

Grand Canyon

National Park Service
U.S. Department of the Interior

Grand Canyon National Park



Environmental Assessment September 2006



Hermit Road Rehabilitation

Grand Canyon National Park • Arizona

Environmental Assessment

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Summary

Grand Canyon National Park proposes to rehabilitate the historic, approximately seven-mile long Hermit Road, located on the South Rim between Grand Canyon Village and Hermits Rest. Proposed actions include widening and resurfacing the road, improving existing trails, overlooks and parking areas, and constructing a multi-modal greenway trail. This Environmental Assessment (EA) evaluates three alternatives for addressing the purpose and need for action (Alternatives B, C and D). The EA also evaluates taking only minimal action (Alternative A, No Action) to address critical safety concerns for comparison with the action alternatives. The EA further evaluates a management option (temporal road closure) to close Hermit Road periodically to all motor vehicles, an option that could be applied to any alternative. The preferred alternative (Alternative D) includes 1) widening the road from its current width of 18- 20 feet to a uniform width of 24 feet; 2) constructing an approximately three-mile long greenway trail from The Abyss to Hermits Rest on the road's north side; 3) minimal improvements to the unpaved rim trail between Powell Point and The Abyss; 4) rehabilitation of the historic paved West Rim Trail between Grand Canyon Village and Maricopa Point; 5) constructing a connecting trail around the Orphan Mine area between Maricopa Point and Powell Point; and 6) making improvements for safety and accessibility at ten of the overlooks and parking areas along Hermit Road.

Public Comment

If you wish to comment on the environmental assessment, you may mail comments to the name and address below or post comments online at <http://parkplanning.nps.gov/>. This environmental assessment will be on public review for 30 days. Our practice is to make comments, including names, home addresses, home phone numbers, and email addresses of respondents, available for public review. Individual respondents may request that we withhold their names and/or home addresses, etc., but if you wish us to consider withholding this information you must state this prominently at the beginning of your comments. In addition, you must present a rationale for withholding this information. This rationale must demonstrate that disclosure would constitute a clearly unwarranted invasion of privacy. Unsupported assertions will not meet this burden. In the absence of exceptional, documentable circumstances, this information will be released. We will always make submissions from organizations or businesses, and from individuals identifying themselves as representatives of or officials of organizations or businesses, available for public inspection in their entirety.

Please Address Comments to:

Joseph F. Alston, Superintendent, Grand Canyon National Park
Attention: Office of Planning and Compliance
P.O. Box 129 / 1 Village Loop
Grand Canyon, Arizona 86023

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Contents	Page
Chapter 1 Project Scope	2
Introduction.....	2
Purpose and Need for Action.....	2
Management and Planning History.....	5
Issues and Impact Topics.....	8
Impact Topics Dismissed from Further Analysis.....	10
Additional NEPA Analysis.....	13
Chapter 2 Alternatives	14
Introduction.....	14
Alternative Development.....	14
Alternative Description.....	15
Alternative A No Action.....	15
Elements Common to All Action Alternatives.....	17
Alternative B Widen for Safe Bus Access.....	25
Alternative C Greenway.....	27
Alternative D Preferred.....	30
Temporal Road Closure.....	34
Alternatives Considered and Dismissed from Detailed Study.....	36
Identification of Environmentally Preferred Alternative.....	39
Mitigation Measures.....	39
Alternatives and Project Objectives.....	46
Chapter 3 Affected Environment and Environmental Consequences	59
Introduction.....	59
Methodology.....	59
Cultural Resources.....	61
Archeological Resources.....	61
Historic Resources and Cultural Landscapes.....	70
Ethnographic Resources.....	83
Natural Resources.....	89
Watershed Values.....	89
Vegetation.....	103
General Wildlife.....	116
Special Status Species.....	127
Soundscape.....	141
Visual/Scenic Resources.....	152
Social Resources.....	163
Visitor Experience and Safety.....	163
Park Operations.....	177
Chapter 4 Consultation and Coordination	187
Literature Cited	191

Contents	Page
Appendices	
Appendix A General Management Plan Excerpts	197
Appendix B Public Scoping Summary	199
Appendix C Compliance Summary and References	204
Appendix D Wildlife and Plant Special Status Species Descriptions	207
Appendix E Recently Completed, In- Progress and Foreseeable Future Actions	214
Appendix F Vascular Plants Documented along Hermit Road, 2005	218
List of Abbreviations and Acronyms	222
Maps	
Map 1 Project Area	3
Map 2 Alternative A No Action	16
Map 3 Alternative B Widen for Safe Bus Access	26
Map 4 Alternative C Greenway	29
Map 5 Alternative D Preferred Alternative	32
Map 6 Temporal Road Closure	35
Map 7 Watershed Boundaries and Level of Existing Disturbance	90
Map 8 Soils in the Hermit Road Area	91
Map 9 Sound Data Collection Stations, Hermit Road Project	144
Tables	
Table 1 Summary of Alternative Components	47
Table 2 Comparative Summary of Environmental Impacts	55
Table 3 Cultural Resources Possibly Affected By Undertakings	73
Table 4 Soil Types in the Vicinity of Hermit Road	92
Table 5 Wildlife Species of Interest on the South Rim	116
Table 6 Special Status Species Pertinent to the Project Area	128
Table 7 Ambient Sound Levels at selected areas of Grand Canyon	142
Table 8 Acoustic Sample Sites on Hermit Road	143
Table 9 Percent Time Human Noise Sources Audible	143
Table 10 Shuttle Bus Off- Loading along Hermit Road, August 2005	164
Table 11 Peak Number of Hikers and Total Number of Bicyclists	165
Table 12 Disturbance estimates by watershed subunit	217
Figures	
Figure 1 Typical Section of West Rim Trail (2004) Proposed for Rehabilitation	17
Figure 2 Example of Typical Overlook Improvements Proposed	19
Figure 3 Proposed Maricopa Point Improvements, Option 1	20
Figure 4 Proposed Maricopa Point Improvements, Option 2	21
Figure 5 Typical Section of Unpaved Rim Trail Proposed for Improvements	27
Figure 6 Typical section of the 1912 Road proposed for use as a greenway	31
Figure 7 Typical Pinyon- Juniper Woodland along Hermit Road	103
Figure 8 Sound Data Collection Stations along Hermit Road	144

Chapter 1 Project Scope

INTRODUCTION

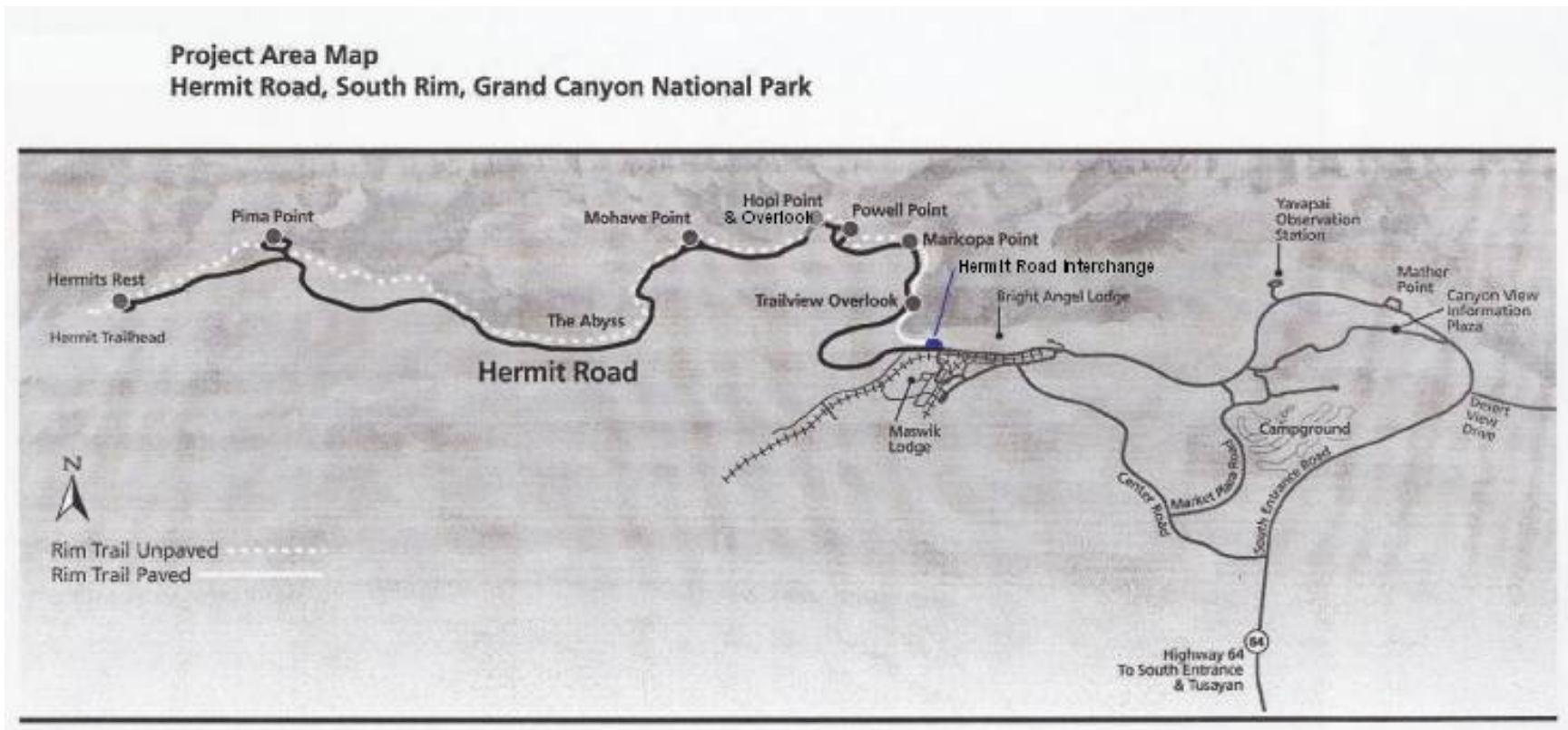
This document's purpose is to disclose expected effects to the human environment of rehabilitating Hermit Road, the historic roadway connecting Grand Canyon Village to Hermits Rest on Grand Canyon National Park's South Rim. Human environment is defined as the natural and physical environment and the relationship of people with that environment. The project area consists of National Park Service (NPS) land along Hermit Road (Map 1). This includes the roadway itself, associated overlooks and parking areas between the road and rim, and the road right-of-way. The road is approximately seven miles long and meanders through pinyon-juniper woodland at approximately 6,800 feet elevation.

PURPOSE OF AND NEED FOR ACTION

Hermit Road and most of its associated overlooks and parking areas are historic, designed and constructed in 1934- 1935 by the Bureau of Public Roads and the National Park Service, and retain a high degree of integrity. However, overall road condition is poor and does not meet current safety standards. The road is too narrow for safe bus passage, especially when bicyclists and pedestrians are on the road. Pedestrian and bicycle use occurs in part because existing trails are inadequate for both pedestrians and bicycles. In some areas there is not room between the roadway and rim for an adequate trail. However, many park visitors walk or bike between scenic overlooks along Hermit Road. Pedestrian and bicycle use, combined with shuttle buses, tour buses and other vehicle traffic on this narrow two-lane road, creates a safety hazard. In addition, inadequate maintenance is threatening the road's historic integrity.

The Grand Canyon National Park is operating under direction of the 1995 General Management Plan (GMP). The GMP provides fairly general and programmatic direction and guidance for resource management, visitor use, and general development for a period of 10 to 15 years. Applicable management objectives and other pertinent direction from the GMP are found in Appendix A. Of particular note are the following recommendations that pertain directly to West Rim Drive (*hereinafter referred to as Hermit Road. Citations have been changed throughout the document to reflect current nomenclature*):

- Maintain and enhance the meandering, rural character of Hermit Road and Desert View Drive, including the feeling that one is removed from the developments of Grand Canyon Village and Desert View. Maintain the existing large undisturbed areas along Hermit Road.
- Hermit Road will be converted to year-round public transit service only.
- Maricopa Point overlook and parking area will be removed due to the proximity of a rare plant population.
- Hopi Point overlook will be redesigned for bike and pedestrian use only.
- Visitors with disabilities who cannot be adequately accommodated by public transportation will be allowed access by private vehicle.



Map I. Project Area

- Bikers (bicyclists) will be allowed on all roads.
- An off- road bike trail system will be provided to link Hermits Rest with Desert View. The trail will be used by both bikers and pedestrians.
- The trail system will generally be north of Hermit Road, so as to avoid road- crossing conflicts, and disturbed areas will be used whenever possible to limit resource impacts.
- A bikeway plan will determine more exact routes, paved and unpaved sections, bike/pedestrian overlooks, and other design details.

Based on this direction from the 1995 GMP, the interdisciplinary team for this project (with input from other internal NPS staff, the public and other agencies) drafted the following desired- condition statement for Hermit Road. The desired condition is based in concept on GMP direction, recognizing the area's specific needs and limitations apparent since GMP preparation. *All deviations from GMP direction were considered and are specifically discussed in Chapter 2, Alternatives, page 17.*

Desired Condition

Hermit Road is a meandering rural road with historic integrity. It passes through large undisturbed forested areas, leading visitors to overlooks where they can get away from Grand Canyon Village's developed areas. The roadway is in good condition and is wide enough to accommodate safe passage of all vehicles. Bike and pedestrian use is separated¹ from vehicle use to allow visitors safe access to scenic overlooks and Hermits Rest, with links to a multimodal trail system (greenway) in other park areas.

Need for Action

Consideration of Hermit Road's existing conditions, GMP direction and the desired condition resulted in development of specific needs and objectives. These guide development of all action alternatives. Needs are to:

- Improve road surface to provide safe bus operations.
- Improve bicyclist and pedestrian experience.
- Provide a safe means of access for all visitors to Hermits Rest.

These actions are needed because:

- The road and overlooks are in poor condition.
- The road's rural character and historic integrity needs to be maintained.
- Lack of maintenance on the walls, culverts and overlooks threatens their integrity.
- Road shoulders are unraveling, effectively narrowing the road surface.
- Road width is too narrow for buses.
- Pedestrians use the road as a walkway.
- The existing path (West Rim Trail) is only formalized from the Village to Hopi Point.
- Pedestrians seek to be as close to the rim as possible, and like to walk along the rim between shuttle bus stops.
- Social trailing impacts natural resources.

¹ *Separated* in this context means that there is, at minimum, enough space between vehicle lanes and bicyclists/pedestrians so that vehicles can safely pass these bicyclists or pedestrians without crossing the centerline and so that pedestrians/bicyclists can safely stay on a relatively flat surface while being passed by a vehicle

- Bicyclists and pedestrians compete with vehicles on the roadway, creating potential safety hazards for all users.
- Pullouts and parking areas don't meet current Americans with Disabilities Act (ADA) standards

Objectives

1. Minimize disturbance to the natural and cultural environment, and restore areas damaged by social trailing and other impacts, to the extent practical, using native species.
2. Improve visitor experience along Hermit Road by:
 - a) Retaining the historic character of the road, overlooks and trail.
 - b) Improving the condition of the road and overlooks.
 - c) Increasing road width to accommodate buses.
 - d) Providing safe access for pedestrians along the rim from the Village to Hermits Rest thereby minimizing social trailing.
 - e) Providing safe access for bicyclists to overlooks, viewpoints and Hermits Rest.
 - f) Improving overlooks and parking to meet current ADA standards.

MANAGEMENT AND PLANNING HISTORY

National Park Service Management Policies 2001 is the guiding document for management of all national parks within the national park system. It is the basic NPS Servicewide policy document and supersedes the 1988 edition. *Management Policies* is the highest of three levels of guidance documents in the NPS Directives System. As stated in its introduction, "It (NPS Directives System) is designed to provide NPS management and staff with clear and continuously updated information on NPS policy and required and/or recommended actions, as well as any other information that will help them manage parks and programs effectively." Among direction on all aspects of park management, *Management Policies* set direction for each unit of the national park system to maintain an up- to- date General Management Plan. *Management Policies'* Chapter 5, Cultural Resource Management; Chapter 8, Use of the Parks and Chapter 9, Park Facilities are most applicable to this project.

The primary purpose of the park's GMP is to provide a foundation from which to protect park resources while providing meaningful visitor experiences. Hermit Road itself was identified in the GMP as a Transportation Subzone of the Development Zone. Transportation Subzones connect development zones. They are primary corridors (paved roads and railways) wide enough for safe travel. This proposal tiers from the GMP and further refines direction for the management of Hermit Road and its associated overlooks and parking areas

Shuttle Service

A shuttle bus system was first introduced on Hermit Road (and in other areas of the South Rim) in 1972 to alleviate traffic congestion (Milner 2004). At the time of the GMP, in 1995, a free shuttle bus service operated on Hermit Road from May through September annually. Private vehicles were not allowed on the road during this time unless they had an accessibility permit, as the buses were not universally accessible. From October to April (seven months) the road was open to all private vehicles, and shuttle buses did not operate during this time. In the late 1990s

NPS modified this operational schedule so that the road was only open to private vehicles for three months in the winter (December through February), with only shuttle buses operating on the road for the rest of the year, with the exception of those visitors with accessibility needs. This annual schedule continues today.

Road Maintenance History

After construction in 1934, minor routine maintenance has occurred (ditch clearing and chip sealing) on a fairly regular basis. No changes, however, have been made to the basic road structure since it was constructed and the road has deteriorated over the last 70 years. The road has not been widened to accommodate larger and faster vehicles. A Traffic Engineering Safety Study (USDOT 2001) was conducted in 2001 to evaluate the road's safety. The study recommended numerous short- and long- term fixes to bring the road to current transportation safety standards.

Internal Scoping

Preliminary internal scoping identifying NPS specialists' concerns regarding Hermit Road rehabilitation began formally in July 2003. A meeting of park staff was held in preparation for a kick-off meeting between NPS and the Federal Highways Administration (FHWA) held in August 2003. The project was discussed with the park's interdisciplinary team (IDT) on 10 September 2003 to generate initial issues and concerns, and again in April, June, September and October 2004. The park's project review board reviewed the project and several preliminary alternatives on 15 September 2003. A site visit and continuing discussions regarding various preliminary alternatives occurred between NPS and FHWA on 10 - 11 May 2004. A project-specific interdisciplinary team was established in October 2004, and began meeting monthly shortly thereafter and for the project's duration. Discussions occurred with the IDT to develop purpose, need and objectives (March and April 2005) and revised alternatives (April 2005). A Choosing by Advantages workshop was held 8 - 10 November 2005 to begin identification of the agency preferred alternative (NPS 2006a). Choosing By Advantages, part of Value Analysis, is a systematic approach to evaluating alternatives in context with the value of identified issues, concerns, and functions. The use of Value Analysis and subsequent Choosing By Advantages protocol is a NPS mandate when evaluating the merits of large projects. An internal review of the draft EA was conducted April through May 2006.

Public Scoping

NPS began the public scoping process in June 2004 with distribution of a general scoping letter describing several preliminary alternatives under consideration for Hermit Road rehabilitation. This letter was distributed to the park's approximately 280- person compliance mailing list, which includes state and Federal agencies and Native American tribes, was posted on the park's website and was included in a press release. Recipients were asked to respond with any issues or concerns with the alternatives described, and with whether they wished to receive a copy of the Environmental Assessment when distributed for public review. Twenty- three letters and e-mails were received in response to the letter; senders are listed below:

- Bill Woodward, Regional Transportation Engineer, United States Forest Service
- Jim Holland, Lake Mead National Recreation Area
- Robert Frankeberger, State Historic Preservation Office
- Steve Spangle, United States Fish and Wildlife Service
- Leigh Kuwanwisiwma, Hopi Tribe

- Rich Rumer and Bill Lazenby, Coalition of Arizona Bicyclists
- Karen Murray, Grand Canyon Trust
- Richard Utterback, Arizona Bicycle Club
- Bill Johnston, Xanterra Parks and Resorts
- 13 private individuals

Responses ranged from concerns regarding bicyclist, pedestrian and vehicle safety, natural and cultural resource protection, planning suggestions, road closure during construction, and specific comments on the various alternatives described.

NPS used this scoping response, in combination with other input from the project IDT and other NPS staff to re-evaluate the project's purpose, need and objectives. Based on this review, NPS developed a preliminary project proposal designed to best meet the purpose and need for taking action and the specific identified project objectives. This preliminary project proposal was described in a second public scoping letter in June 2005, requesting issues and concerns from the public. The preliminary project proposal was similar to Alternative C, Greenway, as described in Chapter 2. The letter made clear that the previous preliminary alternatives described in the June 2004 scoping letter were no longer being considered and that NPS wanted feedback on this new proposal. This letter was sent to the same mailing list used for the initial 2004 scoping effort, including all those that previously commented. Fourteen letters and e-mails were received in response to the letter; senders are listed below. Comments received are summarized in Appendix B, and were used to confirm issues analyzed in this document, and identify a reasonable range of project alternatives.

- Jim McCarthy, Grand Canyon Chapter of the Sierra Club
- Anthony Quintile, Absolute Bikes
- Dennis Carr, High Sonoran Adventures
- Elizabeth Train, Bikes Belong Coalition
- Flagstaff Biking Organization
- Paul Revere Transportation
- Arizona Department of Environmental Quality
- Seven responses from private individuals

EA Distribution

This EA has been distributed to those who responded to either the 2004 or 2005 public scoping effort, to pertinent agencies and tribes and to local libraries. Availability of the EA for the 30-day public review was advertised via press release, publication on the park's website and through the NPS public environment and public comment website.

Agencies and Tribes

At the time of both public scoping efforts, NPS also contacted other agencies pertinent to the project including the State Historic Preservation Office (SHPO), all affiliated Native American tribes, and the U.S. Fish and Wildlife Service (USFWS), initiating informal consultation and soliciting issues or concerns. NPS methods for contacting these groups, and their responses, are detailed in Chapter 5 and Appendix B and are summarized below.

The park contacted the SHPO and requested comments on several preliminary alternatives under consideration and input on the framework for consultation under Section 106 of the

National Historic Preservation Act (NHPA) in June 2004. NPS sent another letter dated 5 August 2005 continuing the dialog under Section 106 consultation and requesting comments on the latest set of alternatives under consideration. A conference call with SHPO was held on 23 August 2005 to discuss the project. Preliminary (15% design drawings) construction documents were sent to SHPO for information and review on 31 August 2006, and on 2 May 2005 a draft Memorandum of Agreement (MOA) between NPS and SHPO, with a draft archeological treatment plan, was sent.

The park contacted all affiliated Native American tribes and requested comments on several preliminary alternatives under consideration in June 2004 and during the second scoping effort in August 2005, requesting comments on the preliminary project proposal. In April, NPS contacted all tribal groups again notifying them of the park's intention to prepare a MOA with the SHPO and asking if they were interested in being a concurring party to the MOA (NPS 2006b).

The park contacted the USFWS requesting comments on several preliminary alternatives under consideration and a list of Federally listed species in the project area in June 2004. The park sent another letter during the second scoping period in July 2005 to update USFWS and request additional comments on the park's preliminary project proposal. NPS met with USFWS on 18 October 2005 to specifically discuss alternatives under consideration, including options for Maricopa Point where sensitive habitat for a rare plant occurs. The park sent preliminary options for Maricopa Point to USFWS for review and comment, prior to preparation of this project's Biological Assessment (BA).

ISSUES AND IMPACT TOPICS

After public scoping, issues and concerns were distilled into distinct impact topics to facilitate analysis of environmental consequences, which allows for standardized comparison between alternatives based on the most relevant information.

An issue is an effect on a physical, biological, social, or economic resource. The predicted effects of an activity create the issue. Issues may come from the public, from within an agency or department, or from another agency (Freeman and Jenson 1998). For this project, the interdisciplinary team identified issues with the preliminary project proposal (shown as Alternative C, greenway in Chapter 2), as described in the June 2005 scoping letter. Internal, public, and other agency comments resulted in the following substantive issues:

- This proposal would construct a greenway trail primarily on Hermit Road's south side (rationale for placing the trail primarily south of the road, instead of north, as the GMP recommended, is including in the Alternatives Considered But Dismissed section of Chapter 2). This will negatively impact visitors using the trail because they will not have canyon views for about 2/3 of the distance to Hermits Rest.
- This proposal creates habitat fragmentation between the road and trail and will diminish the suitability of this woodland habitat for wildlife species.
- This proposal creates additional disturbance to vegetation along the roadway and will likely result in introduction of additional exotic plant species.

- This proposal creates the need for several road crossings for trail users. This may require additional signage and striping and may negatively impact the roadway's historic character.
- This proposal, through road widening and trail construction, would disturb several archeological sites.
- This proposal does not include reduction of vehicle traffic on the roadway, and the opportunity to create a vehicle- free experience for park visitors.

Other concerns and comments brought forward (as shown in Appendix B) included such things as construction costs for the greenway, practicality of greenway use, trail safety for users, appropriate trail width, road safety for users, impacts to natural and cultural resources with trail construction and road widening, impacts to the roadway's historic character, and continued motorized traffic.

Concerns were raised by the park concessionaire, Xanterra Parks and Resorts, regarding area access by visitors during construction. Xanterra operates the Hermits Rest Gift Shop and the tour bus operation on Hermit Road. Both have the potential to be impacted during the construction period. The park is working closely with Xanterra on options available during road construction to minimize adverse impacts to the concessionaire operation; this is addressed in Chapter 3 under park operations.

No other significant issues not already included based on internal scoping came forward through this scoping effort. Identified issues were used to formulate alternatives and mitigation measures. Impact topics were then selected for detailed analysis based on substantive issues, environmental statutes, regulations, executive orders, and *NPS Management Policies 2001*. A summary of some of these compliance- related laws and regulations is provided in Appendix C. A summary of the impact topics and rationale for selection/dismissal are given below.

Relevant Impact Topics

Cultural Resources The 1966 National Historic Preservation Act, as amended, National Environmental Protection Act (NEPA), the 1916 NPS Organic Act, *NPS Management Policies 2001* and other NPS guidelines require consideration of cultural resource impacts. Project undertakings have the potential to affect archaeological resources, sites of special ethnographic significance to American Indians and the Hermit Road, Trail and Overlooks National Register-eligible Historic District. Therefore, this topic is discussed in Chapter 3.

Watershed Values (Soils and Water) Proposed activities, such as road widening (and associated activities including culvert installation and road resurfacing) and trail construction would result in new ground disturbance and potential impacts to watershed values. This topic is discussed in Chapter 3.

Vegetation Proposed activities such as road widening and trail construction would result in new ground disturbance and would disturb vegetative communities in these areas. Tree removal would be necessary. There is potential of increased disturbance to adjacent biotic communities via the spread of exotic vegetation. This topic is discussed in Chapter 3.

General Wildlife Proposed activities would involve some disturbance to vegetative communities and thus disturbance of wildlife habitat. Habitat modification as well as noise

and other activities associated with project implementation have the potential to impact wildlife populations. Impacts to general wildlife populations are discussed in Chapter 3.

Special Status Species Federally listed threatened and endangered species, species proposed for listing on the Endangered Species List and species of particular concern to Grand Canyon National Park have the potential to be affected by proposed actions. A Biological Assessment is being prepared for this project to facilitate consultation with the USFWS and will detail the potential for effects to these species. Impacts to special status species are included in Chapter 3.

Soundscape The NPS is mandated to articulate park service operational policies that would require, to the fullest extent practicable, the protection, maintenance or restoration of the natural soundscape resource in a condition unimpaired by inappropriate or excessive noise sources. Proposed project components would generate construction- related noise in the project area above ambient conditions, and actions have the potential to alter, to some extent, visitor use in the project area. Therefore, soundscape is discussed in Chapter 3.

Visual/Scenic Quality Conserving the scenery of national parks and providing for visitor enjoyment are elemental purposes of the NPS according to the 1916 Organic Act. Scenic resources are integrally tied to action objectives including maintaining the roadway's historic character, and are related to cultural resources such as maintaining cultural landscapes. Proposed project components have the potential to impact the visual appearance of the roadway and associated areas such as overlooks, parking areas and viewpoints, and to alter viewsheds. Therefore, visual/scenic resources are discussed in Chapter 3.

Visitor Experience The 1916 NPS Organic Act and *NPS Management Policies 2001* direct national parks to provide for public enjoyment. Hermit Road and its associated viewpoints, parking areas and rim trail provide an area where visitors can get away from the more urbanized Grand Canyon Village. A primary focus of the project is to improve visitor experience in this area, including improvements in visitor safety, and provide for a variety of visitor opportunities along Hermit Road. One of the primary needs identified for rehabilitating the road is to improve safety for shuttle bus riders, those in private vehicles, pedestrians and bicyclists. This includes reducing potential for vehicle- to- vehicle and vehicle- to- pedestrians/bicycle collisions. This topic is discussed in Chapter 3.

Park Operations Park operations, including shuttle bus operations and concessionaire operations on the roadway and at each end of the roadway near Grand Canyon Village and at Hermits Rest, have the potential to be affected by proposed actions. This topic is discussed in Chapter 3.

IMPACT TOPICS DISMISSED FROM FURTHER ANALYSIS

Air Quality Clean, clear air is essential to preserve Grand Canyon National Park resources, as well as for visitors to appreciate those resources. Grand Canyon National Park is a Federally mandated Class I area under the Clean Air Act. As such, air in the park receives the most stringent protection against increases in air pollution and in further degradation of air quality- related values. The Act then sets a further goal of natural visibility conditions, free of

human- caused haze. Park air quality is generally quite good. Park pollution levels fall below levels established by the Environmental Protection Agency to protect human health and welfare. However, visibility is usually well below natural levels because of air pollution. Most of this pollution originates far outside park boundaries, and arrives as a well- mixed regional haze, rather than as distinct plumes.

Section 118 of the Clean Air Act requires all Federal facilities to comply with existing Federal, state, and local air pollution control laws and regulations. The park air quality specialist has determined that this project, due to its limited scope, would not require NPS consultation with the State of Arizona regarding air quality. However, the use of an asphalt batch plant in the park to support the project is the primary way in which air quality could be affected by the project. However, FHWA will work with the Arizona Department of Environmental Quality (ADEQ) on standard consultations and any permits required for such actions. In addition, mitigation measures have been incorporated into the project to reduce the likelihood of substantial impacts to air quality during batch plant operation (these are listed at the end of Chapter 2).

ADEQ responded to a request for comments on the project and indicated that controlling dust is an important project concern. NPS agrees with this suggestion and recognizes the possibility of raising fugitive dust during project implementation and from disturbed areas afterwards is a possibility. Revegetation of disturbed areas if needed after work is complete, would provide long- term dust control. Mulch and plants would stabilize the soil surface and reduce wind speed/shear against the ground surface.

Trenching and other onsite work would increase dust and combustion- related emissions. Dust raised during ground disturbance would be limited by project size and equipment used. By clearly marking project boundaries, unnecessary soil disturbance and consequent dust generation would be avoided. Water sprinkling can control fugitive dust emissions from light traffic in the project area. Construction equipment can adversely affect air quality by exhaust emissions. Minimizing the extent to which construction equipment idles would help reduce this effect. Minimizing idling would also help reduce noise impacts during construction. Indirect air quality impacts from routine daily vehicle emissions from visitors, employees and official business would be unchanged.

Therefore, local air quality may be temporarily degraded by the operation of the diesel- powered asphalt batch plant, from dust generated from construction activities and emissions from construction equipment under implementation of the alternatives. This degradation would result in an overall negligible impact to air quality, and would last only as long as rehabilitation activities occurred. Impacts to overall park air quality or regional air quality are not expected. Likewise, impacts from foreseeable future projects in the area would be negligible and would be restricted to the construction period. Encouraging non- motorized uses and mass transit options (shuttle bus) along the roadway may also reduce emissions slightly. Thus, cumulative impacts to air quality would be local, short- term and negligible. Therefore, air quality was dismissed from further analysis

Floodplains and Wetlands Executive Order 11988 (Floodplains) and Executive Order 11990 (Wetlands), which require Federal agencies to examine potential impacts of actions on floodplains and wetlands, were reviewed for applicability. Because the project is not in or

near a floodplain or wetland and would not affect this resource, floodplains and wetlands were dismissed from further analysis.

Environmental Justice Executive Order 12898 requires consideration of impacts to minority and low- income populations to ensure that these populations do not receive a disproportionately high number of adverse or human- health impacts. This issue was dismissed from further analysis because each alternative would affect everyone equally and would not disproportionately impact minority or low- income populations.

Prime and Unique Farmland The Farmland Protection Policy Act of 1981, as amended, requires Federal agencies to consider adverse effects to prime and unique farmlands that would result in conversion of these lands to non- agricultural uses. Prime or unique farmland is defined as soil that particularly produces general crops as common foods, forage, fiber, and oil seed; unique farmland produces specialty crops such as fruits, vegetables and nuts. This proposed project's locations and surrounding lands have been evaluated by appropriate park technical area specialists and by specialists from the Natural Resources Conservation Service (NRCS). Based on their observations, the project area is not considered prime or unique farmland (Camp, pers. comm. 2002). Therefore, this topic was dismissed from further analysis.

Socioeconomic Environment Socioeconomic values consist of local and regional businesses and residents, the local and regional economy and park concessions. The local economy and most business in neighboring communities are based on construction, recreation, transportation, tourist sales, services, and educational research; the regional economy is strongly influenced by tourist activity. The GMP Environmental Impact Statement (EIS) discussed socioeconomic environment and impacts extensively. There may be short- term benefits to the local and regional economy resulting from construction- related expenditures and employment under GMP implementation. Local and regional businesses would be negligibly affected in the long- term. For the Hermit Road rehabilitation project, short- term adverse impacts to Xanterra Parks and Resorts, the concessionaire that operates the Hermits Rest Gift Shop and tour bus operations on Hermit Road, could occur during the construction period. NPS is working closely with Xanterra on feasible options to minimize this impact during construction activities and addresses this in the park operations section of Chapter 3. For these reasons, socioeconomic values were dismissed from further analysis.

Wilderness Most of the park has been recommended for wilderness designation. Until Congress formally acts on this recommendation, NPS Policies require that these areas be managed under the provisions of the Wilderness Act. However, the Hermit Road project area is part of a Transportation subzone of the Development Zone as defined in the GMP and is outside recommended wilderness. Proposed actions within this area would not occur in recommended wilderness and would not directly affect wilderness character or wilderness values, with one possible exception: Road closures during the construction period would restricted access to the Hermit Trail. If this occurs, backcountry hikers may instead opt to use the Waldron Trailhead, which is access via roads within recommended wilderness. The potential for adverse impacts to this area from this increased use during the construction period is addressed in mitigation measures and under visitor experience in Chapter 3. For these reasons, wilderness was dismissed from further detailed analysis.

ADDITIONAL NEPA ANALYSIS

The alternatives include all reasonably foreseeable connected actions. Environmental effects estimated for this project consider site- specific effects of all foreseeable actions and mitigation measures. This EA evaluates each action based on reasonable estimation of impacts from preliminary site plans and proposed action descriptions, including those from connected actions.

Monitoring during and following project implementation would verify mitigation- measure effectiveness and impact predictions. This EA will guide any subsequent project implementation. If new information comes to light, or unforeseen and unanalyzed actions become necessary, as further detailed design occurs, additional site- specific environmental analysis will be conducted before implementation.

Chapter 2 Alternatives

INTRODUCTION

The NPS adopted sustainable design as a guiding principle for facility planning and development (DO- 13, *NPS Management Policies 2001*). The objectives of sustainability are to design park facilities to minimize adverse effects on natural and cultural values, to reflect environmental setting, to maintain and encourage biodiversity, to construct and retrofit facilities using energy- efficient materials and building techniques, to operate and maintain facilities to promote sustainability, and to illustrate and promote conservation principles and practices through sustainable design and ecologically sensitive use. Essentially, sustainability is living within the environment with the least impact. The action alternatives subscribe to and support the practice of sustainable planning, design and human use of developed areas and associated public and administrative facilities.

