National Park Service
U.S. Department of the Interior

Dinosaur National Monument
Utah/Colorado

Draft Environmental Impact Statement / Assessment of Effect for the Quarry Visitor Center Treatment Project

March 2007

The Quarry Visitor Center

This page intentionally left blank.

Draft Environmental Impact Statement / Assessment of Effect for the Quarry Visitor Center Treatment Project

Dinosaur National Monument, Colorado and Utah

On July 12, 2006, the National Park Service (NPS) found it necessary to close the Quarry Visitor Center at Dinosaur National Monument due to structural instability. This draft environmental impact statement for the treatment of the Quarry Visitor Center evaluates five alternatives designed to address the structural shortcomings associated with the Quarry Visitor Center:

- Alternative A, No Action/Continue Current Management.
- Alternative B, the Preferred Alternative – Rehabilitate or Replace the Exhibit Hall and Construct a New Facility Off-Site
- Alternative C, Retain the Exhibit Hall and Construct a New Facility at the Quarry Visitor Center Site.
- Alternative D, Retain the Exhibit Hall and Construct Wings Similar to Existing Facility.
- Alternative E, Demolish the Entire Facility and Construct a New Facility at the Quarry Visitor Center Site.

This document analyzes potential impacts on cultural resources, geologic and paleontological resources, visitor use and experience, socioeconomics, public health and safety, and park management and operations.

Public Comment

If you wish to comment on this environmental impact statement, you may mail comments to the name and address below. This environmental impact statement will be on public review for 60 days. Comments may also be submitted electronically through the NPS planning website: http://parkplanning.nps.gov/dino.

This document will be on public review for 60 days after the U.S. Environmental Protection Agency has accepted the document and published a notice of availability in the *Federal Register*. All review comments must be received within that time. Please address written comments to:

Draft Environmental Impact Statement for the Treatment of the Quarry Visitor Center
Dinosaur National Monument
4545 E. Highway 40
Dinosaur, CO 81610-9724

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment, including your personal identifying information, may be made publicly available at any time. While you may ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

EXECUTIVE SUMMARY

Dinosaur National Monument was created on October 4, 1915 to preserve the outstanding fossil resources located in the dinosaur quarry, which was discovered in the early 1900s by Earl Douglass of the Carnegie Museum. It is the only national park unit established for the purpose of protecting a historic dinosaur quarry.

In 1957 and 1958, the Quarry Visitor Center was constructed directly over the fossil bone deposit, for the express purpose of protecting and showcasing the primary feature at the monument, the dinosaur fossils exposed in the rock face. The interpretative experience in the Quarry Visitor Center allowed visitors to experience the fossils through education, viewing, and touching the actual *in situ* fossils. Closure of the visitor center in July 2006, due to structural instability, now prevents visitors from accessing or viewing the fossil wall. The Quarry Visitor Center is the subject of this draft environmental impact statement.

The Quarry Visitor Center is an outstanding example of Mission 66 era visitor centers that embody an architectural style described as "Park Service Modern." Because of its distinctive design and its structural relationship to the resource, the Quarry Visitor Center was designated a National Historic Landmark on January 3, 2001. The Quarry Visitor Center has four interconnecting structural elements that make up the building's character-defining features:

- The Serpentine Entry Ramp;
- The Exhibit Hall;
- The Administrative Wing; and
- The South Wing.

The Quarry Visitor Center has experienced problems with foundation movements since its construction. The building is subjected to extensive structural strain caused by differential movements of underlying expansive clay strata. The upward movement of soil is causing substantial damage to the building, such as cracking walls, heaving and dropping of interior floor slabs, and shifting of plumbing fixtures away from their pipes in the Administrative and South Wings. Other site-specific structural issues include the lifting of the roof beams, causing damage to the glass curtain walls of the Exhibit Hall, uneven floor surfaces posing slip and fall hazards, and ergonomic issues at staff work stations. In addition, the Serpentine Entry Ramp that leads to the second floor of the Administrative Wing has separated from the building, with cracks in the side walls of the ramp at each pier support.

Serious structural damage was noted during the May 2006 structural monitoring inspection that resulted in the closure of the Quarry Visitor Center in July of 2006. The Administrative Wing was identified as the area of greatest concern. The upper floor and ceiling are being compressed against the South Wing. The ceiling and its supporting joists have failed connections in some locations. Based upon the cracking and deformations measured in the exterior wall, the few connections that hold the second floor framing and decking in place are distressed and inadequate for bracing the wall and transferring lateral forces. The roof beams are tied to the exterior walls with clip angles and bolts embedded into the masonry at

every other pilaster. Embedded bolts were observed to have pulled out of the masonry. These failures present life safety hazards.

Attempts to stabilize the building have been ongoing for 40 years, with major projects undertaken in 1967 and during the 1980s. Despite these efforts, the building has continued to deteriorate to the point of closure on July 12, 2006. Park functions have been relocated to other sites in the monument. The structure continues to pose safety concerns to park staff during scheduled inspection and maintenance visits.

Additional health and safety risks within the Quarry Visitor Center include inadequate fire and life safety egress. Because of the movement of the building, rodents and bats are able to enter the building. Accessibility for individuals with limited mobility is restricted in the building, where only the first floor is accessible to visitors with impaired mobility because the serpentine ramp does not meet accessibility standards. Because all public toilet facilities are located on the second floor, visitors and employees with mobility limitations could not use these facilities.

The heating, ventilation, and air conditioning systems are inadequate and need to be replaced or upgraded. Many of the problems are related to the design of the Exhibit Hall, which has glass panels that allow a substantial amount of sunlight to enter the building. This often creates uncomfortably hot conditions within the viewing gallery.

PURPOSE AND NEED FOR THE PLAN

The primary purposes of actions evaluated in this draft environmental impact statement are to:

- Continue to protect the Dinosaur Quarry fossil wall – the resource for which the monument was established.
- Provide all visitors with an opportunity to experience and appreciate the fossil quarry and its significance.
- Protect public and employee health, safety, and welfare by providing a structurally sound visitation and work environment.

OBJECTIVES

Objectives are specific statements of purpose and describe what must be accomplished to a large degree for the action to be considered a success. All action alternatives selected for detailed analysis had to substantially meet all of the objectives and also had to meet the purpose and need for action. The following objectives were developed for the Quarry Visitor Center project:

- Protect the paleontological resources *in situ* on the quarry face and geological resources surrounding the quarry, both over the long-term and during any necessary construction activities.
- Provide visitors opportunities to view fossils *in situ*; provide wayfinding and interpretation of the fossil wall.
- Meet current applicable building codes, including access, exit, and accessibility; solve health and safety issues.
- Provide an environment where employees can work efficiently; provide space for current park management and administration needs.
- Provide visitors orientation information about Dinosaur National Monument and options to enjoy their visit.

ISSUES

Summaries of public involvement during scoping are found in the "Scoping Process and Public Participation" section and in the "Consultation and Coordination" section. The public scoping process identified issues of concern for both the natural and human environments that could be affected by future treatment of the Quarry Visitor Center. Those that might lead to discernable impacts were analyzed. The areas of impact analyses include potential effects on: cultural resources, geologic and paleontological resources, visitor use and experience, socioeconomics, public health and safety, and park management and operations.

ALTERNATIVES

This draft environmental impact statement evaluates five alternatives concerning the treatment of the Quarry Visitor Center within Dinosaur National Monument. Alternatives B, C, and D propose rehabilitation of the Exhibit Hall portion of the Quarry Visitor Center. Rehabilitation would allow this element of the historic property to continue to be used as it has been historically, and could retain much of the historic character of the Exhibit Hall. However, as used in this document, the term "rehabilitate" does not have the precise meaning defined in the Secretary of the Interior's Standards. Rather, the work to be done on the Exhibit Hall would take into consideration the special circumstances affecting the Quarry Visitor Center. That is, the closure of the building due to structural deterioration and inadequacies threatens its overall viability and safety for visitors and staff. Changes must be made in some of the materials and design of the Exhibit Hall to improve these conditions.

Alternative A, the No Action Alternative

This alternative would continue current management of the Quarry Visitor Center. The visitor center was closed on July 12, 2006 after the building monitoring program identified previously unknown structural failures that presented serious life, safety, and health hazards.

As the fossil wall requires protection and structural changes require monitoring, park staff would continue to enter the structure to inspect and report conditions. Individual structural repairs would be performed as necessary to protect the fossil wall and structural integrity of the building. No major rehabilitation or construction efforts would be undertaken.

Current facilities located at the shuttle staging area have been converted to a visitor contact station. Typically, a visitor contact station is less formal and smaller than a visitor center, and generally accommodates fewer visitors. Use of the visitor contact station would allow the display of exhibits from the Quarry Visitor Center and provide for a sales area for the Intermountain Natural History Association. The NPS would evaluate options for providing alternative visitor interpretive opportunities and access to other fossil sites during closure of the Quarry Visitor Center.

Alternative B, the Preferred Alternative – Rehabilitate or Replace the Exhibit Hall and Construct a New Facility Off-Site

This alternative would provide for a shelter and interpretive area at the fossil wall, either by rehabilitating the existing Exhibit Hall or constructing a new structure. The existing Administrative Wing, South Wing, and Serpentine Entry Ramp would be demolished and their functions relocated to the shuttle staging area by construction of a new visitor center, including interpretive and administrative components. The existing shuttle staging facility would be incorporated into the design to the extent practicable.

The new visitor center and administrative offices and new/rehabilitated Exhibit Hall would accommodate the current needs of the monument. The new facilities would be designed to protect public and employee health, safety, and welfare by meeting current applicable current building codes and standards. The new/rehabilitated structures would provide for safe and effective entry and exit and would reduce the need for maintenance activities that currently pose potential hazards. Construction of new facilities would allow for an energy efficient heating and cooling mechanical system; updated fire sprinkler systems; water and waste system and plumbing; and electrical, communication, and security systems.

The Exhibit Hall's steel and glass superstructure would either be stabilized and rehabilitated or demolished and rebuilt to eliminate structural deficiencies, improve ventilation, and reduce access for moisture and animals such as rodents, bats, and birds. The Exhibit Hall foundation would be improved or rebuilt through the installation of structural piers drilled to a depth of approximately 65 to 85 feet below grade. The gantry crane would be salvaged, rehabilitated, and reused.

Water and wastewater utilities would be eliminated at the Quarry Visitor Center site. Potable water would be provided at the shuttle staging area rather than at the Quarry Visitor Center to greatly reduce the potential of leaks into the expansive soils. The remaining utility systems would be replaced, modified, or installed in a manner to minimize leaks into the expansive soils. Utility monitoring systems would be installed to give early warning of any potential problems.

As described for Alternative A, the building monitoring program would continue through implementation of the alternative and would be redesigned to monitor the rehabilitated or new facilities.

Demolition and construction would last approximately 18 months. During this time, the Quarry Visitor Center would remain closed. The NPS would develop an interpretive plan that would identify alternate interpretive opportunities for the period of the project.

Alternative C – Retain the Exhibit Hall and Construct a New Facility at the Quarry Visitor Center Site

This alternative would retain and rehabilitate the Exhibit Hall and demolish the Administrative Wing, South Wing, and Serpentine Entry Ramp. These three components would be replaced on this site with a structure designed to meet park interpretation, operation, and maintenance needs.

The Exhibit Hall's steel and glass superstructure would be stabilized and rehabilitated to eliminate structural deficiencies, improve ventilation, and reduce access for moisture and animals, including rodents, bats, and birds. The Exhibit Hall foundation would be improved through installation of structural piers drilled to a depth of approximately 65 to 85 feet below grade. The gantry crane would be salvaged, rehabilitated, and reused. The connecting walls or structural elements between the Exhibit Hall and the new building would be constructed in a manner that would eliminate stress on the structural elements of the Exhibit Hall.

The Administrative Wing and South Wing would be demolished. The replacement structure would meet current applicable building codes and standards. The replacement structure would provide for safe and effective entry and exit and would reduce the need for maintenance activities that currently pose potential hazards.

Construction of new facilities would allow for improvements to the heating and cooling mechanical system; lighting systems; fire sprinkler system; water and waste systems and plumbing; and electrical, communication, and security systems.

As described for Alternative A, the structural monitoring program would continue through the implementation of the alternative and would be redesigned to monitor the new facilities.

Demolition and construction would last approximately 2 years. During this time, the Quarry Visitor Center would remain closed. The NPS would develop an interpretive plan that would identify alternate interpretive opportunities for the period when the visitor center would be closed.

Alternative D – Retain the Exhibit Hall and Construct Wings Similar to Existing Facility

This alternative would retain and rehabilitate the Exhibit Hall and the Serpentine Entry Ramp. It would demolish the Administrative and South Wings. These components would be replaced with new structures, built with similar materials, designed to replicate the basic form, appearance, and scale of the original wings.

Similar to Alternative C, the Exhibit Hall's steel and glass superstructure would be stabilized and rehabilitated. However, the entry ramp would be retained and rehabilitated to replicate its historic condition (i.e., with stairs at the bottom of the ramp). The wings would replicate their original appearance using salvaged and new materials. The existing foundation system beneath the wings would be removed and a new foundation system installed. Similar to Alternative C, the rebuilt wings would meet all current codes and best professional practices for building safety and egress.

As described in Alternative C, the utility systems would be replaced, modified, or installed in a manner to minimize leaks into the expansive soils. Utility monitoring systems would be installed to give early warning of any potential problems.

As described for the other alternatives, the structural monitoring program would continue through the implementation of the alternative and would be redesigned to monitor the new facilities.

Demolition and construction would last approximately 2 years, and the Quarry Visitor Center would be closed during this time. The NPS would develop an interpretive plan that would identify alternate interpretive opportunities during the closure.

Alternative E – Demolish the Entire Facility and Construct a New Facility at the Quarry Visitor Center Site

This alternative would demolish the structure in its entirety and construct a new, 13,000-square-foot visitor center designed to meet park interpretation, operation, and maintenance needs. The new building would be engineered and constructed to avoid structural problems associated with the underlying expansive soils. A poured concrete foundation system would be installed, with structural piers drilled to a depth of approximately 65 to 85 feet to ensure the stability of the new foundation.

The new building would have improved ventilation and would be appropriately sealed to reduce access for moisture, rodents, bats, and birds. A large glass canopy would be constructed over the quarry that would use energy-efficient glass. The gantry crane would be salvaged, rehabilitated, and reused.

The new building would meet current applicable building codes and standards. New, efficient utility systems would include a heating and cooling mechanical system; energy efficient lighting systems; fire sprinkler system; water, waste systems, and plumbing; and electrical, communication, and security systems. Utility-monitoring systems would be installed to give early warning of any potential problems and to minimize the potential for water leaks.

As described for all of the other action alternatives, the structural monitoring program would continue through the implementation of the alternative and would be redesigned to monitor the new facilities.

Demolition and construction would last approximately 2 years, and the Quarry Visitor Center would be closed during this time. The NPS would develop an interpretive plan that would identify alternate interpretive opportunities during the closure.

Environmental Consequences

Impacts of the five alternatives were assessed in accordance with *Director's Order 12 and Handbook: Conservation Planning, Environmental Impact Analysis, and Decision Making* (NPS 2001). This handbook requires that impacts on park resources be analyzed in terms of their context, duration, and intensity. The analysis provides the public and decision-makers with an understanding of the implications of actions in the short- and long-term, cumulatively, and within context, based on an understanding and interpretation by resource professionals and specialists.

For each impact topic, methods were identified to measure the change in park resources that would occur with the implementation of each alternative. Thresholds were established for each impact topic to help understand the severity and magnitude of changes in resource conditions, both adverse and beneficial.

None of the alternatives evaluated would result in impairment of park resources or values.

Historic Structures

The analysis of environmental consequences revealed that the type and magnitude of work that would be done under all of the action alternatives to adequately address the structural stability concerns would remove or alter original structural elements and materials to the extent that the National Historic Landmark status of the Quarry Visitor Center would be lost, causing a long-term, major, adverse effect to the historic structure.

Under Alternative A, the combination of continued closure and maintenance and repair efforts with ongoing deterioration would lead to incremental losses of integrity of the National Historic Landmark structure, which would have long-term, minor, adverse effects that would eventually lead to major, adverse effects.

Collections

Typically a park's collections are items that have been removed from their original location, analyzed, catalogued, accessioned, and stored in archival facilities. However, at Dinosaur National Park the *in situ* paleontological remains on the fossil wall have been accessioned and are a vital part of the park's collections.

Alternative A would lead to long-term, minor to moderate, adverse effects on the *in situ* fossil collection because of increased potential for damage to the collection from exposure to the elements, vermin entry and deposits, and potential for workers to drop equipment or slip and fall onto the collection.

Alternatives B, C, D, and E would provide long-term benefits to the fossil collection by providing a secure, environmentally sound environment for the collection into the future, and would therefore also have long-term, minor, beneficial effects on cultural resources. During construction, adverse effects on the fossil collection resulting from direct disturbance, vibrations, and/or temperature changes would range from negligible to minor under Alternatives B (with rehabilitation of the Exhibit Hall), C, and D, and would range from minor to moderate under Alternatives B (with replacement of the Exhibit Hall) and E. The higher intensity of effect under Alternatives B and E would be associated with the increased risk during demolition of the Exhibit Hall and construction of a new facility above the fossil collection.

Geologic and Paleontological Resources

The effects Alternative A on paleontological and geologic resources present in the Morrison Formation adjacent to the Exhibit Hall would be long-term, minor, and adverse. Effects would be long-term because of continuing repair activities and altered drainage and infiltration at the site.

Impact analysis revealed that Alternatives B, C, D, and E would have beneficial effects resulting from site improvements designed to eliminate water seepage into and affecting the underlying strata. Long-term, minor, adverse effects could also result under all the action alternatives from site construction activities such as foundation demolition and installation of the new foundation and utilities. In addition, depending on the extent and depth of the bone bed, drilling and placement of new piers could produce long-term, minor to moderate, adverse effects on fossils if the bed is encountered. The potential for these impacts would be the same regardless of the action alternative implemented.

Visitor Use and Experience

Continued closure of the Quarry Visitor Center under Alternative A would have long-term, major, adverse effects on visitor use and experience from the loss of visitor access to the *in situ* fossil wall because this interpretive experience is unique to the Quarry Visitor Center and cannot be offered elsewhere. However, adverse effects would be somewhat ameliorated with development of alternate venues at other locations within the park.

All the action alternatives would result in long-term, major, beneficial effects on visitor use and experience as they would provide visitors access to view the *in situ* fossil wall. Alternative B would offer the greatest flexibility with improved environmental conditions and interpretation at the shuttle staging area site; Alternative C would have long-term benefits resulting from an improvement in environmental conditions in the Exhibit Hall and increased space and circulation and improved interpretation. Alternative D would have beneficial effects because environmental factors would be improved, space would be optimized, and interpretation improved; although, maintaining the historic floor plan would present some constraints. Lastly, Alternative E would offer flexibility with improved circulation and additional bookstore and interpretive space, and environmental conditions and interpretation would be improved. During construction and demolition activities there would be short-term, minor to moderate, adverse effects to visitor use and experience.

Socioeconomics

Continued closure of the Quarry Visitor Center under Alternative A would have long-term minor, adverse effects on the local economy resulting from decreasing visitation and associated declining revenues. The closure would have major long-term, adverse effects on the bookstore cooperating association, the Intermountain Natural History Association (INHA), from dramatically reduced sales receipts and operational constraints in their temporary facilities near the shuttle staging area.

The action alternatives would produce minor, long-term benefits for the local economy as the primary attraction of the fossil wall would again be available to the public. The cooperating association would also benefit from implementation of the action alternatives. Alternative B would result in minor to moderate economic benefits, while Alternatives C, D, and E would produce moderate to major benefits for the bookstore operator.

Public Health and Safety

Alternative A would produce long-term, negligible to minor, adverse effects to park staff who enter the Quarry Visitor Center to implement the structural monitoring program and perform critical maintenance and repairs to protect the fossil wall and maintain structural stability of the building as they would adhere to applicable OSHA protocol.

All of the action alternatives would result in effects on public health and safety, over those conditions that existed prior to closure of the Quarry Visitor Center, which would have long-term, minor benefits, because each alternative was developed to meet current building codes and standards to solve health and safety issues.

Park Management and Operations

Alternative A would have long-term, minor, beneficial effects on park management and operations because maintenance associated with the Quarry Visitor Center would be restricted to maintaining and repairing critical structural elements essential to protection of the fossil wall and maintaining building structural integrity. This would free staff to devote more time to maintenance and repair of other park facilities and infrastructure. These benefits would, however, be offset by relocation of staff to other work sites (including their homes) due to closure of the Quarry Visitor Center. Subsequent reductions in staff efficiency and coordination would continue. Additional staff would be required to provide visitor services and interpretive activities.

Under the action alternatives, long-term, moderate benefits, as related to conditions prior to closure of the Quarry Visitor Center, would result. The new/rehabilitated structures would be designed to meet site-specific needs, thereby reducing maintenance needs. Monitoring of structures at the former Quarry Visitor Center site would continue, due to the nature of the soils.

This page intentionally left blank.

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

This page intentionally left blank.

PURPOSE OF AND NEED FOR ACTION

INTRODUCTION

The NPS is evaluating alternatives for treatment of the existing historic Quarry Visitor Center at Dinosaur National Monument. The visitor center was closed on July 12, 2006 due to structural instability. The intent of this project is to provide long-term protection of the monument's unique resources while allowing all visitors to experience and appreciate the fossils of the quarry wall, the resource for which the monument was established.

The Quarry Visitor Center at Dinosaur National Monument is located about 20 miles east of Vernal, Utah. This unique building was constructed in 1957 and 1958. It protects and allows interpretation of the "greatest quarry of Jurassic dinosaurs in the world."

The building is a National Historic Landmark (NHL) because of its unique Mission 66 (Park Service Modern) design and relationship to the resource. The building's architectural style reflects a major post-World War II shift in NPS planning for visitors, and the style became the centerpiece of a new era of planning for American national parks.

The Quarry Visitor Center was erected specifically to protect and showcase the dinosaur fossils exposed in the rock face that make up one wall of the visitor facility. The structure protects the fossils from vandalism and theft, and from erosion by rain and snow, which would quickly degrade the fossils if they were left exposed to the elements. The building and quarry provide visitors the opportunity to view and touch fossils *in situ* as part of their interpretive experience. The more than 1,500 fossils on the quarry wall have been accessioned into the museum collection, and as such, are considered to be cultural resources. All other fossil resources are discussed under "Geologic and Paleontological Resources."

The Quarry Visitor Center has experienced problems with foundation instability since its construction. Differential movements because of underlying, moisture-sensitive, expansive clay strata have produced extensive structural damage to the building. Attempts to stabilize the building have been ongoing for more than 40 years, with major projects undertaken in 1967 and during the 1980s. Despite these efforts, the building continues to deteriorate and was closed to the public on July 12, 2006. Its continued deterioration produces concerns for the long-term protection of the fossil resource and presents safety concerns to staff during scheduled maintenance and inspections.

Description of the Monument

Dinosaur National Monument is the only national park unit established to protect a historic dinosaur quarry. It contains an extraordinary variety and number of Jurassic-era fossil remains. The monument was created by presidential proclamation on October 4,

1915 to protect the extensive fossil deposits discovered in the early 1900s by paleontologist Earl Douglass of the Carnegie Museum. In 1938, the original 80-acre monument was enlarged by presidential proclamation to convey protection to adjacent public lands containing "various objects of scientific and historic interest." This addition contained the canyons and viewsheds of the Green and Yampa rivers. Additional land was added in 1960, enlarging the monument and providing for new access roads. Currently, a total of 211,141 acres are included within the monument boundaries.

Dinosaur National Monument lies along the Green and Yampa Rivers, and straddles the Colorado-Utah border. There are two visitor centers at the monument. The Canyon Area Visitor Center at park headquarters is east of Dinosaur, Colorado. The Quarry Visitor Center is in Utah, about 7 miles north of Jensen and 20 miles east of Vernal, Utah.

The Quarry Visitor Center was built in 1957 and 1958 over the fossil dinosaur bone deposit that gives the monument its name. The glass and steel "butterfly canopy" of the Exhibit Hall shelters 1,500 fossil specimens that are exposed in relief on the steep incline of the uptilted fossil wall. The building is nestled into a small "valley" quarried away by the Douglass team in the early 1900s. The Quarry Visitor Center was listed as a National Historic Landmark in January 2001 in recognition of its significance in the Mission 66 design movement.

Just southeast of the Quarry Visitor Center, the area was leveled and filled to create a small parking lot, which overlooks the Green River. Distant mountain ranges circle the horizon and provide a colorful backdrop for the viewshed.

The Yampa River is the last naturally flowing (free of dams) river in the 15-river Colorado River system. Twenty-three exposed geological strata (the most complete of such records in lands managed by the NPS) "combine with elevation and topography to create the many habitats that support the startling diversity of plant and animal life" in the monument (NPS no date a).

Dinosaur National Monument is also rich in human history. The monument's canyons and cliffs shelter archeological sites that provide a record of human occupation in this area for more than 10,000 years. Remnants of homesteads evoke a sense of the early human history of the area. Recreational opportunities abound and include camping, fishing, rafting, hiking, and scenic drives. There were approximately 360,000 recreation visits to the monument in fiscal year 2005.

The location of Dinosaur National Monument and the dinosaur quarry is shown on the vicinity map below (Figure 1). Figure 2 shows a more detailed map of the project area (Quarry Visitor Center Site) and the immediate surrounding area, including the shuttle staging area.

FIGURE 1. DINOSAUR NATIONAL MONUMENT VICINITY MAP

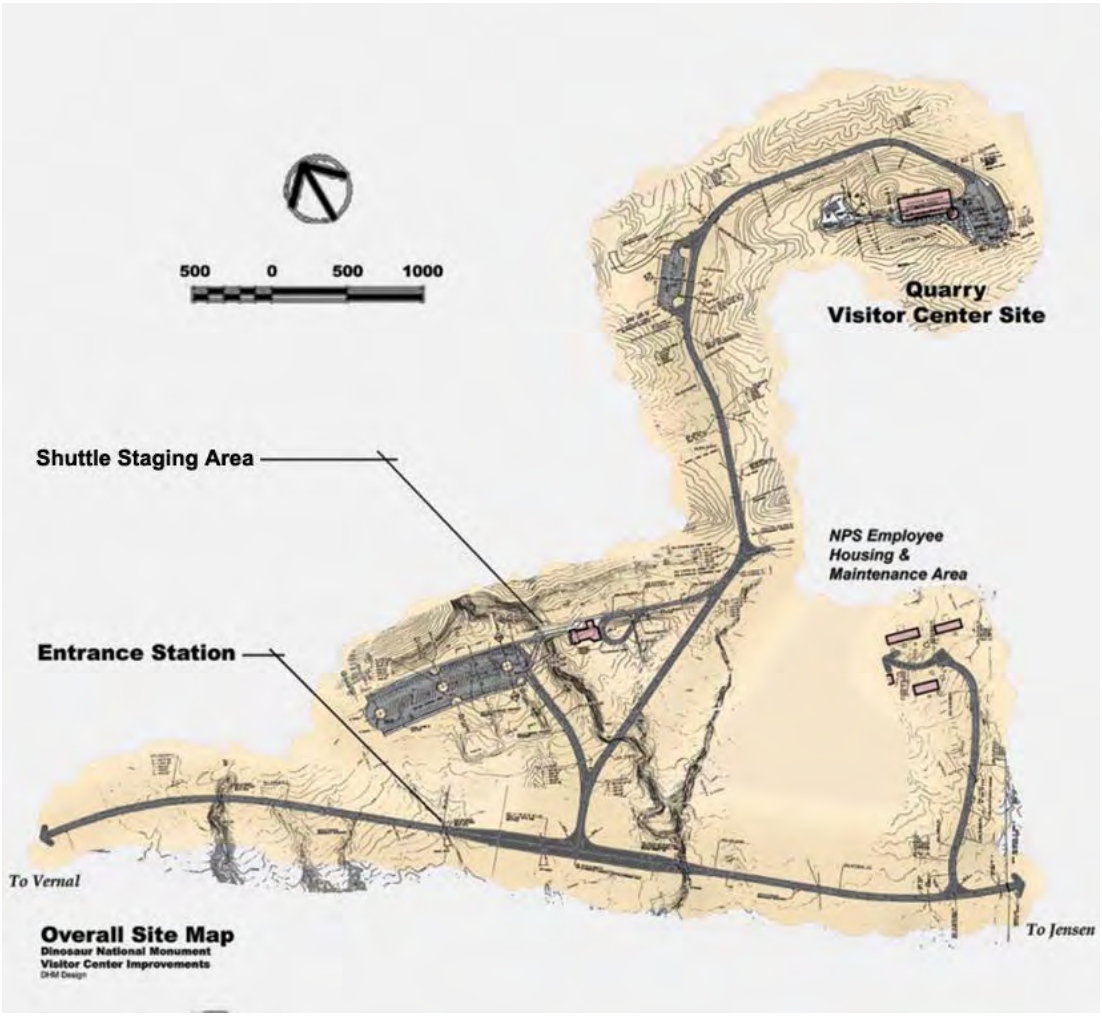

FIGURE 2. PROJECT AREA AND IMMEDIATE ENVIRONS

Purpose of the Project

The primary purposes of this project for treatment of the Quarry Visitor Center are to:

- Continue to protect the Dinosaur Quarry fossil wall – the resource for which the monument was established.
- Provide all visitors with an opportunity to experience and appreciate the fossil quarry and its significance.
- Protect public and employee health, safety, and welfare by providing a structurally sound visitation and work environment.

Need for the Project

The project for treatment of the Quarry Visitor Center is needed to address the building closure due to structural deterioration; to ensure the protection of unique paleontological resources; to allow visitors to experience and appreciate the fossil quarry safely; and to provide visitors orientation information about Dinosaur National Monument and options to enjoy their visit.

