertical portion of an I-beam or girder.
Wing walls	Extensions of a retaining wall as part of an abutment; used to contain the fill of an approach embankment.

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Appendix A

Photographs Representative of Rehabilitation Concerns on the Carriage Road Bridges



Calcium carbonate deposits on Amphitheater Bridge



Calcium carbonate deposits on Waterfall Bridge



Scouring at Seven Sisters Bridge No. 6



Scouring at Eagle Lake Bridge No. 2



Erosion and scouring at Seven Sisters Bridge No. 4



Minor erosion along hiking trail at Duck Brook Bridge



Scouring at Seven Sisters Bridge No. 5



Concrete arch bridge: Jordan Pond Dam Bridge



Social trails at Bubble Pond Bridge



Minor erosion at social trail at Deer Brook Bridge

Appendix B

List of Plant Species Observed Adjacent to the Carriage Road Bridges

Table B-1 List of Plant Species Observed Adjacent to the Carriage Road Bridges

Scientific Name	Common Name	Native/Exotic	Wetland/Upland
Abies balsamea	Balsam fir	N	U
Acer pensylvanicum	Striped maple	N	U
Acer platanoides	Norway maple	E	U
Acer rubrum	Red maple	N	W/U
Acer saccharum	Sugar maple	N	U
Acer spicatum	Mountain maple	N	U
Aesculus hippocastanum	Horse-chestnut	E	U
Alnus incana	Speckled alder	N	W
Apocynum androsaemifolium	Spreading dogbane	N	U
Aralia nudicaulis	Wild sarsaparilla	N	U
Aster macrophyllus	Big-leaved aster	N	U
Aster radula	Low rough aster	N	W
Athyrium filix-femina	Lady fern	N	U
Berberis thunbergii	Japanese barberry	E	W
Betula alleghaniensis	Yellow birch	N	W/U
Betula papyrifera	White birch	N	U
Betula populifolia	Gray birch	N	W/U
Brachyelytrum septentrionale	Grass	N	U
Brasenia schreberi	Water-shield	N	W
Calamagrostis canadensis	Bluejoint	N	W/U
Carex cf. arctata	Drooping wood sedge	N	U
Carex crinita	Drooping sedge	N	W/U
Carex folliculata	Long sedge	N	W/U
Carex gynandra	Nodding sedge	N	W
Carex lurida	Sallow sedge	N	W
Carex cf. stricta	Tussock sedge	N	W
Celastrus orbiculata	Oriental bittersweet	E	W/U
Chamaedaphne calyculata	Leatherleaf	N	W
Comptonia peregrina	Sweetfern	N	U
Cornus canadensis	Bunchberry	N	U
Dactylis glomerata	Orchard grass	E*	U
Dennstaedtia punctilobula	Hay-scented fern	N	U
Diervilla lonicera	Bush-honeysuckle	N	U

Table B-1 List of Plant Species Observed Adjacent to the Carriage Road Bridges (Cont'd.)

Scientific Name	Common Name	Native/Exotic	Wetland/Upland
Doellingeria umbellata	Flat-topped white aster	N	W
Dryopteris intermedia	Evergreen wood fern	N	U
Dryopteris marginalis	Marginal wood fern	N	U
Dulichium arundinaceum	Three-way sedge	N	W
Eleocharis acicularis	Needle spike-rush	N	W
Epigaea repens	Mayflower	N	U
Epifagus virginiana	Beechdrops	N	U
Equisetum arvense	Common horsetail	N	U
Equisetum sylvaticum	Woodland horsetail	N	U
Eupatorium perfoliatum	Boneset	N	W
Euthamia graminifolia	Grass-leaved goldenrod	N	W/U
Fagus grandifolia	American beech	N	U
Fraxinus americana	White ash	N	U
Fraxinus pennsylvanica	Green ash	N	W/U
Gaultheria procumbens	Wintergreen	N	U
Glyceria canadensis	Rattlesnake grass	N	W
Glyceria striata	Fowl mannagrass	N	W
Hamamelis virginiana	Witch-hazel	N	U
Hieracium cf. caespitosum	Yellow king devil	E	U
Hypericum ellipticum	St. Johnswort	N	W
Iris versicolor	Northern blue flag	N	W
Juncus brevicaudatus	Short-tailed rush	N	W
Kalmia angustifolia	Sheep laurel	N	U
Ilex verticillata	Winterberry	N	W
Lonicera spp.	Bush honeysuckles		U
Lonicera morrowii	Morrow's honeysuckle	E	U
Lysimachia terrestris	Swamp candles	N	W
Lycopus uniflorus	Northern water-horehound	N	W
Maianthemum canadense	Canada mayflower	N	U
Mentha arvenis	Field mint	N	W
Myrica gale	Sweet gale	N	W
Myrica pensylvanica	Bayberry	N	W/U

Table B-1 List of Plant Species Observed Adjacent to the Carriage Road Bridges (Cont'd.)

Scientific Name	Common Name	Native/Exotic	Wetland/Upland
Oclemena acuminata	Whorled aster	N	U
Onoclea sensibilis	Sensitive fern	N	U
Osmunda cinnamomea	Cinnamon fern	N	U
Osmunda claytoniana	Interrupted fern	N	U
Osmunda regalis	Royal fern	N	W/U
Oxalis sp.	Wood-sorrel	?	U
Phegopteris connextilis	Long beech fern	N	U
Photinia melanocarpa	Black chokeberry	N	W
Picea rubens	Red spruce	N	U
Pinus resinosa	Red pine	N	U
Pinus strobus	Eastern white pine	N	U
Polystichum acrosticoides	Christmas fern	N	U
Populus grandidentata	Big-toothed aspen	N	U
Populus tremuloides	Quaking aspen	N	U
Potamogeton spp.	Various pondweed species		
Potentilla simplex	Old-field cinquefoil	N	U
Prunella vulgaris	Selfheal	E	U
Pteridium aquilinum	Bracken fern	N	U
Quercus rubra	Red oak	N	U
Rhododendron canadense	Rhodora	N	U
Rosa multiflora	Multiflora rose	E	U
Rubus alleghenienis	Common blackberry	N	U
Rubus hispidus	Swamp dewberry	N	W
Rubus ideaus	Red raspberry	N*	U
Sium suave	Water-parsnip	N	W
Solanum dulcamara	Bittersweet nightshade	E	W
Solidago bicolor	White goldenrod	N	U
Solidago flexicaulis	Zigzag goldenrod	N	U
Solidago cf. canadensis	Canada goldenrod	N	U
Solidago gigantea	Smooth goldenrod	N	W
Solidago rugosa	Rough-stemmed goldenrod	N	U
Sorbus cf. decora	Showy mountain-ash	N	U

Table B-1 List of Plant Species Observed Adjacent to the Carriage Road Bridges (Cont'd.)