This document analyzes a No- Action Alternative and several action alternatives. Analysis of the No- Action Alternative is required under NEPA (40 CFR 1502.14(d)). It provides a baseline for assessing potential impacts of the action alternatives. In developing alternatives many actions were considered and subsequently dismissed. A description of alternatives considered but dismissed from detailed study is included in this chapter. Summary tables comparing alternative components (Table 1) and environmental impacts (Table 2) are also presented at the end of this chapter.

Action alternatives are based on preliminary designs and best information available at the time of this writing. Specific distances, areas, and layouts used to describe the alternatives are only estimates and could change during final site design. If changes during final site design are not consistent with the intent and effects of the selected alternative, then additional environmental compliance would be conducted as appropriate.

ALTERNATIVE DEVELOPMENT

As described in the Management and Planning History Section of Chapter 1, multiple meetings and discussions took place with NPS staff regarding this project. Alternative development began with meetings in July and August 2003 between NPS and FHWA regarding the need for the rehabilitation of the road and the desire to maintain the road's historic integrity. Several preliminary options were developed to address the need for action early on in the process and were described in a scoping letter to interested and affected agencies and the public in June 2004. Using the comments received from the public and the results of an Alternatives Workshop held in November 2004 for NPS and FHWA staff, NPS reconsidered the preliminary alternatives and re- thought the project. Based on this step back NPS used an interdisciplinary approach to redefine the purpose and need for action, develop an existing- and desired- condition statement (as described in Chapter 1) and craft specific objectives for taking action to rehabilitate Hermit Road. Based on this revised information and a new framework for the planning effort, NPS developed a preliminary project proposal (Alternative C, Greenway) to

address the need for action and the objectives. This project proposal was shared with the public and other agencies in a scoping effort in June 2005. Based on comments received during this scoping effort and via internal scoping, NPS developed issue statements (Chapter 1) that formed the framework for a range of alternatives. These alternatives were then reviewed by the IDT and evaluated in a Choosing by Advantages workshop held in November 2005 to weigh the merits of the preliminary alternatives in achieving objectives against cost (NPS 2006a). The results of this workshop and subsequent discussion with park management resulted in selection of an agency preferred alternative. This Alternative is Alternative D, Preferred Alternative, described in detail later in this chapter.

Consideration of impacts to cultural resources was of paramount importance when developing the alternatives considered in detail in this document. Efforts have been taken to avoid adverse impacts where possible, or to minimize the potential for adverse impacts. These efforts can be seen in the Alternatives Considered and Dismissed from Detailed Analysis and the Mitigation Measures sections of this chapter.

ALTERNATIVE DESCRIPTION

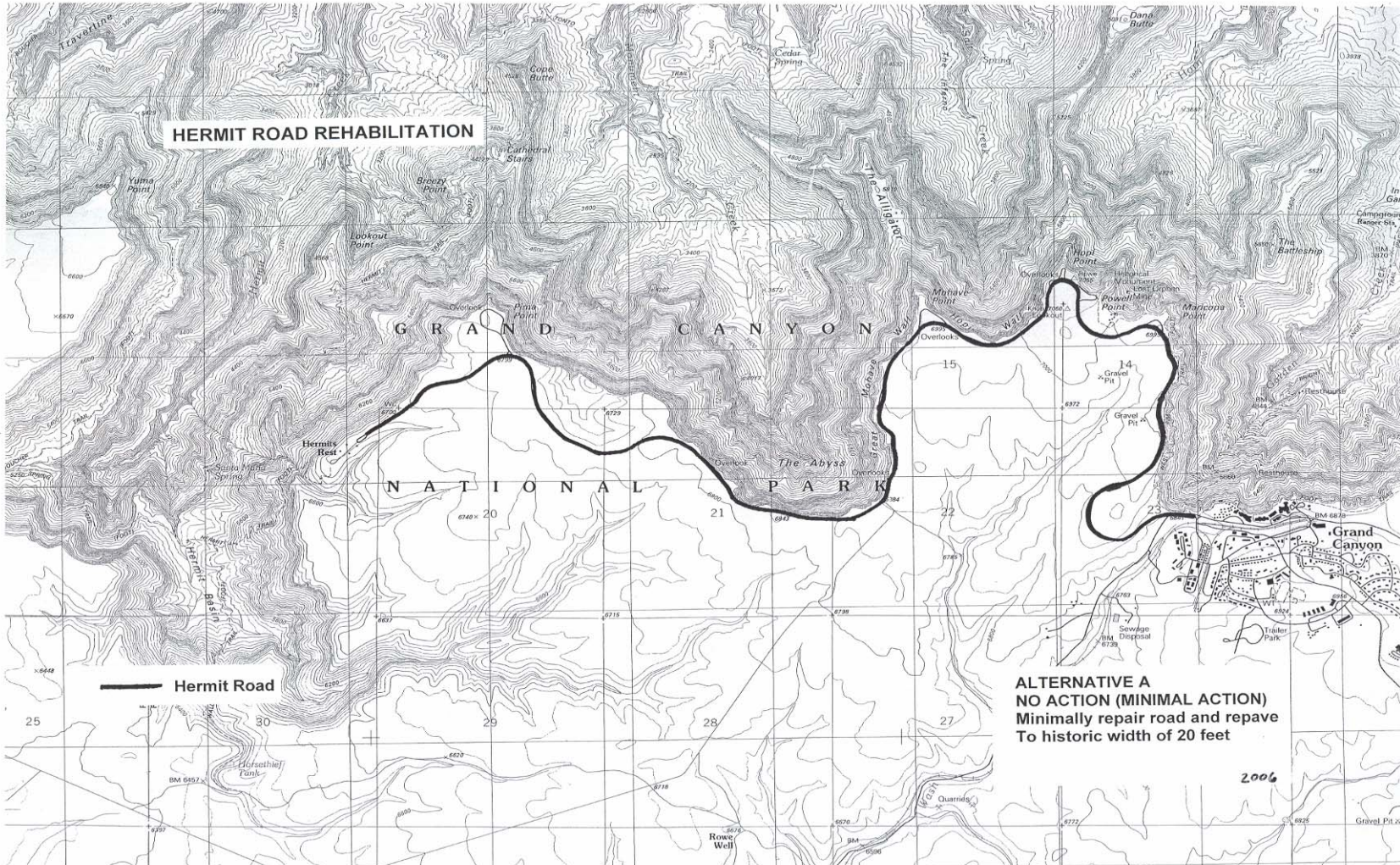
Alternatives are described below. Table 1 summarizes each alternative's primary components, and Table 2 summarizes the expected implementation impacts.

ALTERNATIVE A – NO ACTION (Map 2)

Hermit Road would be minimally repaired under the No- Action Alternative, but no improvements would be made to existing road uses or to pedestrian and bicycle access between Grand Canyon Village and Hermits Rest. The seven- mile road surface would be repaved to its historic width of 20 feet to provide two, ten- foot lanes without a paved shoulder. The operation of a shuttle bus system on this roadway for nine months would continue, and vehicular traffic would be restricted to shuttle buses, tour buses, service vehicles, and private vehicles for visitors with accessibility needs. The road would remain open to all vehicle traffic during the winter (December through February). Bicyclists and pedestrians would continue to use the area year-round. The pedestrian trail existing along the rim on Hermit Road's north side would remain in its current condition: paved from Grand Canyon Village to Maricopa Point, but narrow in places and a dirt path without signage west of Maricopa Point. No improvements would be made to overlooks and their associated access roads and parking areas.

Implementation of Alternative A would result in approximately 20 acres of ground disturbance; none of this disturbance would be new. In other words, all disturbance related to resurfacing and widening the road to its original width would occur underneath the road and within the existing road prism, and would not require removal of road- edge vegetation, although trampling of existing vegetation during construction may occur.

The No- Action Alternative is a minimal- action alternative. It addresses urgent safety concerns related to the road's surface condition by resurfacing the road and restoring its original historic width. This means that in areas where the road edge has unraveled (in some places as much as two feet) NPS would restore the original width and provide a uniform 20- foot width for the seven- mile road length. While this alternative would result in some level of change to the existing condition, it does not meet the purpose and need for action. This alternative provides a basis for comparing the action alternatives' management direction and environmental



Map 2. Alternative A - No Action.

consequences while recognizing the urgent need to minimally fix the road's condition. If the No- Action Alternative was selected, NPS would respond to future Hermit Road needs without major action or course changes.

Elements Common to All Action Alternatives (B, C, and D)

Paved Rim Trail (West Rim Trail) Rehabilitation (Figure 1)

The existing historic paved path would be rehabilitated according to the Secretary of the Interior's Standards for the Treatment of Historic Properties (Weeks and Grimmer 1995) from the Village to Maricopa Point. Improvements include replacement- in- kind to include: removal and replacement of asphalt paving, replacement of missing or broken stones along trail edges, and re- setting of loose or misplaced stones. No new ground disturbance would occur and all work would occur within the existing trail footprint.



Figure 1. Typical section of the West Rim Trail (2004) proposed for rehabilitation

Overlook Improvements

Rehabilitation and improvements would occur at the Hermit Road Interchange and at each major overlook that currently accommodate shuttle buses and/or tour buses (with the exception of Maricopa Point, which is discussed separately). These include the following nine sites: Trailview Overlook I, Trailview Overlook II, Powell Point, Hopi Point, Hopi Overlook, Mohave Point, The Abyss, Pima Point and Hermits Rest (Map 1). Changes proposed at Hopi Overlook and at Hopi Point are specific to each alternative and are discussed under the specific alternative descriptions later in this chapter.

Improvements focus on parking areas, shuttle bus stops, and adjacent pedestrian use areas. Improvements would provide for accessible routes from parking areas to pedestrian paths; improved parking and circulation; reduced potential conflicts between shuttle buses, tour buses, private vehicles, pedestrians and bicyclists; and improved visitor furnishings and facilities

associated with shuttle bus stops. Improvements common to each overlook include: replacement of asphalt paving; raised walkways along existing stone walls to facilitate shuttle bus loading/unloading; concrete braking pads for shuttle bus and/or tour buses to provide a durable- use surface and to clearly delineate bus parking areas; reconfiguration of select wall openings and/or paving to accommodate an accessible route to existing pedestrian paths; placement of trash/recycling receptacles; and, as needed, relocation or replacement of information waysides/kiosks and benches. Existing stone walls and curbing, except as noted for specific overlooks, would be retained in their current configuration. Asphalt trails from the overlooks to viewpoints would be repaired and/or replaced in kind. Improvements would include repair/replacement of asphalt; repair and stabilization of historic and modern rock trail liners and minor alterations to make trails accessible.

Types, quantities and styles of additional site furnishings (bike racks, signage, benches) would be carefully evaluated with cultural resource staff to determine appropriateness and consistency with the surrounding cultural landscape.

Some reductions or increases in pavement are proposed at overlook parking areas to facilitate circulation and parking. Figure 2 displays typical actions that would occur at overlook parking areas. Improvements specific to each overlook are listed below, from east to west along Hermit Road. The majority of work proposed at each overlook would occur within existing footprints, with very little new ground disturbance. However, at both Pima Point and at the Hermit Road Interchange some small areas adjacent to paved surfaces would be disturbed. At entrance roads that access overlook parking areas there would also be slight disturbance outside of the paved surface to accommodate better turning movements for vehicles. These slight modifications would result in approximately 0.5 acres of new ground disturbance.

Hermit Road Interchange - The existing shuttle bus shade shelter would either be removed and replaced or modified and increased in size to accommodate visitor queuing at the shuttle bus stop. Concrete would be used to replace the existing asphalt on the loop. Buses would both load and unload on the north side adjacent to the existing loading area. The lane used for exiting onto Village Loop Drive would be slightly modified to accommodate wider turning radii for buses.

Trailview Overlook I - Existing stairs would be removed from a stone wall opening and replaced with an ADA accessible ramp. A six- inch- high raised walkway for shuttle bus loading/unloading would be placed adjacent to the west side of the existing stone wall. A concrete braking pad for the shuttle bus would be placed adjacent to the raised walkway.

Trailview Overlook II – A stone curb tree well would be constructed around an existing tree within the asphalt paved area. All asphalt paving would be replaced in- kind. Shuttle buses do not stop here, so no improvements would be made for shuttle bus access.

Powell Point – A six- inch- high raised walkway for shuttle bus loading/unloading would be placed adjacent to the west side of the existing stone wall. A concrete braking pad for the shuttle bus would be placed adjacent to the raised walkway. Asphalt paving would be replaced throughout the rest of the overlook/parking area and the overlook would remain in a one- way configuration.

Mohave Point – A six- inch- high raised walkway for shuttle bus loading/unloading would be placed adjacent to the south side of the existing stone wall. A concrete braking pad for inbound and outbound shuttle buses would be placed adjacent to the raised walkway. Access would be one- way, and entrance roads would be widened to accommodate turning radii at their connection point to the main roadway. Asphalt paving would be replaced along entrance/exit roads. There may be a need to widen the asphalt surface slightly at the overlook to better accommodate buses maneuvering in this area.

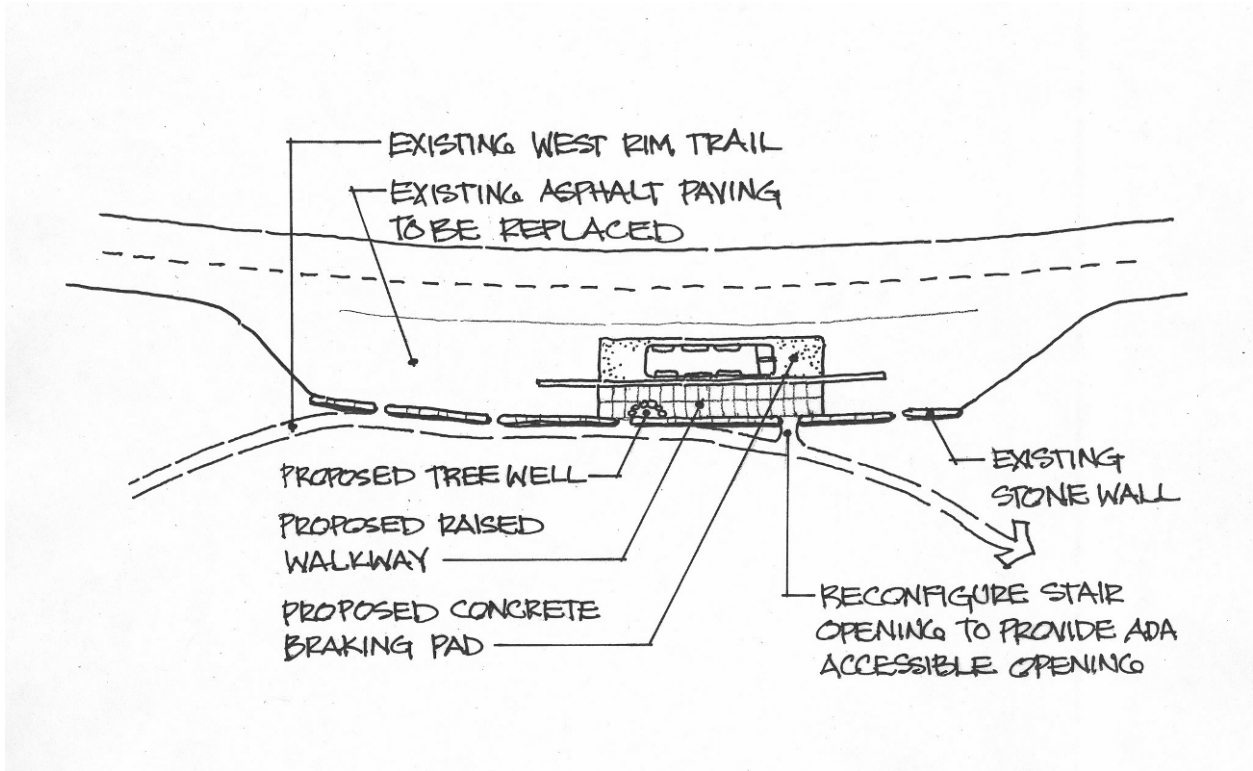


Figure 2. Example of Typical Overlook Improvements Proposed

Abyss – A six- inch- high raised walkway for shuttle bus loading/unloading would be placed adjacent to the south side of the existing stone wall. Concrete braking pads would be placed adjacent to the pedestrian surfacing.

Pima Point – A six- inch- high raised walkway for shuttle bus loading/unloading would be placed adjacent to the south side of the existing stone wall. A concrete braking pad for the shuttle bus would be placed adjacent to the raised walkway.

Hermits Rest - Concrete braking pads would be placed adjacent to the existing curb. The adjacent walkway would be placed flush with the top of the curb, on the north side of the curb and would also be the terminus for the greenway trail (Alternatives C and D). A seat wall would be added to the north side at the bus waiting area.

Maricopa Point – To enhance the protection of a rare plant population and adjacent suitable habitat, and to improve visitor experience, NPS is considering two options for changes to this overlook and parking area, as described below. Each action alternative includes the preferred

option as an alternative component, as described in Table 1. However, in Chapter 3, the environmental consequences of implementing Option 2 instead of the preferred option are described for each alternative and impact topic. When NPS selects an alternative to implement following EA completion, the public comment and analysis period, and preparation of a decision document, the decision-maker would choose either Alternative A, B, C, or D for implementation. The decision would also indicate whether Maricopa Point Option 1 or Option 2 is being selected for implementation.

Option 1 – Preferred (Figure 3) - The parking area and access-road pavement would be removed and the overlook would no longer be accessible by tour bus or private vehicle. The pedestrian path to Maricopa Point would be re-designed and improved to a more direct trail. A new shuttle bus stop would be created near the end of the existing Maricopa Point access road, connecting to the re-designed pedestrian path to the point. The shuttle stop would be a pull-out only, with enough room for a shuttle bus to pull-in, drop off visitors, and pull-out onto Hermit Road west-bound. Shuttle buses would access this new stop directly from Hermit Road, using the existing pavement and flat ground at the access road's west end.

Other paved pathways in the area would be removed so that the paved trail to Maricopa Point would be visible, and the connecting trail (Alternatives B and D) or the greenway (Alternative C) to Powell Point is obvious to visitors at the shuttle stop. The existing rim trail east of Maricopa Point would be directed along the road edge in this area until it reaches the re-designed trail to Maricopa Point and the connecting trail leading to Powell Point. All areas currently denuded by social trailing would be revegetated, and visually appealing buffers (vegetation, rocks, other) between the re-designed trail to the point and the existing fence around the rare plant population would be created.

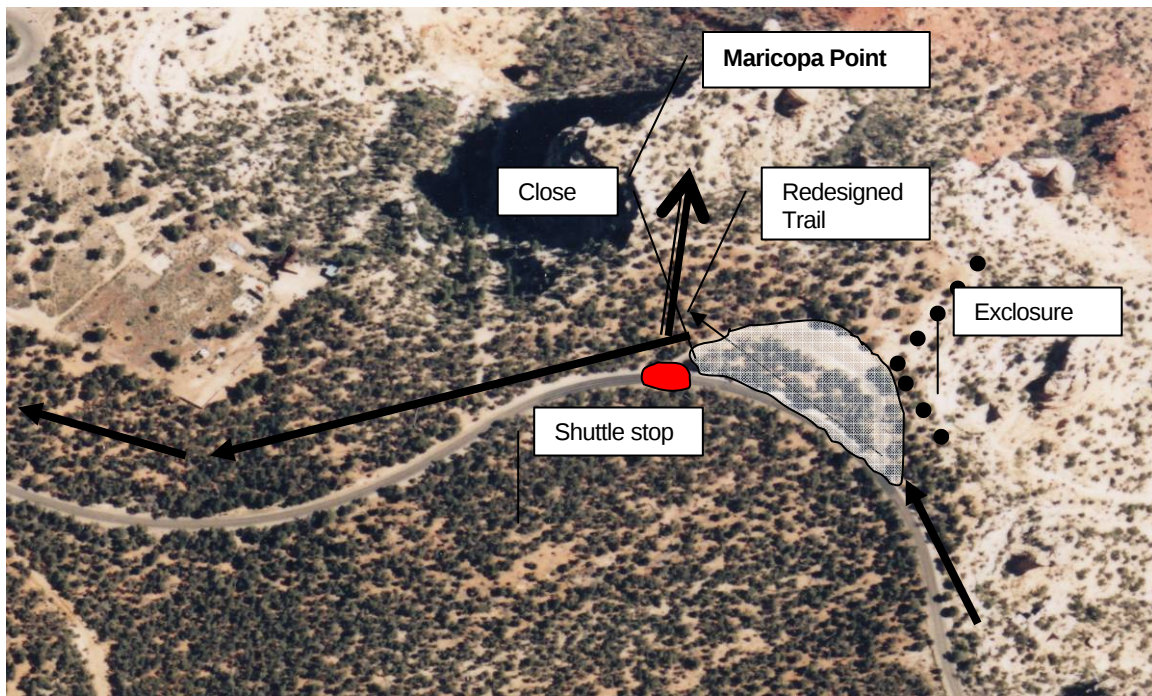


Figure 3. Proposed Improvements at Maricopa Point (Option 1)

Types, quantities and styles of additional site furnishings (bike racks, signage, benches) would be carefully evaluated with cultural resource staff to determine appropriateness and consistency with the surrounding cultural landscape.

Option 2 – Retain Parking Area (Figure 4) - Proposed actions under this alternative would be similar to those described for Option 1, except that the asphalt pavement in the parking area would be replaced. Improvements common to other overlooks would apply to this option as well (such as raised walkways to facilitate shuttle bus loading/unloading; concrete braking pads for shuttle bus and/or tour buses to provide a durable- use surface and to clearly delineate bus parking areas; reconfiguration of select paving to accommodate an accessible route to existing pedestrian paths; placement of trash/recycling receptacles; and, as needed, relocation or replacement of information waysides/kiosks and benches). No changes would be made to visitor access to the area; private vehicles, tour buses and shuttle buses would continue to be allowed overlook access using the existing parking area. However, the shuttle bus stop would be relocated approximately 150 feet west so that it coincides with a more direct, redesigned trail to Maricopa Point, and avoids off- loading visitors adjacent to the fenced sensitive- plant enclosure. Rim trail improvements, as described under Option 1, would occur under this alternative. The redesigned trail to the overlook would be wider than proposed under Option 1 to accommodate larger visitor groups off- loading from tour buses.

Types, quantities and styles of additional site furnishings (bike racks, signage, and benches) would be carefully evaluated with cultural resource staff to determine appropriateness and consistency with the surrounding cultural landscape.

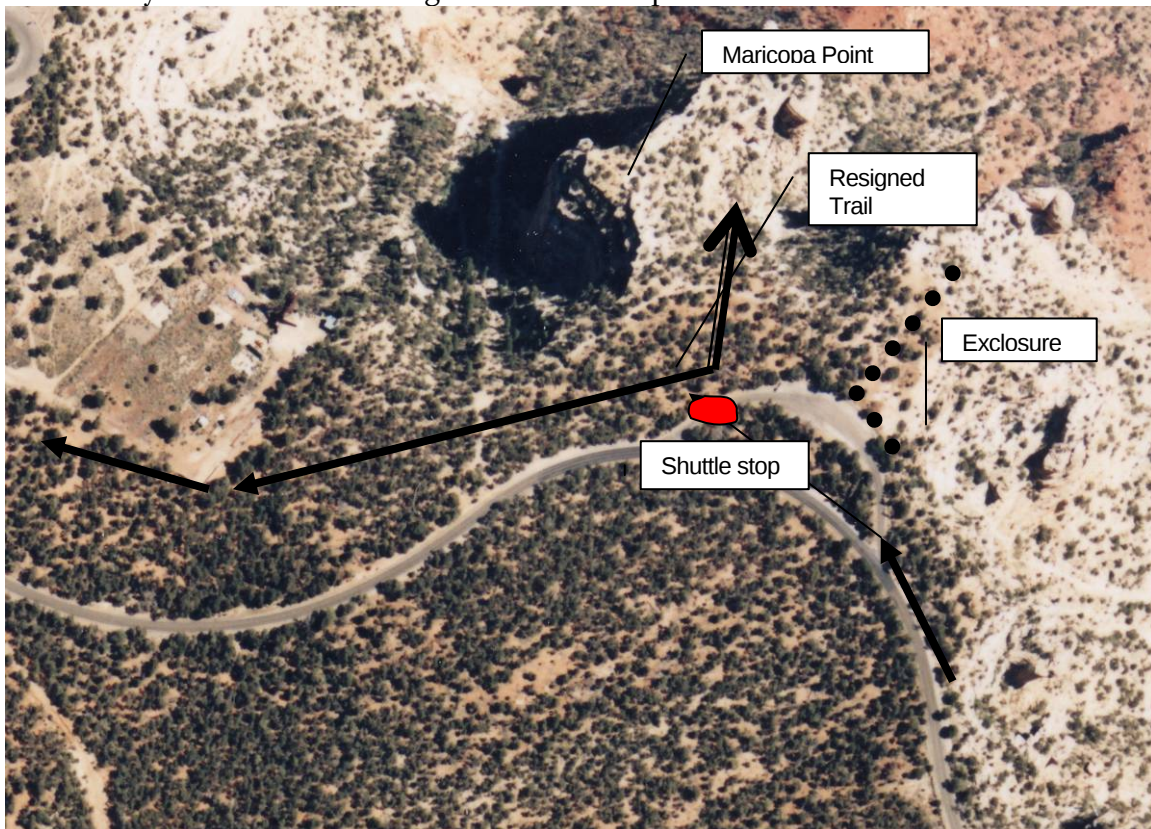


Figure 4. Proposed Improvements at Maricopa Point (Option 2)

Minor Road Realignment

Hermit Road would be realigned and shifted approximately six feet south in three locations between Mohave Point and The Abyss shuttle bus stop. The road would be shifted to accommodate the need for a wider area between the roadway and the rim on the north side in these three areas.

Construction Staging Areas

Existing pullouts and overlook parking areas would be used for construction equipment staging areas during road rehabilitation to minimize disturbance outside existing developed areas. An existing, disturbed, flat area just south of Hermit Road, close to The Abyss shuttle bus stop and an old quarry to the north, may also be used throughout construction for equipment and materials staging. If the road is open during construction (option 3), no more than 50% of the overlooks would be closed at any time.

Asphalt Batch Plant – A diesel- powered asphalt batch plant would be set up in the park for this project. An existing disturbed area at the park dump site (also previously used for this purpose) would be used. The park dump site is located between South Entrance Road and Center Road, approximately ¼ mile west of the South Entrance Road near Grand Canyon Village. The approximately five- to- eight acre previously disturbed site would be used for storing materials necessary for mixing asphalt, the plant itself, and equipment needed to haul the asphalt to the project site.

Salvage and Revegetation Plan Components – A detailed Salvage and Revegetation Plan is being developed for this project to guide vegetation aspects including pre- construction, during construction and post- construction actions. Actions include native seed collection from the project area and nearby park lands for propagation at a nursery, exotic species control near project boundaries (such as along Hermit Road and proposed trail- improvement or trail- construction areas) and salvaging existing trees and shrubs from areas disturbed during construction. Salvaging existing vegetation would require use of backhoe and a small work crew. Crews would operate for a one- to- three week period in the project area, using a pick- up truck and small trailer to transport salvaged trees and shrubs to the park greenhouse or other suitable location for maintenance. The salvaged trees and shrubs would then be used in the project area following completion of project activities to augment screening of the road and trail components and to revegetate areas with excessive social trailing. Trees would also be used as necessary at overlooks and parking areas to replace trees that have died, as deemed appropriate for the cultural landscape. Salvaged vegetation may also be used for other park projects as necessary and feasible. Following construction actions and full implementation of the project, watering of replanted vegetation, continued exotic species control and monitoring of revegetation efforts would continue. The work detailed in the Salvage and Revegetation Plan would occur as early as 2006/2007 and would continue through approximately 2011.

Construction Schedule and Timing/Road Closures

Road rehabilitation and overlook improvements would occur at the same time and are factored into the timing estimates above. Proposed rehabilitation and improvements to the paved rim trail and the unpaved trail would also likely be done during the construction period to take advantage of the area closure to visitors, but could be completed either before or after the road work, as this work is funded differently and would use different work crews.

Greenway trail construction under Alternatives C and D would occur during the road construction period. If Alternative C were selected, the construction period would likely increase by approximately eight months, or one additional construction season, but this would not likely require the road to be closed during the trail construction period.

The proposal under all action alternatives includes rehabilitation of the entire road. This creates a difficult situation for accommodating current operations and visitor use in this popular South Rim area. To either allow for continued visitor access to viewpoints along the road, to Hermits Rest and the Hermit Trailhead or to disallow this access during the construction period is considered in the three options described below. However, in Chapter 3, the environmental consequences of implementing Option 1 or 3 instead of the preferred option are described for each alternative and impact topic. When NPS selects an alternative to implement following EA completion, the public comment and analysis period, and preparation of a decision document, the decision-maker would choose either Alternative A, B, C, or D for implementation. The decision would also indicate whether Road Closure Option 1, 2 or 3 is selected for implementation.

Option 1 –Total Closure: Hermit Road would be completely closed during the construction period. Road construction would begin in 2008 and would take approximately one construction season to complete. Work would likely begin March or April and end in November, dependent on weather conditions. The road would be closed to visitors during the construction period. Shuttle and tour buses would not operate during the construction period, nor would the rim trail be open to hikers. This closure would speed up construction, allowing for the work to be completed in one season.

Option 2 –West to East Partial Closure (Preferred): Road construction would occur from west to east. The road section from west of Mohave Point to Hermits Rest would be completely closed during the construction period. The section of road from the Hermit Road Interchange to Mohave Point would remain open during construction of the western half of the road. Total road construction would begin in 2008 and would take approximately one construction season to complete. Work would likely begin March or April and end in November, dependent on weather conditions. Work on the eastern portion of the road would likely begin in June or July. The west end of the road would be closed to visitors during the entire construction period; the east end of the road would be closed to visitors from late June or July through November. Shuttle buses and tour buses would not operate on the west end for the entire duration, but would be allowed on the east part of the road up until June or July. Portions of the rim trail would be open to correspond with road closures. Use of the Hermit Trailhead would be prohibited throughout the construction period. This closure would speed up the construction allowing for the work to be completed within one season.

Option 3 – Partial Road Closure: Under this option, one lane would generally remain open for the duration of the construction period to allow visitor and employee access through the project area. Construction crews would manage traffic through periodic traffic delays, pilot cars, and other appropriate methods to accommodate construction activities and visitor safety while accessing the project area. Shuttle buses, tour buses and private vehicle access would generally be allowed to continue operations, although some periodic closures to these user groups may be necessary on a site-specific basis. Rim hikers

and bicyclists would not be allowed during the construction period. If a partial closure was implemented for this project, the construction period would increase from one to two seasons.

Substitute Shuttle and Tour Bus Routes During Construction Period

Due to the length of the construction period and its impact on the current use of the road, shuttle and tour bus operations on Hermit Road would need to be modified. Temporary changes in bus operations would be implemented for any action alternative selected. The changes would differ somewhat depending on which road closure option was selected, but under any option selected, some level of replacement bus service would be provided to accommodate visitors displaced from shuttle or tour routes on Hermit Road and to accommodate shuttle and tour bus employees who typically work Hermit Road routes. Areas under consideration for temporary replacement tours are Yaki Point and Yavapai Point. Shuttle service would likely increase on Village routes and out to Yaki Point. Running a shuttle service from the Village to Desert View would also be considered. These modifications to existing routes would be temporary and last only the duration of the Hermit Road construction period.

Slash Removal

Trees and woody vegetation would need to be removed under any action alternative selected to accommodate road widening and new trail construction. The resultant slash created would be removed from the project area where possible and smaller material would be chipped. Larger material, such as usable poles, would be stockpiled in a suitable park location (such as the dump site or other previously disturbed location) and made available for other park uses or given away. NPS would consider giving usable poles to Native American groups for use in construction, as appropriate.

Visitation Changes and Operations

The existing shuttle buses with trailers that are used on the Hermits Rest Route will be replaced by 40- foot compressed natural gas, low floor buses by 2008. No immediate changes in visitation are expected based on implementation of any alternative. It is assumed that some small change (small increase) in operation may be necessary to respond to visitation changes likely over the long- term. This small visitation increase, combined with use of new buses that have slightly less capacity, is expected to result in the addition of two or three shuttle buses.

No changes would occur to the road closure period for private vehicles under any action alternative. Private vehicles would continue to be restricted during nine months of the year, and allowed December – February when shuttle buses are not running. Bicyclists would continue to be allowed to use the roadway under any alternative selected.

The existing speed limit of 30 mph would remain in place from Mohave Point to Hermits Rest. For the segment of road up to Mohave Point, the speed limit would be reduced to 25 mph to meet safety standards.

Any changes in shuttle bus operations, as outlined under specific alternatives described below (closing stops, making new stops, etc.), would require printing and installing new shuttle bus map signs. Any new stops would require installation of new map panels.

ALTERNATIVE B – WIDEN FOR SAFE BUS ACCESS (Map 3)

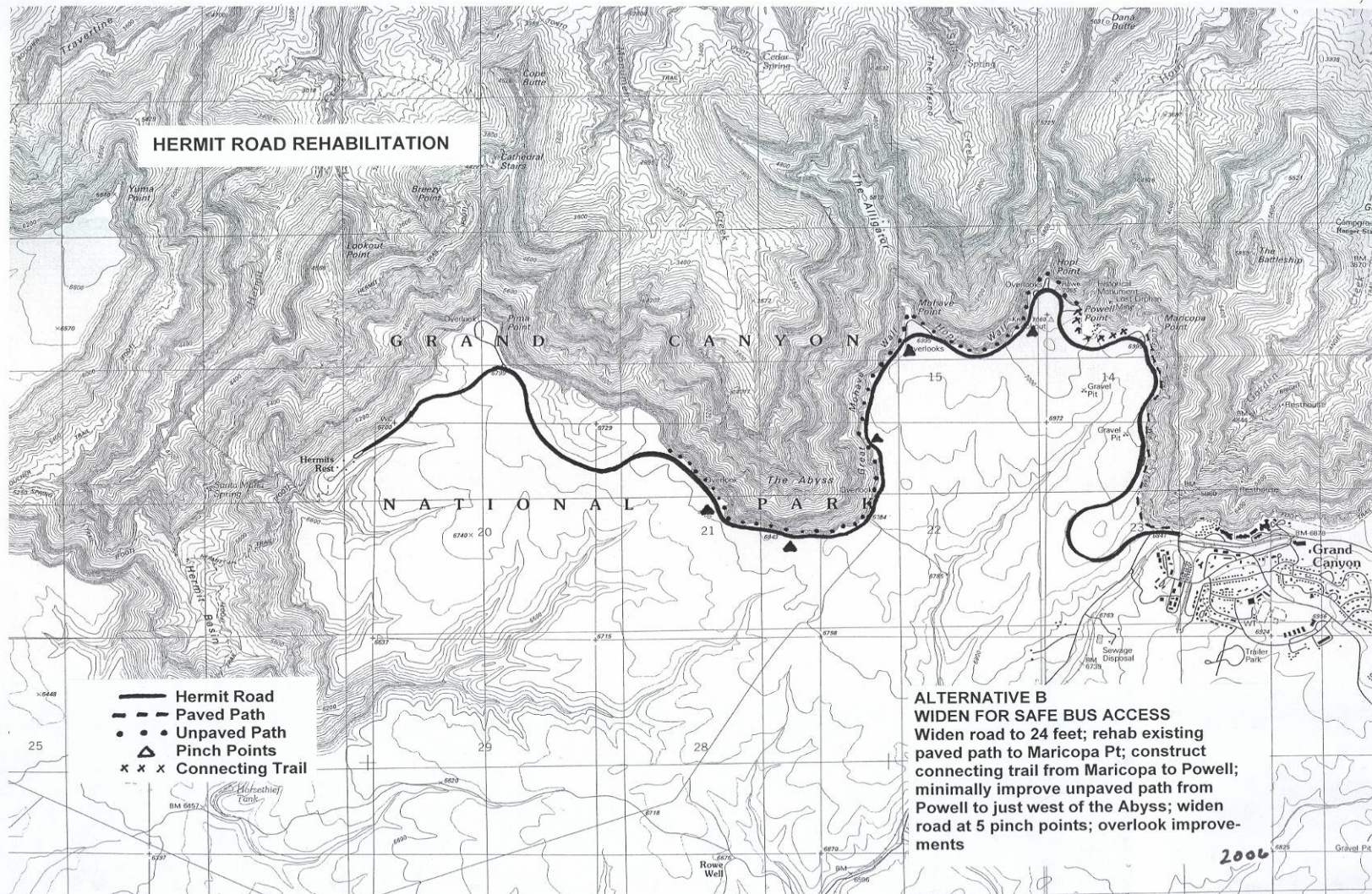
Hermit Road would be widened to a uniform 24 feet for its seven- mile length to provide two, 11- foot- wide vehicle lanes and two, one- foot- wide paved shoulders on each side of the road. This alternative would increase road width three- to- six feet, and would continue to provide two- way bus traffic with no change in current bus operations.