The Quarry Visitor Center is situated on expansive soils (commonly called "bentonite") that have high shrink-swell capacity when they come in contact with water. The upward movement of the soil is causing substantial damage to the building. This has included heaving of interior floor slabs by as much as 8 inches, a subsequent drop in the interior viewing gallery floor by as much as 12 inches, and tilting of the Administrative Wing roof in excess of 10 inches. The movement of surface soils results in continuing upheaval of the floor slabs beneath the Administrative Wing and South Wing, producing cracks and deterioration that can readily be seen on the brick and mortar exterior of the South and Administrative wings (Figure 3).

FIGURE 3. CRACKED EXTERIOR WALL ON ADMINISTRATIVE WING

In addition to causing building damage, soil movement generates unsafe conditions inside the Quarry Visitor Center. Concrete floor surfaces in the Administrative Wing and South Wing, which contain the paleontology laboratory, bookstore, staff office, and reference library, are cracked and broken. Plywood podiums are used to provide level work areas. The uneven floor surfaces throughout the facility pose slip and fall hazards. Staff must improvise, such as by using shims and doorstops, to maintain stable seating. As a result, they face chronic ergonomic challenges at their workstations.

Rising floors cause progressive cracking and buckling of interior walls (Figure 4). In December 2003, an interior wall in the South Wing (between the staff workroom and reference library) failed during the night, collapsing bookshelves. In the Administrative Wing, compression of the first floor between the rising floor slab and second story above has resulted in ceiling joist failure. A manually-operated jack has been placed at this site and is monitored and adjusted to protect against ceiling failure. Shifting floor surfaces have also produced ruptures of plumbing piping and fixtures, which has released water and exacerbated the shrink-swell problems.

The lifting of the roof beams causes compression in the curtain walls of the Exhibit Hall, which leads to cracking of the glass panels and has resulted in falling glass. Although incidents of falling glass occurred when visitors were not present, the unpredictability and risk of these conditions must be addressed.

FIGURE 4. DISTORTED DOORFRAME IN PALEONTOLOGY LAB

Because of shifting soils, the Serpentine Entry Ramp that leads to the second floor of the visitor center has separated from the building. Cracks are evident in the side walls of the ramp at each pier support, suggesting the pier supports are also moving. This movement threatens the fabric of this character-defining element of the National Historic Landmark. In addition, movement of the ramp has necessitated multiple replacements of

the main Quarry Visitor Center entry door. As recently as 2004, the entry door could not be fully opened because the ramp was interfering with the frame and door hinges.

As part of the program to rehabilitate the visitor center, the NPS commissioned a formal monitoring program, and the first of a series of four observation trips took place between May 8 and May 11, 2006 (NPS 2006a). The detailed inspections revealed some previously unknown conditions, beyond those iterated above, that presented serious life, safety, and health hazards resulting from the continued movement of the structure.

The major issues involved the round Administrative Wing and the east wall of the Exhibit Hall. In the round Administrative Wing, the second floor and roof were no longer adequately attached to the exterior walls and are in danger of collapsing. The second floor connections that do exist are seriously distressed and inadequate. Some bolts connecting the roof to the structure are pulled out. These failures all present life, safety and health hazards.

On the east wall of the Exhibit Hall, the glass portion of the wall and the foundation are no longer structurally connected (Figure 5). Even during moderate winds, the glass portion of the wall sways back and forth. A variety of other problems were found to exist in the building. For example, the upper floor of the Exhibit Hall had broken free from its attachment to a few of the cantilevered support beams and had displaced upward by as much as 2 inches. Because of those concerns, the NPS decided that the prudent course of action would be to close the building on July 12, 2006 rather than continue to put park staff and visitors at risk (NPS 2006a).

FIGURE 5. WINDOW CURTAIN SUSPENDED ABOVE FOUNDATION IN EXHIBIT HALL

The Quarry Visitor Center has a documented history of water leaks that have seriously damaged the structure and exacerbated building movement from expansion of soils. There is also the concern that water released into subsurface soils could accelerate natural weathering processes of the geologic formation. Utility waterline breaks in 1983 released about 400,000 gallons of water, which saturated the gravel bedding below the concrete floor and allowed the bentonite to expand. This caused considerable movement and damage to the building. However, as part of the closure of the visitor

center, minimal water service is currently supplied to the structure resulting in a decrease in the source of potentially released water (Dye 2007).

The existing roof drainage configuration has the potential to deliver water into the expansive soils. Historically, the Exhibit Hall had six stormwater drains discharging to ground level. Currently, there are six drains from the roof that connect to one pipe that is no larger than any of the six original collectors. In the event of a heavy rain, the current drain configuration would be overwhelmed, forcing the storm overflow into the moisture-sensitive soils and causing the soils to swell (NPS 2003a).

Additional health and safety risks within the Quarry Visitor Center include inadequate fire and life safety egress and rodent and bat entry. There is only one exit from the building, which serves both staff and visitors. The two existing public entries at the east end of the building are so close to one another that they are considered one exit. Existing egress is not compliant with federal, state, or NPS safety codes. Early warning fire detection and alarm systems are insufficient in both the public and staff areas (NPS 2003a).

Openings in the building exterior envelope from prolonged structural movement allow rodents and bats to enter the building. This poses sanitation concerns and associated health risks. The presence of vermin also poses resource preservation issues for the paleontological resources on the quarry wall. Waste products left by these small animals have unknown effects on the fossils and must be cleaned from the formation. Cleaning requires that staff climb on the fossil face, which could damage these delicate, non-renewable resources.

Until 2003, the gantry crane was used for maintenance of the quarry face. This provided access with little or no physical contact to the fossils. However, building movement has interfered with rail alignment, and the crane is now inoperable.

Accessibility for individuals with limited mobility is restricted within the Quarry Visitor Center. Only the first floor is accessible. However, all public toilet facilities are located on the second floor of the building. The exterior Serpentine Entry Ramp is deceiving, as it appears to comply with accessibility requirements of the Architectural Barriers Act. However, the ramp is not safe for individuals in wheelchairs because of its steepness and lack of landings.

The heating, ventilation, and air conditioning systems are inadequate to control temperatures in the Exhibit Hall. The glass windows allow a substantial amount of sunlight to enter the building, which often creates uncomfortably hot conditions within the viewing gallery. Because the building has no air cooling system, temperatures within the gallery can exceed 100 degrees Fahrenheit, which is extremely uncomfortable for park staff and visitors. Exposure to ultraviolet light has faded the colors of the interpretive message panels, and some original colors (primarily the yellows) are now missing. The glass curtain wall allows sunlight to enter from the sides, while the roof shades from the top. This results in varied lighting in the hall that limits photography of the monument's primary resource.

The Administrative Wing and South Wing of the Quarry Visitor Center did not provide optimal space for current NPS needs. With closure of the Quarry Visitor Center, services and activities have been temporarily relocated to other locations, including the shuttle staging area. Many of the replica fossils have been relocated there so visitors can view and touch them. A temporary viewing center also shows a video about the fossil wall and paleontologists at work. Rangers are available to answer visitor questions, present programs, and offer directions to other fossil viewing localities within the park. Administrative, interpretive and maintenance staff have been relocated to other locations within the park or work from home to accomplish their tasks and duties.

Objectives in Taking Action

Objectives are specific statements of purpose and describe what must be accomplished to a large degree for the action to be considered a success. All action alternatives selected for detailed analysis had to substantially meet all of the objectives and also had to resolve the purpose and need for action. The following objectives were developed for the Quarry Visitor Center project:

- Protect the paleontological resources *in situ* on the quarry face and geological resources surrounding the quarry, both over the long-term and during any necessary construction activities.
- Provide visitors opportunities to view fossils *in situ,* and interpretation of fossil wall.
- Meet current applicable building codes, including access, exit, and accessibility; solve health and safety issues.
- Provide an environment where employees can work efficiently; provide space for current park management and administration needs.
- Provide visitors orientation information about Dinosaur National Monument and options to enjoy their visit.

Purpose of this Environmental Impact Statement

This draft environmental impact statement (EIS) evaluates a range of reasonable alternatives to address the safety shortcomings of the Quarry Visitor Center. The EIS planning process will be completed with publication of the NPS record of decision. The record of decision will announce which alternative has been chosen as the management action for treatment of the Quarry Visitor Center, describe mitigation measures, and document the decision rationale.

This draft EIS has been prepared in accordance with:

- The National Environmental Policy Act (NEPA) of 1969;
- The Council on Environmental Quality (1978) regulations for implementing the National Environmental Policy Act, published in 40 Code of Federal Regulations, Parts 1500-1508;

- NPS *Director's Order 12 and Handbook: Conservation Planning, Environmental Impact Analysis, and Decision Making* (NPS 2001), and
- The National Historic Preservation Act of 1966 (as amended) and its implementing regulations published in 36 Code of Federal Regulations, Parts 60, 800, et seq.

In addition to fulfilling the requirements of the National Environmental Policy Act, this draft EIS is being used to comply with Section 106 of the National Historic Preservation Act.

Background

Importance and Background of the Quarry Visitor Center

The Quarry Visitor Center was constructed as part of the NPS Mission 66 program. Initiated during the 1950s, Mission 66 was designed to serve as the centerpiece of a new, post-World War II era of planning for American national parks. It aimed at replacing small, antiquated, rustic style park facilities that increasingly were proving inadequate for growing numbers of visitors.

Mission 66 visitor centers express the Park Service Modern style, and the Quarry Visitor Center is one of the foremost examples of this design. As part of Mission 66, incorporation of modernistic designs and new technological solutions, and use of industrial materials such as glass, aluminum, concrete, and exposed structural steel made it possible for the NPS to serve numerous visitors quickly and efficiently on a limited budget.

The Quarry Visitor Center also represents post-war ideas in management of both visitors and resources. Mission 66 planners coined the term "visitor center" to describe a building that combined old and new building programs. The visitor center served as a hub for the monument's interpretive programs and museum displays, and was a central place where visitors could be oriented to the monument and its resources and could obtain access to a broad range of visitor services.

The visitor center concept remains the primary facility of park development programs all over the world for parks of various sizes and contexts. Unfortunately, post-World War II concepts of visitor center functions and visitor use patterns were in their infancy during development of the Quarry Visitor Center, and by today's standards, the building's spatial organization, placement and style of exhibits, and flow of visitors are less than optimal.

In 1956, the idea of leaving the paleontological specimens in the ground rather than excavating them for placement in museum display cases was a striking interpretive innovation. At Dinosaur National Monument, paleontological specimens were not separated from their natural context, but instead could be viewed in their original setting. Also innovative was the concept of creating a dramatic, modern building of glass and steel set around and above the uplifted and steeply dipping, fossil-bearing strata.

The glass structure was intended to protect the specimens while providing natural light and a strong visual link to the stark Utah landscape.

Significance of the Dinosaur Quarry

Management Policies 2006 (NPS 2006b) states that one of the major purposes of the NPS is to provide visitors with memorable educational experiences so that visitors will understand, appreciate, and enjoy the significance of the parks and park resources. The Quarry Visitor Center protects one of the richest and most varied deposits of dinosaur fossils in the world. By seeing and touching these amazing fossils in their original context, visitors are able to better understand the Jurassic world and its amazing community of life. Experiencing the fossil wall and the nearby exhibits creates an indelible memory, and these experiences help visitors develop a personal stewardship ethic and a desire to help protect and preserve park resources (West and Chure 2001).

"*Nowhere else on Earth can you stand on the very spot where dinosaurs once lived and see so many of their bones still in their final resting place. Rarely do we get such a vivid look through the shuttered windows of the past*" (West and Chure 2001).

The quarry is valuable to scientists, helping them in the identification of new species and providing data for future and ongoing research. This unparalleled collection includes a range of dinosaur fossils "from petite juveniles to colossal adults," some of which are rare, and often "are the best, and sometimes the only, examples of their kind" (West and Chure 2001).

Description of the Project Area

The Quarry Visitor Center is located in the southwest portion of the park, about 7 miles north of Jensen, Utah in Uintah County. The site is predominantly developed with a paved road leading up from the shuttle staging area, past the employee housing and maintenance area, to the Quarry Visitor Center and parking lot. The building and parking lot are situated on a combination of Morrison Formation fossil-bearing sandstone and quarry spoil material. The Morrison Formation at the Quarry Visitor Center consists of steeply dipping alternating layers of sandstone and shale with some limestone, which dip to the south at an angle of 65 degrees. The north half of the building is supported on the fossil-bearing sandstone of the quarry face, while the south end is founded on steeply dipping bentonite-bearing shale or mudstone/claystone bedrock, along with spoil materials. The quarry spoils used at the site were deposited as fill during the development of the site and are excess soil and rock debris that were removed from the fossil wall during past quarrying operations while paleontologists were exposing and removing fossils. The few portions of the site not improved with the building, parking lot, or walkways, are either quarry spoils or protruding rock formations. As a result, there is minimal vegetation and wildlife in the immediate vicinity of the Quarry Visitor Center.

The Quarry Visitor Center

Four interconnecting structural elements make up the building's character-defining features (Figure 6). They include the Serpentine Entry Ramp, the Exhibit Hall, the Administrative Wing, and the South Wing. These character-defining elements are described below.

Serpentine Entry Ramp

The Quarry Visitor Center main entrance is located at the top of a sloping, S-shaped, concrete entry ramp. The base of the ramp is at grade level near the shuttle bus stop. Its curving form hugs the circular mass of the Administrative Wing as it rises at an approximate 12 percent grade to the glass, double-door entry on the second floor.

The ramp is constructed of poured-in-place concrete of a natural color, with integrated concrete sidewalls. The exterior of the ramp is covered with natural aggregate, which matches the Administrative Wing. The ramp is supported by three steel support columns, which suspend it above grade and give the appearance that the ramp is "floating." The low end of the ramp was originally built with several steps (NPS 2003a).

FIGURE 6. THE QUARRY VISITOR CENTER WITH CLOSURE BARRIER

The Exhibit Hall

The Exhibit Hall is a large, rectangular, steel and glass structure with an asymmetrical "butterfly canopy" roof. The hall is 60 feet wide by 180 feet long, and the roof rises approximately 50 feet above the floor.

The primary support columns are exposed steel beams, supported on footings set to a depth of approximately 40 feet. All four walls of the Exhibit Hall, except where it meets the South Wing, are welded steel frames holding single-pane glass, 36-inch-square windows. Operable windows have been placed in the curtain wall on all four sides.

The entire window system is constrained between the canopy above and the concrete foundation below. The rigid steel frame and single-pane glass are unable to tolerate differential building movement. Much of the original glass has broken or fallen from the frame. It is important to note that the glass window walls do not provide structural support. They are supported by the steel columns and hang from the Exhibit Hall roof.

On the east end of the structure, the window wall is now suspended several inches above the foundation. A wooden molding has been installed to help stabilize the wall windows. This condition is not an indication of overall structural failure (Andrews & Anderson Architects, JVA Inc. *et al.* 2004).

Failure of individual glass panes over time has led to replacement with a mixture of glass types and Plexiglas® panels (Figure 7) that have a variety of tolerance for expansion/contraction and structural movement. Some panes have been lined with protective film intended to prevent broken glass from falling and injuring staff or visitors. This glazing mixture presents a checkerboard appearance of dark and light panes in the Exhibit Hall.

Within the Exhibit Hall, a second-level gallery extends along the south wall. This 12-foot-wide walkway leads from the entrance, along the face of the fossil wall, to a staircase that leads to the ground level.

FIGURE 7. VARIETY OF REPLACEMENT GLASS IN EXHIBIT HALL

A light-duty, traveling gantry crane designed for working and maintaining the fossil wall is housed in the Exhibit Hall (Figure 8). The gantry crane travels along two rails, similar to railroad tracks. The northern rail is located on the top of the wall, and the southern rail is located on the exhibit floor. The gantry crane was operational until approximately 2003, but structural movement has caused interference at the east end of the railings, and the range of travel is now limited (Andrews & Anderson Architect, JVA Inc. *et al.* 2004).

Loss of crane function hampers cleaning, monitoring, and repair of the fossil wall. Staff now performs these duties by climbing directly on the formation.

FIGURE 8. THE GANTRY CRANE

During the 1950s, energy efficiency was not a primary consideration for design and construction. The single-pane glass and metal framework of the Quarry Visitor Center's curtain walls are poor insulators. This makes the Exhibit Hall cold in the winter and hot in the summer.

Administrative Wing and South Wing

The Administrative Wing, situated at the southeast corner of the building complex, is a two-story, cylindrical, concrete/masonry structure. The first floor is a concrete slab on grade. Long, narrow windows contribute to the distinctive, modern design of the building.

A cooperating association sales (bookstore) lobby and two offices occupied the lower level of the Administrative Wing. A stairwell connects the lower level with the upper level, which has an exhibit lobby, an office, and restrooms. The upper level flows onto the visitor gallery and the lower level extends into the solarium space of the Exhibit Hall.

The May 2006 inspection revealed that the Administrative Wing was the greatest area of concern. The upper floor and ceiling are being compressed against the South Wing. The ceiling and its supporting joists have failed connections in some locations. Based upon the cracking and deformations measured in the exterior wall, the few connections that hold the second floor framing and decking in place are distressed and inadequate for bracing the wall and transferring lateral forces. The roof beams are tied to the exterior walls with clip angles and bolts embedded into the masonry at every other pilaster. Embedded bolts were observed to have pulled out of the masonry. These failures present life safety hazards.

The one-story, rectangular South Wing abuts the Administrative Wing and the south side of the Exhibit Hall. This 20-foot-wide by 160-foot-long, reinforced concrete masonry structure provided space for the laboratory, employee offices, the research library, employee break room, and the mechanical room.

The south wall of the Exhibit Hall is an integral part of the South Wing. The support beams of the hall provide support for the gallery platform that joins the two structural components. Expansive soils have caused the south wall to shift, causing corresponding changes in the elevation and appearance of the steel roof beams. The floor slabs beneath the Administrative Wing and South Wing are continually moving, causing cracking of interior walls, compressing of the wall framing, and shifting of plumbing fixtures away from their pipes.

Relevant Laws, Policies, Plans, and Constraints

The following laws, policies, and plans are described in this section to show the regulatory framework within which Quarry Visitor Center treatments must operate and the goals and policies that treatments must meet. Overarching goals and constraints are summarized in this section. More detailed descriptions of relevant laws and policies pertinent to specific impact topics are provided in the "Environmental Consequences" section under each appropriate topic.

NPS Guiding Laws and Policies

NPS Organic Act of 1916

Congress directed the U.S. Department of the Interior and the NPS to manage parks "to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (16 *United States Code* § 1). Congress reiterated this mandate in the Redwood National Park Expansion Act of 1978 by stating that the NPS must conduct its actions in a manner that will ensure no "derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress" (16 *United States Code* § 1 a-1).

Despite these mandates, the Organic Act and its amendments afford the NPS latitude when making resource decisions that balance visitor recreation and resource preservation. By these acts, Congress "empowered [the NPS] with the authority to determine what uses of park resources are proper and what proportion of the park resources are available for each use" (*Bicycle Trails Council of Marin v. Babbitt*, 82 F.3d 1445, 1453 [9th Circuit 1996]).

Courts consistently interpret the Organic Act and its amendments to elevate resource conservation above visitor recreation. *Michigan United Conservation Clubs v. Lujan*, 949 F.2d 202, 206 (6th Circuit 1991) states, "Congress placed specific emphasis on

conservation." The *National Rifle Association of America v. Potter*, 628 Federal Supplement 903, 909 (D.D.C. 1986) states, "In the Organic Act Congress speaks of but a single purpose, namely, conservation." *Management Policies 2006* (NPS 2006b) also recognizes that resource conservation takes precedence over visitor recreation. Section 1.4.3 states, "when there is a conflict between conserving resources and values and providing for enjoyment of them, conservation is to be predominant."

Because conservation remains predominant, the NPS seeks to avoid or to minimize adverse impacts on park resources and values, though they may allow negative impacts when necessary to fulfill park purposes, as long as the impact does not constitute impairment of the affected resources and values (NPS 2006b). That discretion to allow certain impacts within the park is limited by statutory requirement that the NPS must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. An action constitutes an impairment when its impacts "harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values" (NPS 2006b). An adverse impact constitutes impairment to the extent that it has a major adverse effect on 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.

To determine impairment, the NPS must evaluate "the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts" (NPS 2006b). This draft EIS, therefore, assesses the effects of all alternatives on the resources and values of Dinosaur National Monument and determines if these effects would cause impairment.

Management Policies 2006

Several sections from *Management Policies 2006* (NPS 2006b) and accompanying guidance are relevant to the protection of public health and safety and park resources in Dinosaur National Monument. Relevant sections are described below.

The NPS cultural resource program involves stewardship to ensure that cultural resources are preserved and protected, receive appropriate treatments (including maintenance), and are made available for public understanding and enjoyment. In Section 5 of *Management Policies 2006* (NPS 2006b) which is iterated in Directors Order 28, *Cultural Resources Management*, park units are instructed "to employ the most effective concepts, techniques, and equipment to protect cultural resources against theft, fire, vandalism, overuse, deterioration, environmental impacts, and other threats, without compromising the integrity of the resources."

Section 4.8.2.1 of *Management Policies 2006* (NPS 2006b) states that "paleontological resources, including both organic and mineralized remains in body or trace form, will be protected, preserved, and managed for public education, interpretation, and scientific research." Furthermore, this section states, "any [NPS] construction projects in areas with potential paleontological resources must be preceded by a pre-construction surface assessment prior to disturbances. For any occurrences noted, or when the site may yield paleontological resources, the site will be avoided, or the resources will, if necessary, be collected and properly cared for prior to the initiation of the construction disturbance. Areas with potential paleontological resources must also be monitored during construction projects."

Section 8.2.5 of *Management Policies 2006* (NPS 2006b) states that parks will provide a safe and healthful environment for visitors and employees and "will strive to identify recognizable threats to the safety and health of persons and to the protection of property by applying nationally accepted codes, standards, engineering principles, and the guidance contained in Director's Orders 50, 58, and 83 [described in the "Public Health and Safety" section] and their associated reference manuals." In addition, this section states that, when practicable, the NPS will reduce or remove known hazards and apply other appropriate measures, including closures, guarding, signing, or other forms of education.

Natural Resource Management Reference Manual 77

Natural Resource Management Reference Manual 77 (NPS 2005a) offers guidance to NPS employees responsible for managing, conserving, and protecting the natural resources found in NPS units. The "Paleontological Resources Management" section in *Natural Resource Management Reference Manual 77* provides guidance to NPS staff in managing and protecting paleontological resources found within their parks. Specifically, this section calls for the identification of paleontological resources through surveys, evaluating resource significance, and managing appropriately to the nature and significance of the resources. Potential management actions may include no action, monitoring, cyclic prospecting, stabilization and reburial, protective structures, excavation, closure, patrols, and confidentiality of sensitive information.

Dinosaur National Monument, Enabling Legislation

While every NPS unit is guided by the Organic Act, National Environmental Policy Act, and other laws and policies, each unit also has more specific guidance. Typically, this includes enabling legislation or presidential proclamations; statements of mission, purpose, and significance; and broad planning documents such as a general management plan.

Dinosaur National Monument was established by Presidential Proclamation 1313 on October 4, 1915 (39 Stat. 1752). The stated purpose of the 80-acre monument was to preserve the outstanding fossil resources at the dinosaur quarry north of Jenson, Utah.

In 1938, the monument was enlarged to 203,885 acres by Presidential Proclamation 2290 (53 Stat. 2454). This proclamation cited the Organic Act of August 25, 1916, the act that

established the NPS (16 *United States Code* 1a-7), thereby specifically identifying Dinosaur National Monument as an area to be administered for purposes of preservation of natural resources and public use. It also expanded the land base and the administrative responsibilities of the NPS to include the river corridors and adjacent viewsheds for the major canyons of the Green and Yampa Rivers.

Following a controversy in the 1950s that culminated in decisions to not construct dams within the monument, Congress enacted legislation that specified direction for future use and preservation of the monument. This act (74 Stat. 857) made minor revisions in the boundary, enlarging the monument to 211,142 acres and authorizing acquisition of land for construction of entrance roads and administrative sites (NPS 1986).

Purpose and Significance of Dinosaur National Monument

National park system units are established by Congress or the President to fulfill specific purposes, based on the unit's unique and "significant" resources. A unit's purpose, as derived from its presidential proclamation or enabling legislation, is the foundation on which later management decisions are based to conserve resources while providing "for the enjoyment of future generations."

As stated in its general management plan (NPS 1986), the purpose of Dinosaur National Monument is to provide for protection and visitor enjoyment of the outstanding fossil resources and the scenic canyon areas of the Green and Yampa Rivers.

The following statements of significance have been developed to define the most important resources and values of Dinosaur National Monument (NPS 2003b).

- The geologic record at Dinosaur National Monument is significant for the many rock layers exposed in a relatively small area. These 23 formations provide a scenic landscape for understanding the geologic history of the Colorado Plateau.
- The historic Douglass Quarry contains the most concentrated, diverse, and abundant collection of well preserved Jurassic Period dinosaur bones in the world. Fossils from the Morrison Formation enable scientists to reconstruct the 150 million-year-old ecosystem in which the dinosaurs and their contemporaries lived.
- Dinosaur National Monument is the only NPS site established to preserve an *in situ* (fossil bones left in place) historic dinosaur quarry, and is known internationally for the continued discovery and scientific study of new fossil specimens.
- Dinosaur National Monument preserves a portion of the Uintah Basin, which is characterized by an impressive biological diversity that results from the interplay between geologic deposition, uplift, erosion, time, and biological communities.
- Dinosaur National Monument offers outstanding opportunities to experience solitude, natural quiet, dark night skies, and wild environments.

- Dinosaur National Monument reveals an 11,000-year record of continuous human occupation, cultural development, and exploration from Paleo-Indian culture to the present. The pristine and intact cultural resources provide excellent opportunities for research and education.
- Fur trappers, explorers, and early boaters on Dinosaur National Monument's wild rivers set the stage for white water boating – a unique, high-quality, non-motorized boating experience. This history of human interaction with the Green River contributes to a better understanding of our relationship to this river system.
- The proposal to dam the Green River below Echo Park in the 1950s galvanized the nation's fledgling conservation organizations into a potent political power that defended the National Park idea.
- The Yampa River is the last natural-flowing river in the Colorado River System. As such, it provides necessary habitat for all native aquatic and riparian species remaining in the Upper Green River System, and has forestalled the extinction of four endangered fish species. Outstanding research opportunities exist within the monument to compare the river and riparian systems of the Yampa to the regulated flow regime of the Green.

Other Relevant Federal Laws and Policies

National Historic Preservation Act of 1966, as Amended

The goal of the National Historic Preservation Act (NHPA) (16 *United States Code* 470 et seq.) is to have federal agencies act as responsible stewards of our nation's resources when their actions affect historic properties. The National Historic Preservation Act has two major components that affect the responsibilities of federal agencies managing historic properties.

- Under Section 106 of the National Historic Preservation Act, federal agencies are to consider the effects of their undertakings (including the issuance of permits, the expenditure of federal funding, and the implementation of federal projects) on historic resources that are either eligible for listing or are listed in the National Register of Historic Places. The National Register is a listing of areas designated as being of historical and prehistoric significance on a local, state, or national basis; the register is maintained by the NPS. The inventory includes buildings, structures, objects, sites, districts, and archeological resources.
- Section 110 of the National Historic Preservation Act imposes an obligation on federal agencies that own or control historic resources. Under this section, federal agencies must consider historic preservation of historic resources as part of their management responsibilities.

The National Historic Preservation Act created the Advisory Council on Historic Preservation, an independent federal agency, to advise the president and Congress on matters involving historic preservation. The Advisory Council on Historic Preservation is authorized to review and comment on all actions licensed by the federal government

that will have an effect on properties listed in the National Register of Historic Places, or that are eligible for such listing.

National Historic Landmarks Program

The purpose of the National Historic Landmarks Program is to focus attention on properties of exceptional value to the nation as a whole, rather than to a particular locality. The program promotes the preservation efforts of federal, state, and local agencies; Indian Tribes; and private owners; and encourages owners of landmark properties to observe preservation precepts. If not already so recognized, properties designated as National Historic Landmarks are listed in the National Register of Historic Places upon designation as National Historic Landmarks.

Section 8 of the National Park System General Authorities Act of 1970, as amended (90 Stat. 1940, 16 *United States Code* 1-5), directs the Secretary of the Interior to prepare an annual report to Congress which identifies all National Historic Landmarks that exhibit known or anticipated damage or threats to the integrity of their resources. In addition, National Historic Landmarks may be studied by the NPS for possible recommendation to Congress for inclusion in the national park system.

Related Planning Documents for Dinosaur National Monument

General Management Plan

The monument's 1986 general management plan, with the land protection plan component updated in 1988 and 1991, guides management actions to protect natural and cultural resources; upgrade facilities, staffing, and services necessary to support recreational uses; upgrade roads; and improve visitor opportunities to experience monument resources. Specifically, the general management plan recognized the structural problems associated with expansive soils underlying the Quarry Visitor Center and the frequent maintenance requirements, and recommended a professional engineering study be performed (NPS 1986).

Quarry Visitor Center Historic Structure Report

The *Quarry Visitor Center Historic Structure Report* (NPS 2003a) evaluated the condition of the visitor center and surrounding site conditions and provided recommendations for future treatments of the facility. The historic structure report recommended total demolition of the Administrative Wing and South Wing and reconstruction to their former 1958 appearance, re-using as many architectural features as possible. The report also recommended rehabilitating the Exhibit Hall and historic Serpentine Entry Ramp. Many of these recommendations have been integrated into Alternative D, which is analyzed in this draft EIS and presented in the "Alternatives" section.