Scientific Name	Common Name	Native/Exotic	Wetland/Upland
Sparganium americanum	Bur-reed	N	W
Spiraea alba	Meadowsweet	N	W
Spiraea tomentosa	Steeple-bush	N	U/W
Symphyotrichum lateriflorum	Calico aster	N	U
Thalictrum pubens	Tall meadow-rue	N	W/U
Thelypteris noveboracensis	New York fern	N	U
Thelypteris palustris	Marsh fern	N	W
Thuja occidentalis	Northern white-cedar	N	U
Triadenum fraseri	Marsh St. Johnswort	N	W
Trientalis borealis	Starflower	N	U
Tsuga canadensis	Eastern hemlock	N	U
Uvularia sessilifolia	Wild-oats	N	U
Vaccinium angustifolium	Common lowbush blueberry	N	U
Vaccinium corymbosum	Highbush blueberry	N	U
Vaccinium myrtilloides	Velvet-leaf blueberry	N	W
Veronica officinalis	Common speedwell	E	U
Viburnum dentatum	Arrowwood	N	W/U
Viburnum lantanoides	Hobblebush	N	U
Viburnum lentago	Nannyberry	N	U
Viola spp.	Violets	N	U
Verbascum thapsus	Common mullein	E	U

Appendix C

The cost and benefit analysis of the Carriage Road Bridges rehabilitation, completed by Acadia National Park staff, for the Development Advisory Board, during January 2002. The Purpose of this assessment was to monetarily assess the rehabilitation alternatives, comparing the potential long-term costs of each alternative.

VALUE ANALYSIS - Mini VA

Park: Acadia National Park
Project: Bridge Repair
Package: 320
Date: 01/23/02

Component Evaluated:

Phase I - Information:

Background Information/Special Concerns/Constraints/Previous Decisions/Description of Present Proposal/Design Assumptions
16 arch stone bridges, 9 steel bridges, and one stone culvert crossing were built in the 1920's- 1930's prior to the area being esignated as a National Park. These brides are part of the major traffic circulation pattern for the Park. A 2001 Report has concluded that it appears that there are no major defects in the structural integrity, significant deterioration of most bridge is obvious. Masonry work (expertise) is limited in the area.

Functional Analysis/Description of the Present Proposal:

Active Verb	Noun
1. Stop	Deterioration
2. Restore	Historic Fabric
3. Improve	Maintainability
4. Verify	Condition

Phase II - Creativity (Alternatives):

#	Alternative (Brainstormed)	Disposition of Alternative
1	**No Action**	**Not Viable (loss valuable resource and create safety issues for public)**
2	**Immediate Maintenance (Point and cap stone work)**	**Viable**
3	**Stabilization (Water proofing, storm water redirection, with minimal pointing of stone)**	**Viable**
4	**Rehabilitation (Full stabilization with full cleaning and pointing of all stone work and cap stone work)**	**Viable**
5	**Restoration (Full rehabilitation with additional site work to bring each bridge up to original look and condition)**	**Viable**
6		

Phase III - Evaluation

Evaluation Sub-Factors or Variables :

#	Evaluation Variables or Sub-factors	Definition of Variable or Sub-factors (1-10 scale with 10 being highest)
1	Factor 1 Stop Deterioration	10
2	Factor 2 Restore Historic Fabric	9
3	Factor 3 Improve Maintainability	8
4	Factor 4 Verify Condition	7
5		
6		
7		

ACADIA NATIONAL PARK – BRIDGE REPAIR

Choosing by Advantages

COMPONENT;	FUNCTION:									
FACTOR	ALTERNATIVES									
	Alternative 1 Immediate maintenance		Alternative 2 Stabilization		Alternative 3 Rehabilitation		Alternative 4 Restoration			
FACTOR 1 – Stop Deterioration	2 points	20	6 points	60	10 points	100	10 points	100		
Attributes	• Pointing and Cap Stone Work		• Full water-proofing with some stone work		• Full water – proofing and pointing with cap stone work		• Full water – proofing and pointing with cap stone work		•	
Advantages	Will stop some water flow into bridges		Will stop major leaks		Will stop all leaks		Will stop all leaks			
FACTOR 2 – Restore Historic Fabric	0 points	0	2 points	18	6 points	54	10 points	90		
Attributes	• cosmetic repair		•		•		•		•	
Advantages	No restoration		Minimal restoration		Partial restoration		Full restoration			
FACTOR 3- Improve Maintainability	1 point	8	3 points	24	8 points	64	10 points	80		

COMPONENT;				FUNCTION:							
FACTOR	ALTERNATIVES										
	Alternative 1 Immediate maintenance		Alternative 2 Stabilization		Alternative 3 Rehabilitation		Alternative 4 Restoration				
Attributes	• Short term repair with no water-proofing		• Does not include most pointing of stones work		• Long term repair excluding site work		• Full long term repair		•		
Advantages			Will require 5 year re-pointing of Stone work		Requires least maintenance except for site clearings		Requires no maintenance over the long run				
FACTOR 4- Verify Conditions of Structures	0 points	0	10 points	70	10 points	70	10 points	70			
Attributes –	•		•		•		•		•		
Advantages											
Advantages											
TOTAL IMPORTANCES OF ADVANTAGES		**28**		**172**		**288**		**340**			
Initial costs (net)	271,000		921,000		1,400,000		1,560,000				
Importance/Initial Cost Ratios											
Re-design Cost											
Compliance											
Life Cycle Cost (Net)	770,234		1,212,066		1,516,500		1,560,000				

COMPONENT;			FUNCTION:							
FACTOR	ALTERNATIVES									
	Alternative 1 Immediate maintenance		Alternative 2 Stabilization		Alternative 3 Rehabilitation		Alternative 4 Restoration			
Importance/ LCC Ratio	28/77	.36	172/121	1.4	288/151.7	1.9	340/156	2.2		
TOTAL		.36		1.4		1.9		2.2		

Phase IV - Development (Summary of Preferred Alternatives Advantages):

In evaluation of the data, the apparent preferred alternative is Alternative 4, which calls for full restoration of all bridges. Alternative 1 is a cosmetic fix that does not address waterproofing restoration, and maintainability. It will require continued cosmetic repair and risk long term permanent damage. Alternative 2 does address most waterproofing, with minimal restoration, but will also require continued cosmetic repair with some risk to long term permanent damage. Alternative 3 addresses all immediate issues concerning waterproofing, restoration, and maintainability, but does not take into consideration the effect that landscape has on these issues. Risks to long term damage are extremely small. Only Alternative 4 addresses all issues concerning the restoration of these bridges, and does so with no true risk to long term damage.