There are five areas between Hopi Point and the west end of The Abyss where the rim and the roadway are too close together, forcing hikers using the unpaved trail to use the roadway. In these locations (at historic pull- offs), the roadway would be widened up to 28 feet to provide an approximately four- foot- wide designated pedestrian area between existing pullout walls and vehicle travel lanes.

In addition to improvements to the paved West Rim Trail to Maricopa Point (common to all action alternatives), Alternatives B, C and D would include minimal improvements to the unpaved trail from Powell Point to the area where the old 1912 wagon route intersects with the trail west of The Abyss (Figure 5). Improvements would include designation of a single trail and obliteration of other social trails; vegetation removal/trimming as needed; stone/boulder retention at steep areas where trail is sloughing; and stone steps in steep areas.

Changes to Hopi Point and Hopi Overlook (two overlooks in close proximity to each other) would be implemented as part of Alternatives B and D. Shuttle buses currently use Hopi Overlook as both an inbound and outbound shuttle stop for most of the day, while Hopi Point is used by shuttles only at sunset. Under Alternatives B and D, both inbound and outbound shuttle buses would stop at Hopi Point instead and would no longer use the much smaller Hopi Overlook pull- out. A six- inch- high raised walkway for shuttle bus loading/unloading would be placed adjacent to the east side of the existing stone wall at Hopi Point. Concrete braking pads would be added at the shuttle stops. An information wayside would be added within the pedestrian surfacing. Asphalt paving would be replaced throughout the parking area and the entrances to the overlook would be slightly widened to accommodate better turning radii for buses. The result of these changes at Hopi Point would be a one- way loop for buses with both an inbound and an outbound bus stop. The only changes proposed for Hopi Overlook would be a replacement of the asphalt surface in- kind. Tour buses would continue to use Hopi Overlook. Because this would slightly change the bus stops for visitors, new wayfinding signs and changes to park publications would be necessary. These changes would allow the larger Hopi Point area to be the primary shuttle stop where several buses can be easily accommodated within the existing paved areas, and to remove them from the much smaller Hopi Overlook where substantial changes would be necessary to safely accommodate buses (as described under Alternative C).

Alternative B would result in approximately 46 acres of total ground disturbance, approximately 14 acres of which would be new disturbance where vegetation would be removed along the roadway; 11 acres for road widening, one acre for unpaved trail improvements and 0.5 acres for overlook improvements.



Map 3. Alternative B - Widen for Safe Bus Access



Figure 5. Typical section of the unpaved rim trail (2004) proposed for minimal improvements under Alternatives B, C and D

Integral Design Features

In addition to the mitigation measures described at the end of this chapter that are common to any action alternative selected, the following measures would be implemented with Alternative B:

- The surface of the connecting trail between Maricopa Point and Powell Point would be considered carefully during future design phases. NPS would consider alternatives to paving, such as soil hardeners or crusher fines that could provide a uniform surface while minimizing intrusions into the cultural landscape in these areas. The historic paved rim trail that exists between these two locations (and is primarily within the Orphan Mine enclosure) would remain in place to provide flexibility to use this historic alignment if the Orphan Mine area is once again opened to visitors.

ALTERNATIVE C - GREENWAY (Map 4)

Hermit Road would be widened to a uniform width of 24 feet to provide two, 11- foot- wide vehicle lanes and one- foot- wide shoulders on each side of the road, as described under Alternative B. This alternative would increase the width of the road by three to six feet. Alternative C would create a two- way, multi- use, bicycle/pedestrian trail, called a greenway, between Grand Canyon Village and Hermits Rest. The trail would be approximately 7.5 miles long. From the Village to Maricopa Point the greenway would be just south of Hermit Road, separated visually from the roadway by a narrow vegetated buffer ranging from 35- to 75- feet wide. The greenway distance from the roadway would depend on existing landscape features and slope. The greenway would cross north of the road at Maricopa Point and would proceed around the Orphan Mine to Powell Point. From this location to just past The Abyss, the greenway would again be located on the road's south side. From this point on, the trail would

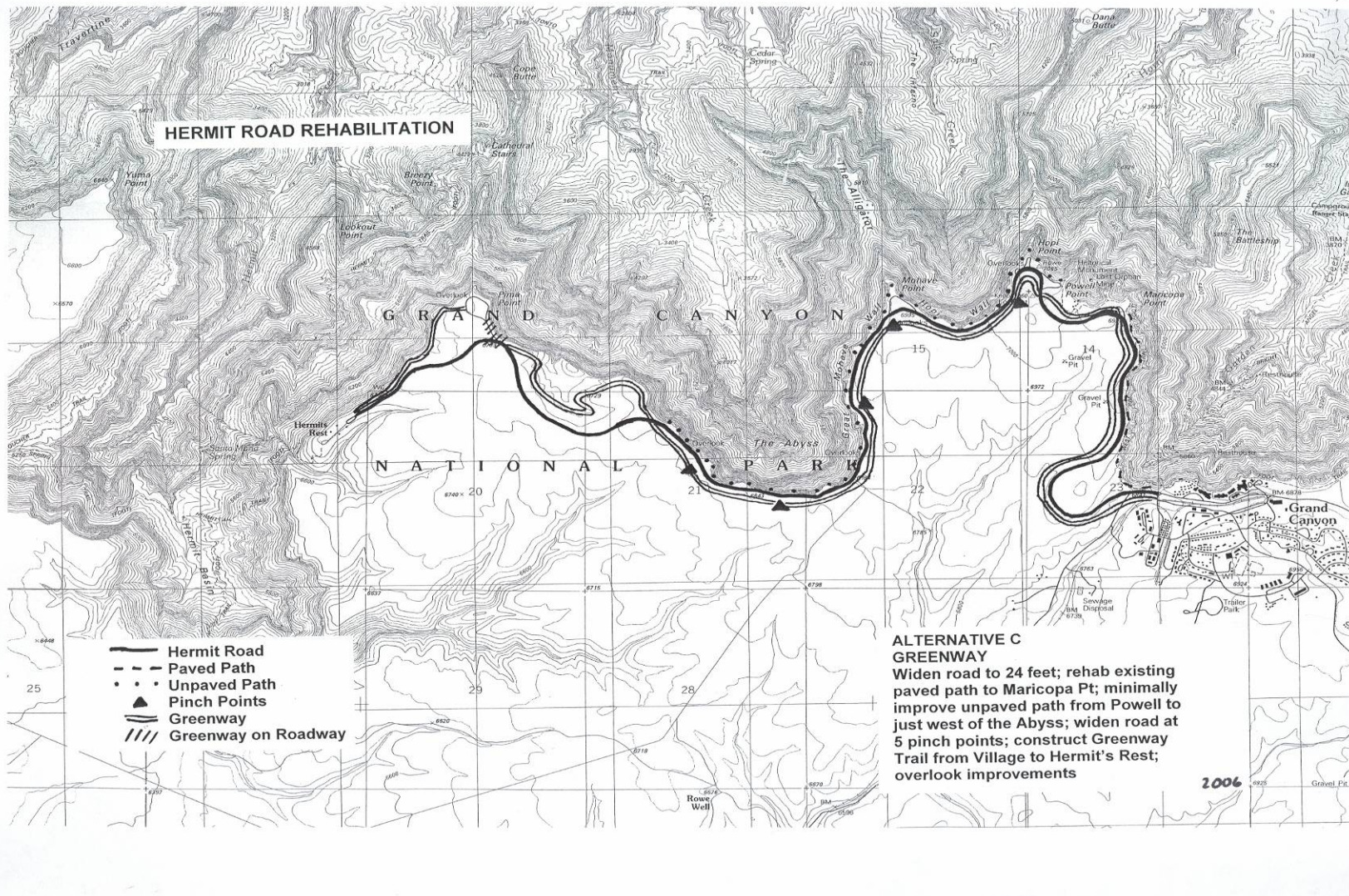
follow the alignment of the old 1912 wagon route north of Hermit Road to Pima Point and would remain on the rim side of Hermit Road to Hermits Rest. The trail would be constructed adjacent to the access road into Pima Point, requiring widening of this 20- foot- wide road approximately ten feet; two feet to accommodate wider travel lanes for buses and eight feet for the Greenway. The trail would be paved, and no more than eight- feet wide. Connections to viewpoints and pullouts currently accessed by shuttle buses would be provided between Grand Canyon Village and The Abyss, requiring approximately 14 to 21 bicycle/pedestrian road crossings. Greenway users would be expected to share the road with other vehicles at overlook areas such as Powell, Mohave and Pima Points.

Alternative C includes installation of interpretive signage along the greenway segment in various locations, particularly on the section between The Abyss and Hermits Rest where the historic 1912 road corridor can be interpreted for visitors. As part of Alternatives C and D, NPS would also evaluate the feasibility of creating trail pull- off(s) or short spur trail(s) to scenic views along the greenway segment between The Abyss and Hermits Rest.

As also described for Alternative B, there are five areas along the roadway between Hopi Point and the west end of The Abyss where the rim and roadway are too close together, forcing hikers using the unpaved rim trail to walk the roadway. In these locations (at historic pull- offs), the roadway would be widened an additional 4 feet (up to a total of 28 feet) to provide a four- foot- wide designated pedestrian area between existing pullout walls and vehicle travel lanes.

Alternative C would also include minimal improvements to the unpaved trail from Powell Point to the area where the old 1912 wagon route intersects with the trail, west of The Abyss, as described in Alternative B and shown in Figure 6. Improvements would include designation of a single trail and obliteration of other social trails; vegetation removal/trimming as needed; stone/boulder retention at steep areas where the trail is sloughing; and stone steps in steep areas.

This alternative would not require changes in shuttle or tour bus operations, with one exception: shuttle buses, tour buses and other vehicles would no longer stop at Hopi Point. Hopi Point would only be accessed by bicyclists or pedestrians using the rim or greenway trail and would no longer be used by shuttle buses or tour buses. Shuttle buses currently only stop at Hopi Point during sunset. Shuttle buses would continue to stop at Hopi Overlook, from which visitors using the shuttle bus can access Hopi Point, but under Alternative C, would also use Hopi Overlook at sunset as well. Hopi Overlook would continue to be a two- way (both an inbound and an outbound) shuttle stop, but changes would be necessary for safety and accessibility, as proposed for other overlooks, to accommodate large buses. These include concrete braking pads on both the north side of the overlook (near the existing wall) and on the inside edge of the vegetated island. Some form of barrier (such as a seat wall or fence) would be constructed adjacent to the bus loading area on the inside edge of the island to protect vegetation in this area. The vegetated island would be reduced in size somewhat on each edge to provide an adequate turning radius for buses, requiring the removal of vegetation. These changes would allow a quieter and less congested experience for bicyclists and pedestrians at Hopi Point and would concentrate the bus use at the nearby Hopi Overlook.



Map 4. Alternative C - Greenway

Alternative C would result in approximately 66 acres of total disturbance. Of this, approximately 27 acres would be new disturbance where vegetation would need to be removed; 11 acres for the roadway, 14 acres for the greenway trail, one acre for unpaved trail improvements and 0.5 acres for overlook improvements.

Integral Design Features

In addition to the measures described at the end of this chapter that are common to any action alternative selected, the following measures would be implemented with Alternative C:

- Location of the greenway trail, including the section between Pima Point and Hermits Rest, would be approved by a park landscape architect during design and construction.
- The style, size, location and extent of signage necessary for the greenway trail, particularly those proposed near road crossings would be carefully evaluated for compatibility with the cultural landscape and scenic resources. A park cultural resource specialist and landscape architect would be part of this evaluation.
- The four sensitive plant locations that occur south of the road and east of Maricopa Point would be avoided during greenway trail construction. The park's South Rim Vegetation Program Manager or their representative would be consulted during future design phases of the greenway to assist in this effort. The need for fencing these areas due to their proximity to the new greenway trail would be evaluated.
- Nine nearby archeological sites would be avoided during greenway trail construction. The Park Archeologist or their representative would be consulted during future design phases of the greenway to assist in this effort. The need for fencing these areas due to their proximity to the new greenway trail would be evaluated.
- After the project is complete, periodic monitoring of the three archeological sites that occur between the roadway and the greenway west of The Abyss to Hermits Rest would be conducted to determine if recreational impacts are occurring.
- The need for fencing of the air quality monitoring station near The Abyss would be considered, due to the proximity of the greenway trail in this area.

ALTERNATIVE D - PREFERRED (Map 5)

The preferred alternative combines actions proposed under Alternative B plus some actions proposed under Alternative C. As described in Alternative B, Hermit Road would be widened to a uniform 24 feet for its full length, and would continue to provide two- way bus traffic. Improvements to the unpaved rim trail between Powell Point and just west of The Abyss would also occur as described under Alternative B. Instead of a greenway trail being constructed for the full length of Hermit Road as described in Alternative C, this alternative would construct an approximately three- mile- long greenway trail segment along the historic 1912 corridor (Figure 6) beginning just east of the 1912 corridor at an historic pull- out on the west end of The Abyss. A new outbound shuttle bus stop would be created using an existing pullout near the location of the 1912 road intersection with Hermit Road, and an additional inbound shuttle bus stop would be added to the existing shuttle bus stop at Pima Point. The trail would be constructed adjacent to the access road into Pima Point, requiring widening of this 20- foot- wide road approximately ten feet; two feet to accommodate wider travel lanes for buses and eight feet for the greenway. The trail would be paved and would be no greater than eight- feet wide for most of its length. For the last approximately 1/3 mile to Hermits Rest, the trail would be narrowed to approximately five feet and would stay on the road's north side. At this location, bicyclists would share the road with vehicle traffic to Hermits Rest. The creation of a new shuttle bus stop

at the start of the greenway trail would allow for visitors to access the trail directly from shuttle buses. The creation of a new return stop at Pima Point would allow greenway trail users to also directly access buses from the greenway trail, facilitating its use, while recognizing its distance from the more developed area of Grand Canyon Village. When shuttle buses become fully accessible in the near future (all current buses are being replaced with fully accessible buses), the greenway would be easily accessible to all visitors.



Figure 6. Typical section of the 1912 road west of The Abyss (2004) on which the greenway trail would be constructed under Alternatives C and D

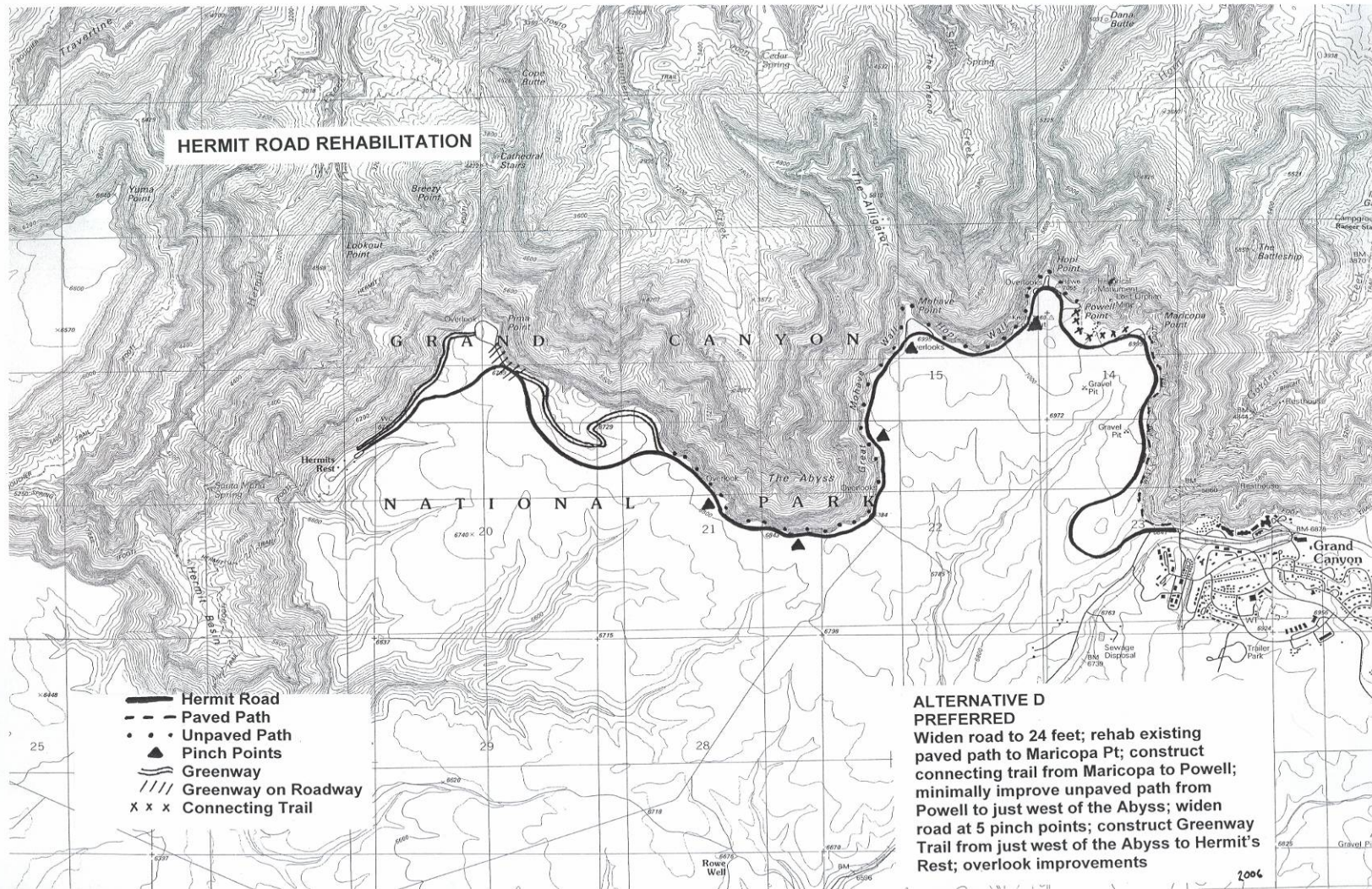
No road crossings would be necessary for the greenway trail under Alternative D. The greenway would be entirely on the north side of the road.

Alternative D also includes installation of interpretive signage along the greenway segment to interpret the historic 1912 road corridor to visitors.

As part of Alternatives C and D, NPS would also evaluate the feasibility of creating trail pull-off(s) or short spur trail(s) to scenic views along the greenway trail segment between The Abyss and Hermits Rest.

This alternative would not require changes in bus operations, with three exceptions:

Hopi Point – As described for Alternative B, Hopi Point would become both the inbound and outbound shuttle stop and would replace Hopi Overlook as the primary shuttle bus stop for this area. Shuttle buses currently use Hopi Overlook as both an inbound and outbound shuttle stop for most of the day, while Hopi Point is used by shuttles only at sunset. Under Alternatives B and D, both inbound and outbound shuttle buses would stop at Hopi Point instead and would no longer use the smaller Hopi Overlook pull-out. A six-inch-high raised walkway for shuttle bus loading/unloading would be placed adjacent to the east side of the existing stone wall.



Map 5. Alternative D - Preferred

Concrete braking pads would be added at the shuttle stops. An information wayside would be added within the pedestrian surfacing. Asphalt paving would be replaced throughout the parking area and the entrances to the overlook would be slightly widened to accommodate better turning radii for buses. The result of these changes at Hopi Point would be a one- way loop for buses with both an inbound and an outbound bus stop. The only changes proposed for Hopi Overlook would be a replacement of the asphalt surface in- kind. Tour buses would continue to use Hopi Overlook. These changes would allow the larger Hopi Point area to be the primary shuttle stop where several buses can be easily accommodated within the existing paved areas, and to remove them from the much smaller Hopi Overlook where substantial changes would be necessary to safely accommodate buses (as described under Alternative C).

West Abyss Shuttle Stop - A new shuttle stop would be created at an existing pull- out, west of The Abyss and east of the 1912 road corridor that would be used for the greenway trail. Improvements would include a six- inch- high raised walkway for shuttle bus loading/unloading placed adjacent to the south side of the existing stone wall. A concrete braking pad for the shuttle bus would be placed adjacent to the raised walkway. Shuttle bus signing would be added, as would recycle/trash receptacles. A small existing pedestrian overlook would be paved with crusher fines surfacing and existing stone stairs would be removed to make this area accessible. An eight- foot- wide opening would be provided in the western most wall to accommodate the greenway trail.

Pima Point - Additional signing would be installed to designate in- bound and out- bound shuttle bus stops at Pima Point. Circulation would remain one- way.

As a result of these changes under Alternative D, outbound buses (on their way west to Hermits Rest) would stop at Trailview Overlook I, Maricopa Point (at the new pull- out constructed adjacent to the roadway), Powell Point, Hopi Point, Mohave Point, The Abyss, West Abyss (at the new stop created here), Pima Point and Hermits Rest. Inbound buses (on their way east to the Village) would continue to provide a semi- express return service and would stop at just three locations: Pima Point, Mohave Point and Hopi Point.

Alternative D would result in approximately 53 acres of total disturbance, of which approximately 15 acres would be new ground disturbance, requiring the removal of vegetation; 11 acres for the road rehabilitation, 1.5 acres for greenway trail construction, one acre for improvements to the unpaved trail and 0.5 acres for overlook improvements.

Integral Design Features

In addition to the measures described at the end of this chapter common to any action alternative selected, the following measures would be implemented with Alternative D:

- Location of the greenway trail, particularly the section between Pima Point and Hermits Rest, would be approved by a park landscape architect during design and construction.
- The surface of the connecting trail between Maricopa Point and Powell Point and the greenway trail would be considered carefully during future design phases. NPS would consider alternatives to paving, such as soil hardeners, soil cement or other additives that could provide a uniform surface and meet accessibility standards while minimizing intrusions into the cultural landscapes in these areas. The historic paved rim trail that

exists between these two locations (and is primarily within the Orphan Mine enclosure) would remain in place to provide flexibility to use this historic alignment if the Orphan Mine area is once again opened to visitors.

- After the project is complete, periodic monitoring of three archeological sites between the roadway and the greenway trail west of The Abyss to Hermits Rest would be conducted to determine if recreational impacts are occurring.
- One archeological site in the proximity of the greenway trail would be avoided with minor trail rerouting.

TEMPORAL ROAD CLOSURE (Map 6)

NPS is considering the option to close a portion of Hermit Road to vehicle access on a daily basis. This management option could be implemented with any of the alternatives; it is not a stand-alone alternative.

Accommodation of pedestrians and bicyclists in a vehicle-free environment would be achieved through a temporal road closure beginning at Mohave Point. The road would be closed at this point to all but pedestrians and bicyclists (provisions would be made for emergency- and concession- vehicle access) during regularly scheduled times. Tour buses, shuttle buses and any visitors with an accessibility permit would turn around at Mohave Point during the closure period.

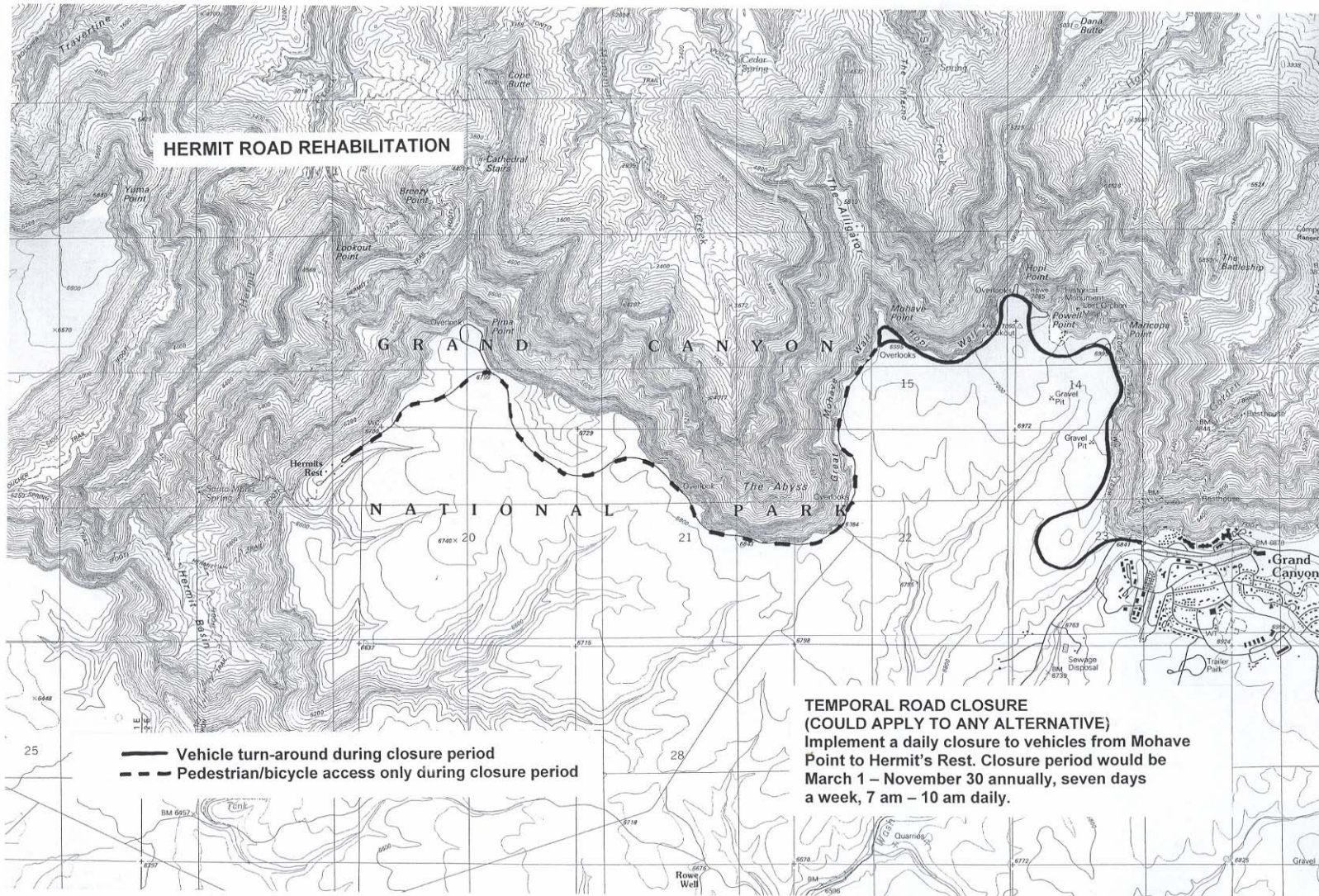
For purposes of this analysis, the closure period would be the same as the nine-month shuttle bus operation, March 1 – November 30, seven days a week, 7 a.m. to 10 a.m. daily. This temporal road closure would not be in effect December – February, when shuttle buses do not run and private vehicles are allowed on the road.

A temporal road closure allows for unique experiences without substantial infrastructure expenditures or resource impacts. If this management option were implemented, it would be adaptively managed so as to respond to future needs, allowing for the testing of the daily time period used and its effectiveness, the length of the yearly closure period, and the impact (positive or negative) it may have on visitors or employees.

A temporal road closure would not result in any additional ground disturbance, if implemented with any of the action alternatives.

All action alternatives propose improvements to Mohave Point that would allow a one-way traffic direction through the overlook allowing vehicles to turn around during the closure period. A gate or other device would be installed on the existing roadway in already disturbed areas to alert the public to the closure.

Consultation with the park's Soundscape Program would occur when developing implementation details for this management option.



ALTERNATIVES CONSIDERED BUT DISMISSED FROM DETAILED STUDY

As part of alternative development and internal and external scoping, several preliminary alternatives and components of alternatives were dismissed from further detailed study. These are described briefly below.

Road Widening

Varying options for widening the road were considered. The range of alternatives presented later in this chapter includes widening slightly to the historic width of 20 feet (Alternative A) and widening to 24 feet (Alternatives B- D). NPS preliminarily considered widening the road up to 22 - 23 feet. This option was ultimately dropped due to the acknowledgement that it would not adequately provide for user safety and would not meet current American Association of State Highway and Transportation Officials (AASHTO) roadway standards. Once the NPS and SHPO were able to agree that widening the road up to 24 feet would not result in an adverse impact to the character of the National Register- eligible roadway, provided certain aspects of design and implementation were met (see Chapter 3), options below 24 feet were no longer considered (except for the No- Action Alternative at 20 feet).

An option to widen the road up to 26- 30 feet to provide additional width for a one- way bike path in each lane was also considered. This option was ultimately dropped due to its substantial changes on historic character. NPS also recognized that the additional striping and other management aspects that a roadway with bike lanes required would result in additional impacts to rural character, conflicting with the project's objectives. For these reasons, road widening options of 22- 23 feet and greater than 24 feet were not considered.

Loop Roads and Bike Paths South of Hermit Road

To minimize the change in width and character of Hermit Road, creation of a one- way, west-bound vehicle and bike lane using the existing road from Grand Canyon Village to Hermits Rest, and construction of a one- way, east- bound roadway using existing disturbed corridors south of Hermit Road were considered. These options would allow for separation of two- way bus traffic and provide for safe vehicle and bicycle use, with widening up to 24 feet. These options for construction of a new road corridor essentially for the full length of the road, south of the existing corridor were ultimately dropped from further consideration due to substantial ground and vegetation disturbance and habitat fragmentation. The area south of Hermit Road (except that in close association with the road right- of- way) is part of the Natural Zone as defined in the GMP. NPS determined that substantial new road construction in this zone would not be in keeping with GMP recommendations for natural zones, would not achieve the GMP vision for “maintaining the existing large undisturbed areas along Hermit Road” (see Chapter 1), and would not adequately meet project objectives, one of which is to minimize disturbance to natural and cultural resources.

One limited loop road option between Mohave Point and just west of The Abyss was also considered. This approximately two- mile long new road segment would be constructed south of the existing road and would provide one- way eastbound vehicle traffic with a separate road. The north side lane of the existing road would be used as a greenway, providing pedestrians and bicyclists with a rim- side experience along The Abyss, a premier viewing opportunity.

Westbound vehicles would use the south side lane. While this alternative had merit in that it would provide this rim- side experience for many visitors on foot or bike, it also created some safety concerns with vehicles sharing the roadway with this two- directional pedestrian/bicycle traffic. It would require new road construction in the natural zone south of Hermit Road and intensive striping and other features on the existing road to accommodate all users safely and would impact the rural nature of the roadway. For these reasons, all of these loop road options south of Hermit Road were not considered further.

NPS also considered construction of a multi- use greenway trail and combinations of bus/bike loops using existing disturbed utility corridors and existing roads south of Hermit Road in the Natural Zone. While trail construction on existing disturbed corridors would not result in as much resource disturbance as new road construction, it would result in substantial changes to habitat quality south of the road. NPS also determined that creating a trail for pedestrians and bicyclists so far from the canyon rim would not improve visitor experience. For these reasons, these trail options away from Hermit Road itself were not considered further.

Addition of Shade Shelters at Shuttle Bus Stops

NPS considered the addition of shade shelters at bus stops along Hermit Road to provide protection for visitors waiting at a shuttle stop during times of inclement weather. Adding shelters would provide additional non- contributing structures to the cultural landscape and could potentially become targets for lightning strikes, providing potential risks to visitors standing under the shelters. For these reasons, this alternative component was dismissed from detailed analysis.

Guardwalls

NPS explored the need for guardwall construction at three locations along the road's north side between Mohave Point and The Abyss. To meet current safety standards, guardwalls were one option considered for these three areas where there is little room between the roadway and rim. Guardwall construction would add non- contributing features to the cultural landscape, adversely impacting the roadway's historic and cultural landscape resources. Guardwalls would also impede important canyon views, an aspect of the visual and scenic resources considered important for this project. An option to shift the road slightly (approximately six feet south in these three locations) was considered instead and is described as an action common to all alternatives in the next section. For these reasons, guardwalls were dismissed from detailed analysis.

Smaller Buses

Based on internal and public scoping, the idea of using smaller buses on the existing (narrow) Hermit Road was preliminarily discussed. The idea to match vehicle size to road size (instead of matching road width to vehicle size) was explored. Buses available on the market today are generally 102- inches wide. The Harvey tour buses are the same width as park shuttle buses. NPS staff recently attended a Transportation Expo in September 2005 to see what is currently available in mass transit. No buses narrower than 102 inches were available.

NPS believes that a mass- transit vehicle size reduction (using something smaller than our current buses) would not accommodate current visitation rates and use patterns. A smaller vehicle with less seating would mean more frequent buses to keep up with visitor demand. To have a steady stream of transit vehicles on Hermit Road would not be consistent with the intent

of the nine- month private- vehicle closure. For these reasons, this alternative was dismissed from detailed analysis.

General Management Plan Recommendations

Chapter 1 lists GMP Hermit Road recommendations. These provide the framework for current planning efforts for road rehabilitation, and are reflected in the desired condition statement, purpose and need and objectives. There are, however, a few GMP recommendations the NPS considered, but ultimately dismissed. These are as follows:

Hermit Road will be converted to year- round public transit service only (GMP, page 27): The park has not implemented a year- round private- vehicle closure on Hermit Road due to the steepness of the first hill heading westbound from the interchange (Hopi Hill), and the safety concern this creates during winter- driving conditions. NPS determined that operating large, heavy vehicles on this stretch of road during winter- driving conditions is unsafe. Thus, private vehicles are allowed on the road, and the shuttle service halts for three months every year. To change this grade during rehabilitation was not considered due to the impact on alignment and character of this National Register- eligible historic roadway.

Maricopa Point overlook and parking area will be removed due to the proximity of a rare plant population (GMP, page 27): Options for Maricopa Point have been explored by the NPS in consultation with the FWS to enhance the protection of rare plant population. As described in the next section, two options for how best to do this are evaluated in detail later in this chapter. While parking removal is part of the preferred alternative for this area, NPS did not explore total closure of the overlook, as prescribed in the GMP. NPS has determined that the overlook itself no longer provides any potential habitat for the species and, while enhancements to how visitors access the overlook are included in the proposals evaluated, NPS has determined there is no need to close the overlook completely. This was an option that was considered but dismissed from detailed analysis for these reasons.

Hopi Point Overlook will be redesigned for bike and pedestrian use only (GMP, page 27): This recommendation is considered under Alternative C, the alternative that includes a greenway trail connection to Hopi Point.