Comprehensive Interpretive Plan

The monument's comprehensive interpretive plan (NPS 2003b) was developed to define and guide the monument-wide interpretive program consistent with the achievement of the monument's goal for interpretation. The long-range interpretive plan component of the comprehensive interpretive plan serves as the long-range vision of the monument's interpretive program for the next several years. The plan addressed the desired future interpretive program to help most effectively communicate each of the monument's primary interpretive themes in a way that assures balance, effectiveness, and attainability.

The plan recognized the potential for temporary closure of the Quarry Visitor Center during the life of the long-range interpretive plan, and incorporated opportunities to translate the monument's primary interpretive messages at alternate locations. The plan specifically identified potential temporary relocation of activities such as interpretive talks, exhibits, demonstrations, costumed storytelling, children and family programs, bookstore sales, and temporary paleontological exhibits to other appropriate facilities in and out of the monument. These facilities include, as appropriate, the shuttle staging area, Headquarters Visitor Center and grounds, Utah Field House of Natural History State Park Museum, Green River Campground, and Split Mountain boat ramp (NPS 2003b). Since closure of the Quarry Visitor Center in July 2006, this plan has been used by park staff to develop interim interpretive and educational programs at locations other than the Quarry Visitor Center.

Utah Field House of Natural History State Park Museum

A new 22,000-square-foot natural history field house and museum opened in June 2004 in nearby Vernal, Utah, approximately 20 miles from Dinosaur National Monument. This museum was constructed to preserve and reveal the abundance of the earth's history found in the Uintah Basin and Uintah Mountains. The museum stores and displays the fossil remains of ancient plant and animal life and other objects of natural history. In the future, the museum is expected to house Dinosaur National Monument's collections, specimens, and paleontological laboratory. This action has been addressed in a separate NEPA compliance document. The environmental assessment for this action was completed in 2005. The Finding of No Significant Impact (FONSI) was signed in September 2005.

Scoping Process and Public Participation

Scoping Activities

Scoping is the effort to involve agencies and the general public in determining the issues to be addressed in the environmental evaluation. Among other tasks, scoping determines important issues and eliminates unimportant issues; allocates assignments among the interdisciplinary team members and other participating agencies; identifies related projects and associated documents; and identifies other permits, surveys, or

consultations required by other agencies. Scoping includes early input from any interested agency or any agency with jurisdiction by law or expertise.

Prior to closure of the Quarry Visitor Center in July 2006, the following scoping activities were performed to determine issues and alternatives to address the deficiencies of the visitor center. Internal scoping began in March 2004 with the initiation of the environmental screening form, which initially identified potential resource effects. A meeting of NPS planning staff was then held in October 2004 to identify background information and previous studies; initiate development of the project purpose, need, and objectives; and schedule alternative concept development.

In January 2005, an alternatives workshop was held and five preliminary alternative concepts were developed by an interdisciplinary team. The team included park staff, NPS regional and design team representatives, and historic structures specialists, with input from the Utah State Historic Preservation Officer.

In March 2005, a value analysis/choosing by advantages workshop was held that focused on the review of the five potential options developed at the alternatives workshop. The interdisciplinary team considered issues and risk factors and evaluated each option for its ability to meet project purpose and objectives in a cost-effective, sustainable manner. The evaluation resulted in retention of three action alternatives to be further evaluated and decisions on why other potential alternatives would not be considered further.

The public scoping process began on June 28, 2004, with the publication in the *Federal Register* (Vol. 69, No. 123) of a notice of intent to prepare an EIS. A public scoping newsletter was distributed to the public in August 2004 soliciting issues and concerns related to the future of the Quarry Visitor Center. A second newsletter was published in February 2005 to inform the public about the alternative concepts and solicit input on the adequacy of the range of alternatives and additional alternatives or concerns the public would like to see considered in the analysis. Specific information related to participation and feedback received during public scoping is presented in the "Consultation and Coordination" section.

With closure of the visitor center, the NPS conducted additional evaluations and developed new schematic alternatives and cost estimates in order to meet the changing situation. With completion of the review, the NPS determined that the option to use the shuttle staging area site as an alternate location for park educational and interpretive programming would be considered.

Agency Consultation

During the initial scoping phases of this draft EIS, the NPS contacted the Advisory Council on Historic Preservation and the Utah State Historic Preservation Officer regarding this project on June 22, 2005. The Utah State Historic Preservation Office also sent a representative to participate in the January 2005 alternatives development meeting. Additional consultation occurred in December 2006 following closure of the Quarry Visitor Center. Consultation with the agency regarding this project is active and

ongoing. The NPS also contacted the U.S. Fish and Wildlife Service on November 23, 2005. Detailed information on agencies consulted and their involvement in the project is included in the "Consultation and Coordination" section of this draft EIS. Copies of correspondence letters are included in Appendix A.

Issues and Impact Topics

Issues are problems, opportunities, and concerns regarding the current and potential future management of the Quarry Visitor Center. Issues were identified by the NPS and the public throughout the public scoping process.

Impact topics are derived from issues. They focus the planning process and the assessment of potential consequences of the alternatives. *Director's Order 12* and handbook (NPS 2001) list impact topics that must be considered, based on the requirements in federal legislation, executive orders, and the Council on Environmental Quality (1978) guidelines for implementing the National Environmental Policy Act. Other impact topics are identified based on region or park-specific concerns, or as a result of scoping. The relevant current conditions of resources associated with the impact topics are discussed in detail in the "Affected Environment" section. Impacts associated with each of the alternatives are described in the "Environmental Consequences" section.

Impact Topics Retained for Analysis

Table 1 presents a summary of issues that are considered to be important by the technical experts on the interdisciplinary team and identifies the corresponding impact topics in "Environmental Consequences" where they have been analyzed and discussed.

TABLE 1. ISSUES TO BE EVALUATED AND CORRESPONDING IMPACT TOPICS

Issue	Impact Topics
The Quarry Visitor Center is a National Historic Landmark recognized as one of the most significant Park Service Modern design visitor centers produced by the Mission 66 program. The structural integrity of the building is threatened by prolonged movement caused by expansive soils under the shallow building foundation system. This movement has persisted ever since initial construction despite repeated stabilization efforts, and a continuation of these existing conditions could lead to structural failure.	Cultural Resources
Structural conditions do not assure the most optimal care for the monument's paleontological and other collections. For example, structural cracks allow egress for moisture, rodents, insects, vermin, and birds, all of which can damage *in situ* paleontological specimens and their setting. Falling glass panes can physically damage specimens.	Cultural Resources

TABLE 1. ISSUES TO BE EVALUATED AND CORRESPONDING IMPACT TOPICS

Issue	Impact Topics
Geologic resources (rock formations and fossils) are threatened by prolonged movement caused by the bentonite content of the surrounding soil strata. This movement, caused by water seepage associated with the Quarry Visitor Center, disrupts rock formation and soil integrity and can loosen and damage fossils.	Geologic and Paleontological Resources
There are potential hazards to geological and paleontological resources from activities undertaken near the geologic formation, both under continued current management and under the proposed action alternatives.	Cultural Resource, Geologic and Paleontological
The Quarry Visitor Center is closed. It is important to communicate to park visitors that they cannot access the facility. It is unlikely all visitors could be notified, and some people would be very disappointed. It is also important to notify people that Dinosaur National Monument is open and still presents a wealth of experiences.	Visitor Use and Experience
During closure or repair and rehabilitation efforts, visitors should still have the opportunity to see and touch real dinosaur bones.	Visitor Use and Experience
Ultraviolet light that enters the Exhibit Hall can degrade exhibits.	Visitor Use and Experience
The conditions at the Quarry Visitor Center resulted in poor visitor flow, hot and cold temperatures in the Exhibit Hall, difficulty in understanding interpretive messages, and crowding in the bookstore area.	Visitor Use and Experience
The closure of the Quarry Visitor Center may affect local tourism and the economy as well as the cooperating association.	Socioeconomics
The Quarry Visitor Center does not meet building codes for safe egress or accessibility.	Public Health and Safety
Hazards in the Quarry Visitor Center include uneven floors, high summer temperatures in the Exhibit Hall, and the potential for glass failure in the window walls.	Public Health and Safety
Prolonged structural movement caused by expansive soils under the building foundation has produced openings in the building envelope where rodents and bats can enter the building. This poses sanitation concerns and associated health risks.	Public Health and Safety

TABLE 1. ISSUES TO BE EVALUATED AND CORRESPONDING IMPACT TOPICS

Issue	Impact Topics
The need for maintenance and repair of the Quarry Visitor Center (such as patching cracking walls, repairing or replacing glass windows, and realigning plumbing) is extensive due to ongoing building movement.	Park Management and Operations
Closure of the Quarry Visitor Center has resulted in loss of office space and relocation of personnel to other work stations.	Park Management and Operations

Impact Topics Dismissed from Further Analysis

The impact topics identified below have been dismissed from further analysis because the range of alternatives would have no effects, or only negligible or minor, short-term effects on these resources, or because the impacts have been evaluated within another impact topic.

Accessibility: By law, following NPS adoption of the Architectural Barriers Act Accessibility Standards (ABAAS), "[f]acilities subject to the Architectural Barriers Act (ABA) must meet the ABAAS if the construction or alteration commences, or the lease is entered into, after May 8, 2006." The accessibility issues associated with the Quarry Visitor Center (no restroom access, uneven flooring, no elevator or lift to the second floor visitor gallery) no longer pose problems now that the visitor center is closed. Accessibility is a standard to be met regardless of the action alternative implemented, and each of the proposed options fully address accessibility mandates, including the requirement to provide reasonable accommodation to known disabilities of qualified applicants and existing employees. Thus, this topic is dismissed from analysis.

Air quality: During implementation of the action alternatives, there would be short-term, highly localized, negligible impacts on air quality from the emissions of construction equipment and potential soil removal/excavation activities. These effects would be negligible because best management practices would be used to minimize fugitive dust and emissions from construction equipment. Specific mitigation measures that would be employed are listed in Table 2, Mitigation Measures in the "Alternatives" section.

Archeological resources: This topic was dismissed because the potential for effects to archeological resources is exceedingly low. There are no known archeological sites or features in the area of potential effect at the Quarry Visitor Center area. Excavations to reveal fossil deposits, and construction of the visitor center, the parking lot, and entry road removed layer after layer of soil and rocks from the area, along with any archeological resources that once might have been present.

It is unlikely that *in situ* archeological resources exist in the vicinity of the shuttle staging area. The house where Earl Douglass homesteaded was destroyed shortly after he left

the area, and the Douglas graves are located outside of the area of potential effect. The general area was graded and leveled during construction of the shuttle staging area and the adjacent parking and roadways. However, to ensure that there would be no effect on any extant historic or prehistoric features, archeological investigations would precede final design for the new facility. If significant resources were discovered, designs would be modified to minimize or avoid effects on the resource, and Section 106 compliance would be completed prior to ground disturbing activities.

Conflicts with land use plans, policies, or concerns: Plans and policies associated with lands adjacent to the monument were reviewed. It was determined that alternatives for treatment of the Quarry Visitor Center would not affect these lands, or the policies and plans of jurisdictions such as the city of Vernal or Uintah County.

Cultural landscape: No cultural landscapes have been formally defined within the area of potential effect, which includes the Quarry Visitor Center, the adjacent parking and park use areas, the shuttle staging area, and access roads in the area. Effects of the proposed project on the Quarry Visitor Center and the *in situ* fossil wall (the primary cultural feature within the area of potential effect), will be evaluated under the topics "Historic Structures" and "Collections" in the "Cultural Resources" section. Therefore, the topic of cultural landscapes will be dismissed from further analysis in this document.

Ecologically critical areas or other unique natural resources: None of the action alternatives would affect any designated ecologically critical areas, wild and scenic rivers, or other unique natural resources, as referenced in the Wild and Scenic Rivers Act, *Management Policies 2006* (NPS 2006b), 40 *Code of Federal Regulations* 1508.27. The unique geologic and paleontological resources of Dinosaur National Monument are evaluated under "Geologic and Paleontological Resources" and "Cultural Resources."

Endangered or threatened species and critical habitats: The Quarry Visitor Center site and its immediate environs do not provide habitat for any federally or state-listed plant or animal species. Therefore, there would be no effects to these species and this topic is dismissed.

Energy requirements and conservation potential: The NPS strives to reduce energy costs, eliminate waste, and conserve energy resources by using energy-efficient and cost-effective technology. Energy efficiency is incorporated into the decision-making process during the design and acquisition of buildings, facilities, and transportation systems that emphasize the use of renewable energy sources. Energy requirements and conservation potential is addressed in the "Sustainability and Long-Term Management" section of this document.

Ethnographic Resources and Concerns: Although the Ute Indian Tribe of the Uintah and Ouray Reservation continue to express an interest in Dinosaur National Monument, none of the actions proposed in this environmental document would have an effect on ethnographic resources valued by tribes. For this reason, the topic of ethnographic resources and concerns has been dismissed from further analysis in this document.

Floodplains and wetlands: Executive Orders 11988 and 11990, Floodplain Management and Wetlands, respectively, require analyses of impacts on floodplains and regulated wetlands. Neither the Quarry Visitor Center site or the shuttle staging area are within the regulatory floodplain of the Green River, and none of the alternatives would have any effect on this floodplain. In addition, there are no wetlands regulated under the provisions of Section 404 of the Clean Water Act, or areas designated as wetlands using the classification system of Cowardin *et al.* (1979), within the area of potential effect.

Indian trust resources: Indian trust assets are owned by American Indians but are held in trust by the United States. Requirements are included in the Secretary of the Interior's Secretarial Order 3206, American Indian Tribal Rites, Federal – Tribal Trust Responsibilities; the Endangered Species Act; and Secretarial Order 3175, Departmental Responsibilities for Indian Trust Resources. According to park staff, Indian trust assets do not occur within the monument. Therefore, there would be no effects on Indian trust resources resulting from any of the alternatives.

Minority and low-income populations (environmental justice): Executive Order 12898, General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires that all federal agencies address the effects of policies on minorities and low-income populations and communities. None of the alternatives analyzed would have disproportionate adverse effects on populations as defined by the U.S. Environmental Protection Agency's 1998 guidance on environmental justice.

Natural or depletable resource requirements and conservation potential: Effects on natural or depletable resources is addressed in the "Sustainability and Long-Term Management" section of this document.

Prime and unique agricultural lands: The Council on Environmental Quality (1980) memorandum on prime and unique farmlands states that prime farmlands have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. Unique agricultural land is land other than prime farmland that is used for production of specific, high-value food and fiber crops. No prime or unique agricultural lands exist in the vicinity of the Quarry Visitor Center; therefore, this impact topic was eliminated from further analysis.

Soils: The Quarry Visitor Center site is developed, and there are minimal surface soils exposed in the immediate surrounding area. The majority of the soils to be affected by the project are quarry spoil, which is fill comprised of soil and rock debris removed from the quarry while Douglass and other paleontologists were exposing and removing fossils. These soils lack productivity and do not support a plant community. Construction of a new visitor center at the shuttle staging area under Alternative B would minimally disturb soil in that vicinity as the proposed location has a hardened covering overlying the already disturbed underlying soils. Construction of minor site improvements proposed under the action alternatives, such as an interpretive shelter or regrading the service road, as well as installation of approximately 300 linear feet of concrete barriers to reduce sloughing of soil and rock debris from the hillside south of the Quarry Visitor

Center, would disturb surface soils and produce short-term, localized, negligible to minor, adverse effects. Long-term, localized, negligible to minor, beneficial effects to soils would occur on the hillside as the barrier system would reduce sloughing of soil and rock from the hillside.

Staging areas for equipment, supplies and excavated soil and construction debris, as well as parking for construction crews, would be necessary and would be located in previously disturbed areas or on hardened surfaces such as the shuttle staging area and Quarry Visitor Center parking lot, at the vehicle overflow turn-out adjacent to the Quarry Visitor Center road, and on the south and west sides of the Quarry Visitor Center. Soil and rock debris removed during construction activities would either be reused onsite or would be temporarily stockpiled for reuse elsewhere in the monument. Disturbed areas, where present, would be reclaimed and replanted with native vegetation. These activities would produce short-term, minor, localized and adverse effects on surface soils associated with disturbance and compaction.

Because effects on surface soils would be only negligible or minor, this impact topic was dismissed from further analysis. An analysis of subsurface soil and other materials derived from the Morrison Formation is included in the "Geologic and Paleontological Resources" section.

Urban quality, historic and cultural resources, and design of the built environment: Historic and cultural resources were included as an impact topic that was considered in detail in this draft EIS. Urban quality and design of the built environment were eliminated from further analysis because the action alternatives would have no effect on urban quality or the built environment outside Dinosaur National Monument.

Wilderness: The monument has 205,672 acres of recommended wilderness. However the project area is located within the monument's developed areas, and would have no effect on the areas recommended for wilderness designation. This topic is therefore dismissed from further consideration.

This page intentionally left blank.

THE ALTERNATIVES

The alternatives include four action alternatives and the no action/continue current management alternative. Major issues related to the protection of park resources, visitor experience, and public health and safety that the action alternatives were designed to address are described in the "Purpose of and Need for Action" section. Although the option of no action/continue current management does not address the closure and ongoing structural, visitor, and safety issues at the Quarry Visitor Center, current conditions are used as the baseline against which the action alternatives are analyzed. This is the context for determining the relative magnitude and intensity of impacts and is consistent with the approach outlined in *Director's Order 12 and Handbook* (NPS 2001). This draft EIS refers to the option of continuing current management as "Alternative A, the No Action Alternative."

Each action alternative analyzed in this assessment includes measures to address the closure and deficiencies of the Quarry Visitor Center. From these, the NPS selected the alternative that best addresses the needs and objectives of the project. This proposed action is referred to as "Alternative B, the Preferred Alternative," and is the NPS' plan of choice for implementation.

DEVELOPMENT OF THE ALTERNATIVES

Prior to closure of the Quarry Visitor Center in July 2006, the following alternatives development activities were performed to determine a preferred alternative to address the deficiencies of the visitor center.

In January 2005, an alternatives workshop was held at Vernal, Utah, with participants from Dinosaur National Monument, the NPS region, Utah State Historic Preservation Office, and design and compliance consultants. The workshop produced five concepts that covered a range of potential futures for the facility. These five concepts included:

- Preserve all of the existing structure.
- Preserve the Exhibit Hall and reconstruct the Administrative Wing and South Wing structures using construction methods and materials that would replicate the existing facility.
- Preserve the Exhibit Hall and construct a new facility at the existing Quarry Visitor Center site.
- Preserve the Exhibit Hall and construct a new facility at another site.
- Demolish the entire structure and construct a new facility at the existing Quarry Visitor Center site.

In March 2005, a value analysis/choosing by advantages workshop was held to evaluate the five concepts developed at the alternatives workshop. Meeting participants used several criteria to identify a range of alternatives that would effectively meet the project purpose and objectives. The evaluation criteria included:

- Protection of resources critical to the monument's mission;
- Operational, safety, and interpretive requirements;
- The Quarry Visitor Center's landmark status; and
- Risks associated with undertaking an effective repair effort.

During the course of the evaluation, the following critical risk areas related to the project were identified:

- The most considerable risk is to the fossil resources. There are potential hazards associated with both continued management of the existing building and construction activities undertaken near the formation with implementation of the action alternatives.
- The findings of the historic structure report and communications from the historic architect (Snow 2005) indicated that there would be substantial risk to the integrity of the wings and ramp if efforts were undertaken to preserve the existing structure in place. With more than 30 percent of the original material damaged or deteriorated, the structure could fail during repair activities.
- Consideration was given to the long-term sustainability of any design placed at the site because of the underlying expansive soils.
- Park staff were concerned that visitor access to the monument's primary resource may be restricted or precluded during project implementation.

With closure of the visitor center, the NPS conducted additional evaluations and developed new schematic alternatives and cost estimates to meet the project objectives. This process revealed that the option of relocating a portion of the educational and interpretive programming and park administrative functions to the shuttle staging area site would meet project objectives and provide a long-term solution to the stability issues posed by the Quarry Visitor Center site. For these reasons, this option has become the proposed course of action, and is referred to as "Alternative B, the Preferred Alternative."

Reasons for dismissing other alternative concepts not carried forward for analysis are included in the "Alternatives Considered and Dismissed" section.

ALTERNATIVE A – THE NO ACTION ALTERNATIVE

The No Action Alternative would continue the current closure of the Quarry Visitor Center. The visitor center was closed on July 12, 2006. The NPS commissioned a formal monitoring program, and the first of a series of four observation trips took place between May 8 and May 11, 2006 (NPS 2006a). The resulting Life Safety Monitoring Report identified some previously unknown conditions that presented serious life, safety, and health hazards. The major issues involved the round Administrative Wing and the east wall of the Exhibit Hall. In the round Administrative Wing, the second floor and roof were no longer adequately attached to the exterior walls and are in danger of collapsing. The remaining second floor connections are seriously distressed and inadequate. Some bolts connecting the roof to the structure were pulled out. These failures all present life, safety and health hazards.

On the east wall of the Exhibit Hall, the glass portion of the wall and the foundation are no longer structurally connected. Even during moderate winds, the glass portion of the wall sways back and forth. A variety of other problems exist in the building. For example, the upper floor of the Exhibit Hall has broken free from its attachment to several of the cantilevered support beams and has displaced upward by as much as 2 inches. Because of those concerns, the NPS decided that the prudent course of action would be to close the building rather than put park visitors and employees at risk.

Because the building would no longer be occupied, structural changes would not be directly observed by park staff. Thus, it would be essential to continue the building monitoring program. NPS maintenance employees would continue their weekly and monthly recordings, observation trips to the Quarry Visitor Center, and reporting of conditions.

Because the Life Safety Monitoring Report (NPS 2006a) recommends extensive structural repairs, temporary measures addressing immediate needs and using limited funds do not appear to be a viable option to long-term maintenance of the Quarry Visitor Center. Individual structural repairs would be performed as necessary to protect the fossil wall and provide limited staff access to the existing structures. Examples of such localized repairs that have occurred in the past and could continue into the future, depending on recommendations of the monitoring program, include repairing roof leaks, providing emergency repairs of waterlines, and replacing broken curtain wall glass. No major rehabilitation or construction efforts would be undertaken. A summary of these past observations and necessary repairs is included in Appendix B.

The office space at the shuttle staging area has been converted to a visitor contact station. This allows limited display of exhibits from the Quarry Visitor Center in a secure location. It also provides a small sales area for the Intermountain Natural History Association. The NPS will evaluate options for providing alternative visitor interpretive opportunities and access to other fossil sites during the closure of the Quarry Visitor Center.

During the summer of 2006, a new range of visitor services and activities were provided at the open air pavilion adjacent to the visitor parking lot at the shuttle staging area. Many of the fossils (and replica fossils) were moved to this site to provide visitors with the opportunity to view and touch them. A "make-shift" auditorium was also established

so a video about the fossil wall and paleontologists at work could be shown. The park staff anticipates providing this type of information every summer.

The current schedule of ranger-led activities would continue to be provided. Each morning a ranger would lead a strenuous hike to a nearby quarry site (DNM-16), which is one of the most important paleontological quarries for Cretaceous-era dinosaurs in the world. (Brigham Young University is conducting an excavation of the site, and has left several fossils in the rocks for visitors to view.) Rangers would continue to lead a fossil walk, take visitors on geology tours, and provide viewing of fossils *in situ*. Visitors could walk along a geology trail and see bones left in the rock along the route. Rangers would also continue to lead hikes at Josie Morris' homestead.

The staff would continue to provide children's activities, including "find a Fossil (a fun activity for all ages), Build-a-Saurus (children get to build a dinosaur), and the Junior Paleontology program. The tram that had originally provided shuttle service between the parking lot and the Quarry Visitor Center would be used to take visitors on park tours. A ranger would give interpretive talks about the geology of the park and its human history, including information on petroglyphs attributed to the prehistoric Fremont culture.

The site layout for Alternative A is presented in Figure 9.

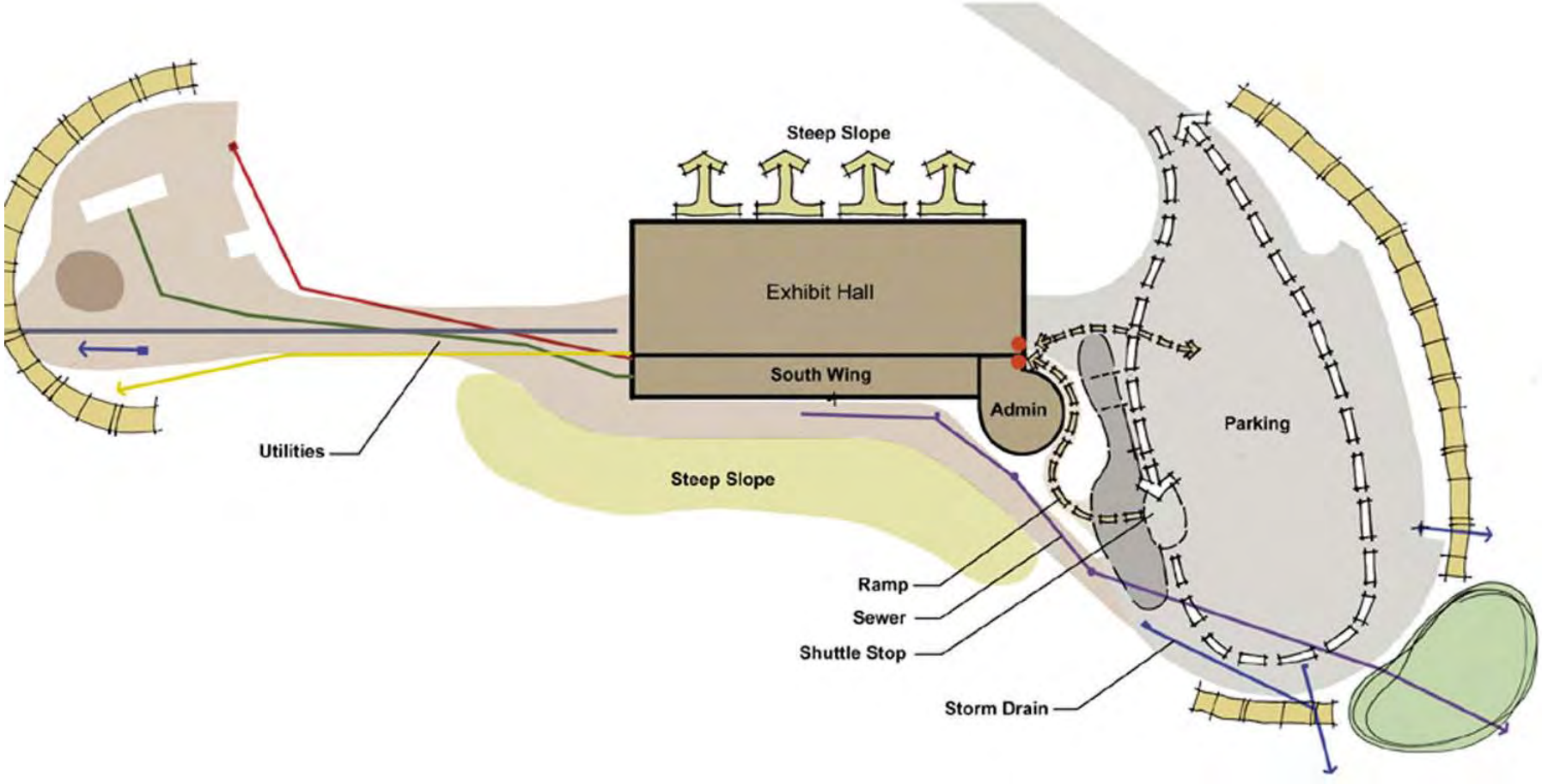

FIGURE 9. SITE LAYOUT FOR EXISTING CONDITIONS UNDER ALTERNATIVE A (NO ACTION)

ALTERNATIVE B, THE PREFERRED ALTERNATIVE – REHABILITATE OR REPLACE THE EXHIBIT HALL AND CONSTRUCT A NEW FACILITY OFF-SITE

This alternative would provide for a shelter and interpretive area at the fossil wall, either by rehabilitating the existing 10,800-square-foot Exhibit Hall or constructing a new structure to provide opportunities for visitors to view the dinosaur bones *in situ*. This alternative would minimize facilities at the Quarry Visitor Center site and allow new interpretive experiences to be developed and showcased at a new location where soils are more stable.

The existing Administrative Wing, South Wing, and Serpentine Entry Ramp would be demolished. Functions provided in these sections of the Quarry Visitor Center, including the bookstore, administrative offices, and much of the interpretive programming space, would be relocated to the shuttle staging area site. The functional spaces currently located in the Administrative Wing and South Wing (other than the paleontology laboratory and library collections and curatorial functions being relocated to the Vernal facility) would be replaced by construction of a new 8,000 to 10,000-square-foot visitor center structure designed to meet park safety, interpretation, operation, and maintenance needs (see Figure 2 for relation to the Quarry Visitor Center site). To the extent practicable, designs for the new structure would incorporate the existing facility, but demolition and reconstruction of some features at the site could be expected.

The new visitor center and administrative offices would accommodate the current needs of the monument, which have changed considerably since the original building's construction. It would be designed to protect public and employee health, safety, and welfare by meeting Occupational Safety and Health Administration standards, the Architectural Barriers Act Accessibility Standard, the Uniform Building Code, and National Fire Codes for safe and effective entry and exit and by reducing the need for maintenance activities that currently pose potential hazards. Fire protection and intrusion alarm systems would be included in the buildings. Primary restroom facilities would be provided at the new visitor center. Utilities, including electricity, potable, water, propane, and connections to the monument's waste water treatment facility, already exist at the site.