Phase V & VI - Presentation & Implementation (Recommendations and Options for Implementation):

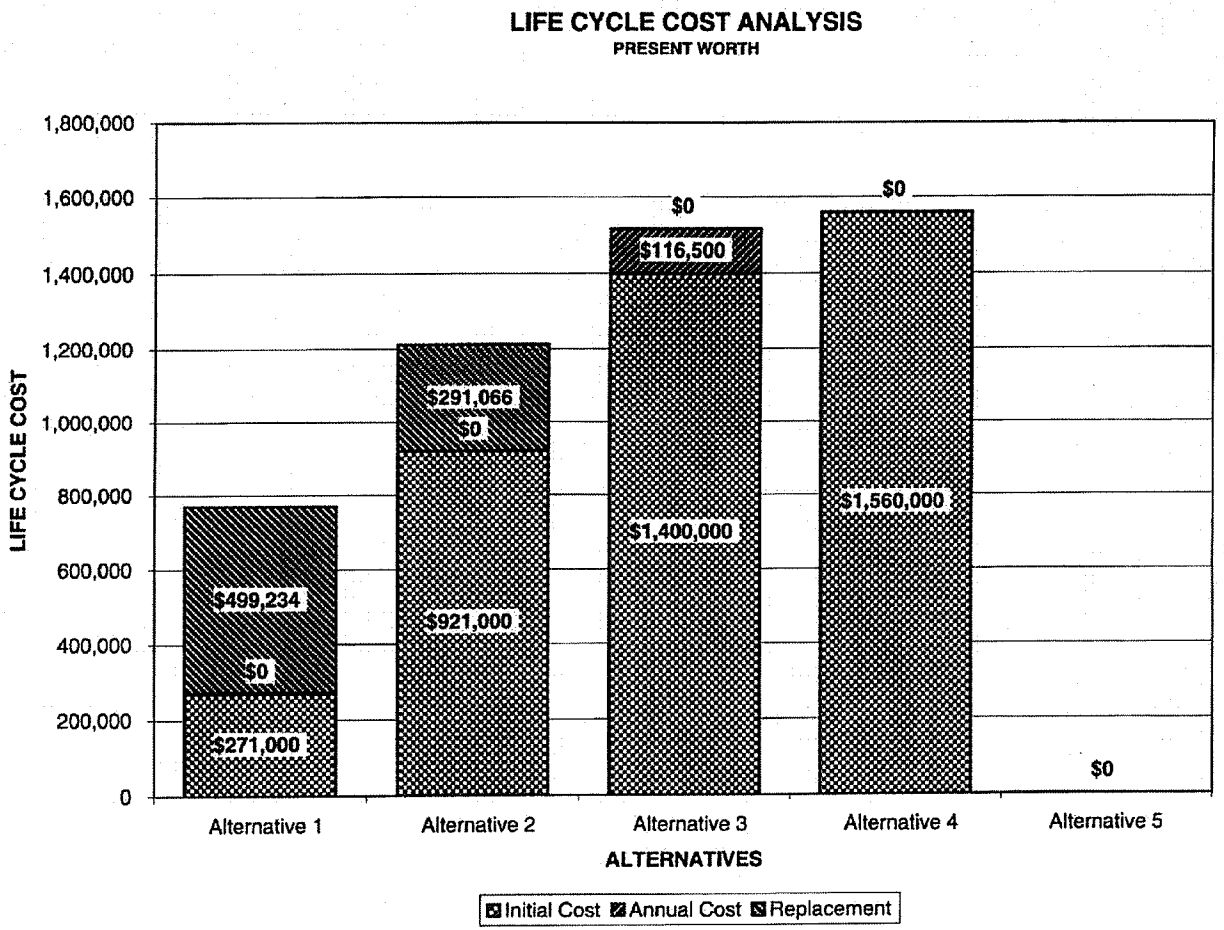
LIFE CYCLE COST ANALYSIS

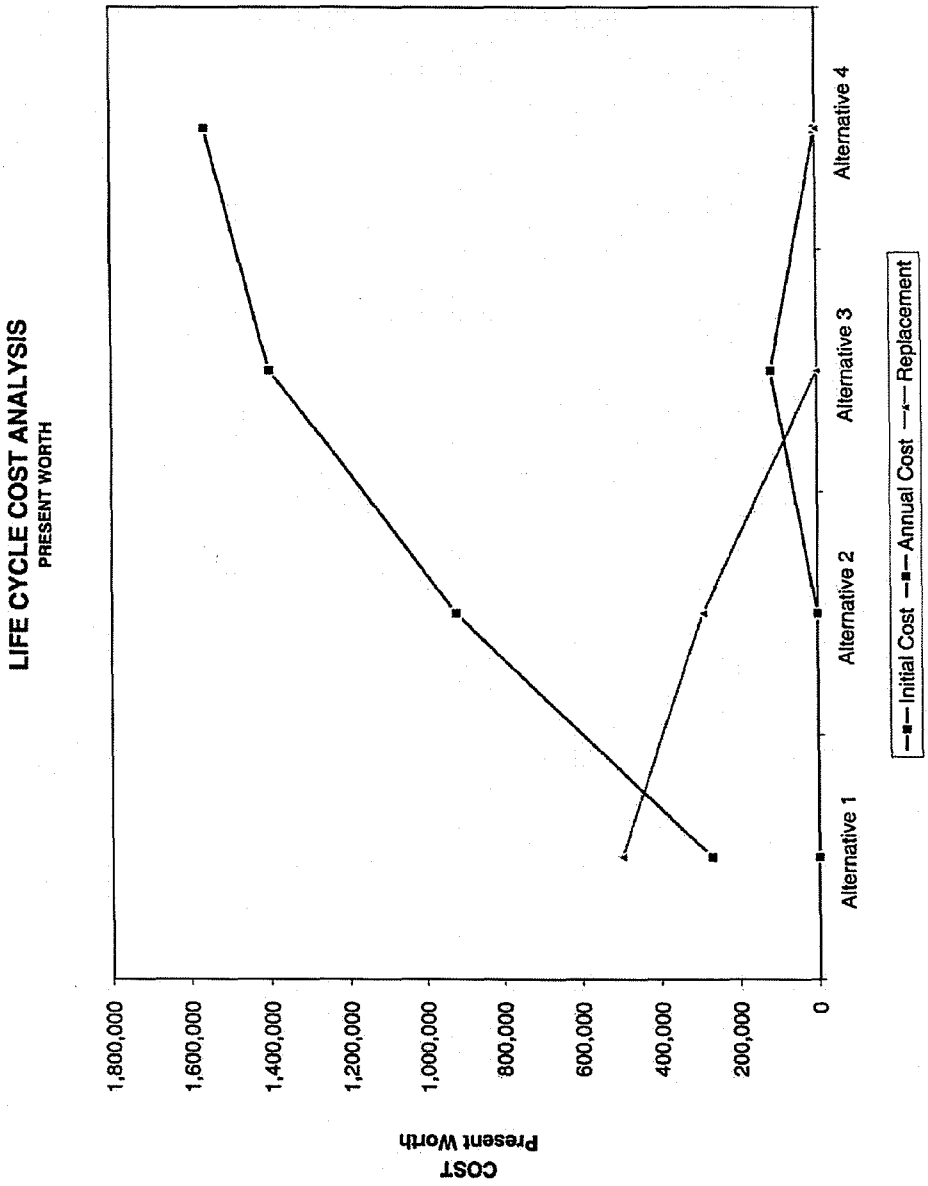
Project/Location:Acadia Nation Park

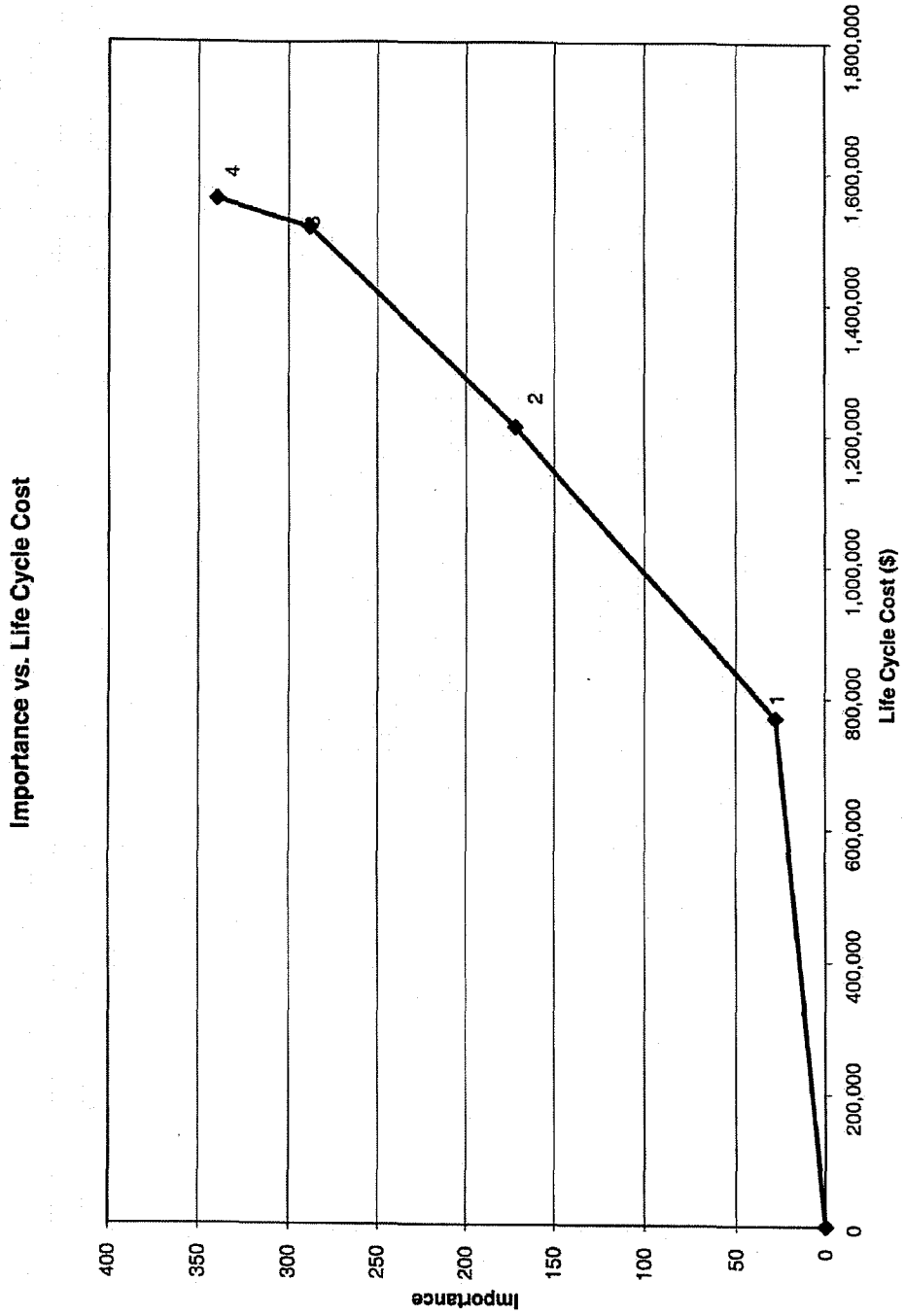
Presentworth Dollars

Subject: Bidge Repair
Description:
Project Life Cycle = 25 Years
Discount Rate = 7.00%
Present Time = Current Date

			Alternative 1 Immediate Maintenance		Alternative 2 Stabilization		Alternative 3 Rehabilitation		Alternative 4 Storation	
INITIAL COSTS	**Quantity UM**	**Unit Price**	**Est.**	**PW**	**Est.**	**PW**	**Est.**	**PW**	**Est.**	**PW**
Construction Costs										
A. Waterproofing	____	$509,000.00		158,000		509,000	$509,000.00	509,000	$509,000.00	509,000
B. Masonry Repointing	____	$315,000.00		0		158,000	$315,000.00	315,000	$315,000.00	315,000
C. CCD Removal from Facades	____	$74,000.00		0		0	$74,000.00	74,000	$74,000.00	74,000
D. CCD Removal from Arches	____	$55,000.00		0		0	$55,000.00	55,000	$55,000.00	55,000
E. Structural Concrete Repair	____	$68,000.00		0		0	$68,000.00	68,000	$68,000.00	68,000
F. Staging	____	$98,000.00		49,000		49,000	$98,000.00	98,000	$98,000.00	98,000
G. Drainage &Site Work	____	$5,000.00		0		0	$5,000.00	5,000	$5,000.00	5,000
H. Streambed/Scour Repairs	____	$15,000.00		0		15,000	$15,000.00	15,000	$15,000.00	15,000
I. Resetting Capstones	____	$64,000.00		64,000		64,000	$64,000.00	64,000	$64,000.00	64,000
J. Cleaning Roadway Drains	____	$1,000.00		0		0	$1,000.00	1,000	$1,000.00	1,000
K. Masonry Crack Repair	____	$10,000.00		0		0	$10,000.00	10,000	$10,000.00	10,000
L. Install Drain Outlets	____	$126,000.00		0		126,000	$126,000.00	126,000	$126,000.00	126,000
M. Slope Erosion Repair	____	$1,000.00		0		0	$1,000.00	1,000	$1,000.00	1,000