An off- road bike trail system will be provided to link Hermits Rest and Desert View. The trail will be used by both bikers and pedestrians....The trail system will generally be north of the road on the East and West rims so as to avoid road crossing conflicts, and disturbed areas will be used wherever possible to limit resource impacts (GMP, page 28): NPS used this statement as the starting point for creation of a greenway (multiple- use) trail proposal between Grand Canyon Village and Hermits Rest as part of this road- rehabilitation project. Based on preliminary field inspections and survey efforts, NPS and FHWA determined that it is not possible, from an engineering standpoint, to construct a multi- use trail on the north side of Hermit Road since, in some places, there is not enough room between roadway and rim. This resulted in a greenway trail proposal as described in Alternative C where the trail would be on the north side wherever possible, but on the south side the remainder of the distance. All action alternatives include improvements to the West Rim Trail (although this rim trail would not be universally accessible to persons with disabilities or by bicycle). NPS believes that these two alternatives meet the GMP's intent for a greenway trail, as much as is feasible, linking Grand Canyon Village to Hermits Rest.

IDENTIFICATION OF THE ENVIRONMENTALLY PREFERRED ALTERNATIVE

The environmentally preferred alternative is determined by applying the criteria suggested in the National Environmental Policy Act of 1969 which guides the Council on Environmental Quality (CEQ). The CEQ provides direction that “[t]he environmentally preferable alternative is the alternative that will promote the national environmental policy as expressed in NEPA Section 101”:

1. Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
2. Assure for all generations safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
3. Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;
4. Preserve important historic, cultural and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice;
5. Achieve a balance between population and resource use that 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.

Through the process of internal and public scoping, the environmentally preferred alternative selected is Alternative D. Alternative D best meets the purpose and need for action and best addresses overall park service objectives and evaluation factors while minimizing impacts to park resources. Alternative D would result in approximately 12 acres of new ground disturbance, requiring vegetation removal: 11 acres for road rehabilitation and one acre for greenway trail construction. All action alternatives result in the same amount of disturbance for road widening since all widen the road to 24 feet. Alternative C would result in more new ground disturbance than Alternative D due to the construction of a greenway trail for the road’s full length. While Alternative B would meet the intent of many of the project objectives and would result in less new ground disturbance than Alternative D, Alternative D goes farther to address the need for a greenway trail, as identified in the GMP and in the project objectives, without requiring as many road crossings as Alternative C. The preferred alternative best achieves the balance between resource use and visitor experience, as specifically identified in numbers 3 and 4 above, while also minimizing new resource impacts as identified in numbers 2, 4 and 5 above.

MITIGATION MEASURES

To minimize resource impacts, the integral design features (i.e., mitigation measures) below are common to all action alternatives, would be followed during implementation and are analyzed as part of the action alternatives. If there are integral design features necessary for an individual alternative, these are listed in the description for that alternative. These actions were developed to lessen the action alternatives’ adverse effects, in combination with foreseeable future actions, and have proven to be very effective in reducing environmental impacts on previous projects.

Contractor Orientation Contractors working in the park are given orientation concerning proper conduct. This orientation is provided both in writing and verbally at a preconstruction meeting. This policy would continue for this project. Orientation would include, but not be limited to:

- Wildlife should not be approached or fed.
- Collecting any park resources, including plants, animals, and historic or prehistoric materials, is prohibited.
- Contractor must have a safety policy and a vehicle fuel spill and leakage policy.
- Other environmental concerns and requirements discussed elsewhere in this EA would be addressed, including relevant mitigation measures listed below.
- Construction specifications would include details related to protective measures for existing vegetation along the roadside, as provided by the cultural resource staff and the park landscape architect.

Limitation of Area Affected The following mitigation measures would be implemented to minimize the area affected by construction activities and to minimize the potential for adverse impacts due to connected actions:

- Staging areas for construction office (a trailer), construction equipment and material storage would either be located in previously disturbed areas near project sites (such as at existing overlook parking areas) or in other disturbed areas that best meet project needs and minimize new ground disturbance. All staging areas would be returned to pre- construction conditions or better once construction is complete. Standards for this, and methods for determining when standards are met, would be developed in consultation with the park's South Rim Vegetation Program Manager.
- Construction zones would be fenced with construction tape, snow fencing, or similar material before construction activity. Fencing would define the construction zone and confine activity to the minimum construction area required. All protection measures would be clearly stated in construction specifications, and workers would be instructed to avoid conducting activities beyond the construction zone as defined by fencing.
- The areas selected for use as substitute shuttle bus and tour bus routes during the construction period would be reviewed by park staff prior to implementation to verify that potential impacts to natural and cultural resources and existing park operations are minimized.

Soil Erosion To minimize soil erosion, the following mitigation measures would be incorporated into the action alternatives:

- Standard erosion control measures such as silt fences, sand bags or equivalent control methods would be used to minimize any potential soil erosion.
- Trenching operations would be by rock saw, backhoe, track hoe, Pionjar, ditch digger and/or trencher, with excavated material side- cast for storage. After trenching is complete, bedding material would be placed and compacted in the trench bottom. Backfilling and compaction would begin immediately after trenching, and the trench surface would be returned to pre- construction contours. All trenching restoration operations would follow guidelines approved by park staff. Compacted soils would be scarified, and original contours reestablished.

- A Salvage and Revegetation Plan, as described under actions common to all action alternatives, would be developed by the park's South Rim Vegetation Program Manager and the Federal Highways Administration in consultation with a landscape architect. Any revegetation efforts would use site- adapted native species and/or site- adapted native seed, and park policies regarding revegetation and site restoration would be incorporated. The plan would consider, among other things, use of native species, plant salvage potential, exotic vegetation and pedestrian barriers. Policy related to revegetation would be referenced from *NPS Management Policies* (NPS 2001b; Chapter 9).

Vegetation To minimize vegetation impacts, prevent exotic vegetation introduction and minimize spread of noxious weeds, the following mitigation measures would be incorporated into the action alternatives:

- Inventories for existing populations of exotic vegetation at construction sites have already occurred in the primary proposed disturbance areas. As design plans develop, these would be cross- referenced with existing vegetation survey information to insure that no new survey is necessary prior to start of work.
- A Vegetation Program specialist would provide input on salvage potential and tree avoidance at project sites where necessary. A supervisory biologist would also spot-check work progress, particularly near sensitive areas such as Maricopa Point and Hermits Rest.
- All construction equipment that would leave the road (e.g., bulldozers and backhoes) would be pressure- washed prior to entering the park. The location selected for vehicle washing, in addition to that selected for the batch plant, would be approved by a supervisory biologist.
- Staging area location for construction equipment would be park- approved, and need for treatment of exotic vegetation would be considered.
- Vehicle parking would be limited to existing roads or the staging area.
- Pruning necessary for this project and for any future periodic maintenance adjacent to overlooks and trails would adhere to the park's tree- pruning guidelines with the goal of retaining health and integrity of trees and shrubs treated. Damage to trees or roots in or adjacent to project areas during construction would be avoided as much as possible.
- Any fill, rock or additional topsoil needed would be obtained from a park- approved source. Topsoil from the project area would be retained whenever feasible.
- All areas disturbed by construction would be revegetated using site- adapted native seed and/or plants.
- All areas disturbed would be mulched with a carbon source to decrease nitrophyllic exotic annual species.
- Exotic species encroachment and distribution would be monitored for two- to- three years following construction completion.
- Revegetation efforts would be initiated as soon as possible following construction to minimize native species competition with exotic species.
- The two uncommon plant communities identified during the vegetation survey would be avoided during road widening under any action alternative, including an approximately ten- meter buffer.

Water Quality and Floodplains To minimize potential water quality impacts, the following mitigation measures would be incorporated into the action alternatives:

- The requirements for a storm- water pollution prevention plan would be addressed by FHWA during the construction contract and would meet all statutory NPS and FHWA standards. All National Pollutant Discharge Elimination System requirements would be met.
- Standard erosion control measures such as silt fences, sand bags or equivalent control methods would be used to minimize any potential sediment delivery to streams.
- The park hydrologist would be consulted on the specific size, location and layout of any new culverts and piping to ensure impacts are minimized.

Special Status Species To protect any unknown or undiscovered threatened, endangered, or special status species, the construction contract would include provisions for the discovery of such. These provisions would require cessation of construction activities until park staff evaluated the impact, and would allow contract modification for any measures determined necessary to protect the discovery. Mitigation measures for known special status species are as follows:

California Condor

- Prior to the start of a construction project, the park would contact personnel monitoring California condor locations and movement to determine condor status in or near the project.
- If a condor occurs at the construction site, construction would cease until it leaves on its own or until permitted personnel employ techniques resulting in the condor leaving.
- Construction workers and supervisors would be instructed to avoid interaction with condors and to contact the appropriate park or Peregrine Fund personnel immediately if and when condor(s) occur at a construction site.
- The construction site would be cleaned up at the end of each work day (i.e., trash disposed of, scrap materials picked up) to minimize the likelihood of condors visiting the site. Park condor staff would complete a site visit to ensure adequate clean- up measures.
- To prevent water contamination and potential condor poisoning, the park- approved vehicle fluid- leakage and spill plan would be adhered to. This plan would be reviewed by the park biologist for adequacy in addressing condors.
- If non- nesting condors occur within one mile of the project area, blasting would be postponed until condors leave or are hazed by permitted personnel.

Sentry Milkvetch and Tusayan Flameflower

- The sensitive plant locations south and north of the road (and all east of Maricopa Point) would be avoided during road widening under all action alternatives. The park's South Rim Vegetation Program Manager or their representative would be consulted during future design phases to assist in this effort. The need for additional fencing and signage around these populations would be considered. Monitoring to

detect any recreational impacts to the populations after construction is complete would also be considered.

- Design and implementation of Maricopa Point improvements would be carefully considered to avoid impacts to both occupied and potential habitat areas for these species.

Soundscapes and Wilderness To minimize construction impacts on soundscapes and wilderness, the following mitigation measures would be incorporated into the action alternatives:

- While road construction activities are not likely to have direct impacts on wilderness values, the potential indirect effects to visitors accessing the backcountry wilderness at the Hermit Trailhead could be mitigated through information contained in the Backcountry Permit package regarding road construction. The park would explore this option and implement it, as feasible, so as to inform backcountry permit holders of construction activities. Refer to the visitor experience section of these mitigation measures for more information related to wilderness and backcountry visitors.
- As time and funding allow, information regarding project implementation and other foreseeable future projects would be shared with the public through park publications and other means (*this measure is also repeated under the Visitor Experience portion of this Section*)
- To reduce noise, construction equipment would not be left idling any longer than is necessary for safety and mechanical reasons, and no construction would occur at night.

Cultural Resources To minimize construction impacts on cultural resources, the following mitigation measures would be incorporated into the action alternatives:

- If previously unknown archeological resources are discovered during the project, a park archeologist would be contacted immediately. All work in the immediate vicinity of the discovery would be halted until the resources could be identified and documented and an appropriate mitigation strategy developed, if necessary, in accordance with the stipulations of the 1995 Programmatic Agreement among the National Park Service, the Arizona State Historic Preservation Officer and the Advisory Council on Historic Preservation regarding the General Management Plan/Environmental Impact Statement, Grand Canyon National Park, Arizona.
- All workers would be informed of the penalties of illegally collecting artifacts or intentionally damaging any archeological or historic property. Workers would also be informed of correct procedures if previously unknown resources were uncovered during construction activities.
- To ensure cultural resource protection, a cultural resource specialist would be assigned to conduct spot monitoring of the project during construction. Consistent monitoring during project implementation would occur specifically to protect historic road features.
- An archeological site occurs adjacent to the roadway in one location where road widening under any action alternative would disturb it (AZ B:16:1125). This site

would be mitigated as part of this project. A mitigation/data recovery plan for the site would be developed in consultation with the SHPO and affiliated Native American groups.

- Wherever possible, vegetation clearing or grading along the road edge would be limited in order to maintain a representative sample of brass caps and benchmarks and to minimize adverse impacts to the road's landscape character.
- In order to protect cultural resources in these areas, the boundaries of the useable areas for staging of equipment and supplies in the disturbed area just south of Hermit Road near The Abyss and the old quarry site to the north will be fenced.
- Areas selected for equipment and materials staging are expected to be in existing disturbed areas or existing paved overlooks where there is no potential for archeological resource disturbance. If the sites selected for these activities change during later design phases for implementation of any of the alternatives, additional archeological surveys would be conducted.
- Any archeological site within 10 meters of road construction activities would be protected with drift fence, or similar barrier, prior to project implementation.
- Slash would not be piled on any archeological site.
- The park landscape architect would be on site during the vegetation clearing and grubbing phases to monitor the implementation of previously established vegetation clearing limits and staging areas, and to provide input into any field changes.

Visual Resources To minimize visual impacts, mitigation measures would include the following:

- Natural, muted colors, that replicate existing location hues, would be used to blend any built materials into the landscape. Materials and their colors (for example, concrete braking pads and pedestrian surfaces at overlooks) would be carefully evaluated to be sure they are appropriate and consistent with the cultural landscape.
- Design plans for road rehabilitation and overlook improvements would be reviewed by the park's landscape architect as they are prepared.
- The park landscape architect would provide input into the Salvage and Revegetation Plan for prescriptions to use for replanting of vegetation along the roadway and in other areas of the cultural landscape.
- Vegetation (to also include shrubs and tree branches) within 6 feet of the road edge would be maintained as much as is feasible.
- Whenever possible, the use of fences along the road and rim area should be avoided. The park landscape architect would be involved with the development of any proposals to cordon off areas to protect resources (such as sensitive plants) and would evaluate the impacts of the proposal so that the Superintendent can make an informed decision. Types of barriers, including materials and structural forms considered, should be evaluated in order to reduce their adverse impacts on the visual/scenic resource and landscape character.

Visitor Experience The following mitigation measures would be incorporated into the action alternatives to minimize construction impacts on visitor experience :

- Backcountry visitors with permits that include access or egress from the Hermit Trailhead would be notified of project implementation through the backcountry permits office. Close coordination would occur with the backcountry permits office. Sufficient advance notice would be provided if restrictions would be necessary on the issuance of future backcountry permits during the road closure period (Road Closure Options 1 and 2).
- Unless otherwise approved by the park, operation of heavy construction equipment would be restricted to dawn to dusk, year- round.
- As time and funding allow, information regarding project implementation and other foreseeable future projects would be shared with the public through park publications (such as *The Guide*) and other appropriate means during construction periods. This may take the form of an informational brochure or flyer distributed at the gate and sent to those with reservations at park facilities, postings on the park's website, press releases and/or other methods. The purpose would be to minimize potential for negative impacts to visitor experience during project implementation and other planned projects during the same construction season.
- Under Road Closure Option 3, overlooks would be closed for construction and also for staging. While the road is open, no more than 50% of the overlooks would be closed at any one time.

Park Operations and Safety The following mitigation measures would be incorporated into the action alternatives to minimize construction impacts on park operations and minimize safety risks to employees and visitors:

- NPS, concessionaires and other park employees and residents would receive the public notification on project implementation and road delays or road closures, as appropriate.

Air Quality Air quality impacts of the action alternatives are expected to be temporary and localized. To minimize these impacts, the following actions would be taken:

- To reduce entrainment of fine particles from hauling material, sufficient freeboard would be maintained, and loose material loads (aggregate, soils, etc.) would be tarped.
- To reduce tailpipe emissions, construction equipment would not be left idling any longer than is necessary for safety and mechanical reasons.
- To reduce construction dust in the short term, water would be applied to problem areas. Equipment would be limited to the fenced project area to minimize soil disturbance and consequent dust generation.
- Landscaping and revegetation would control long- term soil dust production. Mulch and plants would stabilize soil and reduce wind speed/shear against the ground surface.
- The establishment of the asphalt batch plant near Center Road and the South Entrance Road would meet all necessary permit requirements and environmental standards for this type of operation.

Alternatives and Project Objectives

Project objectives are described in Chapter 1 and listed here. The proposed Hermit Road Rehabilitation is guided by the GMP vision for Hermit Road and the purpose and need for action developed specifically for this project. Specific objectives for the planning effort include:

1. Minimize disturbance to the natural and cultural environment and restore areas damaged by social trailing and other impacts, to the extent practical, using native species.
2. Improve the visitor experience along Hermit Road by:
 - a. Retaining the historic character of the road, overlooks and trail.
 - b. Improving condition of the road and overlooks.
 - c. Increasing road width to accommodate buses.
 - d. Providing safe access for pedestrians along the rim from the Village to Hermits Rest thereby minimizing social trailing.
 - e. Providing safe access for bicyclists to overlooks, viewpoints and Hermits Rest.
 - f. Improving overlooks and parking to meet current ADA standards.

The preferred alternative clearly addresses each objective. Alternatives that were considered but dismissed from further analysis were dismissed in part because they did not sufficiently address one or all of these objectives. Table 1 displays alternative components and compares the ability of the alternatives to meet project objectives.

Table 1. Summary of Alternative Components, Hermit Road Rehabilitation, Grand Canyon National Park

Components	Alternative A No Action (minimal action)	Alternative B Widen for Safe Bus Access	Alternative C Greenway	Alternative D Preferred Alternative	Temporal Road Closure
Road Pavement Width	20 feet	24 feet	24 feet	24 feet	<i>If a temporal road closure option was selected, it could be applied to any one of the alternatives</i>
Vehicle Lanes and Shoulders	Two, ten- foot lanes with no paved shoulder	Two, 11- foot lanes with one- foot paved shoulders	Same as B	Same as B	
Miles of Road Paving	Seven miles	Seven miles	Seven miles	Seven miles	
Miles of New Road Construction	None	None	None	None	
Greenway trail Length	No greenway	No greenway	7.5 miles	3.0 miles	
Maximum greenway trail Width	N/A	N/A	Eight feet	Eight feet (trail would be five- feet wide near Hermits Rest)	
Distance between greenway and Road (approximate)	N/A	N/A	35 – 75 feet, average	0.25 miles in some places, adjacent to roadway near Hermits Rest	
Number of Locations Where Road Widened at Pinch Points	N/A	Five locations where road widened to 28 feet	Five locations where road widened to 28 feet; one location near Pima Point where road widened to accommodate greenway trail	Same as Alternative C	
Unpaved Rim Trail Improvements	N/A	Powell Point to point where 1912 road intersects with trail, west of Abyss	Same as Alternative B	Same as Alternative B	

Components	Alternative A No Action (minimal action)	Alternative B Widen for Safe Bus Access	Alternative C Greenway	Alternative D Preferred Alternative	Temporal Road Closure
Connecting Trail Constructed between Maricopa and Powell Points	N/A	Yes	No (part of Greenway)	Yes	
Overlook Improvements	No change	Improvements at ten overlooks	Same as B	Same as Alternative B	
Maricopa Point Changes	No change	Remove parking area pavement, close parking area to private vehicles and tour buses; move shuttle stop; improve rim trail and overlook trail connections	Same as B	Same as B	
Hopi Point and Hopi Overlook Changes	No change	Inbound and outbound shuttle stop created at Hopi Point; shuttle would no longer stop at Hopi Overlook	Hopi Point closed to vehicles; shuttles and tour buses would use Hopi Overlook. Modifications to Hopi Overlook to accommodate inbound and outbound bus stops	Same as Alternative B	
Change in Shuttle and Tour Bus Operations	No change	Shuttle buses would no longer access Hopi Overlook and would use Hopi Point for inbound and outbound stops. Tour buses would still use Hopi Point and Hopi Overlook.	Shuttle buses would no longer stop at Hopi Point at sunset and would use Hopi Overlook instead. Tour buses would not use Hopi Point.	Shuttle buses would no longer access Hopi Overlook and would use Hopi Point for inbound and outbound stops. Tour buses would still use Hopi Point and Hopi Overlook.	For the temporal road closure period (March - November, 7:00 a.m. to 10:00 a.m. daily), tour bus and shuttle bus operations past Mohave Point would stop for that period of time

Components	Alternative A No Action (minimal action)	Alternative B Widen for Safe Bus Access	Alternative C Greenway	Alternative D Preferred Alternative	Temporal Road Closure
				Additional outbound shuttle bus stop added west of Abyss; additional inbound stop added at existing Pima Point stop	
Annual Vehicle Closure Period	No change (road closed to private vehicles March to November)	Same as Alternative A	Same as Alternative A	Same as Alternative A	Road would continue to be closed to private vehicles March to November. In addition, a temporal closure period would be established so all vehicles would not be allowed past Mohave Point from 7:00 a.m. to 10:00 a.m. daily, March - November.
Road Closure During Construction	Hermit Road would be closed to vehicular access (including shuttle and tour buses) from Mohave Point to Hermits Rest for the entire construction period. The eastern portion of the road up to Mohave Point would remain open for the first few months of the construction	Same as A	Same as A	Same as A	

Components	Alternative A No Action (minimal action)	Alternative B Widen for Safe Bus Access	Alternative C Greenway	Alternative D Preferred Alternative	Temporal Road Closure
	period.				
Construction Period Length	One season (approximately April - November)	One season (approximately April – November)	One – two years (while greenway construction would require several addition months after the road construction was complete, it would likely not require a road closure during the construction period)	One season (approximately April – November)	
Number of Bicycle/Pedestrian Crossings	None	None	Approximately 14 – 21	None	
Pedestrians Accommodated?	No change from existing situation, except that road slightly wider in some places	Paved rim trail rehabilitated; minor improvements to unpaved rim trail until just west of Abyss; connecting trail constructed between Maricopa and Powell Points	Paved rim trail rehabilitated; minor improvements to unpaved rim trail until just west of Abyss; greenway trail constructed for bicyclist and pedestrian use	Paved rim trail rehabilitated; minor improvements to unpaved rim trail; connecting trail constructed between Maricopa and Powell Points; greenway trail constructed from The Abyss to Hermit's Rest	During temporal closure period (March – November), roadway would be essentially vehicle- free (and open to pedestrian use) from Mohave Point to Hermit's Rest
Bicyclists Accommodated?	The slightly wider road and smoother repaved surface would be safer than the current cracked, irregular and deteriorated surface.	Road widened three- to- six feet, with a one- foot shoulder	greenway trail provided for entire distance; road widened three- to- six feet, with one- foot shoulder	greenway trail provided for three miles, or 40% of the distance from the Village to Hermit's Rest; road widened three- to- six feet, with a one- foot	During temporal closure period, roadway would be essentially vehicle- free (and open to bicycle use) from Mohave Point to Hermit's Rest

Components	Alternative A No Action (minimal action)	Alternative B Widen for Safe Bus Access	Alternative C Greenway	Alternative D Preferred Alternative	Temporal Road Closure
				shoulder	
Visitors with Disabilities Accommodated?	No change from existing situation; allowed to use private vehicle (eventually shuttle buses will be accessible)	Same as Alternative A regarding vehicle access; accessibility improvements at overlooks	Same as Alternative A and B regarding vehicle use and overlook improvements; accessible greenway trail provided for entire distance from village to Hermits Rest	Same as Alternative A and B regarding vehicle use and overlook improvements; accessible greenway trail provided for three miles (or 40% of the distance from Village to Hermits Rest)	No vehicles with accessible permits allowed during closure period; roadway used by pedestrians and bicyclists meets accessibility standards
Total Disturbance ² (approximate, in acres)	20 acres	<u>46 acres</u> road: 42 West Rim Trail: < one Unpaved trail: 2.5 Overlooks: 0.33	<u>66 acres</u> road: 42 greenway: 20 West Rim Trail: < one Unpaved trail: 2.5 Overlooks: 0.50	<u>53 acres</u> road: 42 greenway: 7 West Rim Trail: < one Unpaved trail: 2.5 Overlooks: 0.50	
New ground disturbance ³ (Approximate)	0 acres	<u>14 acres</u> Road: 11 Unpaved trail: one Connector trail: 0.75 Overlooks: 0.5	<u>27 acres</u> Road: 11 greenway to 1912 road: 13 1912 road to Hermits Rest: one Unpaved trail: one Overlooks: 0.5	<u>15 acres</u> Road: 11 Greenway: 1.5 acres Unpaved trail: one Connector trail: 0.75 Overlooks: 0.5	

²Total disturbance = the entire area between the cut-and-fill limit estimates. This includes existing and proposed pavement limits, shoulders and vegetation areas.

³ New disturbance = area designated by the vegetation lines taken from the topographical survey. This does not include areas already disturbed by the road and existing road shoulder.

Components	Alternative A No Action (minimal action)	Alternative B Widen for Safe Bus Access	Alternative C Greenway	Alternative D Preferred Alternative	Temporal Road Closure
Total Width of Disturbance for greenway trail Construction (disturbance limits)	None	None	20 feet (eight- foot- wide trail and six feet on each side for clearing limits	Same as C	
How Alternatives Meet Project Objectives					
Objective 1 Minimize disturbance to the natural and cultural environment and restore areas damaged by social trailing and other impacts, to the extent practical, using native species.	Would result in no new disturbance to natural or cultural resources, but would not address restoration of areas damaged	Would result in the least amount of new disturbance to natural and cultural resources of the action alternatives and would restore areas damaged by social trailing.	Would result in the highest amount of new disturbance to natural and cultural resources of the action alternatives. Would provide for restoration of areas damaged by social trailing.	Would result in somewhat higher levels of new disturbance to natural and cultural resources than Alternative B, but less than that from Alternative C. Would provide for restoration of areas damaged by social trailing.	Would result in no new disturbance
Objective 2a Improve visitor experience along Hermit Road by retaining historic character of the road, overlooks and trail.	Would retain historic character of the roadway by keeping it at its historic width and would not make any changes to overlooks or trails	While the road would be widened and changes would occur to overlooks and trails, these would be done with the intent of minimizing long- term adverse impacts to the historic character of the area. Without the addition of a greenway trail, new non- contributing elements to the	While the road would be widened and changes would occur to overlooks and trails, these would be done with the intent of minimizing long- term adverse impacts to the historic character of the area. With the construction of the greenway trail, this alternative would result in the most change to the historic character of the area,	While the road would be widened and changes would occur to overlooks and trails, these would be done with the intent of minimizing long- term adverse impacts to the historic character of the area. Would result in slightly more changes than Alternative B, but less than that from	Would not change the historic character of the road, overlooks or trail.

Components	Alternative A No Action (minimal action)	Alternative B Widen for Safe Bus Access	Alternative C Greenway	Alternative D Preferred Alternative	Temporal Road Closure
		historic landscape would be minimized	when compared to the other alternatives.	Alternative C.	
Objective 2b and 2c Improve visitor experience along Hermit Road by improving condition of road and overlooks and widening road to accommodate buses.	Would slightly improve the condition and width of the road, but it would still not meet safety standards for buses	Would improve the condition of the road and its width to safely accommodate buses	Same as Alternative B	Same as Alternative B	Would not result in any changes to current condition of the road
Objective 2d Improve visitor experience along Hermit Road by providing safe access for pedestrians along the rim from the Village to Hermits Rest thereby minimizing social trailing.	Would not result in any changes to existing pedestrian paths; would not minimize social trailing or improve pedestrian access along the rim	Would result in improvements to both the paved West Rim Trail and the unpaved rim trail to provide improved pedestrian access and to minimize social trailing	Same as Alternative B. Alternative C goes further in providing options for pedestrians by construction of a greenway trail separate from the roadway for the entire length of Hermit Road	Same as Alternative B. Alternative D goes further than B in providing a separate greenway near the rim for a portion of the roadway, but does not provide this for the full length of the road	Would not result in any changes to the rim trail. However, pedestrian and bicycle access during the daily closure period would be along the roadway and would not compete with vehicle traffic
Objective 2e Improve visitor experience along Hermit Road by providing safe access for bicyclists to overlooks, viewpoints and Hermits Rest.	Would not result in any changes to bicycle access but would slightly improve the surface of the road and provide a uniform width	Would provide a wider and smoother road, with a paved shoulder where access to all overlooks would be maintained	Would provide a wider and smoother road, with a paved shoulder, where access to all overlooks would be maintained. Also provides a separated greenway trail for the entire length of Hermit Road, with multiple crossings to access overlooks and	Would provide a wider and smoother road, with a paved shoulder. Also provides a three- mile long greenway on the north side of the road with access to viewpoints.	Would not result in any changes to the rim trail. However, pedestrian and bicycle access during the daily closure period would be along the roadway and would not compete with vehicle traffic

Components	Alternative A No Action (minimal action)	Alternative B Widen for Safe Bus Access	Alternative C Greenway	Alternative D Preferred Alternative	Temporal Road Closure
			viewpoints.		
Objective 2f Improve visitor experience along Hermit Road by improving overlooks and parking areas to meet current ADA standards.	No improvements would be made to overlooks and parking areas	Provides safety and accessibility improvements at all overlooks	Same as Alternative B	Same as Alternative B	Would not result in any changes to overlooks or parking areas

Table 2. Comparative Summary of Environmental Impacts

Impact Topic	Alternative A No Action	Alternative B Widen for Safe Bus Access	Alternative C Greenway	Alternative D Preferred	Temporal Road Closure	Cumulative Impacts
Archeological Resources	Negligible direct and indirect adverse impacts	Minor, short- and long- term adverse direct and indirect impacts	Moderate, short- and long- term adverse direct and indirect impacts	Moderate, short- and long- term adverse direct and indirect impacts	No additional impacts	Moderate adverse cumulative impacts for all alternatives
Historic Resources and Cultural Landscapes	Minor direct and indirect adverse impacts	Moderate, adverse direct and indirect impacts	Moderate, adverse direct and indirect impacts	Moderate, adverse direct and indirect impacts	No additional impacts	Moderate adverse cumulative impacts for all alternatives
Ethnographic Resources	Negligible direct and indirect adverse impacts	Negligible direct and indirect adverse impacts	Negligible direct and indirect adverse impacts	Negligible direct and indirect adverse impacts	No additional impacts	Moderate adverse cumulative impacts for all alternatives
Watershed Values	Negligible, adverse direct and indirect adverse impacts	Minor to moderate, direct and indirect adverse impacts	Moderate, adverse direct and indirect adverse impacts	Minor to moderate, direct and indirect adverse impacts	No additional impacts	Minor to moderate adverse cumulative impacts for Alternatives A; moderate adverse cumulative impacts for Alternatives B, C and D

Impact Topic	Alternative A No Action	Alternative B Widen for Safe Bus Access	Alternative C Greenway	Alternative D Preferred	Temporal Road Closure	Cumulative Impacts
Vegetation	Negligible, direct and indirect adverse impacts	Minor, direct and indirect adverse impacts	Moderate, direct and indirect adverse impacts	Minor to moderate, direct and indirect adverse impacts	No additional impacts	Minor to moderate adverse cumulative impacts for Alternative A; moderate adverse cumulative impacts for Alternatives B, C and D
General Wildlife	Negligible, long- term direct and indirect adverse impacts; minor short- term adverse impacts during the construction period	Minor, adverse long- term, direct and indirect adverse impacts; moderate, adverse short- term impacts during the construction period	Moderate, adverse, long- and short- term direct and indirect adverse impacts	Minor, adverse long- term, direct and indirect adverse impacts; moderate, adverse short- term impacts during the construction period	No additional adverse impacts; negligible to minor beneficial impacts in the short- term during the temporal closure period	Minor adverse cumulative impacts for Alternative A; minor to moderate adverse cumulative impacts for Alternative B, C and D
Special Status Species	Negligible to minor long- term adverse direct and indirect impacts; short- term minor adverse impacts during the construction period	Negligible to minor, short- and long- term adverse impacts; moderate beneficial impacts at Maricopa Point for sentry milk vetch.	Minor to moderate, adverse, direct and indirect, long- and short- term adverse impacts; moderate beneficial impacts at Maricopa Point for sentry milk vetch.	Negligible to minor, adverse, direct and indirect, long- and short- term adverse impacts; moderate beneficial impacts at Maricopa Point for sentry milk vetch.	No additional adverse impacts; negligible to minor beneficial impacts in the short- term during the temporal closure period	Minor adverse cumulative impacts for Alternative A, B, C and D

Impact Topic	Alternative A No Action	Alternative B Widen for Safe Bus Access	Alternative C Greenway	Alternative D Preferred	Temporal Road Closure	Cumulative Impacts
Soundscape	Negligible long- term adverse impacts; moderate, adverse, short- term impacts during the construction period	Negligible to minor long- term adverse impacts; moderate, adverse, short- term impacts during the construction period	Minor, long- term adverse impacts; moderate, adverse, short- term impacts during the construction period	Negligible to minor, adverse impacts; moderate, adverse, short- term impacts during the construction period	No additional adverse impacts; moderate, long- term beneficial impact	Minor, adverse cumulative impacts for Alternative A, B, C and D
Visual and Scenic Quality	No additional direct or indirect long- term adverse impacts, but short- term moderate adverse impacts during the construction period	Minor, adverse, moderate- and long- term adverse impacts; short- term moderate adverse impacts during the construction period	Minor to moderate adverse, moderate- and long- term adverse impacts; short- term moderate adverse impacts during the construction period	Minor adverse, moderate- and long- term adverse impacts; short- term moderate adverse impacts during the construction period	No additional adverse impacts	Minor, adverse cumulative impacts for Alternatives A, B and D; minor to moderate for Alternative C
Visitor Experience and Safety	Negligible, beneficial, long- term impacts; short- term, moderate, adverse impacts during the construction period	Minor, beneficial, long- term impacts; short- term, moderate, adverse impacts during the construction period	Moderate, beneficial, long- term impacts; short- term, moderate, adverse impacts during the construction period	Minor to moderate, long- term beneficial impacts; short- term, moderate, adverse impacts during the construction period	Moderate, long- term beneficial impacts	Minor, adverse cumulative impact for Alternative A; minor to moderate beneficial cumulative impacts for Alternative B and D; moderate beneficial cumulative impacts for Alternative C and the temporal

Impact Topic	Alternative A No Action	Alternative B Widen for Safe Bus Access	Alternative C Greenway	Alternative D Preferred	Temporal Road Closure	Cumulative Impacts
road closure option						
Park Operations	Negligible to minor, long-term beneficial impacts; short-term, moderate adverse impacts during the construction period	Minor, long-term beneficial impacts moderate adverse impacts during the construction period	Minor to moderate, long-term, beneficial impacts; moderate adverse impacts during the construction period	Minor to moderate, long-term beneficial impacts; moderate adverse impacts during the construction period	Minor, adverse long-term impacts	Minor to moderate, beneficial cumulative impacts for Alternative A, B, C, D and the temporal road closure option

Chapter 3 – Affected Environment and Environmental Consequences

INTRODUCTION

This Chapter describes the present condition (i.e., affected environment) within the project area and the changes (i.e., environmental consequences) that can be expected from implementing the action alternatives or taking no action at this time. The No- Action Alternative sets the environmental baseline for comparing effects of the other alternatives. The impact topics (see Chapter 1) define the scope of the environmental concern for this project. The environmental effects, or changes from the present baseline condition, described in this chapter reflect the identified relevant impact topics, and include the intensity and duration of the action, mitigation measures and cumulative effects.

The National Environmental Policy Act requires that environmental documents disclose the environmental impacts of proposed Federal action, reasonable alternatives to that action and any adverse environmental effects that cannot be avoided should the proposed action be implemented.

Grand Canyon National Park encompasses approximately 1.2 million acres in northern Arizona. The project is located on the South Rim at approximately 6,800 feet elevation. The primary vegetation community is pinyon- juniper woodland with small pockets of ponderosa pine. The project area includes Hermit Road and its associated overlooks and parking areas, from Grand Canyon Village to Hermits Rest, the woodland areas adjacent to the roadway to the south, and the areas between the road and the canyon rim to the north. Hermit Road is located within the boundaries of two watershed subunits: Hermit Creek and Bright Angel Wash. Average annual precipitation on the South Rim is approximately 15 inches, average daily maximum temperatures in July is 85 degrees F and average daily maximum temperatures in January is 30 degrees F (Warren et al. 1982).