Space within the new structure would be organized to give visitors a sense of entry, provide greeting and orientation space, facilitate efficient circulation patterns, and improve integration of the exhibit area and the bookstore. Space would be available for bookstore and storage, exhibits, restrooms, special programs, and off-season fee collection activities.

Space would be organized to improve staff operational efficiency. Staff facilities would include space for storage, offices with closed doors for supervisors to discuss personnel matters in private, multipurpose room, work areas, a room that could be used by staff for lunches and breaks, employee restrooms, janitor closets, first aid, and other functions.

The 10,800 square foot Exhibit Hall that protects the fossil wall would be rehabilitated or replaced with a new resource-protection structure designed to provide protection of

fossils *in situ* on the quarry wall and opportunities for visitors to view the fossils. This alternative would use the best methods to ensure protection of the fossil wall and longevity of the structure.

Under the rehabilitation scenario, the Exhibit Hall steel/glass superstructure would be stabilized and rehabilitated, if practicable, to eliminate structural deficiencies, improve ventilation, and reduce access for moisture, vermin, and bats and birds. Stability of the Exhibit Hall foundation would be improved through the installation of structural piers drilled to a depth of approximately 65 to 85 feet below grade. Metal fabricated elements of the Exhibit Hall would be straightened or replaced in-kind. The glass window-wall, now a patchwork of different types and shades of glass and other transparent materials, would be replaced with materials and designs that would replicate the original design, but would include a new fastening system and modern materials with improved energy efficiency and ultraviolet ray reduction.

Other structural elements would be retained or replaced in kind. The first and second floor visitors' gallery would be completely rehabilitated with new floors and improved exhibit and interpretation space. The structure would also receive upgrades to utility and high-volume air-conditioning systems. The traveling gantry crane would be salvaged, rehabilitated, and reused. The rehabilitated structure would be designed to protect public and employee health, safety, and welfare by meeting Occupational Safety and Health Administration standards, the Architectural Barriers Act Accessibility Standard, the Uniform Building Code, and National Fire Codes for safe and effective entry and exit and by reducing the need for maintenance activities that currently pose potential hazards. Fire protection and intrusion alarm systems would be included in the buildings.

In the event that further investigations, monitoring and testing of the Quarry Visitor Center indicate that the Exhibit Hall cannot be safety rehabilitated, the entire building would be demolished, a new structure would be constructed to protect the fossil wall, and the administrative and visitor center functions would be contained in a new building at the shuttle staging area.

If rehabilitation of the Exhibit Hall is not feasible, a new resource-protection structure would be constructed to preserve the fossil wall. The new building would emphasize resource protection and would be designed and constructed to avoid problems associated with underlying expansive soils. New structural piers would be installed to a depth of approximately 65 to 85 feet to ensure the stability of the new foundation. The roof canopy would cover the fossil wall, in its entirety, and provide protection from weather, moisture, vermin, and bats and birds. The new structure would also provide limited exhibit and interpretive space. Roof drainage would channel water away from the foundation to eliminate risks resulting from expansive soils. Areas near the building would be topographically surveyed, and the ground would be graded and surfaced to facilitate drainage away from the structure.

Other possible site improvements, such as the addition of a covered waiting area, benches, vault toilet, and regrading of the service drive, would likely be included upon detailed design. No facilities requiring plumbing would be constructed on site, due to the

moisture-sensitive soils. The primary restrooms would be located at the replacement visitor center.

To ensure protection of the fossil wall, public and worker safety, and visitor experience during demolition and construction activities, mitigation measures listed after the alternatives have been incorporated as part of this alternative. These measures have been identified to achieve the greatest degree of protection of park resources. These measures would include using special demolition and excavation techniques to minimize impacts to the fossil wall collection, covering the fossils, and closely monitoring ground-disturbing or structural work that could cause vibrations in the quarry area (see Table 2 and discussion in the Cultural Resources section of this document).

To minimize ground disturbance during project implementation, all staging areas, materials stockpiling, vehicle storage, batch plants, and other construction-related facilities and areas would be located in a previously disturbed area or on hardened surfaces. Candidate sites could include the shuttle staging area and Quarry Visitor Center parking areas, the vehicle overflow turn-out adjacent to the Quarry Visitor Center road, and areas south and west of the Quarry Visitor Center.

Using the shuttle staging area as the location for the new visitor center would allow the park to continue many of the visitor education and interpretation activities that were implemented in the summer of 2006. Monument staff would provide ranger-led hikes and walks, children's activities, and the Junior Paleontology program. Rangers would continue to give interpretive talks about the monument, and provide increased opportunities for visitors to experience the monument's natural and cultural resources beyond those of the fossil wall.

As described for Alternative A, the structural monitoring program would continue through development of the new facilities. Following completion of the rehabilitated or new resource protection structure, the structural monitoring program would be revised to meet the needs of the new structure. Because the underlying expansive soils, wind, temperature changes, and moisture would continue, long-term structural monitoring would enable the NPS to identify and address problems as they develop and enhance building stability and sustainability.

The quarry site Exhibit Hall concept and site layout for Alternative B are presented in Figures 10 and 11. The new visitor center building concept and site layout for Alternative B are presented in Figures 12 and 13. These figures are general representations of the alternative; the actual site layout and appearance and configuration of the new replacement structure would be determined later during design stages.

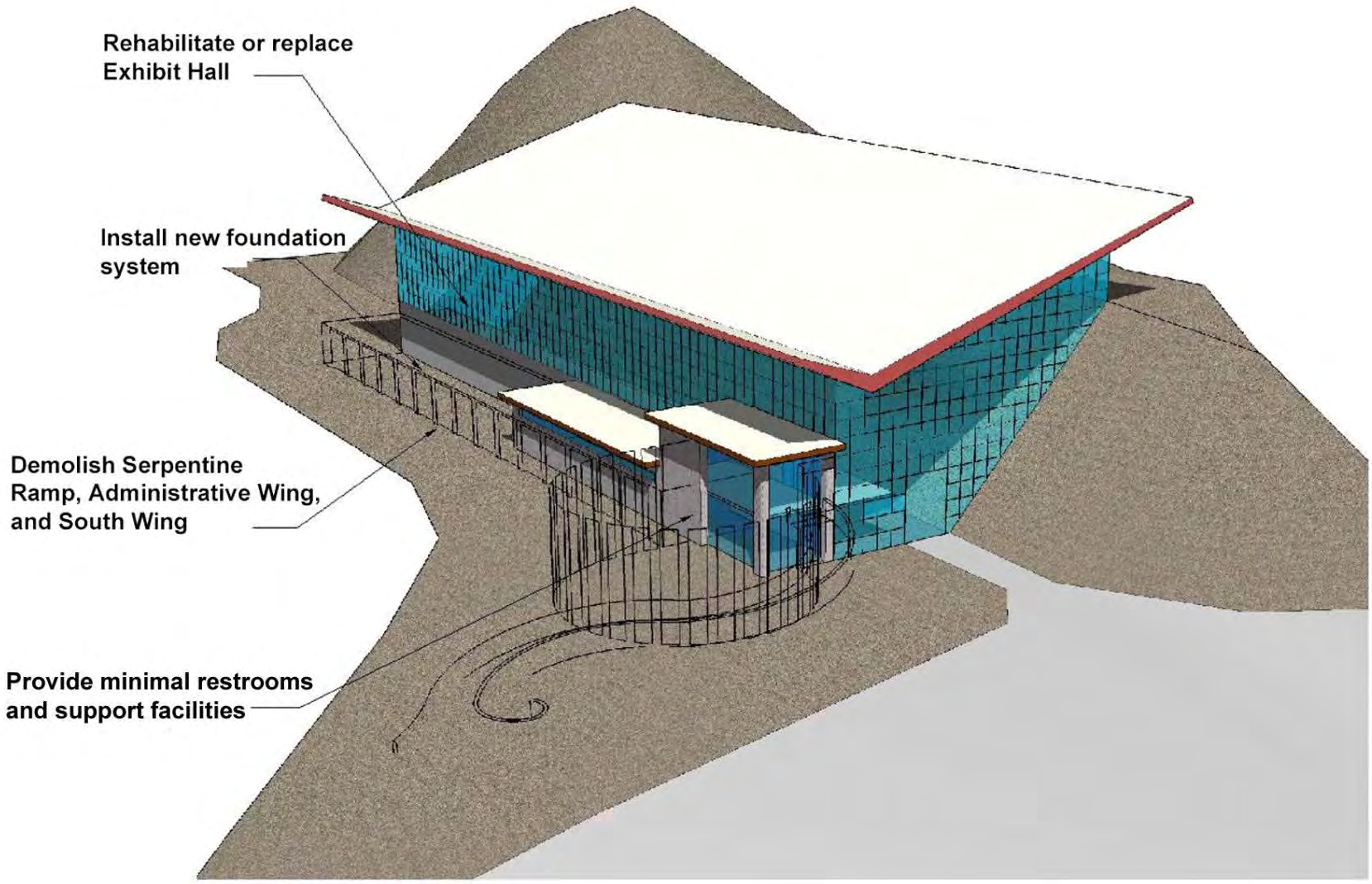

FIGURE 10. ALTERNATIVE B EXHIBIT HALL CONCEPT
(THE PREFERRED ALTERNATIVE – REHABILITATE OR REPLACE THE EXHIBIT HALL AND CONSTRUCT A NEW FACILITY OFF-SITE)

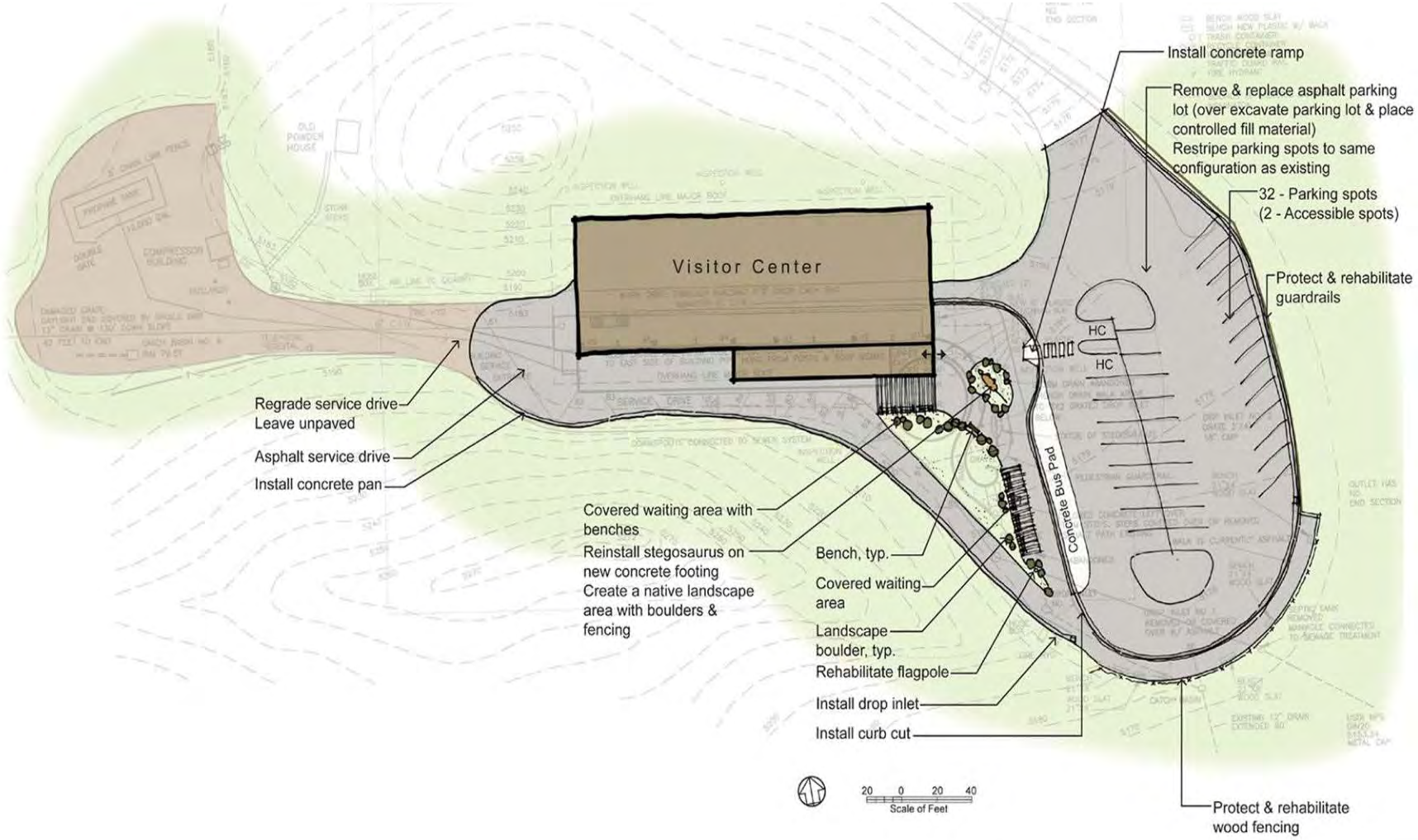

FIGURE 11. ALTERNATIVE B QUARRY SITE LAYOUT CONCEPT
(THE PREFERRED ALTERNATIVE – REHABILITATE OR REPLACE THE EXHIBIT HALL AND CONSTRUCT A NEW FACILITY OFF - SITE)

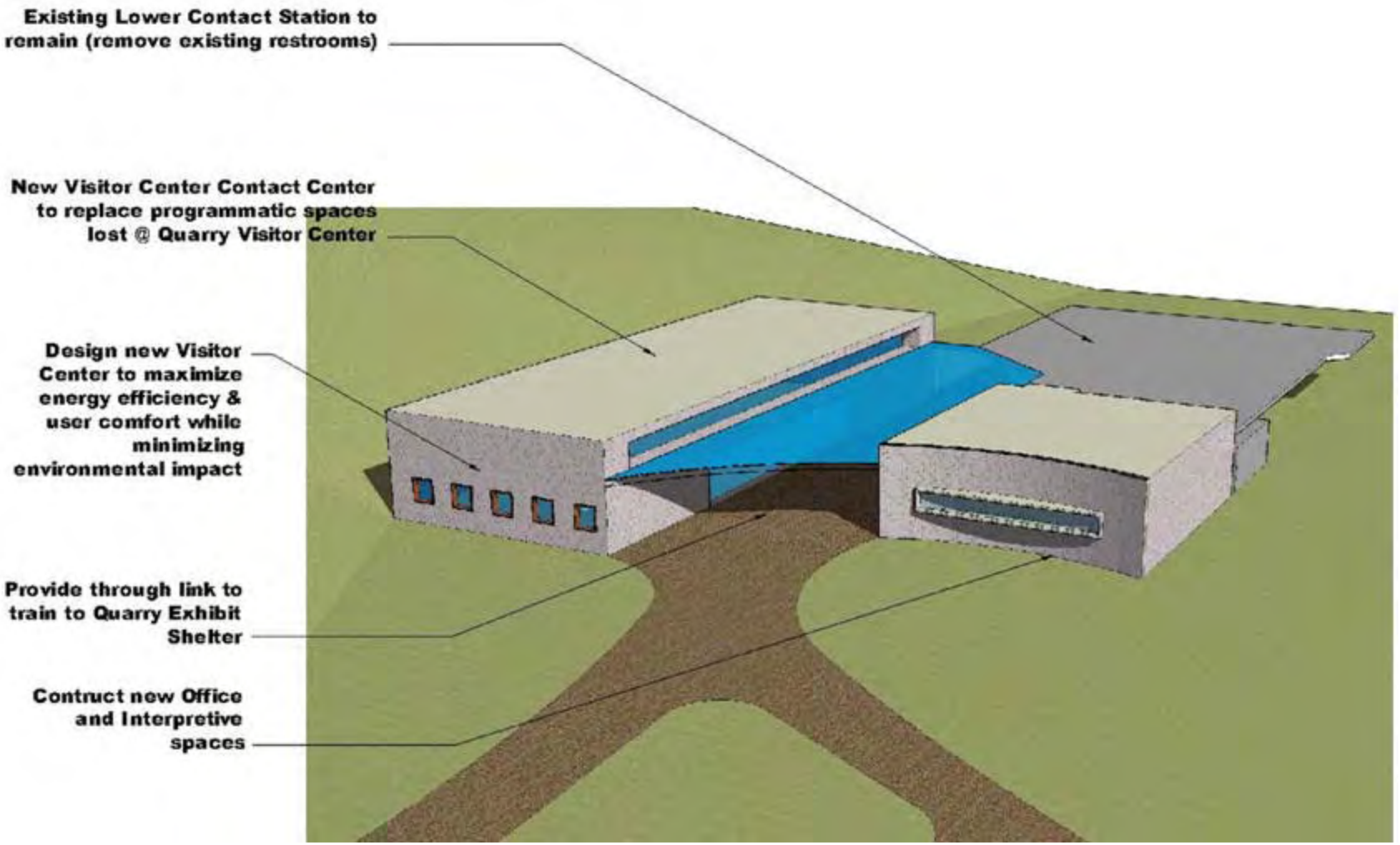

FIGURE 12. ALTERNATIVE B NEW VISITOR CENTER CONCEPT
(THE PREFERRED ALTERNATIVE – REHABILITATE OR REPLACE THE EXHIBIT HALL AND CONSTRUCT A NEW FACILITY OFF-SITE)

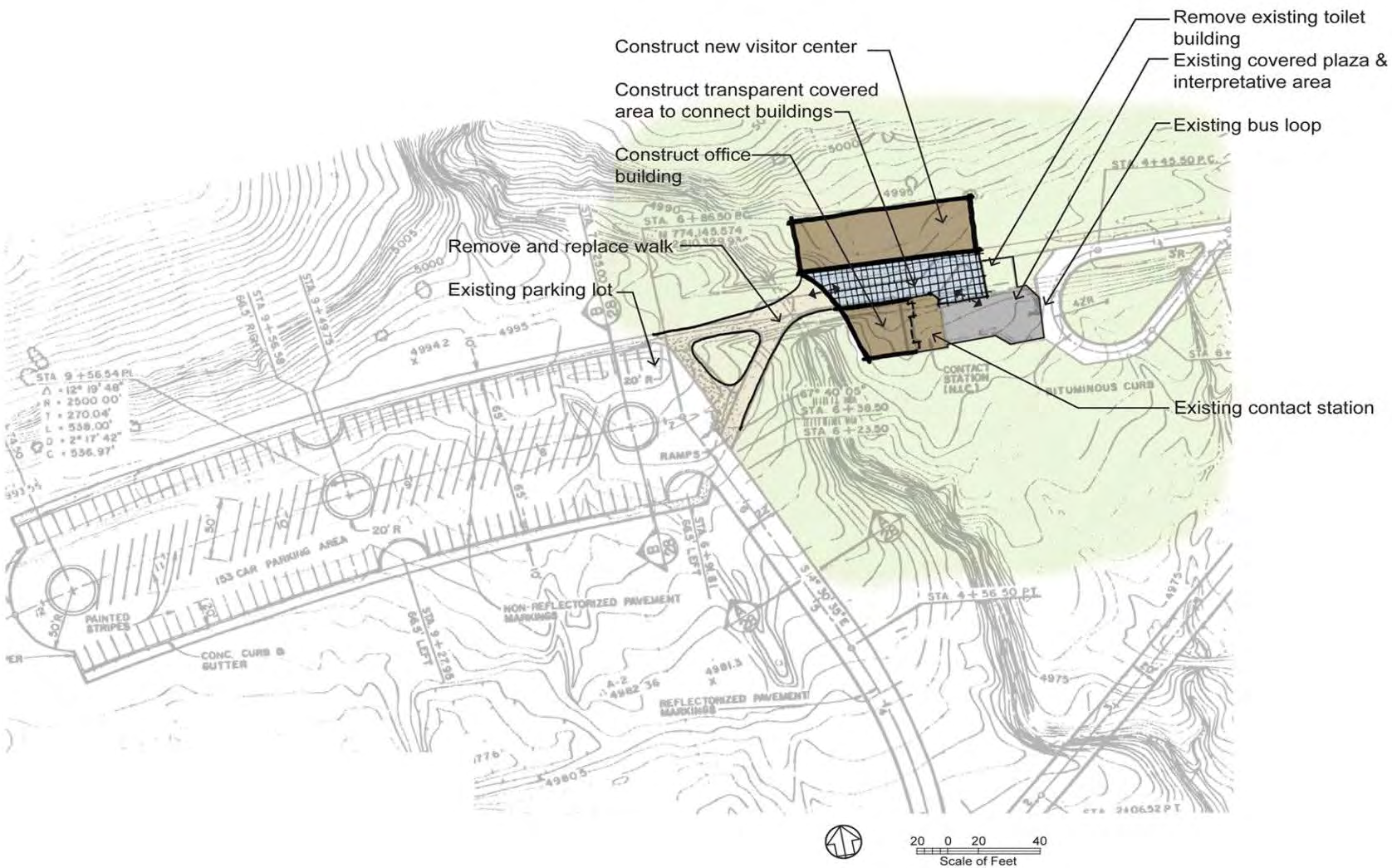

FIGURE 13. ALTERNATIVE B NEW VISITOR CENTER SITE LAYOUT CONCEPT
(THE PREFERRED ALTERNATIVE – REHABILITATE OR REPLACE THE EXHIBIT HALL AND CONSTRUCT A NEW FACILITY OFF - SITE)

ALTERNATIVE C – RETAIN THE EXHIBIT HALL AND CONSTRUCT A NEW FACILITY AT THE QUARRY VISITOR CENTER SITE

This alternative would retain and rehabilitate the 10,800 - square - foot Exhibit Hall and demolish the Administrative Wing, South Wing, and Serpentine Entry Ramp. These three components would be replaced with an approximately 6,400 - square - foot structure designed to meet park safety, interpretation, operation, and maintenance needs.

To ensure protection of the fossil wall, public and worker safety, and visitor experience during demolition and construction activities, mitigation measures listed after the alternatives have been incorporated as part of this alternative. These measures have been identified to achieve the greatest degree of protection of park resources. These measures would include special demolition and excavation techniques to minimize impacts to the fossil wall collection, covering the fossils, and closely monitoring ground - disturbing or structural work that could cause vibrations in the quarry area.

The Exhibit Hall superstructure would be stabilized and rehabilitated to help eliminate structural deficiencies, improve ventilation, and reduce access for moisture, vermin, and bats and birds. The Exhibit Hall foundation stability would be improved through the installation of structural piers drilled to a depth of approximately 65 to 85 feet below grade. Metal fabricated elements of the Exhibit Hall would be straightened or replaced in - kind. The glass window - wall, now a patchwork of different types and shades of glass and other transparent materials, would be replaced with materials and designs that would replicate the original design, but would include a new fastening system and modern materials with improved energy efficiency and ultraviolet ray reduction. Other structural elements would be retained or replaced in kind. The first and second floor visitors' gallery would be completely rehabilitated with new floors and improved exhibit and interpretation space. The structure would also receive upgrades to utility and high - volume air - conditioning systems. The traveling gantry crane would be salvaged, rehabilitated, and reused. The connection walls or structural elements between the Exhibit Hall and the new structures would be constructed in a manner that would eliminate stress on the structural elements of the Exhibit Hall.

The Serpentine Entry Ramp, Administrative Wing, and South Wing would be demolished and replaced with a new structure. The new structure would not be designed to replicate the appearance of the existing wings and ramp.

The existing foundation system beneath the wings would be removed to accommodate the installation of a new foundation for the replacement structure. The new foundation would include drilled piers as footings and a "crawl space" beneath the concrete flooring. This void space would elevate the new floor slabs above the underlying expansive soils and reduce the effects of shrink - swell on the new structure.

The replacement structure would be built to accommodate the current needs of the monument, which have changed considerably since the building's construction. It would be designed to protect public and employee health, safety, and welfare by meeting

Occupational Safety and Health Administration standards, the Architectural Barriers Act Accessibility Standard, the Uniform Building Code, and National Fire Codes for safe and effective entry and exit and by reducing the need for maintenance activities that currently pose potential hazards. Fire protection and intrusion alarm systems would be included in the building.

The replacement structure would include a lift or ramp that would provide access to people with impaired mobility.

Space within the new structure would be organized to give visitors a sense of entry, provide greeting and orientation space, facilitate efficient circulation patterns, and improve integration of the exhibit area and the bookstore. Space would be available for bookstore and storage, exhibits, restrooms, special programs, and off-season fee collection activities.

Space would be organized to improve staff operational efficiency. Staff facilities would include space for meetings and storage, offices with closed doors for personnel matters, multipurpose rooms, research areas, a room that could be used by staff for lunches and breaks, employee restrooms, janitor closets, first aid, and other functions.

The Quarry Visitor Center's current location provides ready access to all utilities necessary to support a visitor center and Exhibit Hall. These include electricity, potable water, propane, and connection to the monument's wastewater treatment facility. Most utilities currently run within the Administrative Wing and South Wing of the building rather than the Exhibit Hall. As a result, construction of a new structure in this area would provide an opportunity to completely replace the utilities contained within the existing building. Systems that would be replaced, modified, or installed to improve safety and energy efficiency would include the heating and cooling mechanical system; lighting system; fire sprinkler system; water and wastewater systems and plumbing; and electrical, communication, and security systems.

The belowground water and sewer lines that are adjacent to the Quarry Visitor Center would be replaced to ensure that water would not leak into the expansive soils in the building vicinity. Manholes and broken sewer pipes, especially those at the south foundation that have been displaced by expansive soils, would be replaced.

New utility systems serving the visitor center would be designed for ease of access for maintenance. Locations and designs for the water and wastewater lines would be carefully engineered to avert flooding of the building or wetting of the soil in the immediate vicinity of the building in the event of a water leak. Utility monitoring systems would be installed to give early warning of any leaks or potential problems.

Roof drainage would be modified to provide adequate capacity and to channel water away from the foundation. Areas near the building would be topographically surveyed, and the ground would be graded and surfaced to facilitate drainage away from the building.

Approximately 300 linear feet of concrete barriers, curb, and gutters would be installed to prevent sloughing from the hillside south of the visitor center. Other possible site

improvements, such as the addition of an interpretive shelter, covered waiting area, benches, and regrading of the service drive, would likely be included upon detailed design.

To minimize ground disturbance during project implementation, all staging areas, materials stockpiling, vehicle storage, batch plants, and other construction-related facilities and areas would be located in a previously disturbed area or on hardened surfaces. Candidate sites could include the shuttle staging area and Quarry Visitor Center parking areas, the vehicle overflow turn-out adjacent to the Quarry Visitor Center road, and areas south and west of the Quarry Visitor Center.

As described for Alternative A, the structural monitoring program currently implemented by the NPS would continue. This program would continue through development of the new facility. Following completion of the new Quarry Visitor Center, the structural monitoring program would be revised to meet the needs of the new structure. Because the underlying expansive soils, wind, temperature changes, and moisture would continue to affect the Exhibit Hall and new components of the visitor center, long-term structural monitoring would enable the NPS to identify and address problems as they develop and enable enhanced building stability and sustainability.

Demolition, stabilization, and construction activities associated with Alternative C would last approximately 2 years, and the Quarry Visitor Center would remain closed during this time. As in Alternative A, visitor activities such as interpretive talks, exhibits, demonstrations, children and family programs, bookstore sales, and temporary paleontological exhibits would be relocated to alternate locations to ensure that the monument's primary interpretive messages were delivered.

The building concept and site layout for Alternative C are presented in Figures 14 and 15, respectively. These figures are general representations of the alternative; the actual site layout and appearance and configuration of the new replacement structure would be determined later during design stages.