N. Encapsulate Steel Stringers	____	$45,000.00		0		0	$45,000.00	45,000	$45,000.00	45,000
O. Replace Wood Railing	____	$14,000.00		0		0	$14,000.00	14,000	$14,000.00	14,000
P. Landscaping	____	$160,000.00		0		0		0	$160,000.00	160,000
Total Initial Cost				271,000		921,000		1,400,000		1,560,000
Initial Cost PW Savings (Compared to Alt. 1)						(650,000)		(1,129,000)		(1,289,000)
REPLACEMENT COST/ SALVAGE VALUE										
Description	**Year**	**PW Factor**								
A.	5	0.7130	271,000	193,219	158,000	112,651	____	0	____	0
B.	10	0.5083	271,000	137,762	158,000	80,319	____	0	____	0
C.	15	0.3624	271,000	98,222	158,000	57,266	____	0	____	0
D.	20	0.2584	271,000	70,031	158,000	40,830	____	0	____	0
E.	10	0.5083	____	0	____	0	____	0		0
F.	20	0.2584	____	0	____	0	____	0		0
G.	10	0.5083	____	0	____	0	____	0		0
H.	20	0.2584	____	0	____	0	____	0		0
I.	0	1.0000	____	0	____	0	____	0	____	0
J. ____	0	1.0000	____	0	____	0	____	0	____	0
Total Replacement/Salvage Costs				499,234		291,066		0		0
ANNUAL COSTS										
Description	**Escl. %**	**PWA**								
A. Maintenance	0.000%	11.650		0		0	10,000	116,500		0
B. Operations	0.000%	11.650	____	0	____	0	____	0		0
C. Electrical	0.000%	11.650	____	0	____	0	____	0		0
E. User Fees	0.000%	0.000		0		0		0		0
F. ____	0.000%	0.000	____	0	____	0	____	0	____	0
Total Annual Costs (Present Worth)				0		0		116,500		0
Total Life Cycle Costs (Present Worth)				770,234		1,212,066		1,516,500		1,560,000
Life Cycle Savings (Compared to Alt. 1)						(441,832)		(746,266)		(789,766)
Discounted Payback (Compared to Alt. 1)	**PP Factor**				36.39 Years		34.38 Years		30.09 Years	
Total Life Cycle Costs (Annualized)	0.0858		66,094 Per Year		104,008 Per Year		130,132 Per Year		133,864 Per Year	