Methodology

The impact analysis and conclusions contained in this chapter were based on park staff knowledge of the resources and site; review of existing literature and park studies; information provided by specialists within the National Park Service and other agencies; and professional judgment. Detailed information on natural and cultural resources in Grand Canyon National Park that is summarized in the 1995 GMP and associated Environmental Impact Statement (EIS) was specifically referenced for information on affected resources in the project area.

Potential impacts in this chapter are described in terms of type (are the effects beneficial or adverse?), context (are the effects site- specific, local or even regional?), duration (are the effects short- term or long- term?), and intensity (negligible, minor, moderate or major). Because definitions of type, context, duration and intensity can vary by impact topic, intensity definitions are provided separately for each impact topic analyzed in this EA.

Cumulative Impacts

Cumulative impact is defined as the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant actions, taking place over a period of time (40 CFR 1508.7). Therefore, it is necessary to identify other ongoing or foreseeable future actions within the vicinity of the project area.

Recently completed and in-progress projects on the South Rim are those projects related to visitor services, construction or fire management that have been completed in the last several years or have recently been started, with an expectation of being complete in the next year. These projects have complete NEPA and NHPA analysis. Projects were included if they were located in the vicinity of Hermit Road, were located within the subunit watershed of portions of the road, or were linked in some way with operations or activities taking place on Hermit Road (Appendix E).

Foreseeable future actions related to visitor services, construction or fire management were considered to be actions that could occur within the next five years which currently have funding or for which funding is actively being sought. Projects were included if they met the same criteria as the above (Appendix E).

A cumulative impact analysis was conducted for the full implementation of the GMP and is documented in the GMP EIS. The general finding in the GMP EIS for cumulative effects to natural resources was a net reduction in natural habitat within the park and the region, but a net reduction less than that for two other alternatives analyzed. Cumulative effects to ethnographic resources could occur, specifically to traditional cultural properties, but a planned ethnographic survey program would minimize this likelihood. Cumulative effects were not expected to historic structures under the assumption that existing cultural resources within the park would be protected and preserved and some historic buildings would be rehabilitated and restored. Cumulative effects to visitor experience in the park under GMP implementation were expected to be positive overall as the result of additional food service and accommodations and contributions to regional and national efforts to expand informational resources, expand interpretive and educational opportunities and disperse tourism in the area. Because the GMP was a general concept plan and because it required that site-specific analyses be conducted for projects identified in the GMP, a cumulative effects analysis that is more specific to impact topics pertaining to Hermit Road rehabilitation is needed.

Impairment

In addition to determining the environmental consequences of implementing the alternatives, National Park Service policy (*Management Policies 2001*) requires analysis of potential effects to determine whether actions would impair park resources.

The fundamental purpose of the national park system, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. National Park Service managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adverse impacts on park resources and values. However, the laws do give the National Park Service the management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a

park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the National Park Service the management discretion to allow certain impacts within parks, that discretion is limited by the statutory requirement that the National Park Service must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. The prohibited impairment is an impact that, in the professional judgment of the responsible National Park Service manager, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values. An impact to any park resource or value may constitute impairment. An impact would be more likely to constitute impairment to the extent that it affects a resource or value whose conservation is:

- necessary to fulfill specific purposes identified in the park’s establishing legislation or proclamation;
- key to the park’s natural or cultural integrity; or
- identified as a goal in the park’s general management plan or other relevant NPS planning documents.

Impairment may result from National Park Service activities in managing the park, visitor activities, or activities undertaken by concessionaires, contractors, and others operating in the park. The potential for impairment is discussed for each applicable resource for each alternative in this chapter. A statement summarizing the conclusions of this evaluation is included in the conclusion statement at the end of the environmental consequences section for each applicable resource in this chapter.

CULTURAL RESOURCES

ARCHEOLOGICAL RESOURCES

Affected Environment

Archaeological evidence of human occupation and use of the Grand Canyon area appears to begin during the Paleoindian⁴ Period (11,500 – 7,500 years before present). Limited archaeological evidence from this period in Grand Canyon consists of one isolated Clovis point fragment and one Folsom point fragment. The Paleoindian Period was followed by the Archaic, Formative, Protohistoric and Historic Periods. Material remains from the early, middle and late phases of the Archaic Period are present at Grand Canyon. Examples include split twig figurines and polychrome pictograph sites. People from the Kayenta, Virgin, and Cohonina cultural traditions occupied the canyon during the Formative Period. The Cohonina people are not visible archeologically as a distinct cultural group after about AD 1150 (Cartledge 1987). Some archeologists suggest (Cartledge 1987, Fairley 1979) that the Cohonina allied themselves with other cultural groups, principally the Ancestral Puebloan and Sinagua traditions, eventually losing what distinct cultural traits they once had by taking on those of their adopted cultures.

Formal settlement of the canyon by the Kayenta and Virgin people (Ancestral Puebloans) appears to end by the 13th century (Gilpin 2004). The end of the formal settlement of canyon

⁴ The terms used in this section are archaeological constructs. They do not represent the names people would have called themselves, nor are they the names modern day descendants use to refer to ancestors. They are devices archaeologists use as tools for scientific discussion.

areas by Ancestral Puebloans did not mean the end of canyon use by descendants of these people. The Hopi continued to travel to the area during the Protohistoric and Historic Periods, for example. People of the Cerbat culture (thought to be ancestral to the modern day Pai people) may have occupied the area late in the Formative Period. Havasupai, Hualapai, and Southern Paiute canyon use becomes visible archeologically during the Protohistoric Period. These groups, in conjunction with the Hopi, Zuni, Navajo and Yavapai and White Mountain Apache, maintain close ties to the canyon into the present.

Euro- American use of Grand Canyon has its origins in the AD 1540 expedition of Garcia Lopez de Coronado. However, it was not until the 1860s that Euro- Americans began to settle in the area. Early activities included ranching, prospecting, mining and tourist- related ventures (Anderson and Brennan 2006).

An archeological inventory survey was conducted in 2005 along the West Rim developed area specifically to examine areas in the vicinity of Hermit Road. A total of 530 acres were surveyed along the historic Hermit Road and immediately adjacent areas. A total of 32 archeological sites and 92 isolated occurrences (e.g., single pot sherds, lithic flakes, historic cans) were located during the survey. Site types included prehistoric and historic artifact scatters, masonry structures, rock alignments, historic quarries and historic road and trail alignments. Prehistoric sites date from the Archaic through the Formative Periods (roughly 2500 BC – 1200 AD). At some project sites Kayenta and Cohonina occupations are evident. At least one site appears affiliated with Cerbat or Havasupai area use.

Thirteen sites have the potential to be impacted directly or indirectly by proposed actions. Only one of these sites, AZ B:16:1125, would be directly disturbed during proposed road widening under all action alternatives. There are nine sites (AZ:B:16:0229, B:16:0244, B:16:0249, B:16:0909, B:16:1121, B:16:1123, B:16:1134, B:16:1135, B:16:1126) that occur near the proposed greenway trail that could be avoided with minor trail rerouting, as documented in the integral design features listed in Chapter 2. With the implementation of these design features, adverse impacts are minimized so that direct impacts to these nearby sites are not expected with implementation of Alternative C. Three additional sites have been documented between the roadway and the proposed greenway west of the Abyss. These sites (B:16:1127, B:16:1130 and B:16:1132) occur in an open area between Hermit Road and the proposed greenway trail alignment west of The Abyss as proposed in Alternatives C and D. Indirect impacts are possible if visitors use the area between the road and the greenway trail under these alternatives (Brennan, pers. Comm. 3/01/06). All other sites located during the survey can be avoided during proposed construction activities, and indirect impacts are not expected. The site that would be directly affected is a small, either late prehistoric or protohistoric lithic scatter located on a small open plateau near the canyon rim, on the north side of Hermit Road, between Mohave Point and The Abyss. Fill from original road construction activities covers a portion of the edge of the site. Because of its prime location near the canyon rim, several social trails crisscross the plateau where the site is located. This site cannot be avoided during proposed road widening actions and a data recovery plan is in the process of being developed.

Environmental Consequences

Methodology

The baseline information used to assess impacts to archeological resources is as described in the methodology section at the beginning of this chapter and includes park staff knowledge of the

resources and site; review of existing literature and park studies; information provided by specialists within the National Park Service and other agencies and professional judgment. Detailed information on natural and cultural resources in Grand Canyon National Park that is summarized in the 1995 GMP and associated Environmental Impact Statement was specifically referenced for information on affected resources in the project area. Additional sources of information on archeological resources used as a basis for this evaluation are as described above in the affected environment section.

Proposed activities have the potential to impact archeological resources through direct disturbance during ground disturbing activities, trampling or increased human use and activity in the area.

The thresholds of change for the intensity of an impact on archeological resources are defined as follows:

Negligible Impacts would be at the lowest levels of detection with neither adverse nor beneficial consequences; historic properties would receive no change to diagnostic artifacts, defining features, or characteristics that contribute to National Register of Historic Places (NRHP) eligibility. Negligible impacts are barely perceptible and alter neither resource condition, such as traditional access and site preservation, nor the relationship between the resource and the affiliated group's body of practices and beliefs. The determination of effect for Section 106 would be "no historic properties affected."

Minor Adverse For archaeological resources, impacts would be detectable but would not diminish the overall integrity of the resource. Impacts such as social trailing, feature degradation, and artifact depletion and displacement could occur and would be measurable but would be localized and would not result in changes to defining elements and would not affect or jeopardize defining features or characteristics or aspects of integrity that contribute to eligibility for the National Register of Historic Places (National Register). Depletion or displacement of artifacts (based on baseline documentation) would not affect research potential or NRHP eligibility. The determination of effect for Section 106 would be "no historic properties affected."

Beneficial Archaeological sites are maintained and preserved. Effects would be measurable and localized. For purposes of Section 106, the determination of effect would be "*no historic properties affected.*"

Moderate Adverse For archaeological resources, disturbance of a site or sites would result in the loss of overall integrity, and *would* jeopardize a site's National Register eligibility. Impacts would include measurable change to character- defining elements and would contribute to increased instability of site landscape. Impacts would require stabilization of eroding sediments and reduction in social trailing, depletion of artifacts, and artifact displacement outside of established trails. The determination of effect for Section 106 would be "*historic properties affected.*" It will be necessary to execute a memorandum of agreement among the National Park Service and the applicable state or tribal historic preservation officer and, if necessary, the Advisory Council on Historic Preservation, in accordance with 36 CFR 800.6(b). Measures identified in the MOA to minimize or mitigate adverse impacts would reduce the intensity of impact under NEPA from moderate to minor.

Beneficial For archaeological sites, effects would be measurable and contribute to the overall stability of the site. Active intervention is undertaken to preserve the site. The determination of effect for Section 106 would be “*no historic properties affected.*”

Major Adverse For archaeological resources, disturbance of a site or sites would result in the loss of overall integrity and significant changes to character- defining elements to the extent that it would no longer be eligible to be listed on the National Register. Impacts would include destabilization of structures or cultural contexts, depletion or displacement of artifact assemblages (based on baseline information), an increase in exposure or vulnerability to natural elements, and compromising of research potential. The determination of effect for Section 106 would be “*historic properties affected.*” In the event of a determination of adverse effect, a MOA would be executed between the National Park Service and the applicable state or tribal historic preservation officer and, if necessary, the Advisory Council on Historic Preservation in accordance with 36 CFR 800.6(b). Measures identified in the MOA to minimize or mitigate adverse impacts would reduce the intensity of impact under NEPA from major to moderate or minor

Beneficial Active intervention is undertaken to preserve the site. Effects would be measurable and contribute to overall stability of site landscape. The determination of effect for Section 106 would be “*no historic properties affected.*”

Duration

Short- term Impact An effect that, within five years, would no longer be detectable as the resource was returned to its predisturbance condition or appearance (e.g., trash and other items that could be removed or vegetation that has been trampled, but has not been denuded).

Long- term Impact A change in a resource or its condition that would not return the resource to predisturbance condition or appearance and for all practical purposes would be considered permanent (e.g., damage to elements or removal of artifacts).

Timing Archaeological site visibility may be more pronounced during the spring growing season, as trampling young vegetation may lead to increased trailing and soil compaction.

Alternative A – No Action

Direct/Indirect Impacts: Surveys have occurred in the vicinity of areas where actions are proposed under Alternative A and under the action alternatives. While many archeological sites were discovered during this survey effort, none were located in areas that would be impacted under the minimal road widening proposed under Alternative A, except that one site (AZ:B:16:1125) adjacent to the road was previously impacted by the original road construction. Alternative A would not create any additional impacts over that which occurred to this site during original construction. Therefore, there would be no change to diagnostic artifacts, defining features or characteristics that contribute to National Register eligibility. While it is possible that some indirect impacts to known sites in the project area may be on- going related to existing use and social trailing, these impacts have not been documented. Changes in current patterns of use or development would not occur under Alternative A. Therefore, the No Action Alternative would have negligible adverse, direct and indirect effects on identified archeological resources along Hermit Road.

CumulativeImpacts: Past development of park facilities on the South Rim has likely impacted archaeological resources in the area. Loss or disturbance of archaeological sites on the South Rim (in conjunction with previous losses and prevailing threats to finite numbers of archaeological resources throughout the region) incrementally diminishes the overall understanding of Grand Canyon’s cultural history. These past impacts are moderate, adverse, local, and long- term. Most of the recently implemented, in- progress and foreseeable future projects that have the potential to affect archeological resources have been reviewed by park cultural resource staff and all efforts to document archeological resources and avoid them during project design would be implemented. Projects with the potential for impact would be discussed with the SHPO as well. Consultation with the SHPO and using park cultural resource staff input during planning and design for future projects would ensure that any adverse effects of future projects on cultural resources would be negligible to minor. Therefore, adverse cumulative effects would be moderate, local, and long- term.

Impairment: Direct, indirect, and cumulative impacts to archeological resources would be negligible to moderate as a result of implementing the no action alternative. These impacts would not result in impairment. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park’s general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park’s archeological resources or park values.

Conclusion: Implementation of Alternative A would result in negligible direct and indirect adverse impacts and moderate, cumulative adverse impacts to archeological resources. There would be no impairment of park resources.

Alternative B – Widen for Safe Bus Access

Direct/Indirect Impacts. Actions common to all alternatives: Improvements to the West Rim trail, unpaved rim trail improvements and overlook improvements would not result in impacts to archeological resources. These project components would result in very little new ground disturbance and would generally be staying within existing disturbed areas adjacent to the trails and overlooks, or in areas adjacent to the roadway that have already been surveyed (road realignment). The project area has been surveyed and no sites have been documented adjacent to these project areas. Mitigation measures and integral design features have been developed (see Chapter 2) to minimize the possibility of adverse impacts if any previously undocumented sites are discovered during the course of the project. The batch plant site, an existing disturbed area near the intersection of South Entrance Road and Center Road near the Village (currently used as a dump and a storage area), has already been surveyed.

Changes proposed at Maricopa Point are also not expected to result in adverse impacts to archeological resources. The archeological survey conducted for this project covered the areas proposed for the connecting trail between Maricopa and Powell and for those areas for which the existing rim trail is proposed to be relocated nearer the road. The selection of either Option 1 or Option 2 would not have any difference in the potential for impact to archeological resources as no sites are known from this area. Minor road realignment, staging areas, use of the batch plant, salvage and revegetation plan components, road closure options during construction, and how slash is disposed of are all actions with little likelihood for impact to archeological resources due to the comprehensiveness of the survey and the fact that no sites have been

located within the vicinity of these areas. Mitigation measures have been developed (see Chapter 2) to minimize the possibility of adverse impacts if any previously undocumented sites are discovered during the course of the project and the implementation of protective measures as necessary.

Road widening: Surveys have occurred in the area of potential affect for Alternative B. While many archeological sites were discovered during this survey effort, only one (AZ B:16:1125) cannot be avoided under road widening for any action alternative. Proposed actions under Alternatives B – D would therefore result in the need to perform data recovery on this site, as described in both the MOA with the SHPO and the data recovery plan being prepared for this project. It is also possible that some indirect impacts to other known sites in the project area may be on- going related to existing use and social trailing, but these impacts have not been documented. Changes in current patterns of use would not occur under Alternative B.

Beneficial impacts are possible with the minimization of social trailing along the unpaved rim trail and the construction of the connecting trail between Maricopa and Powell Points.

The treatment of the slash (downed trees and other woody material generated as a result of road widening) has the potential to impact archeological sites if slash is piled on top of sites. Mitigation measures are included at the end of Chapter 2 to ensure that slash treatments avoid any nearby archeological sites.

A memorandum of agreement is currently being developed between the SHPO and affiliated tribes (if interested) that will, once finalized, guide all Section 106 responsibilities for the implementation of this project. Efforts to minimize impacts to archeological resources are also included as part of this Agreement. Therefore, Alternative B would have moderate long- and short- term adverse, direct and indirect effects on identified archeological resources along Hermit Road. This is primarily due to the need to excavate the site adjacent to the road to accommodate road widening. As described in the impact thresholds, this intensity of impact would be reduced to minor, following the execution of the MOA and the approval of the data recovery plan by the SHPO.

Cumulative Impacts. Due to the implementation of standard mitigation measures and the consultation with SHPO for future projects, as described under Alternative A, cumulative impacts from implementing Alternative B would be similar to those described for Alternative A. Implementation of Alternative B, combined with past, on- going and future projects, would result in adverse cumulative effects to archeological resources that would be moderate, local, and long- term.

Impairment. Direct, indirect, and cumulative impacts to archeological resources would be adverse and minor to moderate as a result of implementing Alternative B. These impacts would not result in impairment. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park's archeological resources or park values.

Conclusion: Alternative B would result in minor long- and short- term adverse, direct and indirect impacts to archeological resources and moderate adverse long- term cumulative impacts. Impacts would be minimized through the execution of a MOA with the SHPO and tribes, an approved data recovery plan, and through the implementation of integral design features (mitigation measures) designed to protect archeological resources.

Alternative C - Greenway

Direct/Indirect Impacts. Actions common to all action alternatives: The impacts to archeological resources from these actions would essentially be the same as those described for Alternative B. However, which option is selected for road closure during the construction period has the potential to impact archeological resources, more so than Alternative A or B due to the greenway trail construction under Alternative C. There are documented sites in the vicinity of the greenway that would be avoided during construction. However, there is an increased possibility of inadvertent damage or impact to these nearby sites the longer the construction period lasts and the more complicated the construction is. Implementation of either Option 1 or 2 would minimize the possibility of this inadvertent disturbance to archeological resources.

Road Widening: Because the road width would be same under Alternative C as it would be under Alternative B, the impacts to archeological resources from these actions would be the same as those described for Alternative B.

Greenway trail: Surveys have occurred in the area of potential affect for Alternative C. There are nine sites (B:16:0229, 0244, 0249, 0909, 1121, 1123, 1134, 1135, 1126) that occur near the proposed greenway trail that would be avoided with minor trail rerouting, as documented in the integral design features listed in Chapter 2. With the implementation of these design features, adverse impacts are minimized so that direct impacts to these nine nearby sites are not expected with implementation of Alternative C. Three additional sites have been documented between the roadway and the proposed greenway west of the Abyss. Based on field evaluation of their proximity to the proposed trail and the existing level of use in this area, indirect impacts to these sites are not expected. There is a slight possibility that these sites could be adversely impacted due to some increased social trailing between the road and the greenway following trail construction. These impacts can be minimized by periodic monitoring to evaluate the formation of any social trails in the area or impacts to the sites. Proposed actions under Alternative C would therefore have the potential to result in change to diagnostic artifacts, defining features or characteristics that contribute to National Register eligibility, but this potential is minimized by the implementation of integral design features and mitigation measures.

There is the potential under Alternative C, however, for social trailing to increase in some areas because of the greenway being located south of the road (and away from the rim) for most of its length; while numerous crossings are proposed as part of this alternative to minimize social trailing from visitors, it is expected that some level of social trailing would develop by visitors choosing “short cuts” from the greenway to get to desired rim views. This social trailing has the potential to impact archeological resources that would not be directly impacted by construction of the trail or road widening efforts, and is a potential effect not expected for Alternatives A or B or D. While Alternative D also proposes a greenway, it is entirely on the north side of the road and near rim views.

A memorandum of agreement is currently being developed between the SHPO and affiliated tribes (if interested) that will, once finalized, guide all Section 106 responsibilities for the implementation of this project. Efforts to minimize impacts to archeological resources are also

included as part of this Agreement. Therefore, Alternative C would have moderate long- and short- term adverse, direct and indirect effects on identified archeological resources along Hermit Road. This is due to the need to excavate one site that cannot be avoided during road widening and the potential for sites to be indirectly impacted due to the greenway trail construction.

Cumulative Impacts. Combining the impacts of implementing Alternative C with past, on- going and future projects, would result in adverse cumulative effects to archeological resources that would be moderate, local, and long- term. Alternative C would directly and indirectly impact some archeological sites and some of these impacts could be long- term. However, with the implementation of mitigation measures to ensure protection of these sites and the way in which future projects would be planned with protection of archeological resources in mind (as described for Alternatives A and B), cumulative impacts for implementation of Alternative C would be similar to those expected for Alternatives A and B.

Impairment. Direct, indirect, and cumulative impacts to archeological resources would be adverse and minor to moderate as a result of implementing Alternative C. These impacts would not result in impairment. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park's archeological resources or park values.

Conclusion: Alternative C would result in moderate long- and short- term adverse, direct and indirect impacts to archeological resources and moderate adverse long- term cumulative impacts. Impacts would be minimized through the execution of a MOA with the SHPO and tribes, an approved data recovery plan, and through the implementation of integral design features and mitigation measures designed to protect archeological resources.

Alternative D - Preferred

Direct/Indirect Impacts. Actions common to all action alternatives: The impacts to archeological resources from these actions would be essentially the same as those described for Alternative B. However, which option is selected for road closure during the construction period has the potential to impact archeological resources, more so than Alternative A or B due to the greenway trail construction under Alternative C. There are documented sites in the vicinity of the greenway that would be avoided during construction. However, there is an increased possibility of inadvertent damage or impact to these nearby sites the longer the construction period lasts and the more complicated the construction is. Implementation of either Option 1 or 2 would minimize the possibility of this inadvertent disturbance to archeological resources.

Road Widening: Because the road width would be same under Alternative D as it would be under Alternative B, the impacts to archeological resources from these actions would be the same as those described for Alternative B.

Greenway trail: The proposed greenway trail segment under Alternative D is limited to that area west of the Abyss to Hermits Rest. There is one site (AZ B:16:1126) that occurs near the proposed greenway trail that would be avoided with minor trail rerouting, as documented in the integral design features listed in Chapter 2. With the implementation of these design features, adverse impacts are minimized so that direct impacts to this one nearby site is not expected with

implementation of Alternative D. Three additional sites have been documented between the roadway and the proposed greenway west of the Abyss, as described under Alternative C, which would not be directly impacted during construction, but have a slight potential to be indirectly impacted following construction, depending on whether any social trailing develops between the roadway and the greenway. This is not expected due to the denseness of the vegetation in this area and the steepness of the terrain. Periodic monitoring to evaluate the formation of any social trails in the area or impacts to the sites would minimize the possibility for any substantial adverse impact. Proposed actions under Alternative D could therefore result in some change to diagnostic artifacts, defining features or characteristics that contribute to National Register eligibility, but this potential would be minimized through implementation of mitigation measures.

There is the potential under Alternative D for changes to occur in the way that visitors use the project area. Increased social trailing in the area between the greenway west of the Abyss and the road is possible, although it is likely to be less than the social trailing expected under Alternative C where the greenway is south of the road.

A memorandum of agreement is currently being developed between the SHPO and affiliated tribes (if interested) that will, once finalized, guide all Section 106 responsibilities for the implementation of this project. Efforts to minimize impacts to archeological resources are also included as part of this Agreement. Therefore, Alternative D would have minor to moderate, short- and long- term adverse, direct and indirect effects on identified archeological resources along Hermit Road.

Cumulative Impacts. Combining the impacts of implementing Alternative D with past, on- going and future projects, would result in adverse cumulative effects to archeological resources that would be moderate, local, and long- term. Alternative D would directly and indirectly impact some archeological sites and some of these impacts could be long- term. However, with the implementation of mitigation measures to ensure protection of these sites and the way in which future projects would be planned with protection of archeological resources in mind (as described for Alternatives A - C), cumulative impacts for implementation of Alternative D would be similar to those expected for Alternatives A and B.

Impairment. Direct, indirect, and cumulative impacts to archeological resources would be adverse and minor to moderate as a result of implementing Alternative D. These impacts would not result in impairment. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park's archeological resources or park values.

Conclusion: Alternative D would result in moderate adverse, short- and long- term, direct and indirect impacts to archeological resources and moderate adverse long- term cumulative impacts. Impacts would be minimized through the execution of a MOA with the SHPO and tribes, an approved data recovery plan, and through the implementation of integral design features (mitigation measures) designed to protect archeological resources.

Temporal Road Closure Option

Direct/Indirect Impacts: Implementation of this option would not result in any new ground disturbance. During the closure period to vehicles, visitors would be allowed to hike or bike the existing road, in addition to using the unpaved rim trail or greenway (if Alternative C or D were also implemented). This option would therefore not result in any additional direct impacts to archeological resources if implemented with any one of the other alternatives. Proposed actions under a temporal road closure would therefore result in no change to diagnostic artifacts, defining features or characteristics that contribute to National Register eligibility. There is the potential under this option, however, for changes to occur in the way that visitors use the project area during the vehicle closure period, but it is expected that most visitors will simply walk or bike the road to access overlooks, view points and Hermits Rest. Increased social trailing is not expected. Therefore, implementation of a temporal road closure would have no additional indirect or direct effects on identified archeological resources along Hermit Road if implemented with any of the other action alternatives.

Cumulative Impacts. Combining the impacts of implementing this option with past, on- going and future projects, would not result in any additional impacts to archeological resources beyond those described for the other alternatives. Because no new ground disturbance or changes to visitor use patterns off of established corridors are expected under this option, cumulative impacts would be similar to those expected for the other alternatives, as described above.

Impairment. No additional direct, indirect, and cumulative impacts to archeological resources would result from implementing the temporal road closure option. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park's archeological resources or park values.

Conclusion: Implementing a temporal road closure would not result in any additional direct, indirect or cumulative impacts to archeological resources.

HISTORIC RESOURCES AND CULTURAL LANDSCAPES

Affected Environment

The *Cultural Landscapes Inventory Professional Procedures Guide* (Page 2001) prepared by the NPS defines cultural landscapes as

settings that human beings have created in the natural world. They reveal fundamental ties between people and land—ties based on our need to grow food, give form to our settlements, meet requirements for recreation, and find suitable places to bury our dead. Cultural landscapes are intertwined patterns of things both natural and constructed—plants and fences, watercourses, and buildings. They range from formal gardens to cattle ranches, from cemeteries and pilgrimage routes to village squares. They are special places—expressions of human manipulation and adaptation of the land

Both a Cultural Landscape Inventory (NPS 2003) and Cultural Landscape Assessment/Treatment Recommendation have been completed for Hermit Road (Milner and Associates 2004). The purposes of these documents were to identify, document, analyze and evaluate contributing and non- contributing cultural- landscape characteristics within the cultural landscape, and to provide specific recommendations and comprehensive vision for the landscape that can guide long- term management. These serve as supporting documents for GMP implementation and for taking actions to rehabilitate Hermit Road. Both reports have been referenced for specific information related to this proposed undertaking.

These documents also formed the basis for a determination of eligibility for Hermit Road to be listed on the National Register of Historic Places. The historic district has been determined eligible by both the NPS and the Arizona SHPO (NPS 2005a and SHPO 3/05).

The Mary Jane Colter Historic District (also designated a National Historic Landmark) consists of four buildings: Hopi House, Lookout Studio (both of which are in Grand Canyon Village), Hermits Rest and Desert View Watchtower. Hermits Rest is located at the western end of the project area. No actions are proposed within the National Register property boundary and this National Historic Landmark building has been determined to be outside the area of potential affect for this project.

The Orphan Mine Historic District (determined eligible for listing on the National Register in 1994) occurs within the project area between Maricopa Point and Powell Point. The site is fenced, and visitors are not allowed access. The access road into the mine site is also gated and locked. Visitors hiking between Maricopa and Powell Points reach the fence, then follow a social trail around the enclosure to Powell Point. No actions are proposed within the National Register property boundary. The proposed connecting trail between Maricopa and Powell Points (proposed under Alternatives B and D) and the proposed greenway trail (under Alternative C) would be constructed south of the existing fence, through the landscape. These actions would occur outside the property boundary and would, in effect, move visitors further from the site by removing the social trail along the fence. Therefore, NPS determined that the district is also outside the area of potential affect for this project.

Prior to construction of today's Hermit Road, Grand Canyon's pioneer prospectors, miners and tourism entrepreneurs built roads and paths leading from Grand Canyon Village as far west as the rim overlooking Hermit Basin (near Hermits Rest). These include a bridle path built by an early tourism operator in the 1890s; a short wagon road to Hopi Point in 1908; the Hermit Rim Road (also called the 1912 Road in this document) built in 1911- 1913 to connect railroad facilities in Grand Canyon Village to Hermits Rest; and other smaller spur and cutoff roads between 1912 – 1935. Although all of these earlier roads contribute to our knowledge of the West Rim's history, none of these retain sufficient historic integrity to be nominated to the National Register.

The historic property and its associated cultural landscape, with the potential to be affected by the proposed rehabilitation of Hermit Road, then, is Hermit Road itself.

Hermit Road, Trails and Overlooks Area

Hermit Road and its associated overlooks and parking areas are historic, designed and constructed in 1934/35 by the National Park Service and the Bureau of Public Roads (with assistance from the Civilian Conservation Corps) as a scenic road, first paved in 1937. The property retains a high degree of integrity. The roadway is two- lane and narrow, with vegetation close to the road shoulder on both sides (see photo, front cover). The road was

designed for vegetation to edge the road. Historic pullouts and overlook parking areas were designed to allow automobiles an opportunity to pull off the road to view the canyon rather than look over the edge while driving. Another pattern of spatial organization is located between the road and the rim, which is occupied by native vegetation and informal social trails. This space varies greatly in width depending on how closely the road approaches the rim. The original intent of the road designers was, for safety reasons, to prevent drivers from having direct views into the canyon from the road.

The aspects of the eligible property pertinent to rehabilitation of Hermit Road include:

Culverts and headwalls Hermit Road originally had twenty- nine culverts and fifty- eight headwalls. Since 1935, nine headwalls have been buried, one has been damaged, and three completely destroyed. The culverts are all virtually identical in design, with apparently no unique situations (NPS 2006b). Culvert ends and headwalls are located generally five- to- nine feet from the pavement edge. A culvert and headwall inspection took place as part of this project to determine how each culvert may be affected by proposed road widening. Of all Hermit Road historic features, culvert headwalls are most threatened from road widening and will need to be evaluated closely during subsequent detailed design of the alternative ultimately selected.

Walls at pullouts and overlook parking areas Historic wet- laid Kaibab Limestone walls in these areas were built according to 1934 specifications. Every pullout and parking area except Maricopa Point has these walls, and archaeological surveys indicate that all survive and are in generally good condition, although some rehabilitation and repair is desirable in many areas. A detailed inventory of the historic walls at each pullout and parking area and a brief condition assessment was prepared in support of this project (Anderson and Brennan 2006).

Benchmarks and brass cap monuments These are features contributing to the original construction phase of Hermit Road. Only two benchmarks (out of the original 35 placed after road construction in 1936) were relocated during the cultural resource survey for this project. They consist of a nail in a pine and a nail in a juniper tree 40- 60 feet from the road. More likely exist but they are difficult to relocate. Brass cap monuments were placed on both sides of the road, presumably to aid in construction. These monuments show up in original construction drawings and the archaeological survey shows that all appear to still be in place (Anderson and Brennan 2006).

West Rim Trail Built in the 1930s at the same time as Hermit Road, West Rim Trail became a formal paved trail through the efforts of the Civilian Conservation Corps. It is a narrow asphalt trail that begins near the Hermit Road Interchange and heads west to Powell Point, closely following the canyon rim. The trail is in poor condition and in need of rehabilitation (Milner 2004). A component common to all action alternatives is rehabilitation of this historic paved trail up to Maricopa Point.

Rural Road Character Hermit Road's rural character (its meandering and narrow alignment and vegetation along road edges) is an important aspect of the cultural landscape. For purposes of this analysis, because this feature of the landscape along Hermit Road is so

closely tied with visual/scenic resources, it is analyzed under the Visual/Scenic Resources section.

The Memorandum of Agreement between NPS, SHPO and any interested affiliated tribes is being prepared for this project (in draft, NPS 2006b) and describes in detail the archeological, historic and cultural landscape resources potentially affected by proposed undertakings. These resources are also summarized in Table 3.

Table 3. Archeological, Historic and Cultural Landscape Resources Potentially Affected by Proposed Undertakings.

Historic Property Component	Location	Nature of potential impact
Archeological Resources		
Archeological site AZ B:16:1125	Between Mohave Point and the east side of The Abyss	Would be disturbed by road widening under Alternatives B, C and D; cannot be avoided under these alternatives. The original road construction impacted this site. Alternative A would not create any additional impacts beyond what occurred during original construction.
Archeological sites AZ B:16:0229, B:16:0244, B:16:0249, B:16:0909, B:16:1121, B:16:1123, B:16:1134, B:16:1135, B:16:1126	In the vicinity of the proposed greenway trail, all but one site (AZ:B:16:1126) is south of Hermit Road	All can be avoided with minor trail rerouting
Archeological sites AZ B:16:1127, B:16:1130, B:16:1132	Between Hermit Road and proposed greenway trail under Alternatives C and D west of The Abyss	Potential for indirect effects after proposed greenway trail constructed under Alternatives C and D
Hermit Road, Trails and Overlooks Historic District		
Culverts and headwalls	Various locations along roadway, primarily south of the road	Proposed road widening and the extent of disturbance necessary for proper drainage, cut and fill, etc.
Benchmarks and brass cap monuments	Various locations along road, primarily south of the road	Proposed road widening and the extent of vegetation clearing along road edges
Walls at pullouts and overlook parking areas	Nine overlook parking areas and nine unnamed pullouts	Proposed overlook improvements to surfaces and alignments
West Rim Trail	Between Grand Canyon Village and Maricopa Point	Proposed rehabilitation efforts (resurfacing, replacing stone edging)

Environmental Consequences

Methodology

The baseline information used to assess impacts to historic resources and cultural landscapes is as described in the methodology section at the beginning of this chapter and includes park staff knowledge of the resources and site; review of existing literature and park studies; information provided by specialists within the National Park Service and other agencies and professional judgment. Detailed information on natural and cultural resources in Grand Canyon National Park summarized in the 1995 GMP and EIS was specifically referenced for information on affected resources in the project area. Additional information sources on historic resources used for this evaluation are as described above in the affected environment section.

The thresholds of change for the intensity of an impact on historic resources and cultural landscapes are defined as follows:

Negligible Impacts would be at the lowest levels of detection with neither adverse nor beneficial consequences; historic properties would receive no change to diagnostic artifacts, defining features, or characteristics that contribute to National Register of Historic Places eligibility. Negligible impacts are barely perceptible and alter neither resource condition, such as traditional access and site preservation, nor the relationship between the resource and the affiliated group's body of practices and beliefs. The determination of effect for Section 106 would be "no historic properties affected."