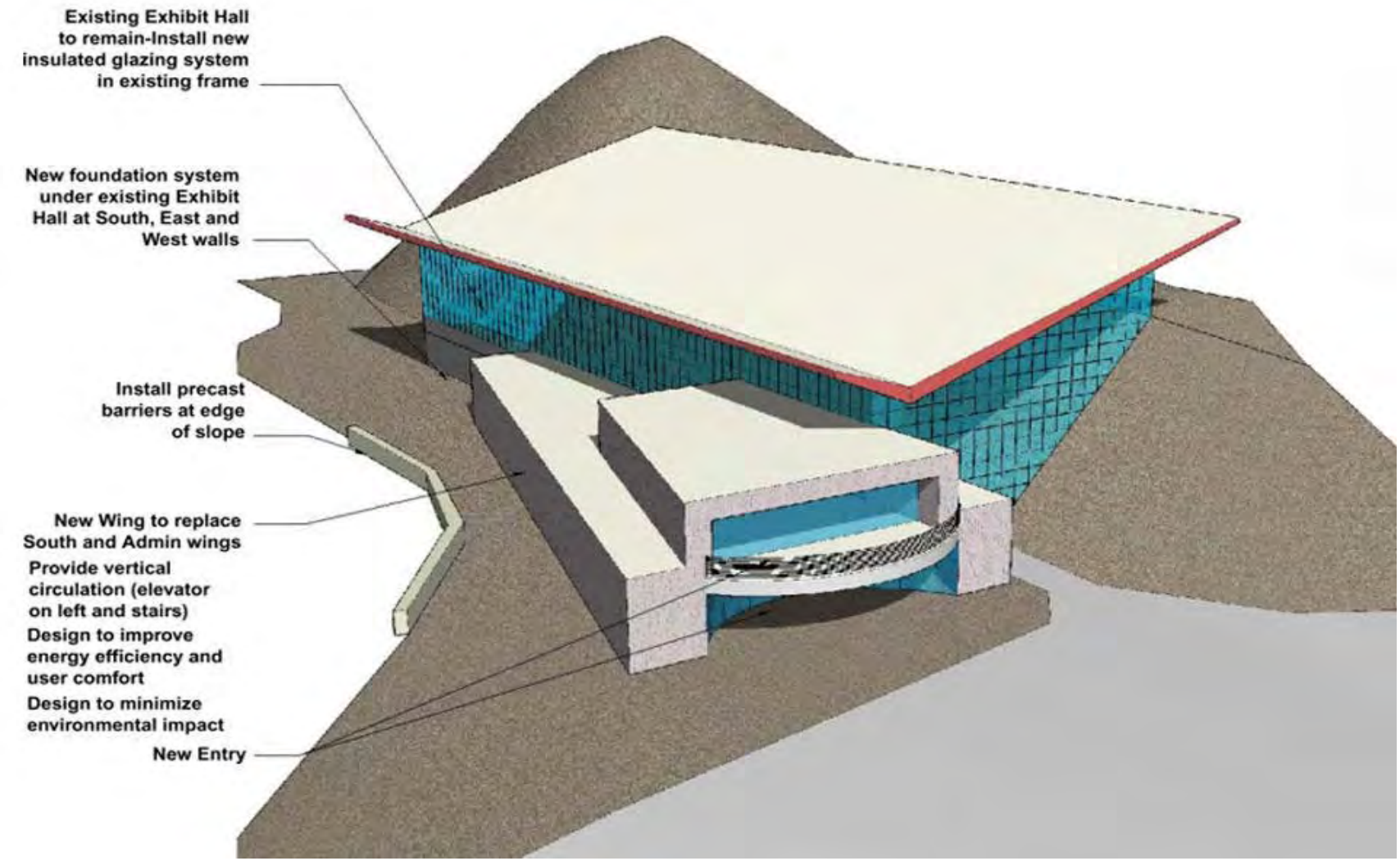

FIGURE 14. ALTERNATIVE C CONCEPT
(RETAIN THE EXHIBIT HALL AND CONSTRUCT A NEW FACILITY AT THE QUARRY VISITOR CENTER SITE)

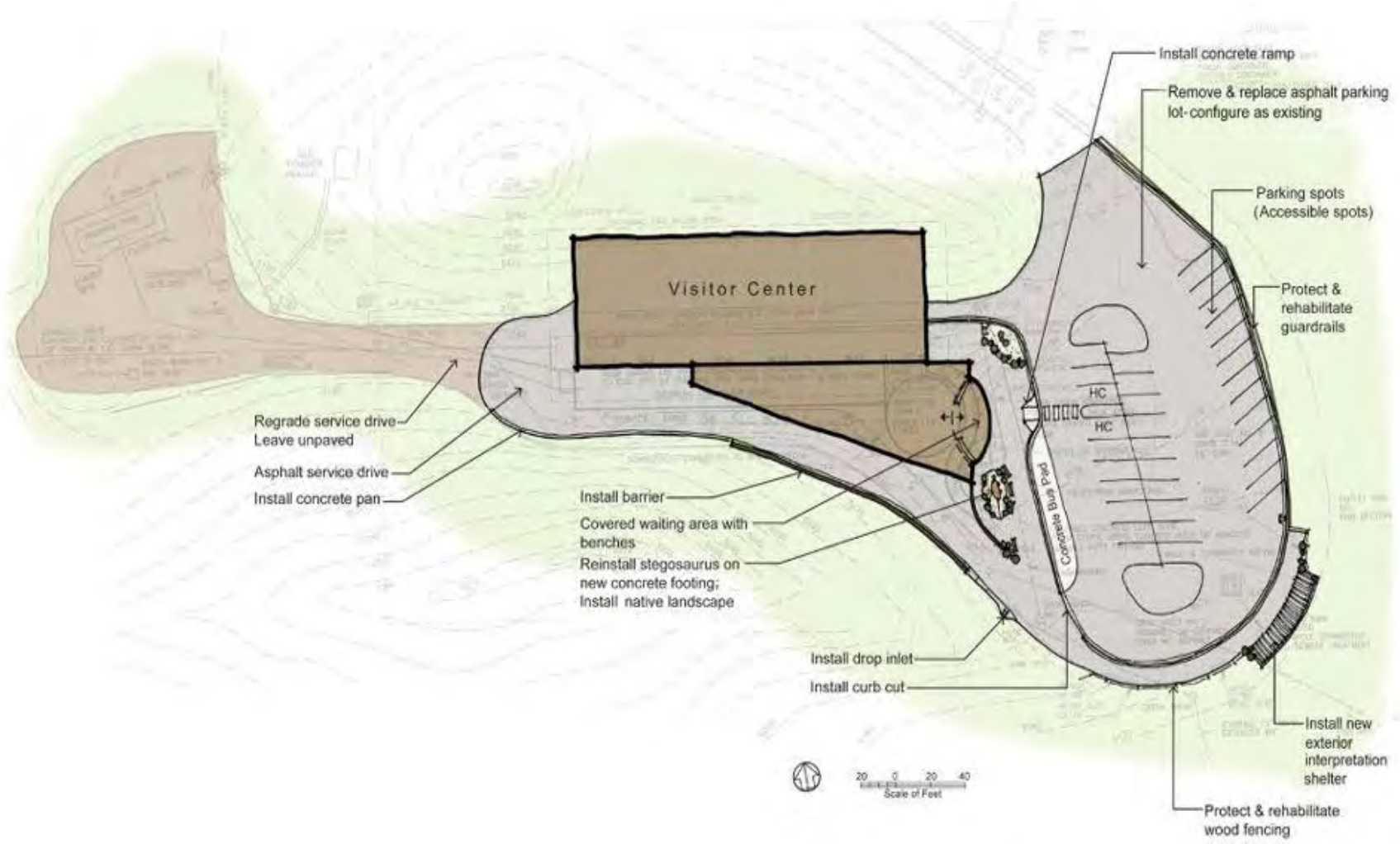

FIGURE 15. ALTERNATIVE C SITE LAYOUT CONCEPT
(RETAIN THE EXHIBIT HALL AND CONSTRUCT A NEW FACILITY AT THE QUARRY VISITOR CENTER SITE)

ALTERNATIVE D – RETAIN THE EXHIBIT HALL AND RECONSTRUCT WINGS SIMILAR TO EXISTING FACILITY

This alternative would retain and rehabilitate the Exhibit Hall and the Serpentine Entry Ramp and demolish the Administrative and South Wings. These components would be replaced with new structures, constructed with similar materials to replicate the basic form, appearance, and scale of the original structure.

As described for Alternative B, mitigation measures presented in Table 2 have been incorporated as part of this alternative. These measures would achieve the greatest degree of protection of park resources and would be implemented during demolition and construction (see Table 2, Mitigation Measures, for additional information).

Similar to Alternative C, the Exhibit Hall steel/glass superstructure would be stabilized and rehabilitated to help eliminate structural deficiencies, improve ventilation, and reduce access for moisture, vermin, and bats and birds. The Exhibit Hall foundation would be improved through the installation of structural piers drilled to a depth of approximately 65 to 85 feet below grade. Metal fabricated elements of the Exhibit Hall would be straightened or replaced in-kind. The glass window-wall would be replaced with materials and designs that replicate the original design, but would include a new fastening system. Other structural elements would be retained or replaced in kind. The first and second floor visitors' gallery floor plan and layout would be rehabilitated consistent with the original design. The structure would also receive upgrades to utility and high-volume air-conditioning systems. The gantry crane would be salvaged, rehabilitated, and reused. The connection walls or structural elements between the Exhibit Hall and the new, rebuilt structures would be constructed in a manner that would eliminate stress on the structural elements of the Exhibit Hall.

The Serpentine Entry Ramp would be retained, stabilized, and restored to replicate its historic condition, i.e., with stairs at the bottom of the ramp (a description of the Serpentine Entry Ramp is provided in the "Description of the Project Area" section). The ramp would be reinstalled and continue to provide the main entry into the Quarry Visitor Center. As in its historic condition, the ramp would not be accessible to those with mobility impairments.

The Administrative Wing and South Wing would be demolished. Components suitable for salvage and reuse, such as original fixtures and furniture, would be retained and reused in the new wings. To ensure protection of the fossil wall during demolition activities, mitigation measures would be implemented, such as developing special demolition and excavation techniques to minimize impacts, covering the fossils, and closely monitoring and ground disturbing or structural work that could cause vibrations in the quarry area (see Table 2, Mitigation Measures, for additional information).

The Administrative Wing and South Wing would be designed and reconstructed to replicate the original building's form and appearance as closely as possible, using salvaged and new materials (with consultation with the Utah State Historic Preservation Officer). The existing foundation system beneath the Administrative and South Wings would be removed to

accommodate the installation of a new foundation for the replacement structure. Similar to that described for Alternative C, the new foundation system would use drilled piers and an excavated void beneath the new concrete floors to reduce the effects of expansive soils on the new structure.

Similar to Alternative C, the rebuilt wings would incorporate elements to protect public and employee health, safety, and welfare by meeting Occupational Safety and Health Administration standards, the Architectural Barriers Act Accessibility Standard, Uniform Building Code and National Fire Codes for safe and effective entry and exit and by reducing the need for maintenance activities that currently pose potential hazards. The wings would include an accessible lift or ramp. Fire protection and intrusion alarm systems would be included in the building.

Space would be optimized as much as possible while working within the constraints of the existing floor layout (in consultation with the Utah State Historic Preservation Officer). Staff facilities would include space for meetings and storage, multipurpose room and research area, lunchroom/breakroom, employee restrooms, janitor closets, first aid, and other similar functions. Space would also be available for bookstore and storage, exhibits, restrooms, special programs, and off-season fee collection activities.

Just as in Alternative C, the following would be replaced, modified, or installed: the heating and cooling mechanical system; energy efficient lighting systems; fire sprinkler system; water, waste systems, and plumbing; and electrical, communication, and security systems. The belowground water and sewer lines that are adjacent to the Quarry Visitor Center would be replaced to ensure that no water leaks into the expansive soils in the building vicinity. Manholes and broken sewer pipes, especially those at the south foundation that have been displaced by expansive soils, also would be replaced.

The installation, replacement, or modification of utilities would be the same as described for Alternative C. Water and sewer lines would be replaced and carefully engineered to ensure that no water leaks into the expansive soils in the building vicinity. New utility systems would be designed for accessible maintenance, and utility monitoring systems would be installed to give early warning of any leaks or potential problems.

Roof drainage would also be modified as described in Alternative C to facilitate drainage away from the building. To prevent sloughing from the hillside south of the visitor center, approximately 300 linear feet of concrete barriers, curb, and gutters would be installed.

Other possible site improvements, such as the addition of an interpretive shelter, covered waiting area, benches, and regrading of the service drive, would likely be included upon detailed design.

To minimize ground disturbance during project implementation, all staging areas, materials stockpiling, vehicle storage, batch plant(s), and other construction-related facilities and areas would be located in a previously disturbed area or on hardened surfaces such as in the shuttle staging area and Quarry Visitor Center parking areas, at the vehicle overflow turn-

out adjacent to the Quarry Visitor Center road, and on the south and west sides of the Quarry Visitor Center.

As described for Alternative A, structural monitoring initiated by the NPS would continue through construction and rehabilitation of the facilities. Following completion of the Quarry Visitor Center rehabilitation, the structural monitoring program would be revisited and modified as appropriate to meet the future needs of the visitor center in this area. Because the underlying expansive soils, wind, temperature changes, and moisture would continue to affect both the Exhibit Hall and the new components of the visitor center, future structural monitoring would be needed to evaluate building stability and sustainability.

All demolition, stabilization, and construction activities associated with Alternative D would be expected to last approximately 2 years, and the Quarry Visitor Center would remain closed during this time. As described for Alternative A, the NPS would continue to offer alternative interpretive opportunities and services at suitable locations during the closure.

The building concept and site layout for Alternative D are presented in Figures 16 and 17, respectively. These figures are general representations of the alternative; the actual site layout and design would be determined later during design stages.

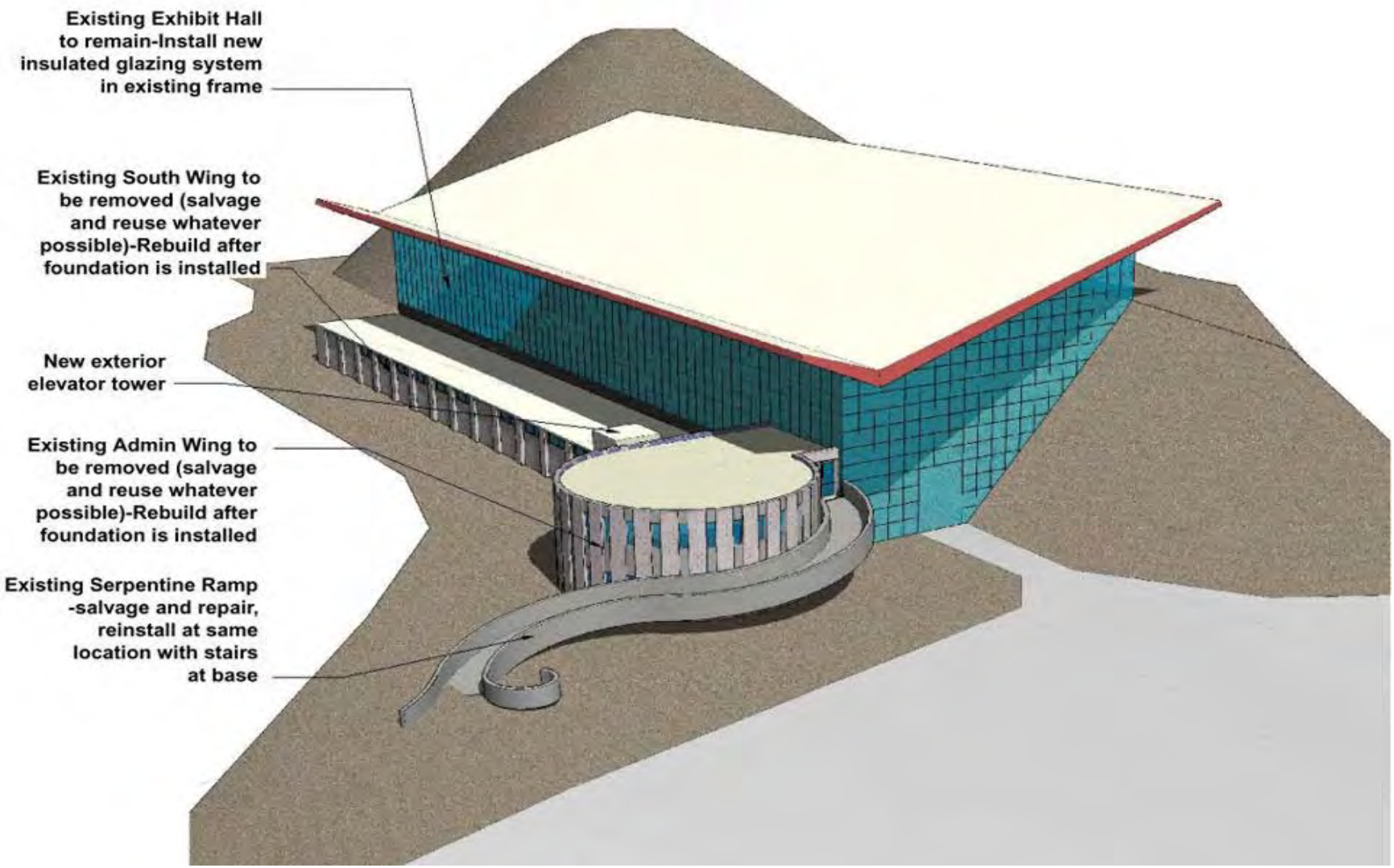

FIGURE 16. ALTERNATIVE D CONCEPT
(RETAIN THE EXHIBIT HALL AND RECONSTRUCT WINGS SIMILAR TO EXISTING FACILITY)

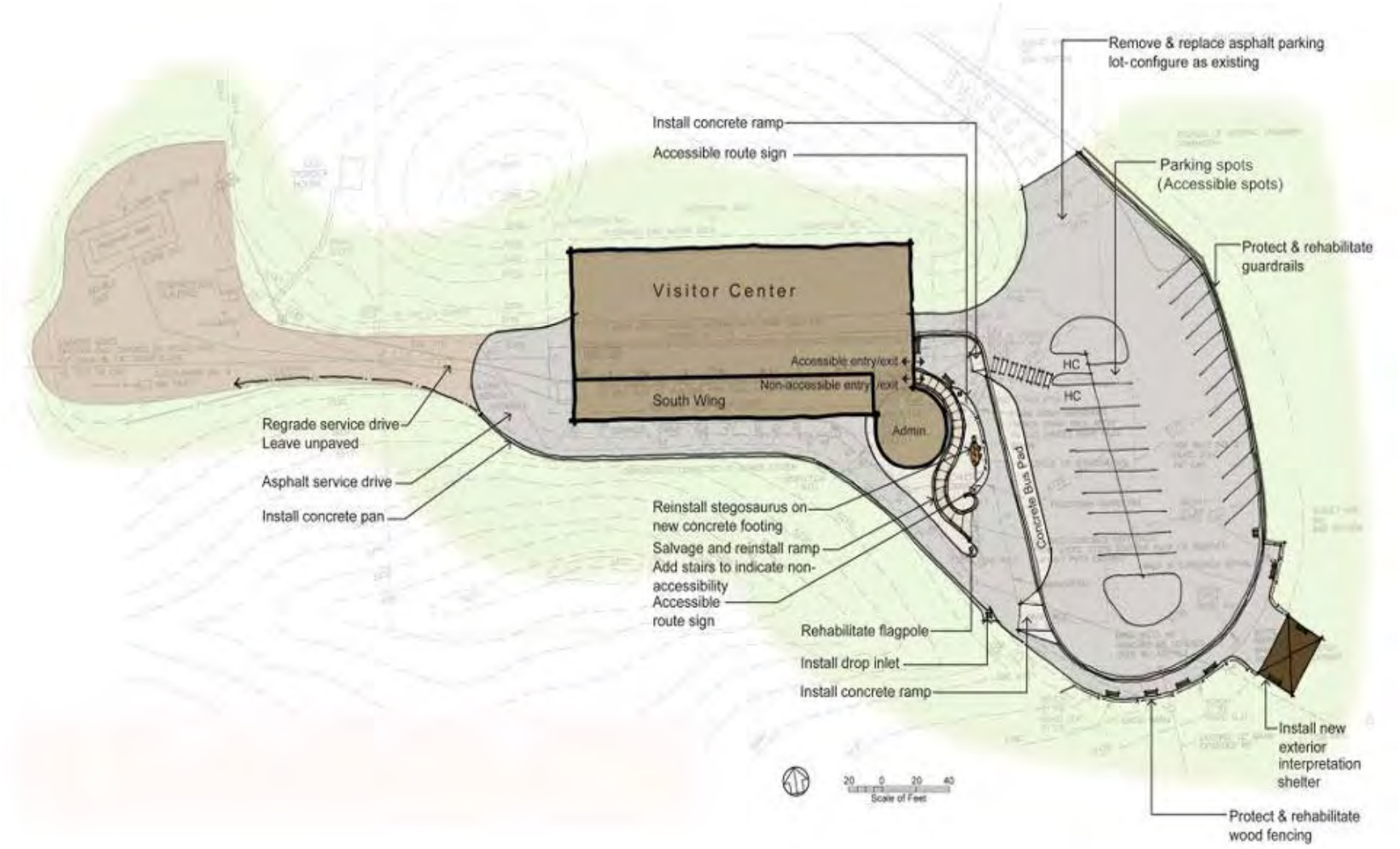

FIGURE 17. ALTERNATIVE D SITE LAYOUT CONCEPT
(RETAIN THE EXHIBIT HALL AND RECONSTRUCT WINGS SIMILAR TO EXISTING FACILITY)

ALTERNATIVE E – DEMOLISH THE ENTIRE FACILITY AND CONSTRUCT A NEW FACILITY AT EXISTING QUARRY VISITOR CENTER SITE

This alternative would demolish the structure in its entirety and construct a new 13,000-square-foot visitor center designed to provide protection of fossils *in situ* on the quarry wall and to meet park interpretation, operation, and maintenance needs. As described for Alternatives B, C, and D, mitigation measures listed after the alternatives have been incorporated as part of this alternative. These measures would achieve the greatest degree of protection of park resources and would be implemented during demolition and construction.

The new building would be engineered and constructed to avoid structural problems associated with underlying expansive soils. A poured concrete foundation system would be installed, with structural piers drilled to a depth of approximately 65 to 85 feet to ensure the stability of the new foundation. The new building would have improved ventilation and be appropriately sealed to reduce access for moisture, vermin, and bats and birds. A large glass canopy utilizing a fastening system and energy-efficient glass would be constructed over the quarry. The gantry crane would be salvaged, rehabilitated, and reused.

The new visitor center would be built to accommodate the current needs of the monument, which have changed considerably since the building's construction. It would be designed to protect public and employee health, safety, and welfare by meeting Occupational Safety and Health Administration standards, the Architectural Barriers Act Accessibility Standard, Uniform Building Code and National Fire Codes for safe and effective entry and exit and by reducing the need for maintenance activities that currently pose potential hazards. It would include an accessible lift or ramp. Fire protection and intrusion alarm systems would be included in the building.

Space within the new structure would be organized to give visitors a sense of entry, provide greeting and orientation space, facilitate efficient circulation patterns, and improve integration of the exhibit area and the bookstore. Space would be available for bookstore and storage, exhibits, restrooms, special programs, and off-season fee collection activities.

Adequate space would also be available for staff facilities, including space for meetings and storage, offices with closed doors for personnel matters, multipurpose room and research area, lunchroom/breakroom, employee restrooms, janitor closets, first aid, and other functions.

The Quarry Visitor Center's current location provides ready access to all utilities necessary to support a visitor center and Exhibit Hall, including electricity, potable water, propane, and connection to the monument's wastewater treatment facility. The following utilities would be installed in the new visitor center: a heating and cooling mechanical system; energy efficient lighting systems; fire sprinkler system; water, waste systems, and plumbing; and electrical, communication, and security systems. All utility systems would be designed for accessible maintenance and located to ensure that no water leaks into the expansive soils in

the building vicinity. Utility monitoring systems would be installed to give early warning of any leaks or potential problems.

Roof drainage would be designed to facilitate drainage away from the building. To prevent sloughing from the hillside south of the visitor center, approximately 300 linear feet of concrete barriers, curb, and gutters would be installed.

Other possible site improvements, such as the addition of an interpretive shelter, covered waiting area, benches, and regrading of the service drive, would likely be included upon detailed design.

To ensure protection of the fossil wall during demolition activities, mitigation measures would be implemented such as developing special demolition and excavation techniques to minimize impacts, covering the fossils, and closely monitoring any ground disturbing or structural work that could cause vibrations in the quarry area (see Table 2, Mitigation Measures, for additional information).

To minimize ground disturbance during project implementation, all staging areas, materials stockpiling, vehicle storage, batch plant(s), and other construction-related facilities and areas would be located in a previously disturbed area or on hardened surfaces such as in the shuttle staging area and Quarry Visitor Center parking areas, at the vehicle overflow turn-out adjacent to the Quarry Visitor Center road, and on the south and west sides of the Quarry Visitor Center.

During project implementation, the monitoring program for Alternative E would emphasize protection of the fossil wall from construction hazards. Once the new facility was complete, a structural monitoring program would be initiated by the NPS to meet the future needs of the visitor center. Because the underlying expansive soils, wind, temperature changes, and moisture would continue to affect the new building, structural monitoring would be needed to evaluate building stability and sustainability.

All demolition, rehabilitation, and construction activities associated with Alternative E would be expected to last approximately 2 years, and the Quarry Visitor Center would be closed during this time. As described for Alternatives B, C, and D, the NPS would provide alternative interpretive opportunities and services at other locations during the project.

The building concept and site layout for Alternative E are presented in Figures 18 and 19, respectively. These figures are general representations of the alternative; the actual site layout and appearance and configuration of the new building would be determined later during design stages.

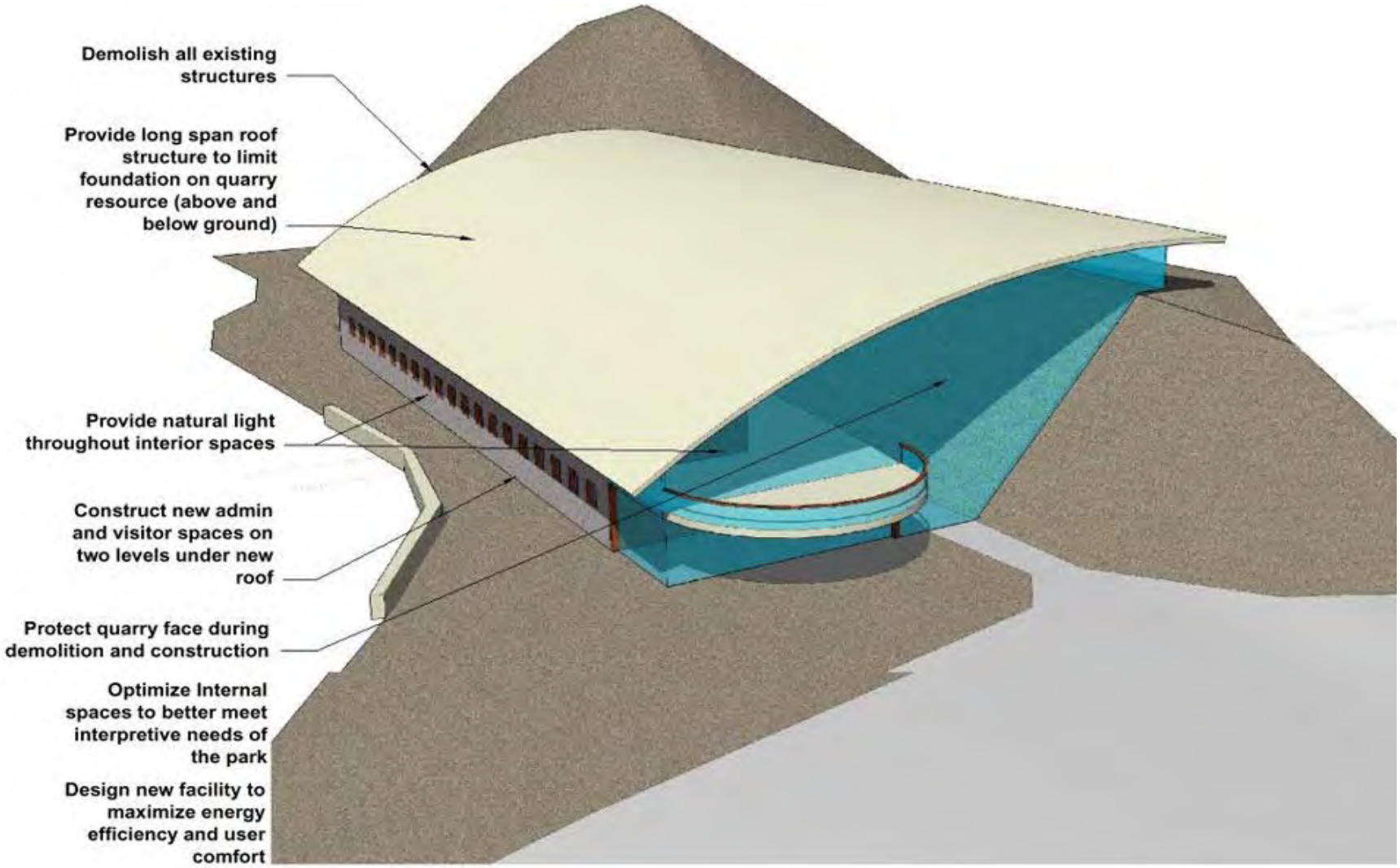

FIGURE 18. ALTERNATIVE E CONCEPT
(DEMOLISH THE ENTIRE FACILITY AND CONSTRUCT A NEW FACILITY AT EXISTING QUARRY VISITOR CENTER SITE)

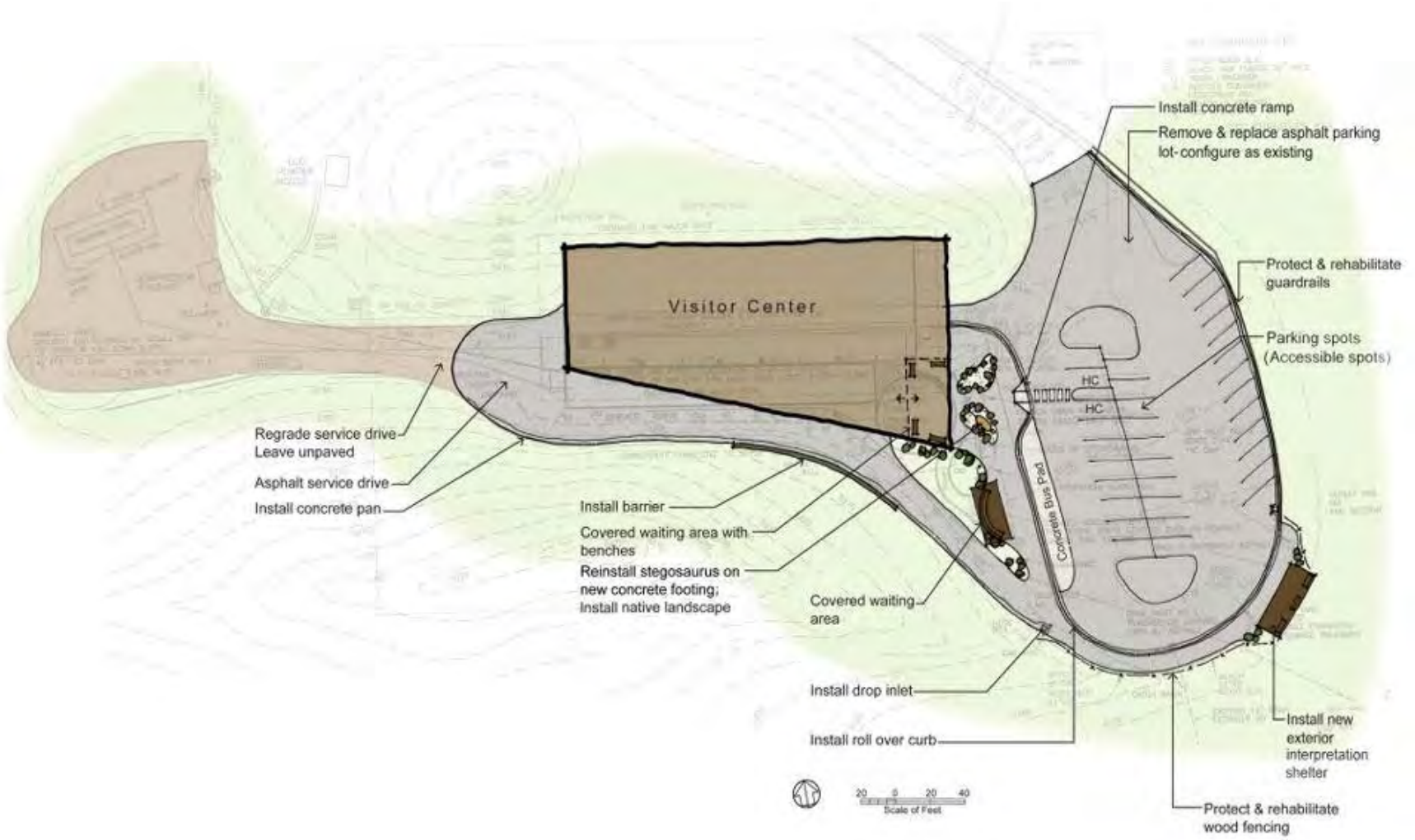

FIGURE 19. ALTERNATIVE E SITE LAYOUT CONCEPT
(DEMOLISH THE ENTIRE FACILITY AND CONSTRUCT A NEW FACILITY AT EXISTING QUARRY VISITOR CENTER SITE)

MITIGATION MEASURES

Under any of the action alternatives, best management practices and mitigation measures would be used to prevent or minimize potential adverse effects associated with the project. These practices and measures would be incorporated into the project construction documents and plans.