LIFE CYCLE COST ANALYSIS
PRESENT WORTH
LIFE CYCLE COST
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
$499,234
$0
$271,000
$291,066
$0
$921,000
$0
$116,500
$1,400,000
$0
$1,560,000
$0
Alternative 1
Alternative 2
Alternative 3
Alternative 4
Alternative 5
ALTERNATIVES
Initial Cost
Annual Cost
Replacement


LIFE CYCLE COST ANALYSIS
PRESENT WORTH
COST
Present Worth
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Alternative 1
Alternative 2
Alternative 3
Alternative 4
Initial Cost
Annual Cost
Replacement


Importance vs. Life Cycle Cost
Importance
Life Cycle Cost ($)
400
350
300
250
200
150
100
50
0
0
200,000
400,000
600,000
800,000
1,000,000
1,200,000
1,400,000
1,600,000
1,800,000
4
3
2
1

Graph Data

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Initial Cost	271,000	921,000	1,400,000	1,560,000	0
Annual Cost	0	0	116,500	0	0
Replacement	499,234	291,066	0	0	0
LCC Cost	770,234	1,212,066	1,516,500	1,560,000	0
Importance	28	172	288	340	0

Page 1

Appendix D

Summary of Historic Architectural Features

Summary of Historic Architectural Features

Bridge	Date	Architect/ Builder	Dimensions	Significant Engineering/Architectural Details
Little Harbor Brook	1919	William Bosworth/ B.W. Candage & Son	41′-6″ long 10′-4″ high 15′-6″ wide	Reinforced concrete **substructure** faced with random-laid, cut granite; single **segmental arch** faced with granite **voussoirs**; arched parapet walls with granite **coping**; decorative **scuppers**; square battered end piers with pyramidal caps.
Jordan Pond Dam	1920	William Bosworth/ B.W. Candage & Son	41′-6″ long 10′-5″ high 16′ wide roadbed	Reinforced concrete substructure faced with semi-coursed, cut granite; single segmental arch faced with granite voussoirs; arched parapet walls with granite coping; decorative scuppers; square battered end piers with pyramidal caps.
Hemlock	1924	William Bosworth/ B.W. Candage & Son	200′ long 35′-6″ high 16′ wide roadbed	Reinforced concrete substructure faced with coursed, cut granite; asymmetrical, curved plan; massive Gothic arch with flanking decorative blind arches; low arched parapet with large, flat stone coping; flared wing walls with scrolled curtails.
Waterfall	1925	William Bosworth/ B.W. Candage & Son	120′ long 31′ high 16′ wide roadbed	Reinforced concrete substructure faced with granite ashlar; asymmetrical, skewed and curved plan; massive round arch with granite faced barrel; flanking round turrets; flat parapet with flat stone coping; flared wing walls with scrolled curtails.
Deer Brook	1925	William Bosworth/ B.W. Candage & Son	78′ long 22′-5″ high 16′ wide roadbed	Reinforced concrete substructure faced with semi-coursed granite; two round arches with granite faced barrels surrounded by voussoirs and quoins; flat parapet with flat stone coping; flared wing walls square **end posts**; circular date medallion.
Hadlock Brook	1926	William Bosworth/ B.W. Candage & Son	46′-10″ long 12′-7″ high 15′ wide roadbed	Reinforced concrete substructure faced with random-laid, cut granite; single segmental arch faced with granite voussoirs; arched parapet walls with granite coping; decorative scuppers; squared, battered end piers.
Chasm Brook	1926	William Bosworth/ B.W. Candage & Son	54′ long 25′ high 16′-5″ wide roadbed	Reinforced concrete substructure faced with random ashlar; curved plan; segmental arch springs from natural ledge; low arched parapet; flared wing walls with scrolled curtails.
Bubble Pond	1928	William Bosworth/Pringle Borthwick	75′ long 20′ high 16′-18′ wide roadbed	Possibly constructed entirely of stone; **elliptical arch** with rough voussoir surrounds; arched parapet flanked by stepped, flared wing walls with square end posts.
Duck Brook	1929	Charles Stoughton/Pringle Borthwick	207′ long 43′ high 20′-27′ wide roadbed	Reinforced concrete substructure faced with quarry-faced, random ashlar; large center round arch flanked by smaller round arches with granite faced barrels; gentle-sloped parapet with dressed coping and horizontal wall openings; round **cantilevered** lookouts; stone stairway.
Amphitheater	1931	Charles Stoughton	245′ long 27′ high 20′-26′-6″ wide roadbed	Reinforced concrete substructure faced with quarry-faced, random ashlar; large skewed round arch with coarse voussoir surrounds; parapet rises to a point at center and is pierced with horizontal openings; flared wing walls with square end posts.

Summary of Historic Architectural Features (Cont'd.)

Bridge	Date	Architect/ Builder	Dimensions	Significant Engineering/Architectural Details
Jordan Stream West Branch	1931	Charles Stoughton	115′ long 22′-3″ high 19′-8″ wide roadbed	Reinforced concrete substructure faced with quarry-faced, semi-coursed ashlar; curved plan; single narrow round arch with random ashlar faced barrel; flat parapet with rectangular stone coping; flared wing walls with rectangular end posts.
Cliffside	1932	Charles Stoughton	250′ long 29′ high 15′-9″ wide roadbed	Reinforced concrete substructure faced with quarry-faced, random ashlar; asymmetrical plan; segmental arch springs on south side from natural ledge; arch flanked by **castellated** lookouts; crenellated parapet walls.
Jordan Pond (Seal Harbor) Road	1932	Charles Stoughton/Wyman & Simpson	85′ long 19′-5″ high 29′-35′-6″ wide roadbed	Reinforced concrete substructure faced with quarry-faced, random ashlar; segmental arch with random ashlar-faced barrel; battered **spandrel** walls; flat and stepped parapet; flared wing walls.
Triad-Day Mountain	1938	NPS	74′-6″ long 20′-6″ high 18′-25′ wide roadbed	Reinforced concrete substructure faced with semi-coursed ashlar; segmental arch with exposed concrete barrel; slender voussoirs of various sizes; flat parapet; curved wing wills.
Dane Farm	1939	NPS, Bureau of Public Roads	83′ long 17′-6″ high 30′ wide roadbed with shoulders	Reinforced concrete substructure faced with random ashlar; segmental arch with exposed concrete barrel; slender voussoirs of various sizes; flat, sloping parapet.
3 Eagle Lake Little Bridges	1929		9′-6″- 9′-10″ long	Concrete slab on steel I-beams; granite abutments; wood post and rail guardrails
6 Seven Sisters Little Bridges	1929-1930		various	Concrete slab on steel I-beams; granite abutments; wood post and rail guardrails

Appendix E

Rehabilitation Phasing Schedule & Carriage Road Loop Closure Plan

PACKAGE 320- CARRIAGE ROAD BRIDGE REHABILITATION
DRAFT SCHEDULING AND PHASING SPECIFICATION

A. Water Prevention and Drainage Contractor will propose a project schedule that will:

1. Maintain one loop of carriage road open for visitor use at all times, loop to include north/south legs both east and west of Sargent Mountain, and east/west legs both north and south of Sargent Mountain.