Minor Adverse Impacts would be detectable but would not diminish the overall integrity of the resource. Impacts such as feature degradation or displacement could occur and would be measurable, but would be localized and would not result in changes to defining elements. They would not affect or jeopardize defining features or characteristics of a historic resource or a character- defining pattern or feature of a landscape listed in or eligible for listing on the Register or aspects of integrity that contribute to eligibility for the National Register of Historic Places (National Register). The determination of effect for Section 106 would be "*no historic properties affected.*"

Beneficial Historic structures and features will be stabilized and preserved in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties. Preservation of landscape patterns and features is in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes*. For purposes of Section 106, the determination of effect would be "*no historic properties affected.*"

Moderate Adverse Disturbance of a site or sites would result in the loss of overall integrity and detection of measurable changes to character- defining elements and would contribute to increased instability of historic structures and features. For cultural landscapes, impacts would alter a character- defining pattern(s) or feature(s) of the cultural landscape, but would not diminish the integrity of the landscape to the extent that its National Register eligibility was jeopardized. Moderate effects would jeopardize a structure's National Register eligibility. The determination of effect for Section 106 would be "*historic properties affected.*" It may be necessary to execute a memorandum of agreement among the National Park Service and the applicable state or tribal historic preservation officer and, if necessary, the Advisory Council on Historic Preservation, in accordance with 36 CFR 800.6(b). Measures

identified in the MOA to minimize or mitigate adverse impacts would reduce the intensity of impact under NEPA from moderate to minor.

Beneficial Beneficial effects would include increasing the stability of a structure or historic feature, maintaining the setting of the structure, or rehabilitating a landscape or its patterns or features. A structure, historic feature or landscape will be maintained and restored in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties with guidelines for the treatment of cultural landscapes*. The determination of effect for Section 106 would be “no historic properties affected.”

Major Adverse Disturbance of a site would result in the loss of overall integrity and significant change to character- defining elements or would alter a character- defining pattern or feature of a landscape (including the proliferation of non- native plant species that may threaten the integrity of setting and traditional vegetative resources) to the extent that it would no longer be eligible to be listed on the National Register. Impacts would include destabilization of structures or cultural contexts, and an increase in exposure or vulnerability to natural elements (e.g. fire, flood, wind). The determination of effect for Section 106 would be “*historic properties affected.*” In the event of a determination of adverse effect, a MOA would be executed between the National Park Service and the applicable state or tribal historic preservation officer and, if necessary, the Advisory Council on Historic Preservation in accordance with 36 CFR 800.6(b). Measures identified in the MOA to minimize or mitigate adverse impacts would reduce the intensity of impact under NEPA from major to moderate or minor.

Beneficial An historic structure or feature or a landscape's patterns or features will be maintained and restored in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes*. Beneficial effects could include maintaining native or culturally significant vegetation. The determination of effect for Section 106 would be “*no historic properties affected.*”

Duration Short- term Impact - An effect that, within five years, would no longer be detectable as the resource was returned to its predisturbance condition or appearance (e.g. trash and other items that could be removed or vegetation that has been trampled, but has not been denuded).

Long- term Impact – A change in a resource or its condition that would not return the resource to predisturbance condition or appearance and for all practical purposes would be considered permanent (e.g., damage to elements or removal of artifacts).

Alternative A – No Action

Direct/Indirect Impacts: While Hermit Road, a historic resource, would be minimally widened and resurfaced under the No Action alternative, it would only be widened to its original uniform historic width of 20 feet. Maintenance of the road in this manner would result in a direct minor beneficial impact to the road by eliminating its continued degradation that has occurred over the years. Substantially fewer historic culverts and headwalls would be removed or destroyed under Alternative A than in Alternatives B, C or D. However, widening to only 20 feet and not implementing the extensive subgrade replacement (as proposed under the action alternatives) would not provide long- term protection for the road and it is likely that it would need continued maintenance and repair after the no action alternative were implemented. By not having an adequately wide shoulder for buses to operate, it is also likely that the shoulder would

continue to unravel over time (as seen on the road today) and would result in long- term adverse impacts to the integrity of the road.

No changes would occur to benchmarks and brass cap monuments, walls at pullouts and overlook parking areas or the West Rim Trail under the No Action Alternative and so these resources would not be changed. However, no improvements would occur to overlooks pathways, overlook parking areas or the historic West Rim Trail where rehabilitation is needed. While this would not result in an immediate direct adverse impact to these historic resources, lack of maintenance and repair over time has the potential to degrade their condition and their character- defining features.

From a cultural landscape perspective, implementation of Alternative A would result in little to no change to constructed elements, roadway width, corridor width, or vegetation (rural road character is evaluated under Visual/Scenic Resources later in this Chapter). No disturbance would occur along the roadway outside of the existing unvegetated right- of- way.

For these reasons, implementation of Alternative A would result in fewer measurable changes to character- defining elements than the other alternatives and would result in both beneficial and adverse minor impacts to historic resources and cultural landscapes.

Cumulative Impacts: Historic structures and historic districts have sustained previous impacts as the result of modifications to some historic resources. Modern buildings have also intruded on the historic setting and adversely impacted structures and districts. Furthermore, previous deterioration of some buildings as a result of natural weathering and use has compromised defining architectural characteristics. These past impacts are moderate, adverse, local, and long- term. Most of the recently implemented, in- progress and foreseeable future projects that have the potential to affect historic resources have been discussed with the SHPO. Consultation with the park’s cultural resource staff and historical architect and consultation with the SHPO as the basis for future projects would ensure that any adverse effects of future projects on historic resources would be negligible to minor. Therefore, adverse cumulative effects would be moderate, local, and long- term.

Impairment: Direct, indirect, and cumulative impacts to historic resources would be minor to moderate as a result of implementing the no action alternative. These impacts would not result in impairment. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park’s general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park’s historic resources and cultural landscapes, or park values.

Conclusion: Implementing the No Action alternative would result in minor, adverse direct and indirect impacts to historic resources and cumulative impacts that would be adverse and moderate. No impairment of park resources would result. Minor beneficial impacts from road resurfacing and prolonging the life of the historic road are also expected.

Alternative B – Widen for Safe Bus Access

Direct/Indirect Impacts: Actions common to all alternatives: historic resources with the potential to be impacted by these actions include the West Rim Trail, overlooks, Maricopa Point and resources near staging areas. “Pinch points” where the road is proposed for additional widening

to accommodate pedestrians has the potential to impact the roadway itself. Other actions such as whether the road is closed or not during construction, how slash is removed and the minor changes expected in visitation and operations would generally not result in impacts to historic resources or cultural landscapes. However, which option is selected for road closure during the construction period has the potential to impact historic resources and cultural landscapes indirectly due to the differences in length of the construction period and level of congestion and activity in the project area during implementation. Option 1 or 2, which would result in a one season construction period (instead of two) and would restrict visitor access to the project area, would reduce the possibility for inadvertent disturbance to historic features or landscape resources along the roadway.

- West Rim Trail – this historic paved trail would be rehabilitated according to the Secretary of the Interior’s Standards (Weeks 1995) and would be considered replacement- in- kind. Work would be monitored by cultural resources staff and aspects of the work are included as part of the MOA with SHPO, so that any potential for adverse impacts would be minimized. Improving the trail through resurfacing and replacing missing stones would result in a beneficial impact to this historic resource.
- Overlook Improvements – proposed improvements at the 9 overlooks would not result in substantial changes to the configuration or use of these areas. Existing historic stone walls and curbing would not be affected except at Trailview Overlook I where existing stone stairs would be replaced with an accessible ramp. This would be done according to the Secretary’s Standards so as to minimize adverse impacts to the historic wall. The construction of other improvements in these areas, including the installation of a raised walkway adjacent to existing stone walls, would add non- contributing features to the historic and cultural landscape, but would only impact a small area of the wall at any one overlook. Other improvements, such as replacement of concrete and paved surfaces is consistent with the historic use of these areas as visitor use areas and would benefit the continued preservation of these historic parking areas. The type and amount of site furnishings selected for use at each site, as described in the section of Chapter 2, would be carefully evaluated by cultural resource specialists to make sure it is consistent with the cultural landscape.
- Maricopa Point – This overlook parking area is not historic, but the pedestrian trail to the overlook is and a portion of the West Rim Trail that remains both east of, and west of, Maricopa Point. The majority of the changes that are proposed under either option 1 or 2 would not result in impacts to historic resources or cultural landscapes, although how proposed trail alignments impact the portions of historic trail in place would need careful evaluation. Under both options the rim trail would be relocated closer to the road on the east end to avoid sensitive plant habitat and a new connecting trail would be constructed on the west end. The east end change is not a concern as the trail in this area becomes non- historic and remains so up until a location near the existing fenced enclosure. Relocating it to the road could be done with little effect to historic or landscape resources, but how this is done needs careful review on site by a cultural resource specialist and landscape architect. Creation of the new connector trail around the Orphan Mine (common to both options) on the west end has the potential to impact the cultural landscape. A mitigation measure has been developed for all action alternatives that requires careful evaluation of the construction of this trail and its appearance, and requires that the historic path remain intact, wherever feasible.

- Staging Areas – all proposed staging areas have been surveyed for cultural resources. Mitigation measures have been developed (see end of Chapter 2) to minimize the likelihood for any impacts to nearby cultural resources.
- Pinch Points – Five areas, as designated on Figure 9, would require widening of Hermit Road an additional 4 feet (for a total road width of 28 feet) to allow pedestrians using the unpaved rim trail to have a suitable path to walk on between the road and the rim. This widening would allow for a 4-foot-wide designated pedestrian area between existing historic pull-out walls and vehicle travel lanes. Each of these locations has been evaluated on site for the potential impacts to historic resources. Adjustments have been made during design so that impacts would not occur to historic stone walls or curbing in these areas. Widening this additional distance would also not result in any additional impacts to existing culverts or headwalls.
- Minor road realignment in three areas between Mohave and the Abyss (shifting the road approximately 6 feet to the south would not result in any adverse impacts to historic resources or the cultural landscape. No additional historic or landscape resources would be affected by this slight shift in these three small areas (such as culverts or headwalls or brass caps or bench marks).

Road Widening: Of the 48 historic culvert headwalls that are in good to excellent condition and eleven that are currently buried (but presumed in good condition), widening the road to 24 feet would result in the need to unbury one of the buried headwalls and to bury or remove up to 8 additional headwalls. The intent of the road widening is to “thread the needle” between culvert headwalls along the entire road where feasible to save existing historic headwalls. Six to eight additional headwalls would be buried or removed. Many of the headwalls and culverts would be retained in place. Up to approximately 20 new culverts would also need to be installed in some places. These changes to historic headwalls and the installation of new non-contributing features (new culverts) to the historic road and surrounding cultural landscape would result in an impact to the road. Mitigation measures common to all alternatives have been developed to minimize the level of adverse impact these changes would have on the historic roadway. These include the measures described above regarding threading the needle between culverts as much as possible, minimizing the number of new culverts installed to only those absolutely necessary for drainage and making any new culverts as unobtrusive as possible so that they are rarely visible from the roadway. Because the majority of the historic culverts would be retained and many of them buried in place (and thus preserved and protected), and impacts of new culverts can be minimized, substantial changes to the historic integrity of the roadway are not expected.

As described in integral design features and mitigation measures, all efforts would be made to minimize the vegetation clearing along the roadway edge during widening so as to maintain benchmarks and brass cap monuments. While some of these historic features have been located, not all of them have, making protection and avoidance of individual ones difficult. However, most occur more than 30 feet from the road edge and would likely not be disturbed as vegetation clearing would not generally occur this far from the road. If most benchmarks and brass cap monuments are retained, or at least a representative sample is maintained, minimal adverse impacts to these resources is expected.

The CLR prepared for Hermit Road (Milner 2004) was prepared for the primary purpose of guiding actions associated with rehabilitation of the road. This document has been used to guide

project components, such as the extent of road widening, and trail and overlook improvements to ensure their compatibility with cultural landscapes.

The potential for adverse impacts to historic resources and cultural landscapes are therefore minimized, more so also by the development of the MOA with the SHPO and tribes that would guide implementation of the rehabilitation of Hermit Road and outline Section 106 responsibilities throughout the process to minimize impacts to all cultural resources. The rural road character aspect of the cultural landscape is being evaluated under the visual/scenic resources section of this chapter. For these reasons, implementation of Alternative B would result in long- term moderate adverse impacts to historic resources and cultural landscapes, minimized through the implementation of design features and mitigation measures (Chapter 2). Short- term moderate adverse impacts are expected during and immediately following construction. Beneficial impacts are also expected through the rehabilitation of historic features following the Secretary's Standards.

Cumulative Impacts. Combining the impacts of Alternative B with past, present and reasonably foreseeable future actions would be similar to Alternative A. While road widening and other actions under Alternative would result in impacts to cultural resources, the beneficial impacts of rehabilitation of these historic features outweighs the potential for adverse effects. This is due to careful planning and involvement during design to make sure impacts are lessened and careful review by SHPO. Combining these actions taken for B with those that would be routinely taken for other future projects ensures that adverse impacts are minimized. For these reasons, cumulative impacts from Implementation of Alternative B would be moderate, long- term and adverse.

Impairment: Direct, indirect, and cumulative impacts to historic resources would be moderate as a result of implementing Alternative B. These impacts would not result in impairment. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park's historic resources and cultural landscapes, or park values.

Conclusion: Implementing Alternative B would result in long- and short- term, moderate, adverse direct and indirect impacts to historic resources and cultural landscapes and cumulative impacts that would be adverse and moderate. Beneficial impacts would also be realized through rehabilitation of historic features according to the Secretary's Standards. No impairment of historic resources or cultural landscapes would result.

Alternative C - Greenway

Direct/Indirect Impacts: The impacts as a result of implementing actions common to all alternatives and road widening are the same as those described for Alternative B. The primary difference between Alternative B and C is in the construction of a greenway trail along the road from the Village to Hermits Rest. This greenway trail construction would also impact the length of the construction period and, as described for Alternative B, an increased construction period length has the potential to impact historic resources and cultural landscapes indirectly.

The changes necessary at Hopi Overlook to accommodate two- way shuttle bus use (concrete braking pads, additional curbing and pedestrian surfaces, wall or fence near island, and removal of some vegetation at the island ends) would result in adverse impacts to the cultural landscape. This is a small area visible from the main roadway and these modifications (the addition of non-contributing features), concentrated in this small area, would result in noticeable changes to the surrounding rural character of the roadway and the resulting appearance would be more urban.

Greenway trail: The construction of this trail for the full length of the roadway would not directly affect the character of the historic roadway and its associated features except with respect to where the trail intersects with the roadway (i.e. the number, type and location of trail crossings), how visible the trail is from the roadway (i.e. how much of a vegetated buffer exists between the trail and roadway) and how the trail is accommodated at Pima Point where there is not enough room between the roadway and the rim to accommodate the trail.

- **Bicycle/Pedestrian Crossings** – Up to 14 – 21 road crossings are anticipated with implementation of Alternative C. These intersections between the historic roadway and the new trail would result in impacts to the rural road character by “urbanizing” a rural setting. Integral design features have been developed, and are listed below, to minimize the adverse impact of these crossings. The type of signage, striping and location of these crossings would need to be carefully evaluated to minimize the intensity of the impact on the character of the historic road and its surrounding cultural landscape. However, as also described under the visual resources section later in this chapter, the road character would be affected by these crossings, regardless of design features intended to minimize the affect and have the potential to adversely impact the historic integrity of the road.
- **Pima Point/Greenway on Roadway** – In order to accommodate the width necessary for the greenway to get to Pima Point, additional road widening would be necessary, both on Hermit Road itself and on the access road into Pima Point (Figure 8). Widening Hermit Road near this junction was evaluated on site by cultural resource specialists and determined to be the most suitable option, rather than impacting historic stone walls and curbing of the historic pull- out in this location. No additional culvert headwalls would be impacted from this additional widening. Impacts of this widening on roads rural character are discussed under visual/scenic resources as well.

The CLR prepared for Hermit Road (Milner 2004) was prepared for the primary purpose of guiding actions associated with rehabilitation of the road. This document has been used to guide project components, such as the extent of road widening, and trail and overlook improvements to ensure their compatibility with cultural landscapes.

The potential for adverse impacts to historic resources and cultural landscapes are therefore minimized, more so also by the development of the MOA with the SHPO and tribes that would guide implementation of the rehabilitation of Hermit Road and outline Section 106 responsibilities throughout the process to minimize impacts to all cultural resources. However, combining the construction of the greenway trail with the widening of the road and the other actions common to all alternatives would result in a long- term moderate adverse impact to historic resources and cultural landscapes, and would be an impact greater than that realized by implementation of Alternative B or D. Short- term impacts during and immediately following construction would also be moderate and adverse. Combining all of these actions together

adversely impacts the historic integrity of Hermit Road and its associated features. The rural road character aspect of the cultural landscape is being evaluated under the visual/scenic resources section of this chapter. These impacts would be minimized through implementation of design features and mitigation measures (Chapter 2).

Cumulative Impacts. Combining the impacts of Alternative C with past, present and reasonably foreseeable future actions would be similar to Alternatives A and B. While road widening and greenway trail construction under Alternative C would result in impacts to cultural resources, careful planning and involvement during design to make sure impacts are lessened, as described in this document, along with the same actions taken for future projects and careful review by SHPO, minimizes the likelihood of substantial cumulative impacts over time. Combining these actions taken for C with those that would be routinely taken for other future projects ensures that adverse impacts are minimized. For these reasons, cumulative impacts from implementation of Alternative C would be moderate, long- term and adverse.

Impairment: Direct, indirect, and cumulative impacts to historic resources and cultural landscapes would be moderate as a result of implementing Alternative C. These impacts would not result in impairment. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park's historic resources and cultural landscapes, or park values.

Conclusion: Implementing Alternative C would result in long- and short- term, moderate, adverse direct and indirect impacts to historic resources and cumulative impacts that would be adverse and moderate. Beneficial impacts would also be realized through rehabilitation of historic features according to the Secretary's Standards. No impairment of historic resources or cultural landscapes would result.

Alternative D - Preferred

Direct/Indirect Impacts: The impacts as a result of implementing actions common to all alternatives and road widening are the same as those described for Alternative B. The primary difference between Alternative B and D is in the construction of a greenway trail between the Abyss and Hermits Rest. This is similar to Alternative C, except that this segment of trail is only for this 3- mile distance and does not include a trail for the full length of the roadway.

Greenway trail: The construction of this trail in this area between the Abyss and Hermits Rest would not directly affect the character of the historic roadway and its associated features except with respect to how visible the trail is from the roadway (i.e. how much of a vegetated buffer exists between the trail and roadway) and how the trail is accommodated at Pima Point where there is not enough room between the roadway and the rim to accommodate the trail. No bicycle/pedestrian road crossings would be necessary for Alternative D.

- Pima Point/Greenway on Roadway – This is the same as described for Alternative C.
- West Abyss Shuttle Stop – a new shuttle stop would be created at the beginning of the greenway trail, using an existing historic pull- out. No changes in width or length of the pull-

out would be necessary to accommodate buses, but some minor site work would be necessary as described in Chapter 2, under Alternative D. An approximately 8- foot- wide section of historic stone wall would need to be removed to accommodate the greenway trail in this location, where there is inadequate space between the rim edge and the pull- out to accommodate the greenway on the north side of the road in this area.

The CLR prepared for Hermit Road (Milner 2004) was prepared for the primary purpose of guiding actions associated with rehabilitation of the road. This document has been used to guide project components, such as the extent of road widening, and trail and overlook improvements to ensure their compatibility with cultural landscapes.

The potential for adverse impacts to historic resources and cultural landscapes are therefore minimized, more so also by the development of the MOA with the SHPO and tribes that would guide implementation of the rehabilitation of Hermit Road and outline Section 106 responsibilities throughout the process to minimize impacts to all cultural resources. The primary difference between Alternative C and D is in the length of greenway trail proposed. By having a shorter segment of greenway that can be entirely north of the roadway, as in this alternative, greatly benefits the historic roadway by eliminating the need for multiple road crossings and the “urbanizing” of the road character this creates under Alternative C. Having a shorter segment of greenway under this alternative and, all on the north side (in an area that can accommodate it separated from the roadway) also limits the potential for changes to the character of the road since the trail would rarely be visible from the roadway except at the terminus near Hermit's Rest. Combining the construction of this smaller segment of the greenway trail with the widening of the road and the other actions common to all alternatives would result in a long- term moderate adverse impact to historic resources and cultural landscapes, and would be an impact greater than that realized by implementation of Alternative B but less than that realized by implementation of Alternative C. Impacts are expected in the short- term during and immediately following construction that are moderate and adverse. The rural road character aspect of the cultural landscape is being evaluated under the visual/scenic resources section of this chapter. These impacts would be minimized through implementation of design features and mitigation measures (Chapter 2).

Cumulative Impacts. Combining the impacts of Alternative D with past, present and reasonably foreseeable future actions would be similar to Alternatives A, B and C. While road widening and greenway trail construction under Alternative D would result in impacts to cultural resources, careful planning and involvement during design to make sure impacts are lessened, as described in this document, along with the same actions taken for future projects and careful review by SHPO, minimizes the likelihood of substantial cumulative impacts over time. Combining these actions taken for D with those that would be routinely taken for other future projects ensures that adverse impacts are minimized. For these reasons, cumulative impacts from Implementation of Alternative D would be moderate, long- term and adverse.

Impairment: Direct, indirect, and cumulative impacts to historic resources and cultural landscapes would be moderate as a result of implementing Alternative D. These impacts would not result in impairment. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other

relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park’s historic resources and cultural landscapes, or park values.

Conclusion: Implementing Alternative D would result in long- term moderate, adverse direct and indirect impacts to historic resources, short- term adverse impacts during and immediately following construction, and cumulative impacts that would be adverse and moderate. Beneficial impacts would also be realized through rehabilitation of historic features according to the Secretary’s Standards. No impairment of historic resources or cultural landscapes would result.

Temporal Road Closure

Direct/Indirect Impacts: Implementation of this option would not result in any new ground disturbance. During the closure period to vehicles, visitors would be allowed to hike or bike the existing road, in addition to using the unpaved rim trail or greenway (if Alternative C or D were also implemented). This option would therefore not result in any additional direct impacts to historic resources or cultural landscapes if implemented with any one of the other alternatives. Proposed actions under a temporal road closure would therefore result in no change to culverts and headwalls, walls at pull- outs and overlook parking areas, benchmarks and brass cap monuments, or to the West Rim Trail. There is the potential under this option, however, for changes to occur in the way that visitors use the project area during the vehicle closure period, but it is expected that most visitors will simply walk or bike the road to access overlooks, view points and Hermits Rest. Increased social trailing is not expected. Therefore, implementation of a temporal road closure would have no additional indirect or direct effects on historic resources or cultural landscapes if implemented with any of the other action alternatives.

Cumulative Impacts. Combining the impacts of implementing this option with past, on- going and future projects, would not result in any additional impacts to historic resources or cultural landscapes beyond those described for the other alternatives. Because no new ground disturbance or changes to visitor use patterns off of established corridors are expected under this option, cumulative impacts would be similar to those expected for the other alternatives, as described above.

Impairment. No additional direct, indirect, and cumulative impacts to historic resources or cultural landscapes would result from implementing the temporal road closure option. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park’s general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park’s historic resources and cultural landscapes, or park values.

Conclusion: Implementing a temporal road closure would not result in any additional direct, indirect or cumulative impacts to historic resources or cultural landscapes.

ETHNOGRAPHIC RESOURCES

Affected Environment

Ethnographic resources are defined by the NPS as any “site, structure, object, landscape, or natural resource feature assigned traditional, legendary, subsistence, or other significance in the cultural system of a group traditionally associated with it” (Cultural Resource Management

Guidelines [DO- 28:191]). The lands of Grand Canyon National Park are traditionally affiliated with ten American Indian groups: Havasupai, Hopi, Hualapai, Kaibab Band of Paiute Indians, Navajo, Paiute Indian Tribe of Utah, White Mountain Apache, Yavapai Apache, San Juan Southern Paiute, and Pueblo of Zuni. Native American groups in the region recognize certain tangible properties as important in their traditional tribal histories. These properties, which may or may not be archeological sites, are referred to as traditional cultural properties in National Register Bulletin 38 (Parker and King 1990). Like other cultural resources, traditional cultural properties are given consideration under NHPA.

Tribal studies of the Colorado River corridor (Neal and Gilpin 2000) identified ethnographic resources that occur within Grand Canyon National Park, primarily on the river corridor but in other areas as well. These included archeological sites (including rock art sites, trails and graves), sacred sites, places mentioned in traditional history, subsistence areas, boundary line, natural landmarks, minerals, plants, animals and water (including springs)

Grand Canyon has long been of importance to native cultures, and figures prominently in the origin/religious beliefs and ceremonial practices of many groups. For example, traditional Hopi and Zuni beliefs hold Grand Canyon as the sacred place from which their ancestors emerged to the present world.

Environmental Consequences

Methodology

The baseline information used to assess impacts to ethnographic resources is described in the methodology section at the beginning of this chapter, and includes park staff knowledge of the resources and site; review of existing literature and park studies; information provided by specialists within the National Park Service and other agencies and professional judgment. Detailed information on natural and cultural resources in Grand Canyon National Park summarized in the 1995 GMP and EIS was specifically referenced for information on affected resources in the project area. Additional sources of information on ethnographic resources used for this evaluation are described above in the affected environment section.

Proposed activities have the potential to impact ethnographic resources through changes in duration and level of human- caused noise.

The thresholds of change for the intensity of an impact on ethnographic resources are defined as follows:

Negligible Impacts would be at the lowest levels of detection with neither adverse nor beneficial consequences; historic properties would receive no change to diagnostic artifacts, defining features, or characteristics that contribute to National Register of Historic Places eligibility. Negligible impacts are barely perceptible and alter neither resource condition, such as traditional access and site preservation, nor the relationship between the resource and the affiliated group's body of practices and beliefs. The determination of effect for Section 106 would be "no historic properties affected."

Minor Adverse For ethnographic resources, impacts would be slight and noticeable and would neither appreciably alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of beliefs and practices. The determination of effect on Traditional Cultural Properties

(ethnographic resources eligible to be listed in the National Register) for purposes of Section 106 would be “*no historic properties affected.*”

Beneficial Impacts would allow access to and/or accommodate a group’s traditional practices or beliefs. The determination of effect on Traditional Cultural Properties (ethnographic resources eligible to be listed in the National Register) for purposes of Section 106 would be “no historic properties affected.”

Moderate Adverse For ethnographic resources, impacts would be apparent and would alter resource conditions or interfere with traditional access, site preservation, or the relationship between the resource and the affiliated group’s practices and beliefs, even though the group’s practices and beliefs would survive. The determination of effect on traditional cultural properties for Section 106 would be “*historic properties affected.*”

In the event of a determination of adverse effect, a Memorandum of Agreement (MOA) would be executed between the National Park Service and the applicable state or tribal historic preservation officer and, if necessary, the Advisory Council on Historic Preservation in accordance with 36 CFR 800.6(b). Measures identified in the MOA to minimize or mitigate adverse impacts would reduce the intensity of impact under NEPA from moderate to minor.

Beneficial Impacts would facilitate traditional access and/or accommodate a group’s practices or beliefs. Beneficial effects would include maintaining natural ecosystem processes. The determination of effect on Traditional Cultural Properties (ethnographic resources eligible to be listed in the National Register) for purposes of Section 106 would be “no historic properties affected.”

Major Adverse Impact(s) would alter resource conditions. Proposed actions would block or greatly affect traditional access, site preservation, or the relationship between the resource and the affiliated group’s body of beliefs and practices, to the extent that the survival of a group’s beliefs and/or practices would be jeopardized. Impacts would result in significant changes or destabilization to defining elements and resource condition and an increase in exposure or vulnerability to natural elements. The determination of effect on Traditional Cultural Properties (ethnographic resources eligible to be listed in the National Register) for purposes of Section 106 would be “historic properties affected.” In the event of a determination of adverse effect, a Memorandum of Agreement would be executed between the National Park Service and the applicable state or tribal historic preservation officer and, if necessary, the Advisory Council on Historic Preservation in accordance with 36 CFR 800.6(b). Measures identified in the MOA to minimize or mitigate adverse impacts would reduce the intensity of impact under NEPA from major to moderate or minor.

Beneficial Impacts would encourage traditional practices and/or accommodate a group’s beliefs or practices. Beneficial effects would include maintaining natural ecosystem processes. The determination of effect on Traditional Cultural Properties (ethnographic resources eligible to be listed in the National Register) for purposes of Section 106 would be “no historic properties affected.”

Duration Short-term Impact - An effect that, within five years, would no longer be detectable as the resource was returned to its predisturbance condition or appearance (e.g. trash and

other items that could be removed or vegetation that has been trampled, but has not been denuded).

Long- term Impact – A change in a resource or its condition that would not return the resource to predisturbance condition or appearance and for all practical purposes would be considered permanent (e.g., damage to elements or removal of artifacts).

Permanent - irreversible changes such that ongoing cultural traditions associated with those resources are lost.

Timing: Ethnographic resources might be more vulnerable to impacts during the spring growing season or at other times of the year depending on specific tribal traditions.

Alternative A – No Action

Direct/Indirect Impacts: While ethnographic resources significant to Native Americans may be present in the vicinity of Hermit Road, no ethnographic resources have been specifically identified. All affiliated tribes have been contacted for any concerns they have with the implementation of this project and no concerns related to ethnographic resources have been identified. The no action alternative does not change existing uses and conditions and therefore would result in only negligible impacts to ethnographic resources.

Cumulative Impacts: Ethnographic resources may exist in the project area and it is possible that some have sustained previous impacts as the result of the overall development of the Hermit Road area. Modern buildings have intruded on historic settings and changed the way the area is used. Past development of park facilities has likely impacted archaeological resources in the area, and is likely to have impacted ethnographic resources. Loss or disturbance of these resources on the South Rim (in conjunction with previous losses and prevailing threats to finite numbers of these resources throughout the region) incrementally diminishes the overall understanding of Grand Canyon’s cultural history. These past impacts are moderate, adverse, local, and long- term. Most of the recently implemented, in- progress and foreseeable future projects that have the potential to affect cultural resources have been discussed with the SHPO and tribal groups. Consultation with the SHPO and affiliated tribes as the basis for future projects would ensure that any adverse effects of future projects on cultural resources would be negligible to minor. Therefore, adverse cumulative effects would be moderate, local, and long-term.

Impairment: Direct, indirect, and cumulative impacts to ethnographic resources would be negligible to moderate as a result of implementing the no action alternative. These impacts would not result in impairment. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park’s general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park’s ethnographic resources or park values.

Conclusion: The No- Action Alternative would have negligible, adverse direct and indirect impacts to ethnographic resources and cumulative impacts that would be moderate, adverse and long- term. There would be no impairment of ethnographic resources.

Alternative B – Widen for Safe Bus Access

Direct/Indirect Impacts. While ethnographic resources significant to Native Americans may be present in the vicinity of Hermit Road, no ethnographic resources have been specifically identified. All affiliated tribes have been contacted during each of the two scoping efforts in 2004 and 2005 and copies of this EA will be forwarded to each affiliated tribe for review and comment. All affiliated tribes have been contacted regarding the project and their interest in becoming signatories on the Memorandum of Agreement regarding cultural resources. No ethnographic resources have been identified during these efforts. If any tribe subsequently identifies the presence of any ethnographic resources within the project areas, appropriate mitigation measures would be undertaken in consultation with the tribes. The location of any ethnographic sites would not be made public. Therefore, implementation of Alternative B would result in only negligible impacts to ethnographic resources.

A detailed evaluation of potential impacts to cultural resources is the subject of consultation with the SHPO and affiliated tribes and will be documented in a memorandum of agreement between the SHPO, the park and interested tribes. For these reasons, Alternative B would result in negligible adverse impacts to ethnographic resources.

Cumulative impacts: Because no ethnographic resources are known to occur in the project area, cumulative impacts are as described under Alternative A.

Impairment: Direct, indirect, and cumulative impacts to ethnographic resources would be negligible to moderate as a result of implementing Alternative B, and would be adverse. These impacts would not result in impairment. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park's ethnographic resources or park values.

Conclusion: Alternative B would result in negligible direct and indirect adverse impacts to ethnographic resources and moderate adverse cumulative impacts. There would be no impairment of ethnographic resources.

Alternative C - Greenway

Direct/Indirect Impacts: While ethnographic resources significant to Native Americans may be present in the vicinity of Hermit Road, no ethnographic resources have been specifically identified. For these reasons, direct, indirect and cumulative impacts are the same as those described for Alternative B.

Impairment: Direct, indirect, and cumulative impacts to ethnographic resources would be negligible to moderate as a result of implementing Alternative C, and would be adverse. These impacts would not result in impairment. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park's ethnographic resources or park values.

Conclusion: Alternative C would result in negligible direct and indirect adverse impacts to ethnographic resources and moderate adverse cumulative impacts. There would be no impairment of ethnographic resources.

Alternative D - Preferred

Direct/Indirect Impacts: While ethnographic resources significant to Native Americans may be present in the vicinity of Hermit Road, no ethnographic resources have been specifically identified. For these reasons, direct, indirect and cumulative impacts are the same as those described for Alternative B.

Impairment: Direct, indirect, and cumulative impacts to ethnographic resources would be negligible to moderate as a result of implementing Alternative B, and would be adverse. These impacts would not result in impairment. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park's ethnographic resources or park values.

Conclusion: Alternative D would result in negligible direct and indirect adverse impacts to ethnographic resources and moderate adverse cumulative impacts. There would be no impairment of ethnographic resources.

Temporal Road Closure

Direct/Indirect Impacts. Implementation of this option would not result in any new ground disturbance. During the closure period to vehicles, visitors would be allowed to hike or bike the existing road, in addition to using the unpaved rim trail or greenway (if Alternative C or D were also implemented). This option would therefore not result in any additional direct impacts to ethnographic resources if implemented with any one of the other alternatives. Proposed actions under a temporal road closure would therefore result in no change to resources nor any changes in access, except those by vehicle. Therefore, implementation of a temporal road closure would have no additional indirect or direct effects on ethnographic resources if implemented with any of the other action alternatives.

Cumulative Impacts. Combining the impacts of implementing this option with past, on-going and future projects, would not result in any additional impacts to ethnographic resources beyond those described for the other alternatives. Because no new ground disturbance or changes to visitor use patterns off of established corridors are expected under this option, cumulative impacts would be similar to those expected for the other alternatives, as described above.

Impairment. No additional direct, indirect, and cumulative impacts to ethnographic resources would result from implementing the temporal road closure option. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park's ethnographic resources or park values.

Conclusion: Implementing a temporal road closure would not result in any additional direct, indirect or cumulative impacts to ethnographic resources.