Mitigation measures undertaken during project implementation would include, but would not be limited to, those listed in Table 2. The impact analyses in the "Environmental Consequences" section were performed assuming that these best management practices and mitigation measures would be implemented.

TABLE 2. MITIGATION MEASURES

Resource Category/Action
Cultural Resources (including protection of the *in situ* fossil collection)
To protect the fossil wall, methods might include: • covering the fossils, • closely monitoring any ground disturbing or structural work that could cause vibrations in the quarry area, • developing special demolition and excavation techniques and equipment to minimize impacts, • sequencing of building deconstruction to limit potential impacts, • establishing barriers to reduce impacts transmitted through the soil, or hand-removing structural elements instead of using large equipment. To minimize ground disturbance, staging areas, materials stockpiling, vehicle storage, and other construction-related facilities and areas would be located in a previously disturbed area or on hardened surfaces away from the building. Mortar would be mixed at the staging areas and transported to the areas under construction. Monitoring instruments would be installed to ensure that vibrations from heavy machinery do not affect the fossil wall. To reduce unauthorized collecting, construction personnel would be educated about the need to protect any paleontological or cultural resources at the site, and about the illegality of collecting or removing fossils. Information would be provided to ensure necessary precautions when working around museum objects within the project area. Protective measures such as blankets and supports or framing would be in-place prior to beginning of work to prevent disturbance of the *in situ* fossil remains. Under Alternatives B, C, D, and E shoring and other protective measures would be established to protect the Exhibit Hall and the fossil wall from structural damage during demolition of other parts of the building.

TABLE 2. MITIGATION MEASURES

Resource Category/Action
The Exhibit Hall and gallery area glass would be removed before demolition/construction work began. Glass removal would be done carefully to prevent panes from shattering and/or falling onto fossil specimens or workers below.
If prehistoric or historic archeological resources are discovered during any portion of the proposed action, work in the area associated with the find would cease until evaluated by the monument's archeologist or designated representative, and procedures outlined in 36 CFR 800 would be followed, potentially including relocation of the work to a non-sensitive area to avoid further disturbance to the site until the significance of the find can be evaluated.
Discovered resources would be evaluated for their potential NRHP significance, and, if needed, mitigation measures would be developed in consultation with the Utah State Historic Preservation Officer and appropriate representatives of affected tribes. Mitigation measures would be cognizant of resource significance and preservation needs, and could include such provisions as changes in project design and/or archeological monitoring of the project and data recovery conducted by an archeologist meeting the Secretary of the Interior's standards.
Landscaping materials would be carefully chosen for their suitability for individual areas as well as compatibility with other park developed area landscaping
Paleontological Resources
Prior to completion of project designs, the monument's management staff and design team would meet with the monument's paleontologist to clarify construction schedules and sequences, review the status and condition of known paleontological resources, and develop a plan for paleontological monitoring of ground-disturbing site work, including demolition activities, soil removal, excavation for new foundations and piers, landscaping activities, and construction of temporary facilities.
Prior to ground-disturbing activities, any previously unrecorded paleontological resources, especially those thought to be exposed in the strata just east of the present Exhibit Hall, would be thoroughly documented. Protective coverings would be developed and installed to ensure that these resources are not harmed during the project.
Potential ground-disturbing activities such grading, drainage modifications, and structural wall and foundation rehabilitation would be carefully planned because these areas may harbor presently unknown paleontological resources. Previous construction activities would be reviewed to help identify potential resources.
Work limits would be established and clearly defined by fencing or other visible barriers to protect sensitive resources.
If paleontological resources are discovered during any portion of the proposed action, work in the area associated with the find would cease and work could be relocated to a non-sensitive area until discovered resources are evaluated by the monument's paleontologist. Construction documents would include stop-work provisions, should paleontological resources be uncovered, or if the exposed resources appear to be threatened. The contractor would be apprised of these protective measures during the pre-construction conference.
To reduce unauthorized collecting, construction personnel would be educated about the need to protect any paleontological resources at the site, about how to protect resources

TABLE 2. MITIGATION MEASURES

Resource Category/Action

inadvertently discovered during construction, and about the illegality of collecting or removing fossils. They would be given specific instructions about stopping construction work, protecting fossil remains from further disturbance, and immediately notifying park personnel if remains are found.

Public Health and Safety

An accident prevention plan, which would include job hazard analyses associated with each major phase of the proposed project, would be required. The plan would address:

- fires,
- power outages,
- windstorms and other natural events,
- the nature of the construction work,
- site conditions, and
- required project inspections and safety meetings.

Measures to reduce effects of demolition and construction on visitor safety and experience would be implemented, including different locations and types of barriers.

All trucks hauling demolition debris and other loose materials that could spill onto paved surfaces would be covered or would maintain adequate freeboard.

- The use of hazardous materials would be approved in advance, including: Analysis of explosive, flammable, poisonous, corrosive, oxidizing, or irritating substances (relative to their safe storage and use),
- Minimization of the use of hazardous chemicals, and
- Use of substances with low or no air quality impacts, and limited persistence or low potential to cause chemical sensitivity.

Lead and asbestos abatement:

- Where appropriate, activities conducted in interior rooms and spaces would be guided by a lead abatement investigation and removal plan. This plan would be compliant with all federal, state, and local requirements in accordance with Title 15, Chapter 53, subchapter IV Section 2688 – Control of Lead - based Paint Hazards at Federal Facilities and the Occupational Safety and Health Administration standard for construction (29 CFR 1926.62).
- Where appropriate, activities conducted in interior rooms and spaces would be guided by an asbestos investigation and removal plan. This plan would be compliant with all federal, state, and local requirements and in accordance with Occupational Safety and Health Administration standards pertaining to employee or worker exposure covered under 29 CFR 1910.1001. Additional work practices would comply with the Construction Standard for the Asbestos Industry (40 CFR 1926.1101 or CFR Title 8 Section 1529).

Visitor Use and Experience

Specific provisions would be followed, to minimize adverse effects on visitors:

- The majority of material deliveries would be made and disruptive work would be done during the week, rather than on weekends or holidays, and early morning or late evening construction work would be encouraged (i.e., before and after peak

TABLE 2. MITIGATION MEASURES

Resource Category/Action

visitation periods).

- Paved areas used by vehicular and pedestrian traffic would be kept clean of construction debris and soils, as necessary.
- Potential additional closure information would be made available at visitor centers and contact locations inside and outside the monument.
- Local newspapers and the monument's website would include updated information regarding any access restrictions during construction and demolition.
- Visitor activities such as interpretive talks, exhibits, demonstrations, children and family programs, bookstore sales, and temporary paleontological exhibits would continue to be provided at alternate locations to ensure the monument's primary interpretive messages are delivered. These facilities would be selected depending on the nature of the interpretive activity, but likely facilities include the shuttle staging area, Headquarters Visitor Center and grounds, Utah Field House of Natural History State Park Museum, Green River campground, and Split Mountain boat ramp.

Air Quality

To the degree possible, impacts to air quality would be mitigated by:

- Reducing vehicle emissions by keeping equipment properly tuned and maintained in accordance with manufacturers' specifications, and not allowing engines to idle,
- Use of best management practices to reduce generation of dust,
- Limiting the types of chemicals (low volatile organic compound ratings) used in new construction and rehabilitation work, and
- Reducing trip generation by encouraging carpooling and shipment of full loads only.
- Any treated wood would comply with standard conditions approved by the Western Wood Preservers Institute that minimize impacts on air quality (currently only wood treated with alkaline copper quaternary ammonium compound is approved for NPS projects).

Noise

If deemed necessary, work to be done on weekends or federal government holidays may be authorized, with prior written approval. To the extent possible, all on-site noisy construction work above 76 A-weighted decibels (dBA), such as the operation of heavy equipment, would be done during daylight hours.

Standard noise abatement measures would include the following elements:

- All construction equipment would be equipped with mufflers kept in proper operating conditions,
- Equipment would be shut off rather than allowed to idle,
- Scheduling would be designed to minimize impacts on adjacent noise-sensitive areas,
- Use of hydraulically or electrically powered impact tools when feasible, and
- Location of stationary noise sources as far from sensitive public use areas as possible.

TABLE 2. MITIGATION MEASURES

Resource Category/Action
Soils and Vegetation
Revegetation efforts would include: • Modern structural applications and techniques that create sustainable landscape designs compatible with the structure, and • Stockpiling and reuse of existing materials. To prevent soil from eroding: • Stored topsoil would be overtopped by anchored matting to prevent siltation from heavy runoff during rainstorms or snowmelt. • Adequate erosion control or drainage structures would be installed and maintained. • Stockpiling of materials would occur on pavement or in areas exhibiting signs of recent disturbance (bare ground). • An adequate hydrocarbon spill containment system would be available on site in case of unexpected spills in the project area.
Sustainability
To the maximum extent possible, reusable materials from the Quarry Visitor Center (e.g., glass, lighting, concrete, piping) would be retained for use in other park areas, used in the rehabilitation of the site, reused, or recycled by the contractor.

ENVIRONMENTALLY PREFERRED ALTERNATIVE

The environmentally preferred alternative is the alternative that will best promote national environmental policy expressed in the National Environmental Policy Act. The environmentally preferred alternative would cause the least damage to the biological and physical environment, and would best protect, preserve, and enhance historical, cultural, and natural resources.

Section 101(b) of the National Environmental Policy Act identifies six criteria to help determine the environmentally preferred alternative. The act directs that federal plans should:

1. fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
2. assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;
3. attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;
4. preserve important historical, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice;
5. achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and
6. enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Alternative A would fail to meet criteria 1 through 4 as the structural integrity of the Quarry Visitor Center has declined to the point that it poses life safety issues. If this decline continues or accelerates, Alternative A may not provide protection of the fossil wall. In addition, continuing degradation of components of the historic structure and recurrent maintenance and repairs could damage and reduce the integrity of structural fabric and character. Continued implementation of the structural monitoring program would identify imminent threats to public health and safety. But, other health and safety issues, such as unsafe working conditions and non-compliance with life safety codes, would continue into the future.

All action alternatives would provide long-term visitor access and interpretation of the fossil resources of the quarry face. However the alternatives vary in the degree to which they meet Criteria 1. Alternatives B, C, and D would continue to provide long-term protection for the park's primary resource (the fossil wall) by rehabilitating or reconstructing the Exhibit Hall. In addition, Alternative B would result in the construction of a new visitor center at a new location, eliminating the need to maintain water and wastewater utilities at the Quarry site. This would eliminate the potential for water leaks into the expansive soils, thereby reducing greatly the risk to the Exhibit Hall and the fossils compared to the other action alternatives.

Alternative E would pose the greatest threat to the fossil resources during large-scale demolition and construction above and adjacent to the fossil wall.

All action alternatives would meet current safety and accessibility requirements for staff and visitors, thereby assuring for all Americans safe, healthful, esthetically pleasing and productive surroundings (criterion 2). Alternative B however would meet this criterion to a greater degree than other action alternatives. Alternative B would incorporate existing infrastructure in areas of prior disturbance in the development of the new visitor center and reclaim the landscape with native plants in areas where demolition of portions of the existing visitor center facility has occurred. This alternative would achieve to a greater degree esthetically pleasing surroundings by reducing the footprint of the physical disturbance at the Quarry site and restoring to a degree the natural surroundings.

All of the action alternatives would improve accessibility, reduce risks to staff and visitors, continue to provide protection and interpretation of the fossil face with limited construction activities adjacent to or above the quarry face, and therefore meet criterion 3 – attain the widest range of beneficial uses without risks to health or safety or other unintended consequences. Alternative B would further achieve this criterion in development of the new visitor center through incorporation of the existing infrastructure of the shuttle staging area and sites of prior disturbance. Alternative B would also reduce the developed footprint at the Quarry site. Construction of the new visitor center in a more environmentally stable site, under Alternative B, reduces potential future risks to visitor and staff and ensures the long-term viability of the facility. Alternative E would pose the greatest threat to the fossil resources during large-scale demolition and construction above and adjacent to the fossil wall. Although the measures would be taken to reduce potential damage to the fossil wall during construction, Alternative E would pose the greatest risk and therefore would meet criterion 3 to a lesser degree.

Alternative C and D and Alternative B if the Exhibit Hall is rehabilitated would preserve important historical, cultural, and natural aspects of our national heritage (criterion 4) through long-term protection of the monument's *in situ* fossil collection and rehabilitation of the Exhibit Hall. All of the action alternatives would result in loss of the National Historic Landmark status of the Quarry Visitor Center. Alternative E would also would not meet criterion 4 as it would result in the demolition of the entire structure and development of a new visitor center on site.

Alternatives B, C, and D, meet criterion 6 to varying degrees. These alternatives would retain the steel superstructure of the Exhibit Hall and partially meet criterion 6 – approach the maximum attainable recycling of depletable resources. Alternative C would have slightly more flexibility in the use of energy efficient materials and design; however, Alternative D would likely involve more reuse of salvageable components and materials. The quantity of reusable materials and the need for rehabilitation or restoration of these components is not known, and the extent of differences between energy conservation potential of the alternatives is also not known. Therefore, no clear distinction can be made between these alternatives in regard to this selection criterion. Alternative E would replace the structure in its entirety, would not reuse any components of the existing facility, and would require construction of a new steel superstructure for all visitor and park operations facilities, which

fails to meet criterion 6 – approach the maximum attainable recycling of depletable resources.

Based on this analysis, Alternative B is the environmentally preferred alternative. Alternative B would reduce the developed footprint and eliminate the potential for water leaks into the expansive soils at the Quarry Visitor Center site and construct the new visitor center in a more environmentally stable site. Thus, Alternative B would greatly reduce the risk to the Exhibit Hall and the fossils and ensure the long-term viability of the facilities compared to the other action alternatives. It best fulfills over the long-term NPS responsibilities as trustee of the outstanding fossil resources; ensures safe, healthful, productive, and esthetically and culturally pleasing surroundings; and attains the wider range of beneficial uses of the environment without degradation and risk to the environment or health and safety.

ALTERNATIVES CONSIDERED AND DISMISSED

Analysis of all design options for rehabilitation of the Quarry Visitor Center led to the dismissal of one potential option. This alternative included components that failed to meet the project objectives; included actions that generated unacceptable levels of resource impacts, or were generally unacceptable per the terms of alternative elimination found in *Director's Order 12*, Section 4.5.E.6 (NPS 2001). The nature of the dismissed features, and the rationale for their rejection, is outlined below.

Preserve all of the existing structure. This alternative was designed with the intent of full preservation of the National Historic Landmark status through extensive rehabilitation of existing materials. This option was dismissed because of concerns that the structure could not be preserved during extensive repair operations. Under this option, the Administrative Wing and South Wing would have been lifted and supported by scaffolding (interior and exterior), and the concrete slab floor would be demolished, excavated, and replaced. The structure would then be lowered back into place, and repairs to block and mortar made. The Serpentine Entry Ramp would be returned to its original configuration, including installation of several steps leading from the ground level onto the ramp slope. Because approximately 30 percent of the existing fabric is degraded or damaged, preservation of the existing fabric could not be assured during project implementation. If undertaken, the evaluation team felt the risk was high that an alternative to replace the wings and ramp would be required as an immediately available back-up in case of catastrophic failure.

SUMMARY AND COMPARISON OF THE ALTERNATIVES

The tables below summarize the elements of the alternatives being considered. Table 3 outlines the components of the alternatives to provide a comparison of the actions under consideration. Table 4 compares how the different alternatives meet the objectives of the plan that were detailed in “Purpose of and Need for Action”. Table 5 summarizes the anticipated effects of the alternatives on the impact topics retained for analysis.

TABLE 3. COMPARISON OF THE ELEMENTS OF EACH ALTERNATIVE

Alternative Elements/Actions	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Exhibit Hall	The Exhibit Hall would remain closed to public and non-essential staff access. Minor repairs and stabilization activities would continue. No major rehabilitation efforts would occur. The structural monitoring program would continue to be implemented.	The Exhibit Hall would be rehabilitated or replaced. If rehabilitation were implemented, metal structural components would be straightened or replaced; window walls would be updated with new fasteners and glass. Under either scenario, new deep piers would be drilled to enhance stability HVAC system would be upgraded for climate control; structural monitoring program would be modified as required by new/rehabilitated structure.	The Exhibit Hall would be retained and rehabilitated. New deep piers would be drilled to enhance stability; metal structural components would be straightened or replaced; window walls would be updated with new fasteners and glass; HVAC system would be upgraded for climate control; structural monitoring program would be modified as required by new structure.	Same as Alternative C.	Exhibit Hall would be demolished and replaced with a modern, efficient, climate controlled structure; foundation would include deep drilled piers; canopy would continue to provide visitor viewing and access to *in situ* fossils; structural monitoring program would be modified for new structure and implemented.

TABLE 3. COMPARISON OF THE ELEMENTS OF EACH ALTERNATIVE

Alternative Elements/Actions	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Serpentine Entry Ramp	No changes would be made to the entry ramp.	The entry ramp would be demolished.	The entry ramp would be demolished and a new entrance would be constructed appropriate for newly constructed wings.	The entry ramp would be retained and rehabilitated to its historic appearance.	The entry ramp would be demolished and a new entrance would be installed appropriate for new visitor center.
Administrative and South Wings	The wings would remain closed to public and non-essential staff access. No major rehabilitation efforts would be undertaken to stabilize the Administrative and South Wings.	Administrative and South Wings would be demolished, and a new interpretive and administrative facility would be built at the shuttle staging area. The new visitor center structure would accommodate current park needs, be better organized for the visitor experience, reduce energy needs, and comply with safety and accessibility requirements.	Administrative and South Wings would be demolished and a new building would be constructed on site. Stability would be enhanced by new foundation with drilled piers and void space to separate floor from expansive soils; new floorplan would better meet park needs for interpretation and operations; compliance with safety codes and accessibility requirements would be included.	Administrative and South Wings would be demolished and reconstructed to replicate the original building's form and appearance. Stability would be enhanced as for Alternative C; little potential for changes to floorplan while adhering to historic configuration; compliance with safety codes and accessibility requirements would be included.	Administrative and South Wings would be demolished, and a new visitor center would be built with foundation and drilled piers appropriate for site conditions. The new structure would accommodate current park needs, be better organized for the visitor experience, reduce energy needs, and comply with safety and accessibility requirements.

TABLE 3. COMPARISON OF THE ELEMENTS OF EACH ALTERNATIVE

Alternative Elements/Actions	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Building size	No additional space for visitors or staff would be provided.	The Exhibit Hall would remain at it current size if rehabilitated. If replaced, it would be approximately 10,000 square feet in size. The new visitor center (located at the shuttle staging area) would be approximately 8,000 to 10,000 square feet in size.	Approximately 300 square feet would be added to enhance visitor circulation and greeting and orientation space.	No additional space would be provided. Reorganization of space would occur to the extent possible while working within the historic layout.	Approximately 1,360 additional square feet would be provided in the newly designed visitor center.
Health and safety improvements	Building would remain closed due to life safety issues. Ongoing maintenance and repair efforts would be used to address critical the conditions that pose risks to the fossil wall.	The new or rehabilitated Exhibit Hall and new visitor center facilities would meet OSHA standards, Uniform Building Code and National Fire Safety Codes, and conditions that pose health and safety risks would be eliminated. Fire and	The rebuilt wings would meet OSHA standards, Uniform Building Code and National Fire Safety Codes, and conditions that pose health and safety risks would be eliminated. Fire and security alarm systems would be installed.	Same as Alternative C.	The new visitor center would meet OSHA standards, Uniform Building Code and National Fire Safety Codes, and conditions that pose health and safety risks would be eliminated. Fire and security alarm systems would be included.

TABLE 3. COMPARISON OF THE ELEMENTS OF EACH ALTERNATIVE

Alternative Elements/Actions	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
		security alarm systems would be installed.			
Gantry crane	No repairs to the gantry crane would be made; it would continue to be inoperable.	Gantry crane would be salvaged, rehabilitated, and reused.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.
Utilities	No new utilities would be replaced.	Minimal utilities would be provided at the Exhibit Hall (no plumbed fixtures). Electricity, propane, water, and wastewater are currently available at the shuttle staging area.	Utilities within the building such as electrical, propane, potable water, and wastewater would be replaced. The HVAC system would be upgraded.	Same as Alternative C.	Same as Alternative C.
Site drainage	No roof drainage or site modifications would occur.	Exhibit Hall roof drainage would be modified to direct flows down and away from the foundation. Areas	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.

TABLE 3. COMPARISON OF THE ELEMENTS OF EACH ALTERNATIVE

Alternative Elements/Actions	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
		surrounding the building would be regraded as needed to facilitate drainage away from the building. Approximately 300 feet of concrete barrier, curbs, and gutters would be installed to prevent sloughing from hillside south of visitor center.			
Structural monitoring program	The structural monitoring program would continue to be implemented in the Exhibit Hall to evaluate building stability and sustainability.	If the Exhibit Hall were retained, same as Alternative A. If a new exhibit area were constructed, a new monitoring program, specific to the structural needs would be developed and implemented.	Same as Alternative A.	Same as Alternative A.	New monitoring program designed for site and structural needs.

Table 4 shows the ability of the four alternatives to meet the project objectives. This provides a way to quickly compare and contrast the degree to which each alternative accomplishes the purpose or fulfills the need identified in “Purpose of and Need for Action”.

TABLE 4. ABILITY OF THE ALTERNATIVES TO MEET PROJECT OBJECTIVES

Objective	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Protect the paleontological resources on the quarry face and geological resources surrounding the quarry, both over the long-term and during any necessary construction activities.	Partially meets this objective because the NPS would continue to provide necessary stop-gap repairs to minimize leaks and stabilize the Exhibit Hall so that the canopy protects the fossil wall. However, drainage problems would still persist and negatively affect underlying geologic resources. In addition, as the building ages and its structural elements become more unstable, threats to the fossil wall, such as falling glass, vermin deposits, and moisture entry, would increase.	Meets this object by stabilizing the Exhibit Hall to alleviate drainage problems associated with the building; provide a sealed building envelope to prevent vermin entry; and continues to provide shelter over the fossil wall to protect it from the elements. However, if the structure is replaced with a new structure, there would be more risk to the fossil wall during construction activities because the existing Exhibit Hall would be demolished.	Meets this object by stabilizing the Exhibit Hall to alleviate drainage problems associated with the building; closing the building envelope to prevent vermin entry; and continues to provide shelter over the fossil wall to protect it from the elements.	Same as Alternative C.	Meets this objective, but to a lesser degree than Alternatives B and C because there would be more risk to the fossil wall during construction activities because the Exhibit Hall would be demolished. Over the long term, similar protection would be provided as in Alternatives B and C.

TABLE 4. ABILITY OF THE ALTERNATIVES TO MEET PROJECT OBJECTIVES

Objective	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Provide visitors opportunities to view fossils *in situ*; provide wayfinding and interpretation of fossil wall.	Fails to meet this objective as the Quarry Visitor Center buildings are closed due to structural instability and life safety issues. Visitors do not have the opportunity to access or view the fossil wall.	Meets this objective by stabilizing or replacing the Exhibit Hall to allow access to the fossil wall *in situ*. Constructs new interpretive and administrative facilities at the shuttle staging area, providing interpretive and educational spaces organized to improve visitor circulation, provide bookstore space, and better integrate messages about a fuller range of park resources and visitor opportunities.	Meets this objective by stabilizing the Exhibit Hall and constructing new wings appropriately designed for site conditions allowing visitors access to the fossil wall *in situ*. Space would also be organized to improve visitor circulation and better integrate the exhibit area and bookstore.	Same as Alternative C.	Meets this objective because the new visitor center would be designed incorporate modern NPS messaging and exhibitry and allows visitors access to the fossil wall *in situ*. Space would also be organized to improve visitor circulation and better integrate the exhibit area and bookstore.
Meet current applicable building codes, including access, exit, and accessibility; solve	Fails to meet this objective as building is closed due to structural instability and life safety issues.	Meets this objective by replacing or rehabilitating the Exhibit Hall in compliance with	Meets this objective by bringing the Exhibit Hall up to standard building and life safety codes (as in	Same as Alternative C.	Meets this objective by replacing all components of the Quarry Visitor Center with a new,

TABLE 4. ABILITY OF THE ALTERNATIVES TO MEET PROJECT OBJECTIVES

Objective	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
health and safety issues.		standard building and life safety codes; improving accessibility for mobility impaired visitors, and solving health and safety issues (e.g., stabilizing structure, replacing glass fastening system, upgrading HVAC systems, etc.). The new visitor center at the shuttle staging area would be constructed in accord with all applicable building codes and standards.	Alternative B). New components constructed adjacent to the Exhibit Hall would meet all applicable building codes and standards.		modern structure that complies with all applicable building codes and standards.
Provide an environment where employees can work efficiently; provide space for current park management and administration	Fails to meet this objective as the Quarry Visitor Center is no longer structurally sound enough to allow use by employees.	Best meets this objective because construction of a new facility at the shuttle staging area would meet present NPS needs.	Meets this objective by rebuilding wings to solve and prevent uneven work spaces and constructing 300 square feet of new space to meet present NPS needs such as	Partially meets this objective by rebuilding wings to solve and prevent uneven work spaces and ergonomic issues; however, layout and use of	Best meets this objective because construction of a new facility that is designed to meet present NPS needs.

TABLE 4. ABILITY OF THE ALTERNATIVES TO MEET PROJECT OBJECTIVES

Objective	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
needs.			through a more efficient layout and reconfigured use of space.	space would be limited by historic floor plan.	
Provide visitors orientation information about Dinosaur National Monument and options to enjoy their visit.	Meets this objective by implementing the new interpretive plan to compensate for loss of visitor access to the *in situ* fossil wall. Provides information to visitors about other experiences and opportunities available in the monument.	Best meets this objective by providing visitor access to the fossil wall and constructing a new visitor center at a separate location. Enhances opportunities for sharing information about the full range of resources and activities available for visitors to experience by continuing many components of the new interpretive plan described for Alternative A.	Meets this objective by providing new interpretive and educational spaces for sharing information about the resources and activities available for visitors to experience beyond the fossil wall.	Partially meets this objective by improving the layout and visitor flow in spaces similar to those that provided interpretation and education in the South Administrative and South Wings. Due to space constraints, opportunities to highlight resources other than the fossil wall could be limited.	Same as Alternative C.

Table 5 provides a brief summary of the effects of each of the alternatives on the impact topics that were retained for analysis. More detailed information on the effects of the alternatives is provided in the "Environmental Consequences" section.