2. Sections around Eagle Lake, Jordan Pond, Day Mountain, Paradise hill and Pemetic Mountain are required to be open June 14-Mid October (Columbus Day). The following bridges will be available for Carriage and visitor traffic during this period: Jordan Pond Dam, Triad Day Mountain, Bubble Pond, Deer Brook, Duck Brook and Eagle Lake Little Bridges.

3. Contractor will consider the following restrictions in developing the schedule (see attached map):

   a. Contractor must maintain vehicle access to all points of the carriage road system and both sides of the bridges being rehabilitated.
   b. Contractor must maintain single lane passage under Triad Day Mountain, and Jordan Pond Road Bridges.
   c. Contractor must maintain single lane passage over Jordan Pond Road and Dane Farm Bridges.
   d. Construction traffic will be confined to the loop(s) being worked and off of the open loop except when there is no recourse but to overlap the loops.
   e. Construction traffic will enter and exit at the nearest gate.
   f. Construction traffic will be prohibited from sections of the carriage road not necessary to access bridges.
   g. Closed loop(s) will be posted by the contractor at all intersections.
   h. Caution signs will be placed at intersections, gates and along segments where open loop(s) and construction traffic meet.
   i. Contractor must permit, but need not facilitate, pedestrian bypass of bridges under rehabilitation.
   j. Snow melt conditions may require shut downs on unpaved (Carriage) roads from mid November through April.

4. Subject to the above restrictions the contractor(s) may schedule multiple bridges for rehabilitation concurrently during the on site performance period of 34 weeks. Prototype attached.

5. Masonry contractor will work on bridges, as assigned by the Contracting Officer, that have had water prevention work completed, and arrange the work and work site as to permit the minimum of an 8ft. access lane on carriage roads and a 10ft. access lane on paved roads at all times.

6. Little Bridges contractor must comply with A: 2., 3 a., d., e., f., h., j., and will arrange the work and work site as to permit the minimum of an 8ft. access lane on carriage roads at all times.

Masonry Arch Bridge Water Prevention Prototype* Schedule—Two Crews—Early Start

No.	Bridge	Weeks	Different Period Than:	Type	Apr 1	Apr 2	Apr 3	Apr 4	May 5	May 6	May 7	May 8	Jun 9	Jun 10	Jun 11	Jun 12	Jun/ Jul 13	Jul 14	Jul 15	Jul 16	Jul 17	Aug 18	Aug 19	Aug 20	Aug 21	Sep 22	Sep 23	Sep 24	Sep 25	Sep/Oct 26	Oct 27	Oct 28	Oct 29	Oct 30	Nov 31	Nov 32	Nov 33	Nov 34
1	Little Harbor Brook	2	Amphitheater	A	X	X	X	X																													X	X
2	Jordan Pond Dam	2	Bubble, JPWB,Cliffside	A	X	X	X	X							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					X	X
3	Hemlock	4	Hadlock, Waterfall	M	X	X	X	X																													X	X
4	Waterfall	4	Hadlock, Hemlock	M	X	X	X	X																													X	X
5	Deer Brook	2	JPD, Bubble	M	X	X	X	X							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					X	X
6	Hadlock Brook	2	Hemlock, Waterfall	A	X	X	X	X																													X	X
7	Chasm Brook	2		M	X	X	X	X																													X	X
8	Bubble Pond	3	Deer Brook, JPD	A	X	X	X								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						X
9	Duck Brook	4		M	X	X									X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						X
10	Amphitheater	4	Little Harbor Brook	M	X	X	X	X																													X	X
11	Jordan Stream West Branch	2	Cliffside, JPD	M	X	X	X	X																													X	X
12	Cliffside	4	JPD, JPWB	M	X	X	X	X																													X	X
13	Jordan Pond (Seal Harbor) Road	1		S																																		
14	Triad-Day Mountain	2		M	X	X	X	X							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					X	X
15	Dane Farm	1		S																																		

M Membrane sheet treatment

A Arch coating treatment

S Shoulder water prevention

Critical tasks for early finish

X Road condition blackout based on anticipated thaw conditions and accessibility by paved road

X Visitor season blackout based on location and use by concessioner

A Contractor Crew A Capable of Both A & M Treatments Based on Early Start, Location, Maintaining Parallel Legs, and Blackouts

B Contractor Crew B Capable of Both A & M Treatments Based on Early Start, Location, Maintaining Parallel Legs, and Blackouts

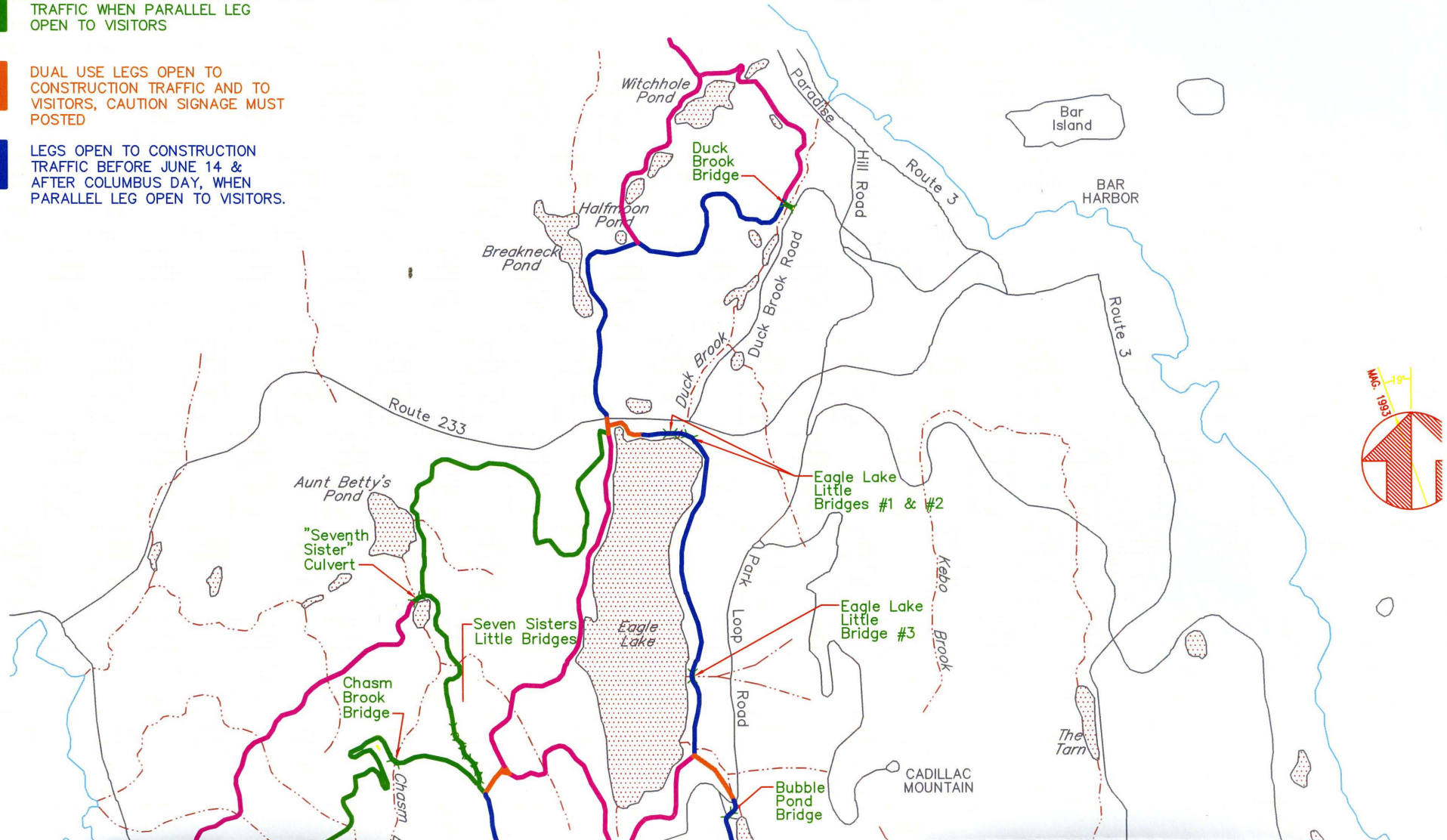
*Note this schedule is a prototype for example purposes only, actual schedule and individual performance times on each site may vary.