NATURAL RESOURCES

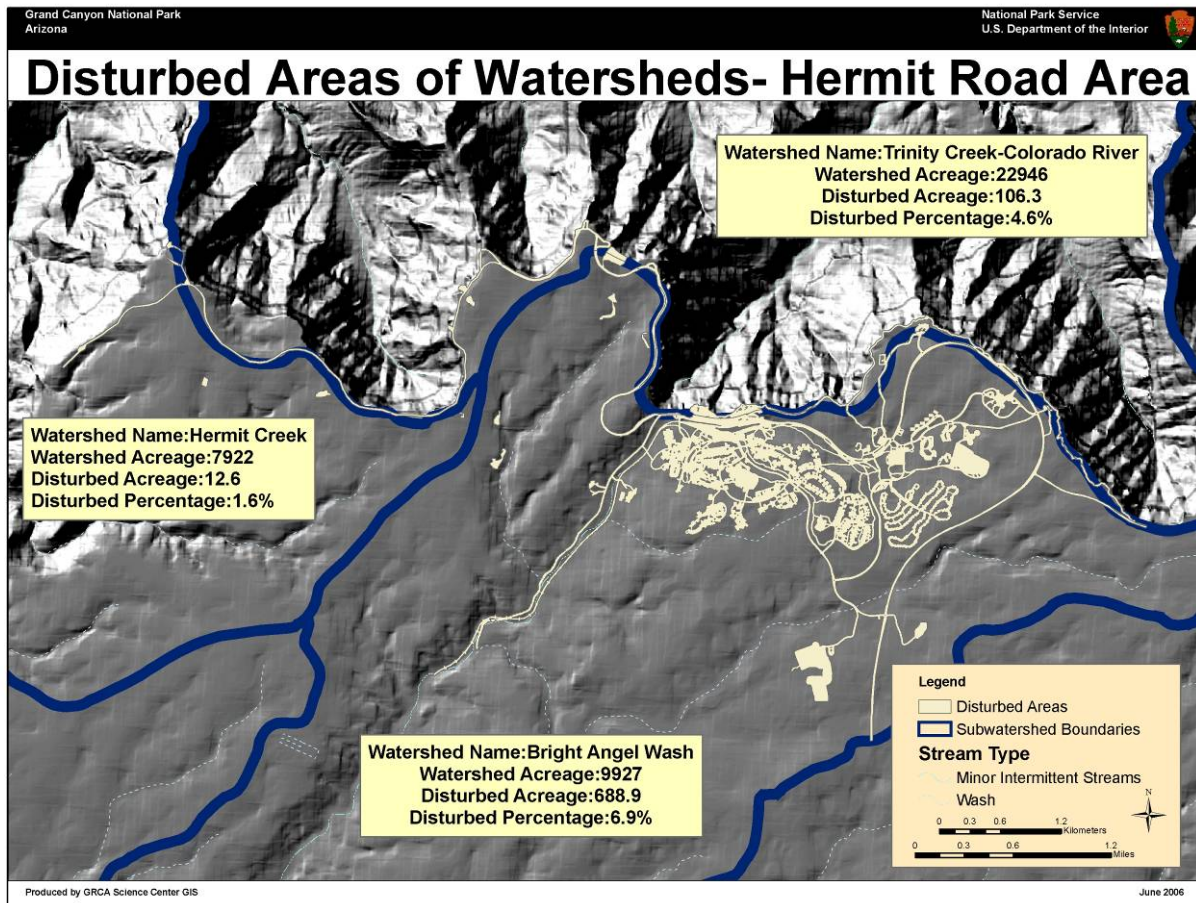
WATERSHED VALUES

Affected Environment

South Rim's developed areas, including the project area, are underlain by Kaibab Limestone, a very porous rock layer. This and other porous sedimentary layers of Grand Canyon create a subdued karst topography in which numerous solution channels and sinks have formed. Little or no surface water is present because water penetrates through the soil and rock layers quickly. The Coconino Plateau, which forms the South Rim, generally slopes south, away from the canyon. Hermit Road lies within the boundaries of two watershed subunits: Hermit Creek and Bright Angel Wash. Both watershed subunits have varying levels of disturbed areas within them, comprised primarily of existing roads, buildings, trails and parking areas (Map 7). Soils tend to be shallow and poorly developed, but stable, with frequent rock outcroppings. Productivity of most park soils is low, so that revegetation is slow and usually requires considerable maintenance. Warren et al. (1982) describes soils in the vegetation type characteristic of the project area as moderately shallow, sometimes with cobbles, with silty loam texture, derived from Kaibab Limestone or volcanic outcrops.

A baseline soil survey of Grand Canyon was completed by the Natural Resources Conservation Service in 2003. The survey provides an initial baseline inventory of park soils to provide information for management of park resources. The study documented that soils in the project area are primarily of the Deama- Rock outcrop complex although several other soil types have been documented in the road vicinity (NRCS 2003). A summary of soil map units is included in Map 8 and Table 4. Soils have been characterized into map units. The map units can be used to determine suitability and potential of a unit for specific uses, and they can also be used to plan the management needed for those uses (NRCS 2003). Generally speaking, soils in the area are of the Deama- Rock outcrop complex and are derived from limestone and sandstone, are well-drained with moderate permeability and have the potential for very high runoff. The potential for shrinking and swelling is low. Depth to bedrock is typically 7 to 20 inches (Table 4).

For purposes of this analysis, it has been estimated that approximately 50% of Hermit Road is within the Hermit Creek watershed subunit, approximately 25% is in the Bright Angel Wash watershed subunit and approximately 25% is within the Trinity Creek- Colorado River watershed subunit (Map 7). The contribution of this construction into the Trinity Creek- Colorado River watershed is not analyzed further. This is a large watershed primarily encompassing areas below the canyon rim. Any contributions to this watershed as a result of additional disturbance related to the rehabilitation of Hermit Road in this small area would be very difficult to measure or quantify. Realizing that standard practices to minimize soil movement or runoff from the project site within this watershed would be incorporated into this project, the evaluation of this small portion of the project was not considered further, from the standpoint of cumulative impacts to watershed values. Watershed values are analyzed for each alternative and both the Hermit Creek and Bright Angel Wash watershed subunits form the basis on which cumulative impacts to watershed values are evaluated.



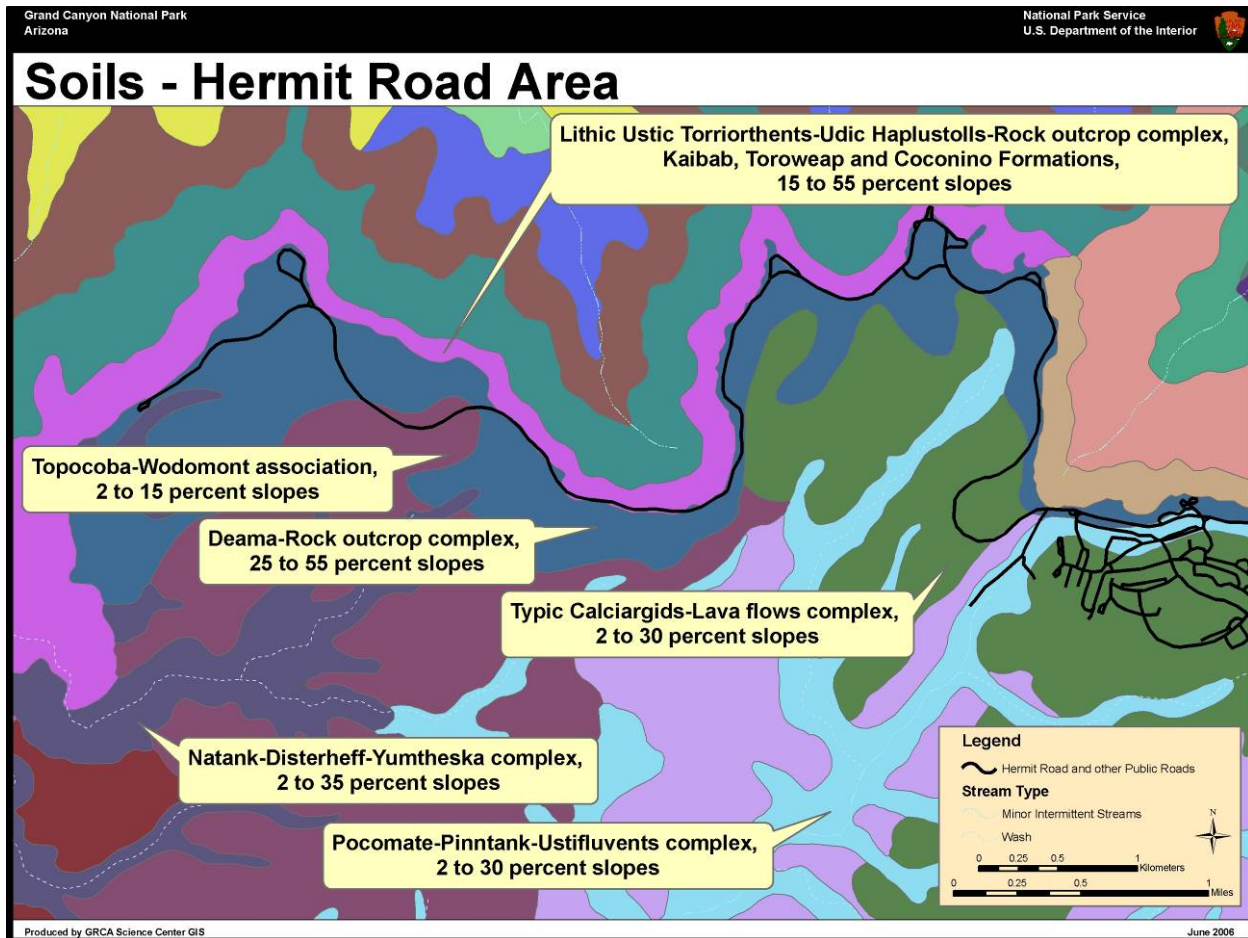
Map 7. Watershed Boundaries and Levels of Existing Disturbance within the Hermit Road Area, South Rim, Grand Canyon National Park

There is no standing water or any major drainage in the project area, although minor intermittent drainages south of Hermit Road do occur. There is no riparian habitat present within or adjacent to the project area. The Grand Canyon Village and nearby surrounding areas are characterized by the absence of surface water, which generally drains through the groundwater system or returns to the atmosphere via evapotranspiration. Surface runoff usually only occurs following severe storm events. This is largely due to the permeable nature of the upper sedimentary layers underlying Grand Canyon Village area (NPS 1995c, Roundy and Vernon 1996) and the evapotranspiration potential of the surrounding pinyon- juniper vegetation type (Huntoon undated).

Environmental Consequences

Methodology

The baseline information used to assess impacts to watershed values is as described in the methodology section at the beginning of this chapter and includes park staff knowledge of the resources and site; review of existing literature and park studies; information provided by specialists within the National Park Service and other agencies and professional judgment.



Map 8. Soils in the Hermit Road Area (to be used with Table 4), South Rim, Grand Canyon National Park

Detailed information on natural and cultural resources in Grand Canyon National Park summarized in the 1995 GMP and EIS was specifically referenced for information on affected resources in the project area. Additional sources of information on soil and water resources used for this evaluation are as described above in the affected environment section.

Watershed values are all those natural resources which interact to maintain a watershed's natural dynamic equilibrium (i.e., maintain a properly functioning watershed). These resources and their individual effects are listed below and are not always mutually exclusive. Individual and relevant resources are, but not limited to soil, surface water, ground water, fluvial and watershed form and function (i.e., hillslope and channel integrity, etc).

- ❑ Increased runoff potential at construction site and affected areas through the addition of impervious surfaces resulting in localized increases in erosion, sedimentation rates and flooding from channel adjustments.
- ❑ Reduction of soil area available for runoff infiltration and recharge area.
- ❑ Funneling flow through new culverts resulting in localized flow energy concentrations, potentially resulting in increases in erosion and sedimentation rates.
- ❑ Decreased ground and surface water quality and quantity from runoff events.

- ❑ Soil disturbance, including compaction will occur as a result of construction activities or in areas of intensive use (i.e., social trailing). Soil disturbance potentially reduces water infiltration rates, increases runoff potential and associated effects and limits vegetation productivity.
- ❑ Erosion may also be locally accelerated by the removal of vegetation through grading activities or pedestrian use.

Table 4. Soil Types in the Vicinity of Hermit Road, South Rim, Grand Canyon National Park (to be used with Map 8)

Soil Map Unit	Description	Location in Project Area
Deama- Rock outcrop complex, 25 to 55% slopes	Deama soils are loamy- skeletal and carbonatic, derived from limestone. Depth to bedrock is 7 to 20 inches and they are well-drained. Soils are well- drained with moderate permeability and the potential for very high runoff.	Characterizes most of the roadway west of Hopi Hill to Hermits Rest
Lithic Ustic Torriorthents- Udic Haplustolls- Rock outcrop complex, 15 to 55% slopes	Occurring below the rim in the project area on steep slopes. Soils are highly variable but are generally colluvium derived from limestone and sandstone. Depth to bedrock can vary from four to 60 inches. Rock outcrops make up approximately 15% of the area (<i>permeability, drainage class and runoff potential not available</i>)	Characterizes that portion of the project area at the rim edge and below, north of Hermit Road.
Typic Calciargids- Lava flows complex, 2 to 30% slopes	Soils in this type are residuum weathered from basalt with depths to bedrock of 20–60 inches. Soils are highly variable in depth, texture and color and/or chemical properties (<i>permeability drainage class and runoff potential not available</i>)	Characterizes most of the area south of Hermit Road between Grand Canyon Village and The Abyss.
Topocoba- Wodomont association, 2 to 15% slopes	Soils in this type are alluvium derived from limestone and sandstone, with depths to bedrock ranging from six to 40 inches. Soils are well- drained with moderately slow permeability and low runoff potential.	Characterizes a small area along Hermit Road between The Abyss and Pima Point.
<i>*two other soil types appear on Map 8 but are not within the area potentially affected by Hermit Road.</i>		

The thresholds of change for the intensity of an impact on watershed values are defined as follows:

Negligible Change in watershed values/resources (i.e., soil, surface water, groundwater, floodplains and wetlands, fluvial and watershed form and function (i.e., hillslope and channel integrity, etc.) that may be measurable and/or perceptible but of no consequence. A U.S. Army Corps of Engineers 404 permit would not be required. No mitigation measures would be needed (naturally mitigated in a season).

Minor Changes in watershed values/resources would be measurable, although the changes would be small, likely short- term, and the effects would be localized. A U.S. Army Corps of Engineers 404 permit would not be required. Little if any mitigation measure would be needed and would be 100% effective.

Moderate Changes in watershed values/resources would be measurable, readily apparent and likely of long duration past construction phase but would be relatively local in extent. U.S. Army Corps of Engineers 404 permit could be required, but no long- term degradation of wetland function would occur. Mitigation measures would be necessary and the measures would likely succeed

Major Changes in watershed values/resources would be readily measurable and observable over a large area and would have substantial consequences. May have affects beyond park boundaries. U.S. Army Corps of Engineers 404 permit could be required. Mitigation measures would be necessary and their success would not be guaranteed.

Nature of the Impact Adverse impacts would result from those actions that degrade watershed form and function (i.e., increased soil removal, compaction, or erosion potential, reduction of soil productivity, reduction of water quality, fluvial channel form and function, etc.). Beneficial impacts would result from revegetation of social trailing and denuded areas; improved drainage from rehabilitated road or improve water quality (e.g., reduce non- point source pollution).

Duration Short- term impacts would result in less than or equal to one- to- three years following implementation and long- term impacts would result greater than three years following implementation.

Alternative A – No Action

Direct/Indirect Impacts. Approximately 13 acres of soil have been disturbed for existing developments in the 7,922 acre Hermit Creek watershed subunit, representing less than 1% of the subunit watershed. Approximately 689 acres of soil have been disturbed for the existing developments in the 9,927 acre Bright Angel Wash watershed subunit, representing approximately 7% of the watershed subunit (Figure 9). Construction activities can result in reduced water infiltration, reduced soil porosity, reduced water holding capacity, reduced aeration of the soil, increased surface runoff, and increased soil erosion (except in those areas that are covered by impervious surfaces) through the compaction and displacement of soil.

In the Hermit Creek watershed where soils are of varying types but generally well- drained with low to moderate permeability (NRCS 2003), low rainfall and lack of steep slopes, effects from the low level of past activities have been minimal. The impacts to watershed values have been

adverse, negligible to minor, local and long- term. The Bright Angel Wash watershed encompasses Grand Canyon Village. Soils in the Village area are highly permeable, although rates of infiltration are slow and runoff can be high. Soils in other parts of the watershed, as shown in Figure 10, are variable but some exhibit high runoff potential as well. The impacts from past disturbances in the watershed are not well understood, but are considered minor to moderate, based on observations of channel response to high runoff events in Bright Angel Wash.

Construction activities proposed under the No Action alternative are limited to minimal widening of the road to its original width, resulting in disturbance confined to the existing road corridor. This would result in approximately 20 acres total disturbance (over the entire road corridor, which would span several watersheds, including the Hermit and Bright Angel), none of which would occur outside existing disturbed areas. Adherence to standard mitigation measures and best management practices to minimize the likelihood of off- site soil movement during construction activities under Alternative A would minimize the potential for any off- site impacts. No new ground disturbance is proposed under Alternative A. Therefore, this alternative would not result in any additional effects to watershed values within the Hermit Creek or the Bright Angel Wash watershed subunits.

Cumulative Impacts. Hermit Creek Watershed Subunit: Approximately 13 acres of soil have been disturbed for existing developments in the 7,922 acre Hermit Creek watershed subunit, representing less than 1% of the subunit watershed. Under the no action alternative, no additional new ground disturbance would result and therefore would not contribute to any new disturbance within the watershed. Foreseeable future projects (Appendix A and Table 12) would not result in any additional development in the watershed subunit, although some prescribed burning (1,000 acres) is planned for this watershed. Although prescribed burns are a disturbance to the site and result in some changes to vegetation and ground cover in the areas burned, they would not appreciably or measurably affect soils. Soil movement may result following the burn due to the temporary loss of ground cover in some areas, but this movement would be limited to small areas, generally less than 1 acre in size and distributed throughout the burn unit, where prescribed fire intensity was greatest due to existing high fuel loads. Combining taking no action at this time with existing and future development (13 acres) and future planned prescribed fire (1,000 acres) would result in disturbance to approximately 1,013 acres which is approximately 13% of the watershed subunit. The majority of these acres are derived from prescribed fire and do not necessarily constitute a net loss of soils or of watershed function. The majority of the watershed is essentially undisturbed pinyon- juniper woodland with some ponderosa pine stringers within the park boundary.

Bright Angel Wash Watershed Subunit: Approximately 689 acres of soil have been disturbed for the existing developments in the 9,927 acre Bright Angel Wash watershed subunit, representing approximately 7% of the watershed subunit. Under the no action alternative, no additional new ground disturbance would result and therefore would not contribute to any new disturbance within the watershed. Recently implemented and foreseeable future construction projects would result/have resulted in approximately 15 acres of additional development, approximately 230 acres of wildfire and 3,920 acres of prescribed burning (Table 12). The Long Jim fire (230 acres) burned in spring 2004 in a mosaic pattern, with areas of low, moderate and high severities within the fire perimeter. Areas that burned at high severity were limited, and most (estimated at approximately two- thirds of the area have been classified, a year after the fire, as low or

moderately low in severity. It has been demonstrated that soils can be altered under the influence of fire (Cilimburg and Short 2004). Soil response can be both beneficial and adverse. In general, the effects of low- and moderate- low severity fire are beneficial while the effects of high and moderate- high severity are adverse. Lower severity fires burns are important for nutrient cycling and reducing the depth of litter and duff to maintain site productivity for grasses and forbs (Laughlin et al. 2004), as well as reducing ground fuels and fuel ladders. The short term impacts of this fire on watershed values have likely included increased soil movement, soil loss and sedimentation to downstream drainages (Rihs, pers.com. 8.10.06). These short- term impacts should stabilize within 3- 5 years following the fire. The Topeka prescribed burn also occurred in a portion of the watershed in 2004 and is expected to be burned again in 2009. Predicted effects of prescribed burning on watershed values are as described under Hermit Creek watershed analysis; although prescribed burns are a disturbance to the site and result in some changes to vegetation and ground cover in the areas burned, they would not appreciably or measurably affect soils over the long- term.

Wildland Urban Interface (WUI) treatments are planned for the Bright Angel Wash watershed subunit on approximately 1,200 acres (as described briefly in Appendix E and Table 12). These are fuel reduction treatments proposed around Grand Canyon Village. In order to reduce the level of fuel- loading and fire susceptibility of the developed areas of Grand Canyon Village, actions in this interface may include pruning trees, limbing, clearing dead and down woody debris, and thinning small diameter trees to provide adequate spacing. Work would typically be done with handtools but mechanized equipment may be considered as well. These actions would result in minimal disturbance to the ground surface, particularly if the woody debris is taken off site to be burned. If piles are burned on site, this has the potential to result in localized high soil temperatures below the piles, but this is a short- term adverse impact with little potential for long- term effects to soils in the watershed as a whole. If mechanized equipment is used some ground disturbance could result but would be minimized through the use of rubber tired equipment and operation in small areas adjacent to roadways. WUI treatments would be implemented with the objective of reducing the risk of wildfire. Watershed values can be directly impacted by high intensity wildfire and therefore, reducing this potential has a beneficial impact to watershed values in the area.

Combining taking no action at this time with existing and future development (704 acres) would result in disturbance to approximately 7% of the watershed subunit. Combining taking no action at this time with existing and planned fire activities (5,350 acres) would result in disturbance to approximately 54% of the watershed subunit. The additional acres of estimated development within the watershed in the foreseeable future are a relatively small amount and does change the percentage of development within the subunit as a whole. The majority of the acreage planned for disturbance in the future is derived from fire activities; prescribed fire and WUI treatments and these actions are planned with the objectives of improving forest and woodland conditions and minimizing the likelihood of wildfire in these areas. For these reasons, these fire activities do not necessarily constitute a net loss of soils or of watershed function over the long- term. In some cases these proposed treatments would improve soil conditions by reducing ground cover, enhancing nutrient cycling and opening up the canopy so that herbaceous cover can increase and stabilize bare soil.

For these reasons, combining minimally widening Hermit Road to its historic width with past and planned activities within both watershed subunits would result in minor to moderate, long-term adverse impacts to watershed values.

Impairment. No additional direct and indirect effects would result from implementation of the no action alternative. Cumulative adverse impacts under the no action alternative would be minor to moderate. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the Park or to opportunities for enjoyment of the Park; or (3) identified as a goal in the Park's general management plan or other relevant NPS planning documents, there would be no impairment of the Park's watershed values.

Conclusion: Taking minimal action at this time to rehabilitate Hermit Road, combined with past, on- going and foreseeable future actions would result in minor to moderate impacts to watershed values.

Alternative B – Widen for Safe Bus Access

Direct and Indirect Impacts: The lack of steep slopes and perennial water in the project area substantially reduces the risk of negative impacts to soils and water from widening the road to 24 feet under Alternative B. While approximately 46 acres of total disturbance would result from implementing this alternative, of which approximately 14 acres would be new ground disturbance, direct impacts during construction would be minimized through implementation of standard mitigation measures (point source treatments) to minimize soil movement off- site during construction (see Chapter 2). Appropriate sizing and design of culverts would be done in consultation with the park hydrologist so as to be adequate for the level of water movement expected and necessary to minimize impacts downstream. Trampling from increased personnel and use of equipment in these areas would result but it would be short- term, lasting only during construction. Mitigation measures have been developed (see Chapter 2) to address the need to replant areas following construction to minimize any long- term impacts. Equipment staging areas would be chosen in existing disturbed areas to minimize soil disturbance and compaction. While impacts would be greater than Alternative A, and there would be some increased potential for runoff or erosion during construction, impacts to wetlands or floodplains, decreases in water quality or the potential to affect fossil and/or unique mineral deposits would be minimal. Adding additional pavement (an impervious surface) to widen the road adds a long-term impact to the watersheds through which Hermit Road occurs. The effects of this additional pavement would be minimized through adequate design of culverts and drainage, adequate slopes off the road and appropriate design features to minimize runoff beyond the limits of the road right- of- way, all things factored into the design by Federal Highways.

New ground disturbing activities under Alternative B would primarily be associated with road widening. Improvements to the unpaved rim trail, to overlooks and parking areas and construction of the connector trail between Maricopa Point would result in approximately 2- 3 acres of additional new ground disturbance, generally adjacent to existing disturbed areas. These acreages are generally spread out over the project area and are not expected to result in any appreciable soil movement in any one area. In addition, these actions, particularly the construction of the connector trail and the improvements along the unpaved trail are intended

to minimize the extensive social trailing throughout portions of the project area, which would have a beneficial impact on watershed values.

The implementation of either option 1 or option 2 for the Maricopa Point improvements would not result in any measurable impact to watershed values when combined with the other actions proposed for each alternative. This is a small area with many areas already disturbed. However, reducing the level of social trailing in the area and creating easily navigable trail connections should reduce the likelihood of increased soil movement and loss in the area and allow for vegetation to return to areas restored. If the preferred option were implemented and the parking area were removed, there would be an opportunity for site restoration in this area, benefiting the rare plant population and the quality and stability of the soil, over the long- term. If option 2 was implemented and the parking area was replaced in its current location, no additional impacts would result beyond what is on- going under the current situation. However, option 2 does not go as far as the preferred option in reducing social trailing. With the same level of visitor use and the same user groups accessing the parking area, there would likely be continued social trailing through the area.

The implementation of any option for road closure during the construction period would not appreciably affect watershed values when combined with the other actions proposed for each alternative. However, implementing the either Option 1 or the preferred option to close the road to visitors during the construction period would result in a shorter construction period, limiting construction to one construction season instead of two. This would minimize the possibility of bare ground remaining in the project area over the winter season and would therefore minimize the possibility for increased erosion from unprotected disturbed areas until the project could start back up again the following year. These impacts would be relatively minor, reduced through implementation of mitigation measures but would be greater for option 3 than for either Option 1 or the preferred option.

The use of staging areas identified and the establishment of a batch plant have no potential for impacts to watershed values as these sites are already disturbed and mitigations are in place to minimize any off- site impacts. Salvage and revegetation components of the action alternatives can be ground- disturbing but are not expected to result in any additional impacts beyond those described for construction actions. Vegetation salvage and then revegetation actions are designed to minimize the impacts of construction activities by replanting disturbed sites. While short- term impacts during the use of salvage and revegetation are possible (use of a backhoe and other equipment off established roads) these impacts are negligible over the long- term. Treating slash as described in actions common to all alternatives would not result in any additional impacts to watershed values than those described for construction actions.

For these reasons, Alternative B would result in direct and indirect, minor to moderate, adverse short- term impacts and minor to moderate long- term impacts to watershed values.

Cumulative Impacts. Hermit Creek Watershed Subunit: Implementing Alternative B would result in an additional 7 acres of new ground disturbance within this watershed (approximately 50% of the roadway and other associated improvements are estimated to be within this watershed as described under methodology previously in this section). Foreseeable future projects (Appendix A and Table 12) would not result in any additional development in the watershed subunit, although some prescribed burning (1,000 acres) is planned. The effects of

these foreseeable projects are as described under cumulative impacts of Alternative A. Combining the estimated 7 acres of new disturbance to past development projects would result in approximately 20 acres of disturbance, representing less than 1% of the watershed as a whole. Combining planned prescribed fire (1,000 acres) to this estimated level of development would result in disturbance to approximately 1,020 acres within the subunit watershed, which is approximately 13% of subunit watershed. The majority of these acres then are derived from prescribed fire and do not necessarily constitute a net loss of soils or of watershed function, as described previously. Therefore, the majority of the watershed is essentially undisturbed pinyon- juniper woodland with some ponderosa pine stringers. This condition would not appreciably or measurably change with implementation of Alternative B combined with other past and planned actions in this watershed subunit.

Bright Angel Wash Watershed Subunit: Implementing Alternative B would result in an additional 3.5 acres of new ground disturbance within this watershed (approximately 25% of the roadway is estimated to be within this watershed as described under methodology previously in this section). Recently implemented and foreseeable future projects (Appendix A and Table 12) would result in approximately 15 acres of additional development in the watershed subunit. Combining the estimated 3.5 acres of new disturbance to past and future development projects would result in approximately 708 acres of disturbance, representing approximately 7% of the watershed as a whole and not appreciably or measurably changing the percentage of the watershed developed, when compared to the existing condition. Combining this with past and planned fire activities (wildfire, prescribed fire and WUI treatments (5,350 acres) would result in disturbance to approximately 6, 058 acres within the subunit watershed, which is approximately 61% of subunit watershed. The majority of these acres then are derived from fire activities and do not necessarily constitute a net loss of soils or of watershed function, as described above. Staggering these treatments over time, as is planned, allows for recovery of some areas prior to any new disturbances to occur in other areas, minimizing cumulative impacts through time. Adherence to mitigation measures and standard best management practices for both development projects and fire activities are common to the current and planned implementation for this projects, also minimizing the potential for long- term adverse impacts to watershed function as a result of disturbance within the watershed.

For these reasons, Alternative B would result in moderate, adverse, cumulative impacts to watershed values and these impacts would primarily occur within the Bright Angel Wash watershed subunit.

Impairment. Adverse impacts under Alternative B would be minor to moderate. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the Park or to opportunities for enjoyment of the Park; or (3) identified as a goal in the Park's general management plan or other relevant NPS planning documents, there would be no impairment of the Park's watershed values.

Conclusion: Alternative B would result in minor to moderate, direct and indirect impacts to watershed values. Cumulative impacts would be moderate and would primarily occur within the Bright Angel Wash watershed subunit, as a result of future planned actions more than as a result of implementation of Alternative B. Implementation of this alternative would not result in

impairment of watershed values, minimized through the implementation of best management practices and various point- source treatments. Implementing both the preferred option for Maricopa Point and the preferred option for road closure during construction would result in less impact to watershed values than implementing the two other options for these project components.

Alternative C - Greenway

Direct/Indirect Impacts. As stated for Alternative B, the lack of steep slopes and perennial water in the project area substantially reduces the risk of negative impacts to soils and water resources from project actions under Alternative C. Impacts to watershed values from road widening to 24 feet, construction of the connector trail, unpaved trail improvements, West Rim Trail improvements and overlook and parking area improvements are as previously described for Alternative B. Actions common to all action alternatives (such as staging areas, batch plant, salvage and revegetation, and slash treatment) are as described for Alternative B. The analysis for Alternative C, then, focuses on the additional disturbance created by the construction of the greenway trail. As displayed in Table 1, Alternative C would result in approximately 65 acres of total disturbance, 27 acres of which would be new ground disturbance. Approximately 14 acres of this would be a result of greenway trail construction. The design of the trail along the length of Hermit Road would incorporate as much flexibility as possible so that would following existing disturbed corridors and openings in the canopy so that tree removal and new ground disturbance would be minimized. However, tree removal and soil disturbance cannot be avoided during construction and impacts would result. These potential impacts, as for road construction, could include such things as reduced water infiltration, reduced soil porosity, reduced water holding capacity, reduced aeration of the soil, increased surface runoff, and increased soil erosion (except in those areas that are covered by impervious surfaces) through the compaction and displacement of soil. These impacts would be reduced over time by revegetation of disturbed areas adjacent to the trail over time and the implementation of mitigation measures during and following construction (Chapter 2) to minimize the likelihood of soil movement during and after construction. The placement and design of culverts for the trail would be carefully evaluated to appropriately address proper drainage.

Combining the road widening, unpaved rim trail and overlook improvements, and connector trail construction with implementation of the greenway trail under Alternative C would therefore result in approximately 27 acres of new ground disturbance with the potential for impacts to watershed values. Impacts from implementing Maricopa Point and road closure options during the construction period are the same as those described for Alternative B. Implementation of Alternative C would therefore result in moderate, adverse, short- and long-term impacts to watershed values, minimized through the implementation of mitigation measures.

Cumulative Impacts. The cumulative impacts of implementing Alternative C are very similar to those described for Alternative B, except that additional disturbance would be created in both watershed subunits as a result of greenway trail construction. Because the greenway generally parallels the roadway, it is estimated that the same breakdown of trail lengths within each watershed subunit can be used as described for the roadway under the methodology section. In other words, approximately 50% of the proposed greenway would occur in the Hermit Creek watershed subunit and approximately 25% of it would occur within the Bright Angel Wash

watershed subunit. This equates to an additional 7 acres of disturbance within Hermit Creek and an additional 3.5 acres within the Bright Angel watershed subunit.

Hermit Creek Watershed Subunit: Combining 7 acres of additional disturbance for the greenway with road widening and other improvements in this watershed (7 acres) would result in 14 acres of new ground disturbance for Alternative C. Combining this with past and future planned activities would result in 1,027 acres or approximately 13% of the watershed. This is the same as described for Alternative B. While the construction of the greenway trail would result in additional direct and indirect impacts during and following construction, this low level of additional disturbance within the watershed as a whole would not result in additional cumulative impacts within the Hermit Creek watershed beyond what was described for Alternative B.

Bright Angel Wash Watershed Subunit: Combining 3.5 acres of additional disturbance for the greenway with road widening and other improvements in this watershed (3.5 acres) would result in 7 acres of new ground disturbance for Alternative C. Combining this with past and future planned activities would result in 712 acres of development, or approximately 7% of the watershed. This is the same as described for Alternative B. While the construction of the greenway trail would result in additional direct and indirect impacts during and following construction, this low level of additional disturbance within the watershed as a whole would not result in additional cumulative impacts from development within the Bright Angel Wash watershed beyond what was described for Alternative B. Combining these development acreages to those for fire activities is also the same as that described for Alternative B.

For these reasons, Alternative C would result in moderate, adverse, cumulative impacts to watershed values and these impacts would primarily occur within the Bright Angel Wash watershed subunit.

Impairment. Direct and indirect adverse impacts under Alternative C would be moderate and cumulative impacts would also be adverse and moderate. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the Park or to opportunities for enjoyment of the Park; or (3) identified as a goal in the Park's general management plan or other relevant NPS planning documents, there would be no impairment of the Park's watershed values.

Conclusion: Implementation of Alternative C, combined with past, on- going and foreseeable future actions would result in moderate, adverse impacts to watershed values, minimized through the implementation of best management practices and various point- source treatments. Implementing both the preferred option for Maricopa Point and the preferred option for road closure during construction would result in less impact to watershed values than implementing the two other options for these project components.

Alternative D - Preferred

Direct/Indirect Impacts. As stated for Alternatives B and C, the lack of steep slopes and perennial water in the project area substantially reduces the risk of negative impacts to soils and water resources from project actions under Alternative D. Impacts to watershed values from road widening to 24 feet, construction of the connector trail, unpaved trail improvements, West Rim

Trail improvements and overlook and parking area improvements are as previously described for Alternative B. Actions common to all action alternatives (such as staging areas, batch plant, salvage and revegetation, and slash treatment) are as described for Alternative B. The analysis for Alternative D, then, focuses on the additional disturbance created by the construction of the greenway trail from the Abyss to Hermits Rest. This is similar to the analysis for the greenway trail presented under Alternative C except that there would be less new disturbance resulting from the shorter greenway proposed under Alternative D than what is proposed under Alternative C.

As displayed in Table 1, Alternative D would result in approximately 53 acres of total disturbance, 15 acres of which would be new ground disturbance. Approximately 1- 2 acres of this would be a result of greenway trail construction. The design of the trail along the existing 1912 in this area would incorporate as much flexibility as possible so that the trail would stay on existing disturbed corridors as much as possible so that tree removal and new ground disturbance would be minimized. However, tree removal and soil disturbance cannot be avoided during construction and impacts would result, but these would be substantially less than that created by Alternative C. These potential impacts, as for road construction, could include such things as reduced water infiltration, reduced soil porosity, reduced water holding capacity, reduced aeration of the soil, increased surface runoff, and increased soil erosion (except in those areas that are covered by impervious surfaces) through the compaction and displacement of soil. These impacts would be reduced over time by revegetation of disturbed areas adjacent to the trail over time and the implementation of mitigation measures during and following construction (Chapter 2) to minimize the likelihood of soil movement during and after construction. The placement and design of culverts for the trail, as needed, would be carefully evaluated to appropriately address proper drainage.

Combining the road widening, upaved rim trail and overlook improvements, and connector trail construction with implementation of the greenway trail under Alternative D would therefore result in approximately 15 acres of new ground disturbance with the potential for impacts to watershed values. Impacts from implementing Maricopa Point and road closure options during the construction period are the same as those described for Alternative B. Implementation of Alternative D would therefore be similar to those impacts described for Alternative B and would result in minor to moderate, adverse, short- and long- term impacts to watershed values, minimized through the implementation of mitigation measures.