TABLE 5. SUMMARY OF IMPACTS BY ALTERNATIVE

Historic Structures	
Alternative A	Alternative A would have long-term, major, adverse effects on the Quarry Visitor Center from continued damage and loss of structural elements and integrity.
Alternative B	If the condition of the Exhibit Hall allows its rehabilitation, Alternative B would have a long-term, major adverse effect on the Quarry Visitor Center by changing the character of the building and by altering its basic form, features, materials, and spatial arrangement. Rehabilitation of the Exhibit Hall would have a minor beneficial effect by preserving some of the ambiance of this NPS Modern building. If the condition of the Exhibit Hall precludes its rehabilitation, and a new building is erected over the fossil wall, the effects also would be adverse, long-term, and major. In either case, the existing structure would be de-listed as a National Historic Landmark, a long-term, major adverse effect. There are no other projects that would affect the Quarry Visitor Center at present or in the foreseeable future, so there would be no cumulative effects on the structure.
Alternative C	Alternative C (including rehabilitation of the Exhibit Hall) would have a long-term, major, adverse effect on this NHL structure by changing the character of the building and by altering its basic form, features, materials, and spatial arrangement. Construction activities during erection of a new building adjacent to the Exhibit Hall would likely have an adverse effect on the Exhibit Hall. There are no other projects that would affect the Quarry Visitor Center at present or in the foreseeable future, so there would be no cumulative effects on the structure.
Alternative D	Implementation of Alternative D would have long-term, major, adverse effects on the historic Quarry Visitor Center by replacing original structural elements with modern buildings (albeit with a similar design and scale). There would be no cumulative effects on the Quarry Visitor Center.
Alternative E	Complete demolition of the Quarry Visitor Center would be a long-term, major, adverse effect on this historic structure. There would be no cumulative effects on the Quarry Visitor Center.
Collections	
Alternative A	Continuation of monitoring efforts and localized repairs would help reduce the intensity of adverse effects, but Alternative A would have long-term, minor to major, adverse effects on collections from loss of integrity and failure of structural elements that would physically damage collections and allow egress for rodents, birds, insects, and moisture. The inoperative gantry crane would contribute to these adverse effects on collections because researchers and maintenance crews would have to continue to

TABLE 5. SUMMARY OF IMPACTS BY ALTERNATIVE

	climb the steep slope to access fossils or building elements requiring work, and slips and falls could damage fossils. Cumulative effects on paleontological collections would be long-term, minor to moderate, and adverse. Should conditions worsen to the point where structure failure of the Exhibit Hall seems likely, proactive measures would be developed for the *in situ* collections so that Alternative A would not result in impairment of cultural resources or values.
Alternative B	With mitigation during rehabilitation, construction activities and installation/removal of protective coverings, repairs to the gantry crane, etc. would result in long-term, negligible to minor, adverse effects to the collections from direct disturbance, vibrations, temperature changes, and exposure. Long-term moderate benefits would accrue from implementation of this alternative by providing a secure, environmentally sound environment for the collections for the foreseeable future. Removal and replacement of the Exhibit Hall would have long-term minor to moderate adverse effects on the park's collections from exposure to the elements, unauthorized intrusion, and dropped tools or materials. Benefits would accrue from a new building and include better protection from the elements and natural forces. Cumulative effects on the paleontological resource collection would be long-term, minor, and beneficial. Should conditions worsen to the point where structure failure of the Exhibit Hall seems likely, proactive measures would be developed for the *in situ* collections so that Alternative B would not result in impairment of cultural resources or values.
Alternative C	Construction activities and installation/removal of protective coverings, repairs to the gantry crane, etc. would result in long-term, negligible to minor, adverse effects to the collections from direct disturbance, vibrations, temperature changes, and exposure. Long-term minor to moderate benefits would accrue from implementation of this alternative by providing a secure, environmentally sound environment for the collections for the foreseeable future. Cumulative effects on the paleontological resource collection would be long-term, minor, and beneficial. Should conditions worsen to the point where structure failure of the Exhibit Hall seems likely, proactive measures would be developed for the *in situ* collections so that Alternative C would not result in impairment of cultural resources or values.
Alternative D	Long-term, negligible to minor, adverse effects to collections would accrue during construction (from collateral damage, exposure, etc.), but long-term, minor to moderate benefits would be gained as collections would be better protected for future research and education. Cumulative effects on collections would be long-term, minor, and beneficial. Should conditions worsen to the point where structure failure of the Exhibit Hall seems likely, proactive measures would be developed for the *in situ* collections so that Alternative D would not result in impairment of cultural resources or values.
Alternative E	Long-term effects on collections of implementing Alternative E would be adverse

	(minor to moderate) during the project from demolition and construction activities, and beneficial (moderate) upon its completion as the museum collections benefit from increased protection beneath a new structure. Cumulative effects on collections would be long-term, minor, and beneficial. Alternative E would not result in impairment of cultural resources or values.
Geologic and Paleontological Resources	
Alternative A	Alternative A would produce long-term, localized, minor, adverse effects on geologic resources, including the fossil-bearing strata, from altered drainage and infiltration at the site and repair activities. However, these adverse affects are being ameliorated by a reduced water supply to the visitor caused by its closure. There would be no impacts to geologic and paleontological resources from implementation of this alternative at the shuttle staging area. There would be no cumulative effects from implementation of Alternative A. Alternative A would not result in impairment of geologic or fossil resources or values in Dinosaur National Monument.
Alternative B	Alternative B would produce long-term, localized, minor, beneficial effects on geologic resources, including the fossil-bearing strata, from altered drainage and infiltration at the site and repair activities. Minor, long-term, localized, adverse effects at both locations would occur to the rock formations and surface soils/materials from the direct effects of construction and use of the structures. There would be no cumulative effects from implementation of Alternative B. Alternative B would not result in impairment of geologic or fossil resources or values in Dinosaur National Monument.
Alternative C	There would be long-term, localized, minor, beneficial effects on rock formations and fossil-bearing strata. These effects would result from the site improvements designed to eliminate water seepage into and affecting the underlying expansive bentonite-bearing bedrock and soil. Long-term, localized, minor, adverse effects on geologic resources would result from site construction activities such as foundation removal and installation of the new foundation and utilities. Depending on the extent and depth of the bone bed, piers drilled into the sandstone could produce long-term, localized, minor to moderate, adverse effects on fossils if the fossiliferous bed is encountered. There would be no cumulative effects from implementation of Alternative C. Alternative C would not result in impairment of geologic or fossil resources or values in Dinosaur National Monument.
Alternative D	There would be the same long-term, localized, minor, adverse and beneficial effects on geologic or paleontological resources as outlined for Alternative C. Beneficial effects would result from the site improvements designed to eliminate water seepage into and affecting the underlying expansive bentonite-bearing bedrock and soil, and adverse effects would result from the direct effects of site construction activities. As described in Alternative C, depending on the extent and depth of the bone bed, piers drilled into the sandstone could produce long-term, localized, minor to moderate,

TABLE 5. SUMMARY OF IMPACTS BY ALTERNATIVE

	adverse effects on fossils if the fossiliferous bed is encountered. There would be no cumulative effects from implementation of Alternative D. Alternative D would not result in impairment of geologic or fossil resources or values in Dinosaur National Monument.
Alternative E	There would be the same long-term, minor, localized, adverse and beneficial effects on geologic resources as outlined for Alternatives C and D. Beneficial effects would result from the site improvements designed to eliminate water seepage into and affecting the underlying expansive bentonite-bearing bedrock and soil, and adverse effects would result from the direct effects of site construction activities. As described in Alternatives C and D depending on the extent and depth of the bone bed, piers drilled into the sandstone could produce long-term, minor to moderate, localized adverse effects on fossils if the fossiliferous bed is encountered. There would be no cumulative effects from implementation of Alternative E. Alternative E would not result in impairment of geologic or fossil resources or values in Dinosaur National Monument.
Visitor Use and Experience	
Alternative A	Continued closure of the Quarry Visitor Center would result in long-term, major, adverse effects on visitor use and experience. Although interpretation and exhibits of the monument's fossils would be made available at the shuttle staging area and other areas of the park, this does not mitigate the effects of the quarry closure and the inability of visitors to handle, understand, and appreciate the unique park resource. The confined space of the bookstore would result in minor, long-term adverse effects. The cumulative effect on the visitor experience would be long-term, adverse, and major.
Alternative B	Rehabilitation of the existing or construction of a new Exhibit Hall to protect and provide an *in situ* viewing of fossils and construction of a new visitor center that would provide enhanced interpretation in a climate controlled safe environment would result in long-term, major, beneficial effects. During demolition and reconstruction, noise, delays, and access restrictions at the upper and lower sites and interruption of visitors services at the visitor parking lot and shuttle staging area would produce short-term, minor to moderate, adverse effects on visitors. Cumulative effects to visitor experience would be long-term, major, and beneficial.
Alternative C	Rehabilitation of the Exhibit Hall, replacing the wings and entry ramp to protect and provide an *in situ* viewing of fossils and providing enhanced interpretation in a climate controlled safe environment would result in long-term, major, beneficial effects under Alternative C. During demolition and reconstruction, noise, delays, and access restrictions at the upper and lower sites would produce short-term, minor, adverse effects on visitors. Cumulative effects to visitor experience would be long-term, moderate, and beneficial.

Alternative D	Rehabilitation of the Exhibit Hall, reconstructing the wings and entry ramp similar to the historic structure would protect the park's primary resource, provide visitors an *in situ* viewing of fossils, and enhance interpretation in a climate controlled safe environment would result in long-term, major, beneficial effects under Alternative D. During demolition and reconstruction, noise, delays, and access restrictions at the upper and lower sites would produce short-term, minor, adverse effects on visitors. Cumulative effects to visitor experience would be short-term, major, and adverse and long-term, moderate, and beneficial.
Alternative E	Construction of a new Quarry Visitor Center to protect park's primary resource, provide visitors an *in situ* viewing of fossils, and enhanced interpretation in a climate controlled safe environment would result in long-term, major, beneficial effects under Alternative E. During demolition and reconstruction, noise, delays, and access restrictions at the upper and lower sites would produce short-term, minor, adverse effects on visitors. Cumulative effects to visitor experience would be long-term, major, and beneficial.

Socioeconomics

Alternative A	Continued closure of the Quarry Visitor Center would reduce visitation to the monument over the long-term, producing minor, adverse economic effects in the gateway communities and counties. Relocating the cooperating association (bookstore operator) to the shuttle staging area would continue to dramatically limit revenues, resulting in long-term, major adverse economic effects to INHA. There would be cumulative long-term, negligible benefits to the local economy. Cumulative effects to the cooperating association would be long-term, adverse, and major.
Alternative B	Exhibit Hall improvements and development of the new visitor center would likely restore park visitation to historic levels, and therefore traditional local economic activity associated with park visitation. This would produce long-term, minor economic effects. Relocating the bookstore to the visitor center would likely restore a portion of cooperating association revenue, producing long-term, minor to moderate economic benefits for INHA. There would be cumulative long-term, minor benefits to the local economy. Cumulative effects to the cooperating association would be long-term, beneficial and minor.
Alternative C	Opening a new Quarry Visitor Center would likely restore park visitation to historic levels, and therefore traditional local economic activity associated with park visitation. This would produce long-term, minor economic effects. Providing a bookstore location adjacent to the quarry face would likely restore the majority of cooperating association revenue, producing long-term major economic benefits for INHA. There would be cumulative long-term, minor benefits to the local economy. Cumulative effects to the cooperating association would be long-term, beneficial and moderate.

TABLE 5. SUMMARY OF IMPACTS BY ALTERNATIVE

Alternative D	Re-opening a replicated Quarry Visitor Center would likely restore park visitation to historic levels, and therefore local economic activity associated with park visitation. This would produce long-term, minor economic effects. Providing a bookstore at the traditional site near the quarry face would likely restore the majority of cooperating association revenue, producing long-term major economic benefits for INHA. There would be cumulative long-term, minor benefits to the local economy. Cumulative effects to the cooperating association would be long-term, beneficial and moderate.
Alternative E	Developing a modern Quarry Visitor Center would likely restore park visitation to historic levels, and therefore local economic activity associated with park visitation. This would produce long-term, minor economic effects. Providing an expanded bookstore facility near the quarry face would restore and possibly increase historic cooperating association revenue, producing long-term major economic benefits for INHA. There would be cumulative long-term, minor benefits to the local economy. Cumulative effects to the cooperating association would be long-term, beneficial and moderate to major.
Public Health and Safety	
Alternative A	Alternative A would produce long-term, negligible to minor, adverse effects on maintenance personnel health and safety due to the hazards of entering and working in the failing structure. These adverse effects would be offset by adherence to OSHA protocol. There are no other projects or actions that would contribute to cumulative effects on public health and safety.
Alternative B	There would be long-term, minor, beneficial effects over those conditions that existed prior to closure of the Quarry Visitor Center to health and safety by eliminating or reducing hazards related to the structural deficiencies caused by the underlying bentonite-bearing soil and by implementing fire and life code standards into new construction. Implementation of the revised structural monitoring program would have long-term, minor, beneficial effects. Construction activities would produce short-term adverse effects of minor intensity. There are no other projects or actions that would contribute to cumulative effects on public health and safety.
Alternative C	There would be long-term, minor, beneficial effects to public health and safety, over those conditions that existed prior to closure of the Quarry Visitor Center, by eliminating or reducing, through the application of engineering and design principles, hazards related to the structural deficiencies caused by the underlying bentonite-bearing soil and by implementing fire and life code standards into new construction. Implementation of the revised structural monitoring program would have long-term, minor, beneficial effects. Construction activities would produce short-term adverse effects of minor intensity. There are no other projects or actions that would contribute to cumulative effects on

	public health and safety.
Alternative D	Similar to Alternative C, there would be long-term, minor, beneficial effects, over those conditions that existed prior to closure of the Quarry Visitor Center, to public health and safety by reducing or eliminating structural and building hazards related to the movement of the underlying bentonite-bearing soil and implementing fire and life safety code standards into new construction and rehabilitation activities. Implementation of the revised structural monitoring program would have long-term, minor, beneficial effects. Construction activities would produce short-term, adverse effects of minor intensity. There are no other projects or actions that would contribute to cumulative effects on public health and safety.
Alternative E	Similar to Alternatives B, C, and D there would be long-term, minor, beneficial effects, over those that existed prior to closure of the Quarry Visitor Center, to public health and safety by reducing or eliminating structural and building hazards related to the movement of the underlying bentonite-bearing soils and implementing fire and life safety code standards into new construction. Implementation of the revised structural monitoring program would have long-term, minor, beneficial effects. Construction activities would produce short-term, adverse effects of minor intensity. There are no other projects or actions that would contribute to cumulative effects on public health and safety.
Park Management and Operations	
Alternative A	The No Action Alternative would have long-term, moderate, adverse effects on park management and operations resulting from the relocation of park staff functions to other locations. The continued activities related to structural monitoring and maintenance of the building movement caused by expansive soils, monitoring of site monitoring wells, and seasonal inspection of the underground utilities along with standard park-wide maintenance and management activities would result in long-term, negligible, adverse effects to park operations. Cumulative effects to park operations would be long-term, minor to moderate, and adverse.
Alternative B	There would be long-term, moderate, beneficial effects to park management and operations under Alternative B. Rehabilitating/rebuilding the Exhibit Hall and constructing a new visitor center and administrative offices at the shuttle staging area would reduce maintenance burden and provide a comfortable and ergonomic workplace. Long-term, negligible adverse effects would be associated with continuation of the structural and groundwater monitoring programs utility system and backfill inspections, and continuation of standard park-wide maintenance operations. Short-term, minor, adverse effects would result from monitoring construction activities. Cumulative effects to park operations would be long-term, beneficial, and minor to moderate in intensity.
Alternative C	There would be long-term, moderate, beneficial effects to park management and operations by rehabilitating and rebuilding the visitor center thereby reducing

TABLE 5. SUMMARY OF IMPACTS BY ALTERNATIVE

	operations and maintenance in response to the building movement caused by expansive soils. These long-term benefits however would be moderated by the long-term, negligible adverse effects associated with continuation of the structural monitoring program, seasonal groundwater monitoring and utility system and backfill inspections, and continuation of standard park-wide maintenance operations. Short-term, minor, adverse effects would result from monitoring construction activities. Cumulative effects to park operations would be long-term, beneficial, and minor to moderate in intensity.
Alternative D	There would be the same long-term, moderate beneficial and negligible adverse effects on park operations as described in Alternative C. Short-term effects on park management and operations related to construction activities would be the same as in Alternative C, minor and adverse. Cumulative effects to park operations would be long-term, beneficial, and minor to moderate in intensity.
Alternative E	There would be the same long-term, moderate, beneficial and minor, adverse effects on park operations as described in Alternative C and carried through in D. Short-term effects on park management and operations related to construction activities would be the same as described in the other Alternatives, minor and adverse. Cumulative effects to park operations would be long-term, beneficial, and minor to moderate in intensity.

AFFECTED ENVIRONMENT

CULTURAL RESOURCES

Introduction

Cultural resources of concern for this draft EIS include historic structures and museum collections. (Paleontological resources will be discussed both as part of the monument's collections [*in situ* fossil wall] and as a natural resource present in the vicinity of the proposed project [the fossil-bearing Morrison formation beneath the Quarry Visitor Center site].) The National Historic Preservation Act and its implementing regulations provide guidance for deciding whether cultural resources are of sufficient importance to be determined eligible for listing in the National Register of Historic Places (National Register). The NPS provides potentially eligible and unevaluated resources (that is, cultural resources that have not been evaluated for National Register eligibility) with the same level of protection as listed or eligible historic properties.

The following sections provide background information and discuss the current status of cultural resources in the project area. For conformance with Section 106 of the National Historic Preservation Act, the area of potential effect would be the Quarry Visitor Center and the surrounding area, including the parking lot, access road and project staging areas, as well as the shuttle staging area, parking, access, and immediate surroundings.

Site History

During the late 1800s and early 1900s, paleontologists from institutions such as Yale University and the Carnegie Museum visited Morrison Formation sites in Colorado and Wyoming, and entered into a heated competition to see who could discover and name the most dinosaurs. (The Morrison Formation was known to contain sediments that were deposited under conditions favorable for the burial and preservation of skeletal remains.) The remains these paleontologists discovered were excavated, and most were transported to Eastern universities and museums.

In 1907, Carnegie Museum paleontologist Earl Douglass began exploration of the Uinta Basin in northeastern Utah, a region that contains numerous areas where the 150 million-year-old Morrison Formation is exposed on the flanks of the Uinta Mountains. On August 19, 1909, Douglass found a series of large *Apatosaurus* vertebrae weathering out of the Morrison Formation in a hilltop site that would become today's Dinosaur National Monument quarry, a site that would go on to be one of the most productive dinosaur quarries of the Morrison Formation. This quarry marks the area where some of the best paleontological remains of Jurassic-age dinosaurs known from North America have been exposed.

Douglass brought his family to Utah, and built a cabin on a modest homestead. Douglass and his helpers spent 15 years excavating at the site, then known as the Carnegie Quarry, and

collected fossils for the Carnegie Museum, the Smithsonian Institution, and the bulk of the collections were sent to the Carnegie Museum, which operated the Carnegie Quarry until 1923. When the surrounding area was opened to homesteading in 1913, the quarry site was plagued by theft and vandalism, which Douglass tried to control by staking out the area as a mining claim. The government denied this claim, so Douglass then worked to have the quarry set aside as a national monument, resulting in President Woodrow Wilson's proclamation of the area as Dinosaur National Monument on October 4, 1915. In 1924, the last of the fossils from the west side of the excavation were sent to Salt Lake City and Douglass moved to the university where he became a consulting geologist.

During his work with the fossils, Douglass had struggled to find ways to best exhibit the paleontological remains. At first he envisioned skeletons mounted "in relief on one side of the paleontological hall of the museum in the position in which they had been found" (NPS 2005b). Douglass eventually concluded that the excavated fossils needed to be covered to protect the specimens and to provide shelter for researchers and visitors. He suggested that the north side be a "natural wall…with the skeletons in place" while a "roof with ample sky lights would cover the whole" (NPS 2005b).

In the decade following World War II, national parks all across the nation experienced a ten-fold increase in visitation that outpaced the parks' aging infrastructure and cramped visitor facilities, including those at Dinosaur National Monument. To help serve these large numbers of visitors on a limited budget and to launch the NPS into the modern era, in 1955 a new, comprehensive 10-year program known as Mission 66 was initiated. Under Mission 66 park facilities were overhauled and new facilities constructed, including a new kind of park public facility, the visitor center, often built in a modern design.

This new "Park Service Modern Architecture" incorporated modernistic designs and technical solutions, and replaced traditional methods of craftsmanship by more efficient methods of machine production. Designs of the revolutionary new "modern" structures grew out of European influences, emphasized volume, regular organization of plan, and absence of applied ornamentation, and used inexpensive industrial materials such as glass, aluminum, concrete, and exposed structural steel (NPS 2005b).

Park Service Modern architecture was a response to the new context of postwar social, demographic, and economic conditions in the United States, and the architecture became the "centerpiece of a new era of planning for American national parks" (NPS 2005b). New visitor centers centralized activities, provided space for adjacent parking, and by effectively intercepting visitors, contributed to resource protection. Mission 66 structures in national parks were designed to "enable visitors to look past or through the structure to the resource beyond" and, unfortunately, were often built "right on top of the resource" (NPS 2003a).

Mission 66 breathed new life into the promises for the quarry, and in 1956 funds were appropriated for a modern museum/visitor center at Dinosaur that would be distinctly different in design than any other national park facility. The new structure would "provide an appropriate setting for modern paleontological research" where visitors would witness actual excavation by professional paleontologists (NPS 2005b). Exhibits and extensive laboratory facilities would be complimentary to the ongoing excavations.

In November 1956, the design for the "ultra modern" building – a "model of Mission 66 design and achievement" featuring a glass and steel observation deck, concrete ramp, and cylindrical "tower" – was accepted. The massive glass wall on either end of the building was the highlight of the design, and the extensive use of glass and steel created an atmosphere suggestive of modern innovation.

Exhibits in the new visitor center were developed by the NPS. The colorful interiors were intended to "relieve the monotony of the valley's gray surroundings and, perhaps, create the effect of an oasis in the desert" and the "Dusklite glass" panels were designed to eliminate the reflection of the summer sun from the nearby hills (NPS 2003a).

This Mission 66 achievement was described as a landmark educational facility and "the only place in the world where visitors can see bones in the rock and watch paleontologists at work" (NPS 2005b). Inside the visitor center, almost 1,500 bones were exposed in place on the quarry face, which served as the back wall of the building. The visitor center also housed a preparation laboratory, research facilities, a bookstore, and additional exhibits about the monument and its dinosaurs.

R.K. McCullough Company of Salt Lake City completed the visitor center in 1958. By today's standards, the construction schedule at Dinosaur was on an extremely fast track (less than fourteen months passed from contract award to completion of construction). Unfortunately, no systematic analysis of site environmental conditions was done, and "hints of problems" with the building emerged even before construction was completed. Over the next 45 years, the NPS struggled to keep up with building problems primarily caused by water damage and expansive soils (see Appendix B for a descriptive chronology of the structure's development and use).

In 1953, Dr. Theodore White, Dinosaur National Monument's first paleontologist, began to work with a staff of fossil preparators to create the permanent quarry exhibit that visitors see today. The 183- by 35-foot display of fossil bone that lies precariously on the 65 degree slope of the north rock wall of the visitor center required years of tedious work in "quarrying away the sterile rock, working the bone out in relief, cleaning the surface with hand tools, and treatment of the fossil bone with a preservative" (NPS 2005b).

In the early 1990s, excavation within the quarry building was halted. Most of the main bone bearing strata had been exposed, and without further excavation, transverse and longitudinal geological sections of the quarry face could be retained for future research. Paleontological work then began to focus on other sites in the monument containing such taxa as frogs, salamanders, mammals, and plant fossils that give scientists a better and more comprehensive understanding of the total Morrison ecosystem.

Historic Resources in the Project Area

In recognition of its significance as one of the four best examples of modern design visitor centers in the NPS, the Quarry Visitor Center was designated a National Historic Landmark on January 3, 2001. The building's period of significance is based on the time during which it was initially constructed and first opened to the public (1957-1958), and prior to any

subsequent modifications. Four interconnecting structural elements make up the building's character-defining features: the Exhibit Hall, the Administrative Wing, the Serpentine Entry Ramp, and the South Wing (see descriptions of these structural elements in the "Description of the Project Area" section). The Earl Douglass Workshop-Laboratory is listed in the National Register of Historic Places and is located in the vicinity, but is outside the area of effect for this project.

Collections

Typically, most parks' archives and artifact collections are housed in acid-free boxes on museum shelves or in storage facilities. At Dinosaur National Monument most of their paleontological collections are on permanent display exactly where they were found – embedded in the massive up-tilted stone wall that forms one side of the visitor center. The fossilized remains of perhaps 1,500 bones, representing 13 different species of fossil vertebrates, are exposed on the wall where they can be studied and interpreted as part of their paleoecological context (that is, they can be studied in terms of the associated geologic data that provide information about the ancient environment).

The monument's paleontological resources, described as "the world's greatest single deposit of fossil dinosaur bones," provide a major window into the Jurassic world (West and Chure 2001). Excavations at the quarry uncovered the most nearly complete *Apatosaurus* skeleton known, measuring over 70 feet long and almost 15 feet tall at the hips (the term *Apatosaurus* means "deceptive lizard" for its almost unbelievable size). Five of the seven species of sauropods found in North America are present at the quarry, and include a more slender, close relative of *Apatosaurus* known as *Diplodocus* (meaning "double beam" for T-shaped bones in its tail).

Approximately three-fourths of the dinosaur fossils found here are popularly known as brontosaurs, large land animals whose length may have been 70 to 80 feet long and whose weight averaged 20 tons or more. Some of the sauropods found at the quarry belong to the genus *Camarasaurus* ("chamber lizard" named for the hollows in its vertebrae) while the smaller sauropods, *Camarasaurus lentus*, tended to be more compact than their relatives. The most complete skeleton unearthed at the quarry was a half-grown *Camarasaurus lentus* (West and Chure 2001).

Although less well known than the *Apatosaurus* or *Diplodocus*, the *Barosaurus* ("heavy lizard," for the huge, heavy neck bones) rivaled them in size, reaching 70 to 80 feet in length and weighing about 25 tons. One of the types of dinosaurs found at the quarry (*Stegosaurus*, "plated lizard") is noted for its array of triangular bony back plates and sharp tail spikes.

The sauropods both outnumbered and outweighed the carnivorous theropods, whose remains account for about 5 percent of all the quarry's fossils. The theropods varied widely in size, suggesting they fed on different sizes of prey. The largest theropod (*Allosaurus)* weighed about 2 ½ tons and reached a length of about 30 feet. Smaller predators include *Ceratosaurus* and a small theropod known as *Ornitholestes* ("bird robber"). Other small dinosaurs include *Camptosaurus* ("bent lizard") and *Dryosaurus* ("oak lizard").

Large numbers of fossilized dinosaur skulls are found at Dinosaur National Monument. Also unique to Dinosaur are the large number of juvenile dinosaurs; juvenile specimens were rare in the fossil record because their softer, undeveloped bodies are more easily lost.

Findings suggest that these species lived in a mosaic of river, lake, and floodplain environments. The landscape would have included scrub forest and a savannah-like ecosystem based on perhaps 30 inches of rainfall, with periods of dryness and flooding (West and Chure 2001). At the quarry and in other places in the monument are other fossil remains including fossil wood, crocodiles, turtles, and other smaller creatures such as frogs, salamanders, fish, lizards, and mammals.

NPS guidelines and policies such as *Management Policies 2006, Director's Order 24: NPS Museum Collections Management,* and *Natural Resource Management Reference Manual 77* provide for management, preservation and protection of paleontological resources. These guidelines mandate that:

- paleontological resources will be protected, preserved, and managed for public education, interpretation, and scientific research, and
- study and management of fossils should be conducted in the paleoecological context (that is, in terms of the geologic data associated with a particular fossil that provides information about the ancient environment).

However, management of this fossil collection requires a much different approach than typical museum collections. Dinosaur National Monument experiences a wide variation in temperature extremes, from around -48 to more than 100 degrees Fahrenheit. The glass canopy moderates these extremes, but temperatures still can vary widely on the exposed wall, depending upon the amount of sunshine reaching a particular area. Nights, particularly during the winter, can be extremely cold, contributing to temperature variations. In combination with moisture, these temperature extremes can cause deterioration of the fossil bones from expansion and contraction of the fossil materials and their surrounding matrix. The effect that extreme temperatures, and/or temperature changes can have on consolidants used on the fossils also is unknown.

The canopy shelters the remains from wind, rain, and snow, but other natural forces also can affect the collections. Isostatic rebound from removal of the rock that overlaid the fossil-bearing strata may be contributing to an existing natural crack system that runs through the quarry face. This active crack system continues to grow through rock and bone. On the 65-degree slope, gravity threatens free-standing or surface skeletal materials by dragging fragments of rock and fossil bone down the wall face.

Prior to the 1960s, unexcavated portions of the quarry outside and north of the Exhibit Hall tended to direct water towards the structure, and seepage could be detected on the fossil wall. Although most of the drainage problems have since been corrected, water seepage may still be contributing to expansion and contraction of underlying strata and subsequent displacement or deterioration of paleontological specimens.

Damage to the structure caused by expansion and contraction of the underlying bentonitic soils allows birds, bats, mice, and other rodents to enter the exhibit area. Deposits of small-animal feces are unsightly and pose a health hazard to humans. Effects of animal droppings on the preservatives used on the fossils are unknown, but they may pose a further threat to the integrity of the fossil specimens.

Mitigation of these problems is more difficult because the monument lacks base data on:

- the amount, direction, and type of movement within the quarry deposits;
- long-term effects of gravity;
- fluctuating moisture levels within the wall;
- temperature variations in different areas of the wall; and
- quantifiable effects of the above forces on both the consolidants used to stabilize the fossil bone and on the bones themselves.

Current planning calls for most of the monument's collection and research functions, including the laboratory, paleontological offices, and the extensive library to be shifted to a new museum facility in Vernal, Utah. The exception to this would be the 1,500 fossil specimens on display on the north wall of the Exhibit Hall and the specimens contained in glass display cases, which are used to enhance interpretation of the fossil wall. The environmental assessment for this action was completed in 2005. The Finding of No Significant Impact (FONSI) was signed in September 2005.