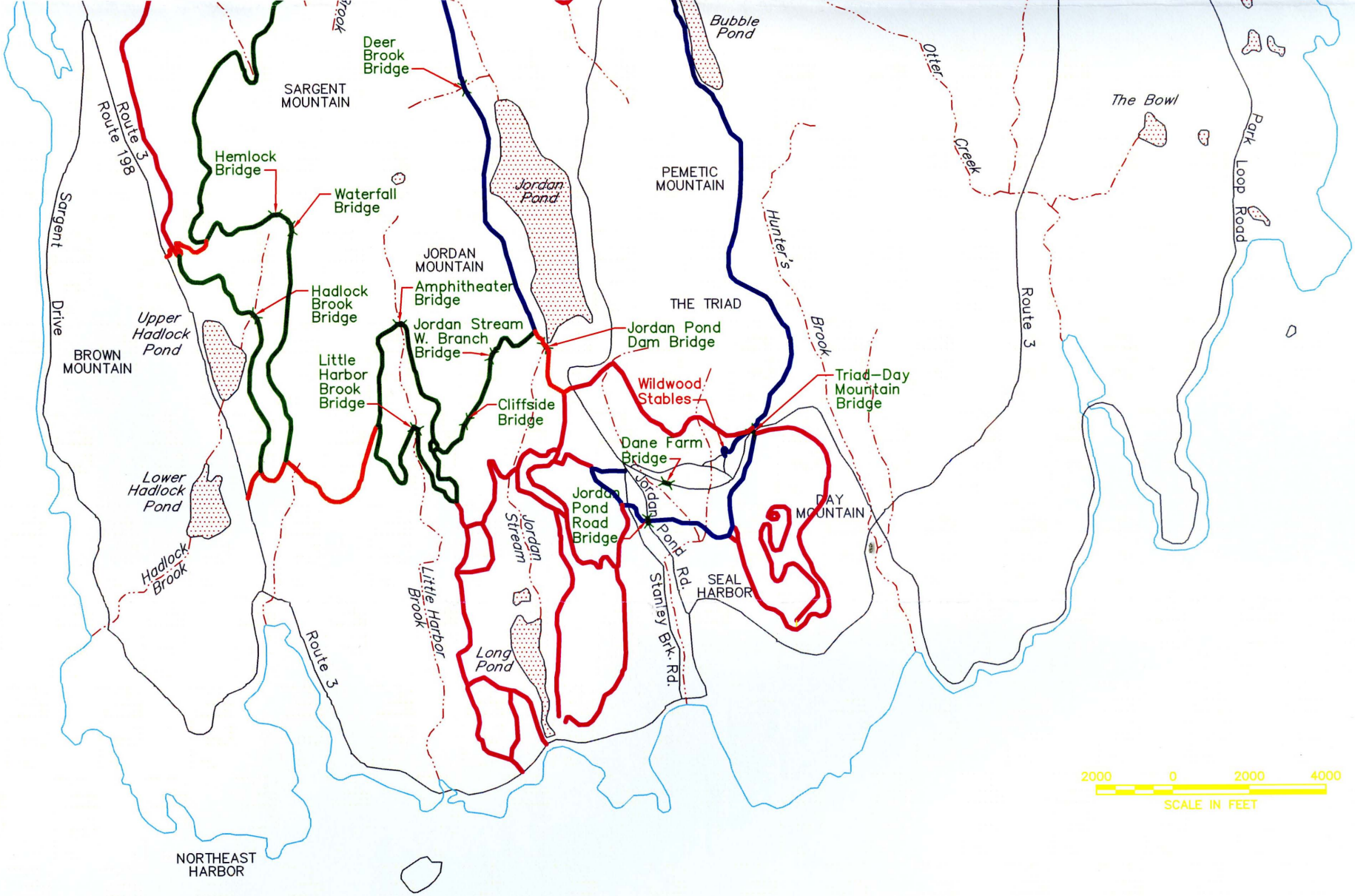
LEGS NOT OPEN TO CONSTRUCTION AT ANY TIME

LEGS OPEN TO CONSTRUCTION TRAFFIC WHEN PARALLEL LEG OPEN TO VISITORS

DUAL USE LEGS OPEN TO CONSTRUCTION TRAFFIC AND TO VISITORS, CAUTION SIGNAGE MUST POSTED

LEGS OPEN TO CONSTRUCTION TRAFFIC BEFORE JUNE 14 & AFTER COLUMBUS DAY, WHEN PARALLEL LEG OPEN TO VISITORS.




Deer Brook Bridge
SARGENT MOUNTAIN
Bubble Pond
Otter Creek
The Bowl
Park Loop Road
Route 3
Route 198
Hemlock Bridge
Waterfall Bridge
Jordan Pond
PEMETIC MOUNTAIN
Hunter's Brook
Sargent Drive
JORDAN MOUNTAIN
Amphitheater Bridge
Hadlock Brook Bridge
THE TRIAD
Upper Hadlock Pond
Jordan Stream W. Branch Bridge
Jordan Pond Dam Bridge
BROWN MOUNTAIN
Little Harbor Brook Bridge
Cliffside Bridge
Wildwood Stables
Triad–Day Mountain Bridge
Dane Farm Bridge
Lower Hadlock Pond
Jordan Pond Road Bridge
DAY MOUNTAIN
Jordan Stream
Jordan Pond Rd.
Stanley Brk. Rd.
SEAL HARBOR
Hadlock Brook
Little Harbor Brook
Long Pond
Route 3
NORTHEAST HARBOR
2000 0 2000 4000
SCALE IN FEET

Appendix F

Response From U.S. Fish and Wildlife Service

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Maine Field Office
1168 Main Street
Old Town, ME 04468-2023
(207) 827-5938

January 17, 2003

Mark W. Christopher
Woodlot Alternatives
30 Park Drive
Topsham, ME 04086

Thank you for your letter requesting information or recommendations from the U.S. Fish and Wildlife Service. This form provides the Service's response pursuant to Section 7 of the Endangered Species Act (ESA), as amended (16 U.S.C. 1531-1543), and the Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661-667d).

Project Name/Location/County: Carriage Road Bridges on Acadia National Park

Date of Receipt of Incoming Letter: December 24, 2002 **Log Number: 03-062**

Based on the information currently available to us, no federally-listed species under the jurisdiction of the Service are known to occur in the project area, with the exception of occasional, transient bald eagles (*Haliaeetus leucocephalus*). Accordingly, no further action is required under Section 7 of the ESA, unless: (1) new information reveals impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered; (2) this action is subsequently modified in a manner that was not considered in this review; or (3) a new species is listed or critical habitat determined that may be affected by the identified action.

The peregrine falcon (*Falco peregrinus*), a Federal species of concern (which was formerly listed as endangered and threatened) nests on Jordan Cliffs near the Deer Brook, Jordan Stream, and Jordan Pond Dam bridges. At this time, the peregrine falcon is afforded no protection under the Federal ESA. However, we strongly encourage you to consider this species in your project planning. I would recommend that you coordinate your activities closely with Acadia National Park biologists. They are familiar with this pair of falcons and can help make specific recommendations for your project. In general, I would not anticipate that bridge repair activities would affect falcons that nest on the cliffs. The peregrine falcon is listed as endangered by Maine Inland Fisheries and Wildlife, and as such, is protected from taking. We encourage you to contact MDIFW's Endangered Species Group (Beth Swartz, Natural Heritage Data Manager, Maine Inland Fisheries and Wildlife, 650 State St., Bangor, ME 04401 Phone: 207 941-4476) for more information.

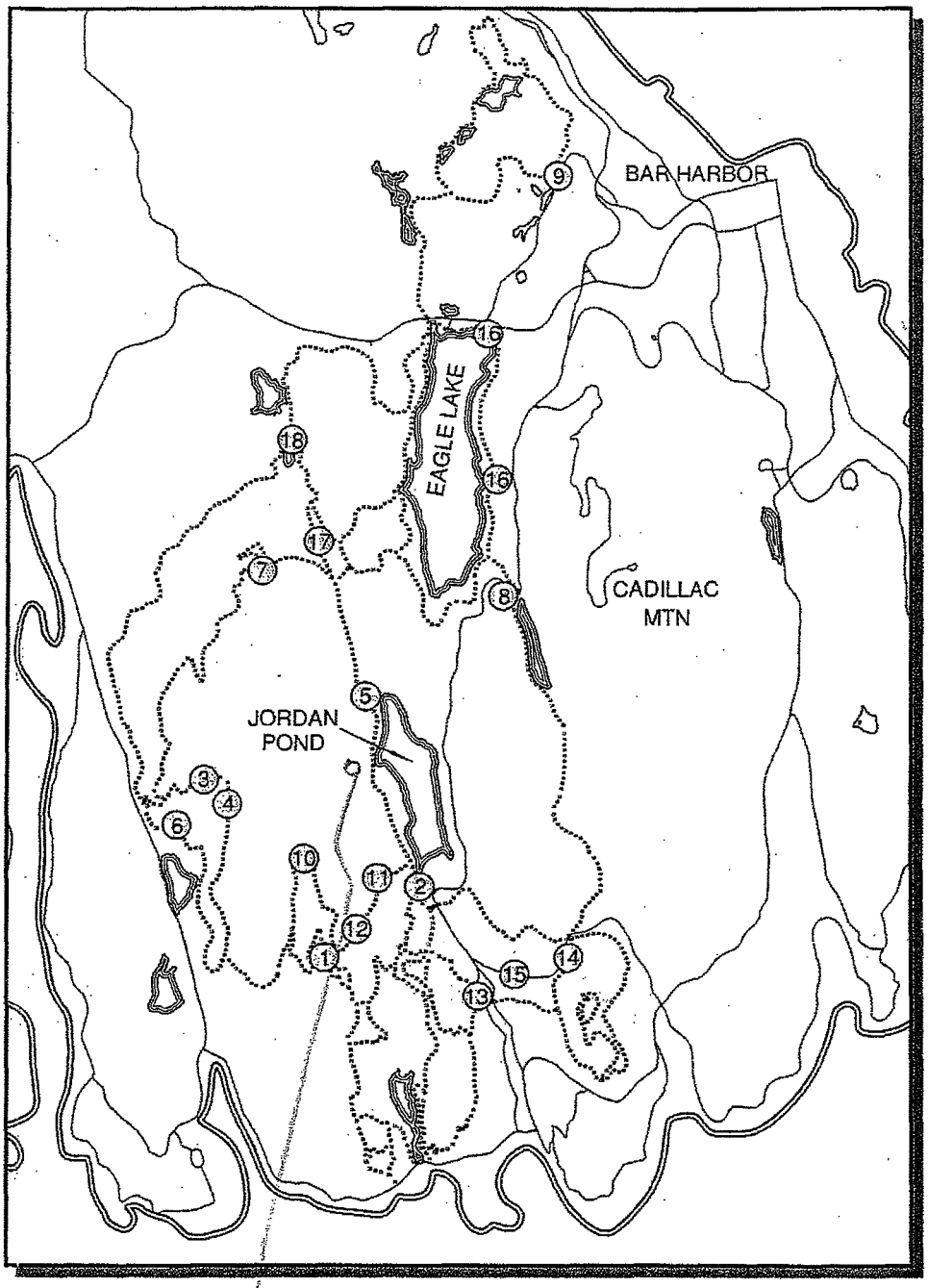
A list of federally-listed species in Maine is enclosed for your information. Please contact the Maine Department of Inland Fisheries and Wildlife and Maine Natural Areas Program for an up to date account of state-listed species in the project area.

If you have any questions, please call me at (207) 827-5938.

Sincerely,

Mark A. McCollough,
Endangered Species Biologist

Enclosure



1. LITTLE HARBOR BROOK BRIDGE
2. JORDAN POND DAM BRIDGE
3. HEMLOCK BRIDGE
4. WATERFALL BRIDGE
5. DEER BROOK BRIDGE
6. HADLOCK BROOK BRIDGE
7. CHASM BROOK BRIDGE
8. BUBBLE POND BRIDGE
9. DUCK BROOK BRIDGE
10. AMPHITHEATER BRIDGE
11. JORDAN STREAM WEST BRANCH BRIDGE
12. CLIFFSIDE BRIDGE
13. JORDAN POND (SEAL HARBOR) ROAD BRIDGE
14. TRIAD–DAY MOUNTAIN BRIDGE
15. DANE FARM BRIDGE
16. EAGLE LAKE LITTLE BRIDGES (3)*
17. SEVEN SISTERS LITTLE BRIDGES (6)*
18. SEVEN SISTERS GILMORE MEADOW **

* STEEL STRINGER BRIDGES (ALL OTHER BRIDGES ARE MASONARY ARCH BRIDGES)

** CULVERT

CARRIAGE ROAD
SHORELINE
ROAD
LAKE OR POND
(17) BRIDGE LOCATION

CARRIAGE ROAD BRIDGE LOCATIONS

Jordan Ridge
Peregrine falcon

NOT TO SCA





As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

February 2003

United States Department of the Interior – National Park Service