GEOLOGIC AND PALEONTOLOGICAL RESOURCES

Dinosaur National Monument is located in the northernmost reaches of the Colorado Plateau region in northwestern Colorado and extreme east-central Utah (NPS no date, West and Chure 2001). Near the project area, the Uinta Mountains taper off into small folds in a series of east-west narrow hogback ridges and valleys. Mesozoic Era (248 to 65 million years before present) rock formations encircle Split Mountain, an area of the Uinta Mountains bisected by the deep gorge of the Green River. Rock formations encountered in the Quarry and shuttle staging area consist of a series of Mesozoic Era sandstones, mudstones, shales, and limestones and various evaporates that make up (in ascending order) the Stump, Morrison, and Cedar Mountain Formations, the Dakota Sandstone, and Mancos and Mowry Shales (Hagood and West 1999, McCormick 2003, and NPS 2005c).

The Morrison Formation is extensive and ranges from central New Mexico to Montana, with equivalent strata extending farther north into Alberta and British Columbia. This sedimentary formation consists of a series of soft shale, claystone, mudstone, and siltstone interbedded with fine- to coarse-grained, cross-bedded sandstone (Kowallis *et al.* 1998, Peterson and Turner 1998, McCormick 2003, Turner and Peterson 2004). Mudstone and marlstone (limey clay) predominate in the upper part of the Morrison while shale is more abundant in the lower part. The Morrison includes local deposits of conglomerate and limestone. Within the Morrison is a sharp vertical transition in clay content at about midway up the formation (Kowallis *et al.* 1998, Peterson and Turner 1998, Turner and Peterson 2004). A dominantly mixed-layer non-swelling clay is found in the mudstone and shale of the lower parts of the formation; while a dominantly smectite mixed-layered swelling clay (bentonite) is found in the upper and represents different source areas of volcanic ash.

Locally, the Morrison Formation at the Quarry Visitor Center consists of steeply dipping alternating layers of sandstone and shale with some limestone (NPS 2003a). The stratification dips to the south at an angle of 65 degrees from the horizontal, with a strike essentially parallel to the south wall of the building (Figure 20).

The north half of the building is supported on the hard 12-foot-thick, weather-resistant, fossil-bearing sandstone of the quarry face, while the south end is founded on steeply dipping bentonite-bearing shale or mudstone/claystone bedrock, along with soil and rock debris derived from fossil quarrying operations (Andrews & Anderson *et al.* 2004).

The bone bearing sandstone layer is not laterally extensive due to the limited extent of exposure on the hillside. However, it may extend some distance underground (West and Chure 2001). Limited areas of the bone-bearing strata are exposed on both the east and west sides of the Exhibit Hall, and fossils are evident on the surface. This portion of the formation is subject to weathering and deterioration, and is not included in the monument's fossil collection.

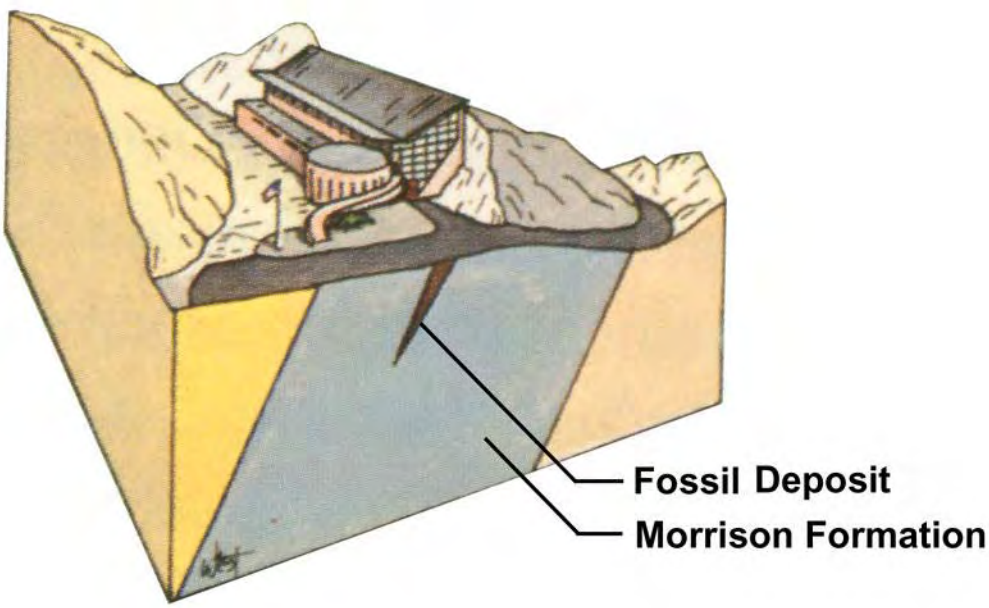

FIGURE 20. STRATA BENEATH THE QUARRY VISITOR CENTER

Because of the steep dip of the fossil-bearing sandstone layer, the depth of the shale or mudstone/claystone beneath the southern portion of the Quarry Visitor Center may exceed 30 feet (NPS 2003a). A thin limestone bed is exposed at ground surface approximately 20 feet south of the south wall of the rectangular building. The south Quarry Visitor Center foundation, walks, and parking area were constructed on a combined base of Morrison Formation derived soils and soil and rock debris removed by paleontologists as they exposed and removed dinosaur bones from the quarry (NPS 2003a). This spoil lacks productivity and does not support any plant communities

The Morrison Formation yields a large and varied fossil fauna and flora that represent a diverse number of ecosystems present at the time of deposition. Fossilized dinosaur bones and skeletons have been recovered from the exposed fossil-bearing sandstone bed at the Quarry Visitor Center's quarry face. The dinosaur fossils represent the remains of sauropods, theropods, and ornithopods, of which the sauropods represent three-fourths of all the fossils found in Dinosaur National Monument (NPS 2005c, West and Chure 2001, and Turner and Peterson 2004). Dinosaur fossils present at the quarry and elsewhere in the Morrison Formation include remains of: *Apatasaurus (Brontosaurus)* (Deceptive lizard), *Camarasaurus* (Chamber lizard), *Barosaurus* (Heavy lizard), *Diplodocus* (Double beam), *Ornitholestes* (Bird robber), *Dryosaurus* (Oak lizard), *Camptosaurus* (Bent lizard), *Allosaurus* (Other lizard), *Ceratosaurus* (Horned lizard), and *Stegosaurus* (Plated lizard). Other fossils encountered representing other faunal communities include mammals, crocodiles, turtles, lungfish, frogs, salamanders, fish, lizards, crayfish, bivalves, gastropods, ostracods, sponges, and a diverse assortment of insects.

Fossil flora indicates that the climate was warm and seasonally dry and that an overstory of Aracaria "pines", ginkos, tree ferns, and cycads were present while a groundcover of small ferns, cycads, horsetails, fungi, and mosses filled in the spaces between the larger plant species (West and Chure 2001, Turner and Peterson 2004). The presence of charophytes and stromatalites in water ecosystems also attest to the variety of plant fossils found in the Morrison Formation. Additional information on fossils present/found at the quarry face can be found in the description of the fossil collection contained in the "Cultural Resources" section of this draft EIS.

To the southwest of the Quarry Visitor Center, lies the shuttle staging area, proposed site of the new visitor center as described in Alternative B (Figure 13). The USGS geologic map of the area (Rowley *et al*, 1979) indicates that Lower Cretaceous Mancos Shale is likely present at some depth (the adjacent bedrock here dips south towards the shuttle staging area and parking lot at about a 65-degree angle [Madsen, 2007]). The map shows Holocene and Pleistocene pediment deposits in the flats below the monocline for some distance to the east and west of the buildings and parking lot. These are poorly sorted silt, sand and gravel deposits, fan deposits and colluvium resting on a pediment surface "cut on soft rocks" (most likely Mancos Shale, though possibly Frontier Sandstone).

The likelihood of finding significant fossils in this area is slight given the extensive surface disturbance dating back to at least the turn of the last century (Madsen, 2007). An occasional shark or fish tooth has been found in ant hills out in these flats. Any future disturbances caused by construction and operation of the new visitor center are not expected to significantly effect fossil resources due to the disturbed nature of the soils and scarcity of occurrence. Significant problems in either the shuttle staging area, parking lot, or nearby maintenance and housing areas that has been attributed to an unsuitable substrate have not occurred (Madsen 2007).

VISITOR USE AND EXPERIENCE

Visitors come to Dinosaur National Monument to learn about dinosaurs through first-hand, tactile experiences with fossils, and to explore the monument's 210,000 acres of natural areas. Though the primary activity at the monument is interpretation of the quarry wall containing *in situ* exposed fossils at the Quarry Visitor Center, outdoor recreational activities include biking, bird watching, camping, and various water activities on the Yampa and Green Rivers. Ranger-led talks and walks are provided at the visitor center and throughout the monument, both day and evening.

Dinosaur National Monument hosts an average of 385,145 visitors per year, based on information from 1995 through 2005 (Figure 17) (NPS 2005d). The most popular months for visiting the monument are June, July, and August, with the least visitation in December, January, and February (see Figure 18). Other attractions in the region include Steinaker State Park, the Utah Field House of Natural History State Park Museum, and Red Fleet State Park (in Utah), and Elkhead Reservoir and Routt National Forest (in Colorado).

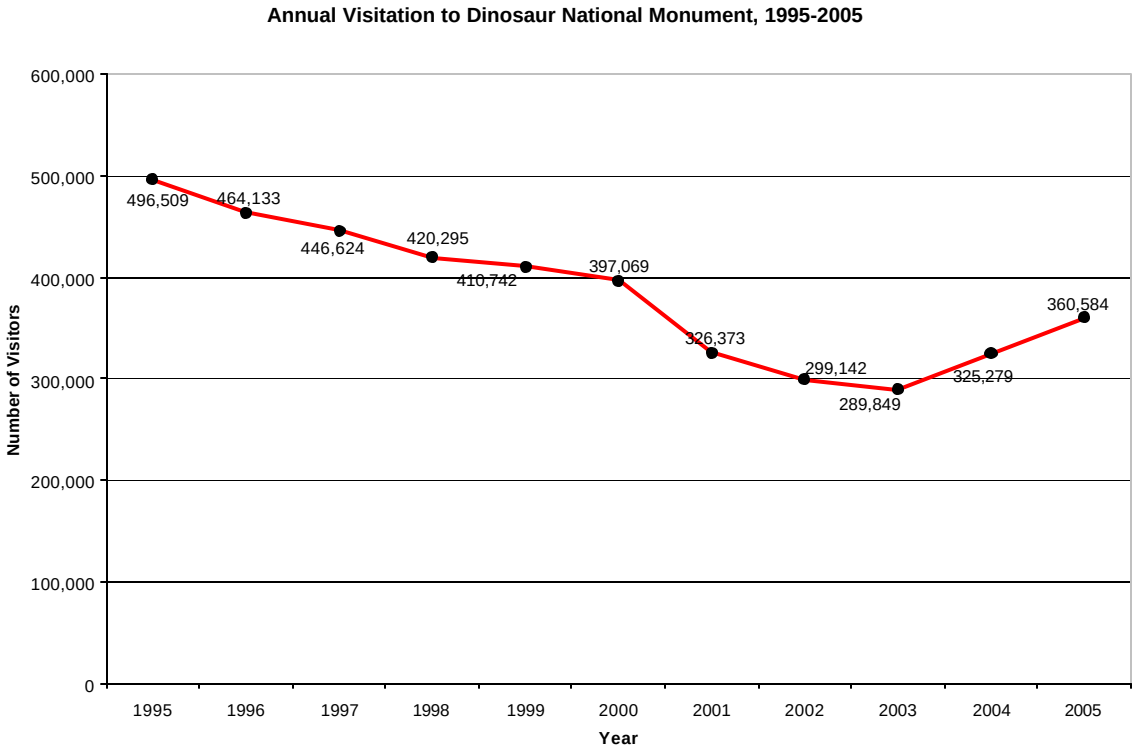

FIGURE 21. ANNUAL VISITATION RATES AT DINOSAUR NATIONAL MONUMENT

Source: NPS Public Use Statistics Office

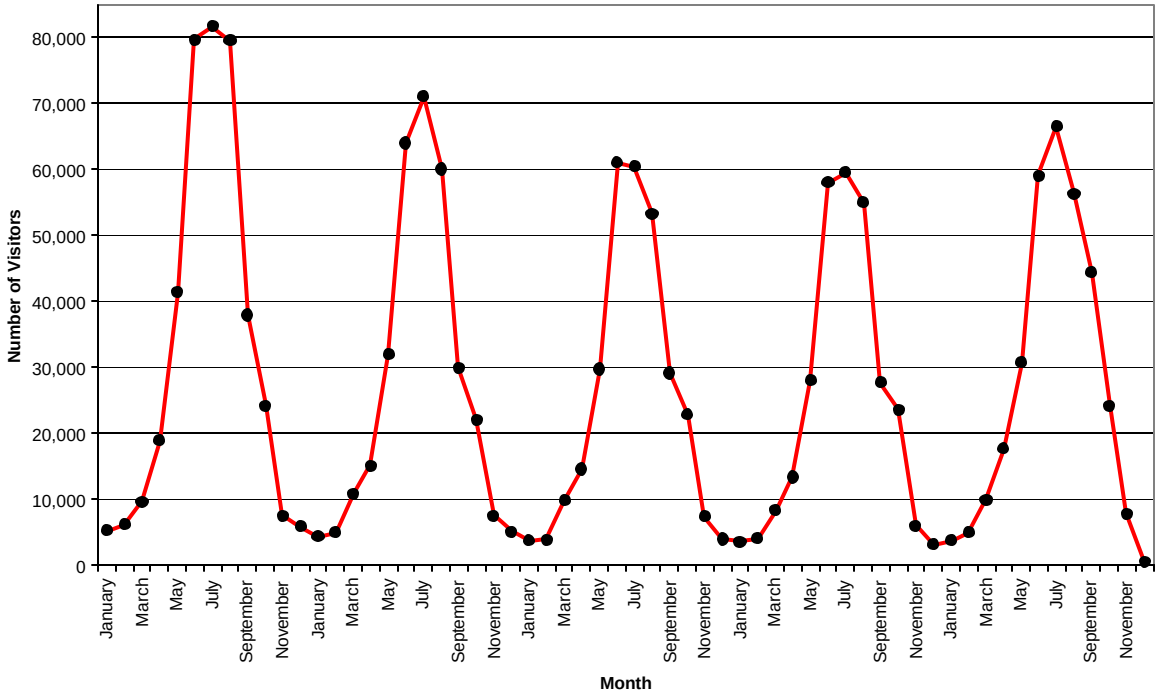

FIGURE 22. MONTHLY VISITATION RATES AT DINOSAUR NATIONAL MONUMENT

Source: NPS Public Use Statistics Office

In July 2006, the Quarry Visitor Center closed after the first of four structural monitoring observations identified previously unknown structural conditions that presented serious life, safety, and health hazards. Statistics from January to November 2006 indicate that visitation to the monument had declined by nearly 13 percent compared to visitation in 2005. The drop in visitation can be attributed in part to the closure of the Quarry Visitor Center, as viewing the *in situ* fossil bones at the cliff face draws nearly 53 percent of park visitors (Whitman 2004). However, statistics indicate that visitation was also lower in May and June of 2006 compared to 2005 before the closure had occurred. This drop in visitation can be attributed to a number of factors such as the overall national decline in visitation to national and state parks, the increasing cost of gasoline, and increased competition for lodging accommodations in the region due to an influx of oil and gas workers (Risser 2007).

Other facilities available for visitor use at the park include the shuttle staging area, Headquarters Visitor Center, six picnic areas, six campgrounds, and 13 trails (NPS 2005c). Upon entry to the monument, visitors can take the auto route (north) allowing for panoramic views of the park.

The goal of interpretation at Dinosaur National Monument is to convey the range of relevant primary interpretive messages as set forth in the Comprehensive Interpretive Plan (2003). These are:

- The diverse and accessible fossil resources in Dinosaur National Monument allow personal discovery and reflection upon life and the history of Earth, including deep time, change, adaptation, survival, evolution, and extinction.
- Dinosaur National Monument's scenic river canyons, world-class geologic resources, and biological diversity provide opportunities for people to encounter uncrowded wild environments, better understand and appreciate the complexity of ecosystems, contemplate their place in nature, and renew their sense of well-being.

There are two auto tours available in the monument: the Tour of the Tilted Rocks and the Journey Through Time Tour. These range from 1.5 to 4 hours and 22 to 62 miles in length (NPS 2005c). There is also a self-guided geology walk outside the Quarry Visitor Center. The geology walk is 0.8 miles in length and leads visitors along a trail that illustrates 80 million years of geologic history, in which visitors can touch fossils still in place within the layers of rock.

Visitors arriving at the monument pass the fee collection station and then choose the road to the Quarry Visitor Center area or the auto tour route. Visitors first arrive at the shuttle staging area. Following closure of the Quarry Visitor Center, this open air pavilion was converted into a visitor contact station for the summer months. Rangers provide interpretive services and ranger-led activities. Exhibits of fossils from the quarry are also displayed here. This space provides a small sales area to the Intermountain Natural History Association where visitors can purchase books and merchandise that further educate the visitor about the park's resources.

The Quarry Visitor Center, which is currently closed to the public, was created to protect the monument's fossil resources while allowing visitors to have direct experience with them in the context in which they were discovered. Thus, the building was constructed both around and atop the fossil resource. This not only provided a cognitive connection that was intimate and built on a human scale, as visitors viewed the fossil wall from two walkways that ran the length of the wall, but also allowed for the visual connection of the quarry wall to its vast, natural surroundings outside the structure. The Exhibit Hall was the primary vehicle for this experience.

The Exhibit Hall was constructed as an open gallery, in which the quarry wall was the centerpiece. Although displays and interpretive media were nearby and complemented the resources *in situ*, the structure and its arrangement of interior space drew visitor attention to the wall. This allowed for an independently-directed learning and exploration experience of the facility and various types of media exhibits on the two floors of the gallery. Interpretive talks were given by rangers, and visitors could approach the quarry wall to touch and photograph the dinosaur bones.

Prior to the closure, the visitor circulation pattern at the Quarry Visitor Center began on the upper level (referred to as the mezzanine level), accessed via the Serpentine Entry Ramp on the second floor, where visitors overlooked the fossil wall. Visitors would progress past interpretive exhibits along the viewing platform/walkway, down the stairs, to the lower level where they could get a closer look at the fossils and even touch the resource.

An important feature of the interpretive path was that it occurred on two different floor levels, as viewing the bones from a close vantage point and at the actual height of the exposed fossil face allowed the visitors to see more detail and gain a sense of the layering that occurred over time. This unique experience of viewing fossil exhibits that have not been excavated but left *in situ*, greatly enhanced the interpretation of paleontology, geology, and the context in which the bones were discovered.

SOCIOECONOMICS

Dinosaur National Monument straddles the Colorado/Utah border, lying north of Highway 40. The town of Dinosaur, in Moffat County, Colorado, serves as the eastern gateway community. The town of Vernal, in Uintah County, Utah, is the monument's western gateway community, and the main source of lodging, food, and services for monument visitors.

Uintah County

Uintah County is one of the fastest growing counties in the state of Utah and has a population of 26,019 (Utah Dept. of Workforce Services 2005a). The three industries that are the largest employers in Uintah County are local and federal government; trade, transportation, and utilities; and the mining industry (Utah Dept. of Workforce Services 2005d). The majority of mining jobs support oil and natural gas extraction. Near the end of 2003, jobs in the hospitality and leisure industry decreased, along with the gross taxable sales in the county for hotels and lodging (Utah Dept. of Workforce Services 2005a and 2005b). Despite the rural location of the county, agriculture is not a particularly influential industry in the county's economy; an average of 80 percent of the labor force is employed in non-farm jobs (Utah Dept. of Workforce Services 2005a).

The largest city in Uintah County is Vernal, Utah, with a population of approximately 7,900 (Utah Dept. of Workforce Services 2005a). Vernal serves as the gateway community for Dinosaur National Monument on the west side, where most visitors access the Quarry Visitor Center. The primary industry in Vernal is education, health and social services followed by retail trade (U.S. Census Bureau 2005). The accommodation and food service industry accounts for approximately ten percent of the jobs in Vernal, indicating the importance of tourism to the city (U.S. Census Bureau 2005).

Moffat County

Moffat County is located in northeastern Colorado and lies midway between Denver and Salt Lake City. It has a population of 13,184. The county's primary income-generating industries include agriculture, forestry, fishing and hunting, and energy extraction (U.S. Census Bureau 2005). However, the county's largest employer is the tourism industry, accounting for 1,116 (17.6 percent) of the estimated 6,337 jobs in 2003 (Colorado Dept. of Labor 2003). The next largest employers are the local government and retail trade (accounting for 13.6 and 12.7 percent of employment, respectively) (Colorado Dept. of Labor 2003).

Dinosaur, Colorado is the gateway community for the eastern entrance of Dinosaur National Monument and has a population of approximately 340. The primary local income-generating industries are agriculture, forestry, fishing and hunting, and mining (33.3 percent of employment), followed by construction and retail trade (each at 14.7 percent) (U.S. Census Bureau 2005). Most people in Dinosaur work in construction, energy extraction, and maintenance occupations (U.S. Census Bureau 2005). Less than eight percent of jobs in

Dinosaur are in the arts, entertainment, recreation, accommodation and food services sector, indicating that tourism is not a primary driver of the local economy (U.S. Census Bureau 2005).

Economic Impacts of Tourism in the Counties

Rural counties in Utah depend on tourism-based economic influxes to a greater degree than urban counties. Uintah County is among the fastest growing counties in Utah, in regard to traveler spending. Between the years 2002 and 2003, traveler spending in Uintah County grew by 41 percent, the second fastest in the state. Visitors to the area spent approximately $72.6 million in 2003. This visitor spending translated into local tax revenues of $1.52 million (Utah Division of Travel Development 2003 and Utah Office of Tourism 2004). Visitation to Dinosaur National Monument is estimated to account for 17.5 percent of the tourism in the county (Utah Division of Travel Development 2003), or approximately $12.7 million in revenue.

Uintah County is somewhat dependent upon tourism, as 16 percent (1,628) of its total employment is based in tourism-related jobs. This rate of employment has grown steadily from 1998 to 2002, more than doubling during that time (Utah Office of Tourism 2004).

Moffat County (in Colorado) is quite different, as 9 percent (518) of its total employment is based in tourism. Visitation to Moffat County does have a notable impact, however; visitors who stayed overnight spent $25.1 million in 2003, which contributed $0.7 and $0.8 million in local and state taxes, respectively. Visitor spending also supported 490 jobs in the county (Dean Runyan Associates 2004).

Economic Impacts of Dinosaur National Monument in the Gateway Communities

In 2003, the majority of visitors to the monument were day visitors from outside the local area, accounting for 51 percent of the monument's annual visitation (NPS 2005e). Of the non-local visitors, 18.4 percent stay in local lodging establishments, contributing the greatest amount to the local economy, followed by visitors who camped overnight in the area (13 percent). Of the $12.7 million in local revenue generated by the park annually, the hotel sector is the primary benefactor ($7.01 million in sales), followed by food and drinking establishments ($2 million). Park visitors supported 203 jobs in the local area and, consequently, $2.41 million in wages and salaries in 2003. As visitor spending circulated through the local economy, it added an estimated $2.27 million in sales and 35 jobs (NPS 2005e).

The park estimates that visitation has decreased by 13 percent since closure of the Quarry Visitor Center. Assuming that visitation is tied directly to economic activity in the nearby communities, a 15 percent decline in sales receipts and revenues would reduce the park's contribution from $12.7 million to $10.8 million.

Cooperating Association

The park's cooperating association, the Intermountain Natural History Association (INHA) operated the bookstore in the Quarry Visitor Center. This non-profit organization aids the education and scientific activities at Dinosaur and Fossil Butte National Monuments, as well as three national forests and one Bureau of Land Management site. The bookstore at the Quarry Visitor Center was 800 square feet in size, and generated approximately $400,000 to $500,000 in sales each year. The INHA has reported that this represents approximately two-thirds of their annual sales (Millet 2005). Since 1956, the organization has given more than $2.1 million in donations to the sites in which it operates (INHA 2005).

Since the closure of the Quarry Visitor Center, INHA has been operating a small station at the shuttle staging area. Using a combination of bookmobile, utility trailer, and awning cover, INHA has continued to offer educational materials, and to support the park by providing staff to provide interpretive and park information services to visitors. INHA recently received permission to place a modular housing unit in the parking lot at the shuttle staging area to serve as their base of operations. The unit would be approximately 720 square feet in size and would accommodate sales and administrative office space. The modular unit is expected to be in place in April 2007 (Millet 2007).

PUBLIC HEALTH AND SAFETY

Dinosaur National Monument is open all but three days of the year. Therefore, park personnel are present throughout the year to respond to the safety needs of staff and visitors. The NPS has proprietary jurisdiction in Utah and concurrent law enforcement jurisdiction in Colorado within the monument and is responsible for directing visitors and staff to safe locations and exits during times of emergency, such as flooding, fire, or storms.

The Quarry Visitor Center closed on July 12, 2006 after the first of four structural monitoring observation trips identified previously unknown structural conditions that present serious life, safety, and health hazards. Even though the structure is closed to the public, park staff are still required to enter the structure to continue the Life Safety Code compliance monitoring and maintenance program.

Before closure of the structure visitors and park staff encountered the following health and safety issues. The lifting of roof beams causes cracking and falling of glass from the glazed curtain walls of the Exhibit Hall. Observations by park employees indicate that wind is usually a factor in window failure (Dye 2005a). Windows have been displaced from their framing since construction of the Quarry Visitor Center in 1957 (NPS 2003a). It was reported as recently as 1998 that a window had shattered and fallen during visitor hours and, during the spring of 2005, one window fell out of the frame and landed on the roof above the paleontology laboratory (Dye 2005a). A fall safety concern is also realized due to the constant repair and replacement of the windows by park maintenance staff.

Shifting of structural components in the Exhibit Hall has resulted in misalignment of the rail track of the gantry crane. The gantry crane has become inoperable and cannot be moved along the fossil wall. Without the gantry crane, researchers and maintenance staff must ascend and descend the steep slope to reach the fossils or building elements that require maintenance.

Additionally, the Serpentine Entry Ramp has broken at its support and separated from the building. Uneven floor surfaces throughout the facility pose slip and fall hazards (Figure 23). No reports of slips/falls were received from visitors or park staff within the last 2 years (Dilsaver 2005). However, one e-mail was received from a visitor expressing concern of the uneven surfaces and possibility of trips or falls. In response, the NPS implemented a program in April 2005 to mitigate the presence of cracks and uneven flooring by repairing cracks, transitioning uneven surfaces, laying down striping, placing warning cones, and posting notices. Similarly, in May 2005, bookshelves in the bookstore were reconfigured, not due to the cracked and uneven floor but to enhance customer flow. These actions have resulted in fewer incidences of trips or falls. A survey of ergonomic stresses and stressors on park employees due to the uneven floor and work surfaces was conducted sometime prior to 2000 (Dilsaver 2005) and resulted in improvements in workplace conditions with no reported incidences.

The Exhibit Hall windows allow a substantial amount of sunlight to enter the building creating uncomfortable conditions within the viewing gallery. Air temperatures can reach

temperatures high enough to cause heat-related illnesses in the summer months. To date, no reports of heat-related illness have been received (Dilsaver 2005).

Other additional health and safety risks within the Quarry Visitor Center include inadequate and non-compliant fire and safety egresses, hazardous building components, and breached plumbing. There is one exit from the building. According to Life Safety Code, an additional exit is required. Additionally, the structure is not completely protected by a fire suppression system (NPS 2003a). A fire detection system was installed in 1996 (NPS 2003a, Dye 2005b). However, this system lacks audio/visual devices (strobes), and therefore do not meet National Fire Prevention Association standards.

FIGURE 23. UNEVEN FLOOR IN STAFF WORK AREA

Due to the prolonged structural movement over the years, openings exist in the building envelope where rodents and bats enter the building. Although there have been no known occurrences of pest-related illnesses, rodent and bat entry poses sanitation concerns and health risks.

Other hazards to health include the presence of lead and/or asbestos based window glazing putty, lead based paint, Halon gas, asbestos pipe insulation, radon gas, and toilet fixtures far enough out of plumb to cause a normal flush to exit the bowl and deposit wastewater on the floor (NPS 2003a).

PARK MANAGEMENT AND OPERATIONS

The superintendent of Dinosaur National Monument is responsible for managing the monument, its staff, concessionaires, all of its programs, and its interactions with persons, agencies, and organizations interested in the monument. Park staff provide the full scope of functions and activities to accomplish management objectives, including interpretation and education, resource protection, law enforcement, emergency services, public health and safety, science, visitor services, utilities, maintenance, and management support.

The Quarry Visitor Center was closed on July 12, 2006. As the building is no longer occupied, only essential maintenance staff enter the building to continue their weekly and monthly recordings, observations trips to the Quarry Visitor Center, and reporting of conditions. Based on the report of conditions, individual structural repairs would be performed as necessary to protect the fossil wall and provide limited staff access to existing structures. Staff also perform seasonal monitoring activities such as backfill and utility system testing and groundwater monitoring one day each month (Dye 2005a, and 2007).

Staff and cooperating association employees formerly working in the Quarry Visitor Center have been relocated elsewhere to other park facilities to carry on their functions (Dye 2007). Prior to closure, six employees worked in the Quarry Visitor Center year-round, including two interpretive employees, three natural resource specialists, and one bookstore employee. In general, the NPS hires about four seasonal employees to assist with interpretation during the summer months. These summer workers are also located in the Quarry Visitor Center (Moos 2005).

Facilities and maintenance staff at the monument include about 12 employees who are responsible for maintaining all park facilities in working order. Approximately four seasonal employees provide additional support during summer months (Moos 2005). The monument currently has one full-time and two part-time employees assigned to maintaining the Quarry Visitor Center in addition to their other duties.

This page intentionally left blank.