Cumulative Impacts. The cumulative impacts of implementing Alternative D are very similar to those described for Alternatives B, except that additional disturbance would be created in both watershed subunits as a result of greenway trail construction. The proposed greenway for Alternative D occurs within both the Trinity Creek- Colorado River watershed subunit and the Hermit Creek subunit watershed (Figure 9). For purposes of this analysis, it is grossly estimated that approximately half of the proposed trail (0.75 acres) would occur in the Hermit Creek watershed, that section between Pima Point and Hermits Rest. As described under the methodology section above, for purposes of this analysis, actions within the Trinity Creek- Colorado River watershed are not evaluated further. No actions, beyond those previously described for Alternative B and C would occur within the Bright Angel Wash watershed subunit.

Hermit Creek Watershed Subunit: Combining 0.75 acres of additional disturbance for the greenway with road widening and other improvements in this watershed (7 acres) would result

in approximately 8 acres of new ground disturbance for Alternative D. Combining this with past and future planned activities would result in 1,028 acres or approximately 13% of the watershed. This is the same as described for Alternatives B and C. While the construction of the greenway trail would result in additional direct and indirect impacts during and following construction, this low level of additional disturbance within the watershed as a whole would not result in additional cumulative impacts within the Hermit Creek watershed and would be very similar to those described for both Alternatives B and C. For these reasons, Alternative D would result in moderate, adverse, cumulative impacts to watershed values and these impacts would primarily occur within the Bright Angel Wash watershed subunit.

Impairment. Direct and indirect adverse impacts under Alternative D would be minor to moderate and cumulative impacts would be adverse and moderate. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the Park or to opportunities for enjoyment of the Park; or (3) identified as a goal in the Park's general management plan or other relevant NPS planning documents, there would be no impairment of the Park's watershed values.

Conclusion: Implementation of Alternative D, combined with past, on- going and foreseeable future actions would result in moderate, adverse impacts to watershed values, minimized through the implementation of best management practices and various point- source treatments. Implementing both the preferred option for Maricopa Point and the preferred option for road closure during construction would result in less impact to watershed values than implementing the two other options for these project components.

Temporal Road Closure

Direct/Indirect Impacts: Implementation of this option would not result in any new ground disturbance. During the closure period to vehicles, visitors would be allowed to hike or bike the existing road, in addition to using the unpaved rim trail or greenway (if Alternative C or D were also implemented). This option would therefore not result in any additional direct impacts to soil or water resources, if implemented with any one of the other alternatives. Proposed actions under a temporal road closure would therefore result in no change to watershed values. There is the potential under this option, however, for changes to occur in the way that visitors use the project area during the vehicle closure period, but it is expected that most visitors will simply walk or bike the road to access overlooks, view points and Hermits Rest. Increased social trailing is not expected. Therefore, implementation of a temporal road closure would have no additional indirect or direct effects on watershed values if implemented with any of the other action alternatives.

Cumulative Impacts. Combining the impacts of implementing this option with past, on- going and future projects, would not result in any additional impacts to watershed resources beyond those described for the other alternatives. Because no new ground disturbance or changes to visitor use patterns off of established corridors are expected under this option, cumulative impacts would be similar to those expected for the other alternatives, as described above.

Impairment. No additional direct, indirect, and cumulative impacts to watershed values would result from implementing the temporal road closure option. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific

purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park's watershed resources or park values.

Conclusion: Implementing a temporal road closure would not result in any additional direct, indirect or cumulative impacts to watershed values.

VEGETATION

Affected Environment

The primary biotic community represented in the project area is Great Basin Conifer Woodland which is typically characterized by the unequal dominance of two conifers: juniper (*Juniperus*) and pinyon (*Pinus*). This community is the most common on South Rim, transitioning into areas of ponderosa pine of the Sierran Montane Conifer Forest at higher elevations and into the Great Basin Desert Scrubland at lower elevations below the canyon rim. Great Basin conifer woodland is the most extensive vegetation type in the Southwest. Habitats tend to be rocky, with predominately thin soils (Brown 1994). In the project area, dominant tree species include pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) with an understory of woody shrubs and herbaceous species (Figure 7). Warren et al. (1982) characterized the project area as the Pinyon Pine- Juniper- Big Sagebrush- Cliffrose series. This series is found on low to rolling limestone outcrops of all aspects with shallow and rocky soils. It is widespread on South Rim, differing from other common woodland types (Juniper- Big Sagebrush- Pinyon Pine) in higher species richness and greater prominence of cliffrose (*Cowania Mexicana*)



Figure 7. Typical Pinyon- Juniper Woodland Along Hermit Road, South Rim, Grand Canyon National Park, 2005.

These characterizations of vegetation were confirmed by a survey conducted specifically for this project in 2005. A total of 146 vascular plant species were identified in plots during the spring and summer of 2005 along the Hermit Road corridor (Appendix F). The survey found high species richness and a great variety of understory vegetation throughout the area (Crawford 2005). Overstory diversity consisted of Utah juniper, two- needle pinyon (*Pinus edulis* Engelm), ponderosa pine (*Pinus ponderosa* P. & C. Lawson), large, single- trunked Mexican cliffrose (*Purshia Mexicana* (D.Don) Hendrickson), and Gambel oak (*Quercus gambellii* Nutt.). Utah juniper was the dominant overstory species with the broadest range of diameter classes, including many trees over 22 inches in diameter at breast height. Large individuals of two-needle pinyon were also common. Tree density in the project area averages approximately 486 trees per hectare. Along the proposed greenway alignment in Alternative D, this density is estimated at 229 trees per hectare (Crawford 2005).

Unique Plant Communities - An uncommon community was identified in just two locations along Hermit Road, consisting of three primary species: slender woodstar (*Lithophragma tenellum* Nutt.), sego lily (*Calochortus nuttallii* Torr. & Gray) and tall mountain larkspur (*Delphinium scaposum* Greene). These species are described in more detail in Appendix D. Efforts should be made to avoid these unique areas during project implementation.

Cryptobiotic soil was located throughout the project area, with large expanses occurring in and around The Abyss, south of Hermit Road. Cryptobiotic soils are an important component of healthy ecosystems and serve many important functions including erosion control, water and nutrient absorption, and contribution of nitrogen and organic matter to soils (Crawford 2005).

Old- growth - The pinyon- juniper community in the project area has many characteristics of an old- growth woodland. While a thorough investigation of tree ages, size classes and structural diversity has not been conducted in the project area, walk- throughs by NPS botanists and vegetation specialists have indicated that many areas both to the north and south of Hermit Road exhibit typical characteristics of an old- growth woodland community (Floyd et al. 2003). Large, scattered juniper and pinyon occur in the overstory, smaller trees of these species in the understory, with a wide variety of other species (as described above) are present, and pockets of varying tree densities and openings exist. Dead and down woody material is common in the area. For purposes of this analysis, the vegetation surrounding Hermit Road is considered old-growth. It is important to note, however, that much of Grand Canyon National Park's South Rim seems to exhibit similar woodland characteristics and so this definition could be broadly applied to many park areas south of the canyon.

Exotic Species - Seventeen exotic plant species were located during the 2005 survey, or approximately 17.5% of the surveyed flora. They were located throughout the project area, but concentrated at both east and west ends of the project area, near Grand Canyon Village and Hermits Rest, respectively. Exotic species of highest concern in the project area include Mediterranean sage (*Salvia aethiopsis* L.), horehound (*Marrubium vulgare* L.), London rocket (*Sisymbrium irio* L.), Russian thistle (*Salsola tragus* L.), and crossflower (*Chorispora tenella* (Pallus) DC.). All these species are considered among the highest priority species for park eradication (Crawford 2005).

Special status plant species are discussed later in this Chapter.

Environmental Consequences

Methodology

Baseline information used to assess impacts to vegetation is described in the methodology section at the beginning of this chapter and includes park staff knowledge of the resources and site; review of existing literature and park studies; information provided by specialists within the National Park Service and other agencies and professional judgment. Detailed information on natural and cultural resources in Grand Canyon National Park summarized in the 1995 GMP and EIS was specifically referenced for information on affected resources in the project area. Additional information sources on vegetation used for this evaluation are as described above in the affected environment section.

Those aspects of the vegetation resource that would be affected by proposed activities include the following:

- ❑ Changes in potential for spread of exotic species
- ❑ Changes in habitat quality for native species along developed edges
- ❑ Changes in existing woodland habitat area
- ❑ Loss of old- growth pinyon- juniper woodland

The thresholds of change for the intensity of an impact on vegetation are defined as follows:

Negligible a change to a biotic community that is not measurable or perceptible.

Minor a measurable or perceptible, small, localized change to a biotic community. The change is of little consequence.

Moderate a change to a biotic community that is measurable and of consequence but is localized.

Major a measurable change to a biotic community. The change is large and/or widespread and could have permanent consequences for the species or resource.

Nature of the Impact Adverse impacts would result from removal of native vegetation; creation of disturbed ground prone to exotic species establishment; removal of woodland habitat and loss of old- growth pinyon- juniper. Beneficial impacts would result from revegetation of social trailing and denuded areas with native species.

Duration Short- term impacts would occur less than or equal to two- to- three years following implementation. Long- term impacts would typically occur greater than five years following implementation.

Methodology for Estimating Tree Removal The total tree removal estimates provided by alternative (described in the next section and summarized in Tables 1 and 2) were calculated by a trained forester using aerial photo interpretation. Preliminary design drawings for each alternative, showing predicted disturbance areas both for the road widening and trail construction, were overlain onto aerial photos to estimate the number of trees within the construction limits. Trees within the predicted areas of disturbance were marked and then

tallied for each alternative. These estimates are for total numbers of trees and do not attempt to calculate tree species, age or size class.

Alternative A – No Action

Direct/Indirect Impacts. Approximately 13 acres of primarily pinyon- juniper woodland (with some pockets of ponderosa pine forest) have been modified with existing developments in the 7,922 acre Hermit Creek watershed subunit and approximately 689 acres within the Bright Angel Wash watershed subunit. This impact to vegetation is considered adverse, but site- specific and confined to existing developed areas, so constitutes a long- term but minor effect to vegetation in this area.

The construction of existing roads and buildings primarily in the Bright Angel watershed subunit and to a lesser extent in the Hermit Creek watershed subunit, has resulted in the presence of exotic vegetation in these areas. Ground has been disturbed for the construction of existing visitor services, housing, roads, and utilities. Ongoing exotic vegetation control programs, which include hand pulling, mechanical treatments, and a small amount of herbicide control, would continue under the No- Action Alternative. Because the size of the current program is limited, existing populations of exotic vegetation would continue to spread and slowly replace native vegetation. This would most likely occur along roads and utility corridors. These impacts would be minor, adverse, local, and long- term.

Implementing minimal action at this time to rehabilitate Hermit Road and widen it to its historic width of 20 feet would result in 20 acres of total disturbance, but no new ground disturbance. All construction activities would occur within the existing non- vegetated road prism and would not result in the loss of vegetation. Implementing Alternative A would therefore not result in any loss to old growth pinyon- juniper woodland, no change in habitat quality for native plant species along road edges, and no potential for increases in social trailing in the project area, above the existing condition. While the potential exists for increases in exotic species spread due to construction activity and construction equipment in the project area, this would be minimized through the implementation of mitigation measures (see end of Chapter 2). Therefore, implementation of Alternative A would result in negligible, short- and long- term adverse impacts to vegetation.

Cumulative Impacts. Hermit Creek Watershed Subunit: Past development has resulted in soil compaction and displacement and vegetation removal on approximately 13 acres within the watershed subunit, with no new development planned in the foreseeable future. While some projects are planned none of these would result in vegetation removal or ground disturbance, except for an approximately 1,000 acre prescribed burn, as described in Appendix E. Prescribed burning is designed to reduce fuel accumulation and restore fire back to into the ecosystem in order to reduce the risk of large- scale unwanted wildfire. Broadcast prescribed burning is the primary tool used outside of developed areas to reduce fuel accumulations. Although prescribed burning results in changes to the vegetative composition of stands treated, these changes are typically limited to the understory and are short- term changes. Prescribed fire would not result in changes to the overall vegetation type or stand composition. For these reasons, prescribed fire would not result in substantial changes in the long- term use of these areas by wildlife and are designed to provide for the natural inherent variability in these stands. Short- term impacts to vegetation from prescribed burning and past development may result, but would constitute less than 13% of the watershed subunit. The majority of the watershed subunit would remain essentially undisturbed pinyon- juniper woodland (with ponderosa pine stringers).

Bright Angel Wash Watershed Subunit: Past development has resulted in soil compaction and displacement and vegetation removal on approximately 689 acres within the watershed subunit, with approximately 15 acres of recently implemented or planned new development. Few of the recently implemented or in- progress projects in this watershed required tree removal, except for construction of Phase III of the greenway trail, Market Plaza bus stop and the South Rim Transportation Plan. The Market Plaza bus stop was recently completed and required the removal of 2 relatively large ponderosa pines that could not be avoided. The greenway trail project would require the removal of some low- density pinyon- juniper woodland (NPS 2002b); specific tree removal estimates are unknown, but considered relatively small. The South Rim Transportation Plan is still in planning phases with alternatives in the concept stage. It has been estimated that approximately 5- 10 acres of new ground disturbance could result from implementation of this project, likely near Canyon View Information Plaza near Grand Canyon Village and in the vicinity of the entrance station for the construction of a bypass lane. Cumulative impacts include decreased wildlife security, disturbance to adjacent habitat, and fragmentation. However, this disturbance to vegetation and wildlife habitat through planned projects and associated tree removal would occur within the existing developed area of the South Rim where development already exists and visitation levels are high during peak season. Impacts would also be mitigated by allocating the necessary funding for this project to salvage grasses, shrubs and small trees that can be used to revegetate disturbed areas with native species. These local, short- and long- term, adverse impacts would be minor to moderate, because of the widespread availability of pinyon- juniper woodland with the Bright Angel Wash watershed subunit and the concentration of the disturbance in a relatively small area associated with Grand Canyon Village. Trees would need to be removed for these actions, but tree removal estimates are unknown at this early stage of planning. Loss of trees and other vegetation for these projects would have minor to moderate adverse, local, long- term impacts on vegetation communities.

The Long Jim III fire burned approximately 230 acres in spring 2004 within the watershed subunit. The fire burned in a mosaic pattern, with areas of low, moderate and high severities within the fire perimeter. Areas that burned at high severity were limited, and most (estimated at approximately two- thirds of the area have been classified, a year after the fire, as low or moderately low in severity. Because burned areas with the fire perimeter will recover and are providing suitable habitat for a variety of wildlife and plant species, the effect of the Long Jim III fire is not considered a net loss of vegetation or habitat, and now contributes vegetative and habitat diversity to the area (see also wildlife analysis section).

Prescribed burning was conducted in 2004 on approximately 3,920 acres of the watershed subunit, both within the park boundary and on adjacent Kaibab National Forest land and is expected to be burned again in 2009. A description of the prescribed fire activities and impacts to vegetation are the same as those described above for the Hermit Creek watershed subunit.

WUI treatments are also planned for this watershed on approximately 1,200 acres surrounding Grand Canyon Village. These treatments are designed to reduce fuel accumulations and the susceptibility of these areas to large- scale unwanted wildfires, with the intent of protecting developed areas from fire. While trees would be removed during these treatments, target trees are small- diameter, understory trees. Unlike prescribed burning, WUI treatments are designed to be a more intensive management tool specifically around developments to maintain, over the long- term, a more open stand of trees. Like prescribed fire, these changes would not result in

changes to the vegetative composition of the areas, but would limit the amount of vegetation in the understory over the long- term. Not all areas proposed for WUI treatments would be treated at the same time and this staggering of treatments within the 1,200 acres proposed over a 10- year period or so, would minimize the likelihood of substantial changes in the ways these areas are used by wildlife or how understory vegetation is affected over a large area. It is likely that an opening up of the understory and a thinning of small diameter trees would encourage the growth of herbaceous species and increase the species diversity of grasses and forbs in treated areas.

Combining taking no action at this time with existing and future development (704 acres) would result in disturbance to approximately 7% of the watershed subunit. Combining taking no action at this time with existing and planned fire activities (5,350 acres) would result in disturbance to approximately 54% of the watershed subunit. The additional acres of estimated development within the watershed in the foreseeable future is a relatively small amount and does change the percentage of development within the subunit as a whole. The majority of the acreage planned for disturbance in the future is derived from fire activities; prescribed fire and WUI treatments and these actions are planned with the objectives of improving forest and woodland conditions and minimizing the likelihood of wildfire in these areas. Cumulative impacts would include decreased wildlife security, disturbance to adjacent habitat, and fragmentation. However, this disturbance of vegetation and wildlife habitat through planned projects and associated tree removal would occur nearby the existing developed area of the South Rim where development already exists and visitation levels are high in peak season. These local, short- and long- term, adverse impacts would be minor because of the widespread availability of pinyon- juniper habitat within the watershed subunit.

For these reasons, combining minimally widening Hermit Road to its historic width with past and planned activities within both watershed subunits would result in minor to moderate, long-term adverse impacts to vegetation.

Impairment. Adverse impacts to vegetation under Alternative A would be cumulative, and minor to moderate. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of the park's vegetation resources.

Conclusion: The No- Action Alternative would result in no additional direct or indirect adverse impacts to vegetation, but cumulative impacts are expected to be minor to moderate and there would be no impairment of park resources.

Alternative B – Widen for Safe Bus Access

Direct/Indirect Impacts. Implementing Alternative B and widening Hermit Road to 24 feet would result in approximately 11 acres of vegetation disturbance along the road edge. Based on aerial photo interpretation and the methods described in the Vegetation Methodology section above, the project area is classified as old- growth pinyon juniper woodland. Within this area adjacent to the roadway, up to approximately 1,400 – 1,450 trees of all size classes, would be removed within these 11 acres along the road. The impact of this removal would be minimized by

salvaging as many suitable trees as possible for use in revegetating disturbed areas in the project area following construction, other disturbed areas throughout the park (including areas needed to minimize social trailing between Hermit Road and the rim and improvements to the unpaved rim trail, as part of Alternative B), as needed, and by minimizing the width of vegetation removal along the road corridor as much as practical. This would be achieved during later design phases when slopes adjacent to the roadway are designed. The estimate of 1,400 to 1,450 trees is based on gradual slopes away from the road. Based on more detailed survey efforts during later design phases this slope may be increased somewhat to minimize the width of vegetation removal adjacent to the widened road. Construction along the road edge would increase the potential for spread of exotic species and changes in habitat quality for native species along developed edges, but these impacts can be minimized through implementation of mitigation measures (end of Chapter 2).

There is a possibility that construction activities and trenching under any action alternative could damage tree root systems in the area. Root damage can sometimes result in tree mortality within a 5- 10 year period. This would create the potential for hazard trees adjacent to the project area over time and the need for them to be removed in the future.

Tree removal would occur in existing developed areas of the South Rim and would not occur in areas of continuous, undisturbed forest. Compared to the availability of pinyon- juniper woodland on the South Rim, much of which meets the criteria for old- growth as used for this analysis, and the concentration of this tree removal adjacent to the existing road and other developed areas along the roadway, these impacts are lessened.

An increase in the amount of disturbed ground would increase the potential for the spread and introduction of exotic vegetation. Mitigation measures such as pressure washing of ground-disturbing equipment would substantially reduce the risk of introducing a new exotic species. Post- construction revegetation, monitoring, and treatment would also reduce the risk of spreading exotic populations and introducing new species.

Vegetation disturbance under Alternative B would primarily occur along Hermit Road during road widening efforts. Other aspects of Alternative B (West Rim Trail and unpaved rim trail improvements, construction of the connector trail and improvements to overlooks) would result in some new ground disturbance, although tree removal would likely be minimal. While individual trees and shrubs in select areas would be removed for these proposed actions, they would likely be scattered throughout the project area. All improvements would occur with the objective of minimizing tree removal as much as possible. Trees removed would be evaluated for their salvage potential as well. In addition, the improvements to developed trails are intended to minimize extensive social trailing throughout portions of the project area, which would have a beneficial impact on vegetation resources.

The implementation of either option 1 or option 2 for the Maricopa Point improvements would reduce the current level of social trailing and on- going impacts to vegetation in the areas denuded by trampling, although option 1 would go farther in alleviating this situation by removing some visitor user groups and the way in which visitors access the area. Option 1 would also remove the large paved parking area and allow for restoration of the area, benefiting the rare plant population nearby and the possibility for re- establishment of native plant species. If option 2 was implemented and the parking area was replaced in its current location, no additional impacts would result beyond what is on- going under the current situation.

The implementation of any option for road closure during the construction period would not appreciably affect vegetation when combined with the other actions proposed for each alternative. However, implementing either option 1 or 2 to close the road to visitors during the construction period would result in a shorter construction period, limiting construction to one construction season instead of two. This would minimize the possibility of bare ground remaining in the project area over the winter season and would therefore minimize the possibility for increased encroachment by exotic species during the time that the project was shut down until the following year. These impacts would be relatively minor, reduced through implementation of mitigation measures, but would be greater for option 3 than for either option 1 or the preferred option.

The use of staging areas identified and the establishment of a batch plant have no potential for impacts to vegetation as these sites are already disturbed and mitigations are in place to minimize any off- site impacts. Salvage and revegetation components of the action alternatives can be ground- disturbing but are not expected to result in any additional impacts beyond those described for construction actions. Obviously the trees selected for salvage would have been lost during construction so no additional tree removal would result from these actions. Salvage and then revegetation actions are designed to minimize the impacts of construction activities by replanting disturbed sites. While short- term impacts during the use of salvage and revegetation are possible (use of a backhoe and other equipment off established roads) these impacts are negligible over the long- term. Treating slash as described in actions common to all alternatives would not result in any additional impacts to vegetation than those described for construction actions.

For these reasons, Alternative B would result in direct and indirect, minor adverse short- term and long- term impacts to vegetation.

Cumulative Impacts. Hermit Creek Watershed Subunit: Implementing Alternative B would result in an additional 7 acres of new ground disturbance within the watershed (as described under the watershed values section of this Chapter). Foreseeable future projects (Appendix E and Table 12) would not result in any additional development, although 1,000 acres of prescribed burning is planned. The effects to vegetation as a result of these actions are as described under the cumulative impacts section of Alternative A. Combining the estimated 7 acres to past development would result in approximately 20 acres of disturbance, representing less than 1% of the watershed as a whole. Combining this with the planned prescribed fire would result in disturbance to 13% of the watershed. The majority of these acres are from prescribed fire and do not represent a loss of vegetation as described previously. Therefore, the majority of the watershed is essentially undisturbed pinyon- juniper woodland and this condition would not appreciably or measurably change with implementation of Alternative B.

Bright Angel Wash Watershed Subunit: Implementing Alternative B would result in an additional 3.5 acres of new ground disturbance within the watershed (as described under the watershed values section of this Chapter). Foreseeable future projects (Appendix E and Table 12) would not result in approximately 15 acres of additional development. Combining the estimated 3.5 acres of new disturbance to past and future developments would result in approximately 708 acres of disturbance, representing approximately 7% of the watershed as a whole and not appreciably or measurably changing the percentage of the watershed developed, as a whole, when compared to the existing condition. Combining this with the past and planned

fire activities would result in disturbance to 61% of the watershed. The majority of these acres are from fire activities that do not represent a loss of vegetation and are occurring in and around the existing developed area of Grand Canyon Village, and would be staggered through time, as described for Alternative B, cumulative impacts.

Therefore, Alternative B would result in moderate, adverse, cumulative impacts to vegetation and these impacts would primarily occur within the Bright Angel Wash watershed subunit.

Impairment. Direct and indirect adverse impacts to the biotic community under Alternative B would be minor and cumulative impacts would be adverse and moderate. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of the park's vegetation resources.

Conclusion: Alternative B would result in adverse, minor, direct and indirect impacts to vegetation. Cumulative impacts would be moderate and there would be no impairment of park resources.

Alternative C - Greenway

Direct/Indirect Impacts. Impacts to vegetation from road widening to 24 feet, construction of the connector trail, unpaved trail improvements, West Rim Trail improvements and overlook and parking area improvements are as previously described for Alternative B. Actions common to all action alternatives (such as staging areas, batch plant, salvage and revegetation, and slash treatment) are as described for Alternative B. The analysis for Alternative C, then, focuses on the additional disturbance created by the construction of the greenway trail. As displayed in Table 1, Alternative C would result in approximately 65 acres of total disturbance, 27 acres of which would be new ground disturbance. Approximately 14 acres of this would be a result of greenway trail construction. Under Alternative C, approximately 3,950 – 4,000 trees would be removed within the area of road construction and greenway trail construction. As described for Alternative B, the level of new ground disturbance and tree removal would be minimized as much as possible along the road corridor in later design phases which is likely to reduce the level of tree removal in these areas. The design of the trail along the length of Hermit Road would incorporate as much flexibility as possible so that would follow existing disturbed corridors and openings in the canopy so that tree removal, in these areas as well, would be minimized. However, tree removal cannot be avoided during construction and impacts would result, minimized also through the salvage of vegetation and the subsequent revegetation of suitable disturbed areas following construction, as described for Alternative B.

There is a possibility that construction activities and trenching under any action alternative could damage tree root systems in the area. Root damage can sometimes result in tree mortality within a 5- 10 year period. This would create the potential for hazard trees adjacent to the project area over time and the need for them to be removed in the future. This has the potential to occur with greenway trail construction as wells as road construction.

Tree removal would occur in existing developed areas of the South Rim and would not occur in areas of continuous, undisturbed forest. Compared to the availability of pinyon- juniper

woodland on the South Rim, much of which meets the criteria for old-growth as used for this analysis, and the concentration of this tree removal adjacent to the existing road and other developed areas along the roadway, these impacts are lessened. However, tree removal estimates for Alternative C as compared to Alternative B are almost three times higher due to the length of the greenway trail through woodland habitat. While the path chosen for the trail would use as many existing roads and trails as much as possible, there are areas of dense vegetation that would require extensive tree removal.

Construction along the road edge and for the greenway would increase the potential for spread of exotic species and changes in habitat quality for native species along developed edges, but these impacts can be minimized through implementation of mitigation measures (end of Chapter 2). Increases in social trailing between the greenway and the rim are expected in some areas due to the desire for greenway users to want to be near the rim. While design features have been developed for Alternative C to decrease the likelihood of social trailing (more delineated road crossings for all overlooks and pull-outs) some social trailing is expected. This would have an adverse impact to vegetation over time by trampling and exotic species introduction. However, it is also possible that social trailing in some areas may be reduced under this alternative due to the improvements to the unpaved rim trail, the West Rim Trail and overlook and parking area improvements.

Impacts from implementing Maricopa Point and road closure options during the construction period are the same as those described for Alternative B.

Implementation of Alternative C would therefore result in moderate, adverse, short- and long-term impacts to vegetation, minimized through the implementation of mitigation measures.

Cumulative Impacts. The cumulative impacts of implementing Alternative C are very similar to those described for Alternative B, except that additional disturbance would be created as a result of greenway trail construction. Because the greenway generally parallels the roadway, it is estimated that the same breakdown of trail lengths within each watershed subunit can be used as described for the roadway under the methodology section. In other words, approximately 50% of the proposed greenway would occur in the Hermit Creek watershed subunit and approximately 25% of it would occur within the Bright Angel Wash watershed subunit. This equates to an additional 7 acres of disturbance within Hermit Creek and an additional 3.5 acres within the Bright Angel watershed subunit.

Hermit Creek Watershed Subunit: Combining 7 acres of additional disturbance for the greenway with road widening and other improvements in this watershed (7 acres) would result in 14 acres of new ground disturbance for Alternative C. Combining this with past and future planned activities would result in 1,027 acres or approximately 13% of the watershed. This is the same as described for Alternative B. While tree removal estimates are relatively high for this alternative, when compared to the watershed as a whole and to the extent of the pinyon-juniper vegetation type in this area of the south rim, the effect of this removal is not landscape-scale or widespread. Therefore, while the construction of the greenway trail would result in additional direct and indirect impacts during and following construction, this level of additional disturbance and vegetation removal within the watershed as a whole would not result in additional cumulative impacts within the Hermit Creek watershed beyond what was described for Alternative B.

Bright Angel Wash Watershed Subunit: Combining 3.5 acres of additional disturbance for the greenway with road widening and other improvements in this watershed (3.5 acres) would result in 7 acres of new ground disturbance for Alternative C. Combining this with past and future planned activities would result in 712 acres of development, or approximately 7% of the watershed. This is the same as described for Alternative B. While the construction of the greenway trail would result in additional direct and indirect impacts during and following construction, this level of additional disturbance within the watershed as a whole would not result in additional cumulative impacts from development within the Bright Angel Wash watershed beyond what was described for Alternative B. Combining these development acreages to those for fire activities is also the same as that described for Alternative B.

For these reasons, Alternative C would result in moderate, adverse, cumulative impacts to watershed values and these impacts would primarily occur within the Bright Angel Wash watershed subunit.

Impairment. Direct and indirect adverse impacts under Alternative C would be moderate and cumulative impacts would also be adverse and moderate. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the Park or to opportunities for enjoyment of the Park; or (3) identified as a goal in the Park's general management plan or other relevant NPS planning documents, there would be no impairment of the Park's vegetation resources.

Conclusion: Implementation of Alternative C, combined with past, on- going and foreseeable future actions would result in moderate, adverse impacts to vegetation, minimized through the implementation of integral design features and mitigation measures. Implementing both the preferred option for Maricopa Point and the preferred option for road closure during construction would result in less impact to vegetation than implementing the two other options for these project components.

Alternative D - Preferred

Direct/Indirect Impacts. Impacts to vegetation from road widening to 24 feet, construction of the connector trail, unpaved trail improvements, West Rim Trail improvements and overlook and parking area improvements are as previously described for Alternative B. Actions common to all action alternatives (such as staging areas, batch plant, salvage and revegetation, and slash treatment) are as described for Alternative B. The analysis for Alternative D, then, focuses on the additional disturbance created by the construction of the greenway trail from the Abyss to Hermits Rest. This is similar to the analysis for the greenway trail presented under Alternative C except that there would be less new disturbance and tree removal from the shorter greenway proposed under Alternative D than what is proposed under Alternative C.

As displayed in Table 1, Alternative D would result in approximately 53 acres of total disturbance, 15 acres of which would be new ground disturbance. Approximately 1- 2 acres of this would be a result of greenway trail construction, with little tree removal expected. The design of the trail along the existing 1912 in this area would incorporate as much flexibility as possible so that the trail would stay on existing disturbed corridors so that tree removal and new ground disturbance would be minimized. However, tree removal and soil disturbance cannot be avoided during construction and impacts would result, but these would be substantially less

than that created by Alternative C. These impacts would be reduced over time by revegetation of disturbed areas adjacent to the trail over time and the implementation of mitigation measures during and following construction (Chapter 2) to minimize the likelihood of soil movement during and after construction.

There is a possibility that construction activities and trenching under any action alternative could damage tree root systems in the area. Root damage can sometimes result in tree mortality within a 5- 10 year period. This would create the potential for hazard trees adjacent to the project area over time and the need for them to be removed in the future. This has the potential to occur with greenway trail construction as well as road construction.

Tree removal would occur in existing developed areas of the South Rim and would not occur in areas of continuous, undisturbed forest. Compared to the availability of pinyon- juniper woodland on the South Rim, much of which meets the criteria for old- growth as used for this analysis, and the concentration of this tree removal adjacent to the existing road and other developed areas along the roadway, these impacts are lessened. However, tree removal estimates for Alternative D are very similar to Alternative B. This is, therefore much less than those predicted for Alternative C due to the shorter length of the greenway trail and the fact that most of its length would be along the existing 1912 road corridor, requiring little tree removal.

Construction along the road edge and for the greenway would increase the potential for spread of exotic species and changes in habitat quality for native species along developed edges, but these impacts can be minimized through implementation of mitigation measures (end of Chapter 2). Increases in social trailing between the greenway and the rim are possible in some areas due to the desire for greenway users to want to be near the rim, but this possibility is much reduced over what might be expected under Alternative C. In Alternative D, the greenway is on the north side of the road and in some places quite close to the rim edge. Alternative D also includes the potential for creating trail spurs in suitable locations to provide rim views in areas where the trail is a distance from the rim. This should reduce the potential for social trailing between the greenway and the rim.

Implementation of Alternative D would therefore be similar to those impacts described for Alternative B and would result in minor to moderate, adverse, short- and long- term impacts to watershed values, minimized through the implementation of mitigation measures.

Cumulative Impacts. The cumulative impacts of implementing Alternative D are very similar to those described for Alternative B, except that additional disturbance and vegetation removal would be created as a result of greenway trail construction. The proposed greenway for Alternative D occurs within both the Trinity Creek- Colorado River watershed subunit and the Hermit Creek subunit watershed (Figure 9). For purposes of this analysis, it is grossly estimated that approximately half of the proposed trail (0.75 acres) would occur in the Hermit Creek watershed that section between Pima Point and Hermits Rest. As described under the methodology section above, for purposes of this analysis, actions within the Trinity Creek- Colorado River watershed are not evaluated further. No actions, beyond those previously described for Alternative B and C would occur within the Bright Angel Wash watershed subunit.

Hermit Creek Watershed Subunit: Combining 0.75 acres of additional disturbance for the greenway with road widening and other improvements in this watershed (7 acres) would result in approximately 8 acres of new ground disturbance for Alternative D. Combining this with past and future planned activities would result in 1,028 acres or approximately 13% of the watershed.

This is the same as described for Alternatives B and C. While the construction of the greenway trail would result in additional direct and indirect impacts during and following construction, this low level of additional disturbance and associated vegetation removal would not result in additional cumulative impacts within the Hermit Creek watershed and would be very similar to those described for both Alternatives B and C. For these reasons, Alternative D would result in moderate, adverse, cumulative impacts to vegetation and these impacts would primarily occur within the Bright Angel Wash watershed subunit.

Impairment. Direct and indirect adverse impacts under Alternative D would be minor and cumulative impacts would be adverse and moderate. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the Park or to opportunities for enjoyment of the Park; or (3) identified as a goal in the Park's general management plan or other relevant NPS planning documents, there would be no impairment of the Park's vegetation resources.

Conclusion: Implementation of Alternative D, combined with past, on- going and foreseeable future actions would result in minor to moderate, adverse impacts to vegetation, minimized through the implementation of integral design features and mitigation measures. Implementing both the preferred option for Maricopa Point and the preferred option for road closure during construction would result in less impact to watershed values than implementing the two other options for these project components.

Temporal Road Closure

Direct/Indirect Impacts: Implementation of this option would not result in any new ground disturbance or vegetation removal. During the closure period to vehicles, visitors would be allowed to hike or bike the existing road, in addition to using the unpaved rim trail or greenway (if Alternative C or D were also implemented). This option would therefore not result in any additional direct impacts to soil or water resources, if implemented with any one of the other alternatives. Proposed actions under a temporal road closure would therefore result in no change to vegetation; no loss of old- growth pinyon- juniper woodland, no potential for increased spread of exotic species and no changes in habitat quality for native species. There is the potential under this option, however, for changes to occur in the way that visitors use the project area during the vehicle closure period, but it is expected that most visitors will simply walk or bike the road to access overlooks, view points and Hermits Rest. Increased social trailing is not expected. Therefore, implementation of a temporal road closure would have no additional indirect or direct effects on vegetation if implemented with any of the other action alternatives.

Cumulative Impacts. Combining the impacts of implementing this option with past, on- going and future projects, would not result in any additional impacts to vegetation resources beyond those described for the other alternatives. Because no new ground disturbance or changes to visitor use patterns off of established corridors are expected under this option, cumulative impacts would be similar to those expected for the other alternatives, as described above.

Impairment. No additional direct, indirect, and cumulative impacts to vegetation would result from implementing the temporal road closure option. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general

management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park’s watershed resources or park values.

Conclusion: Implementing a temporal road closure would not result in any additional direct, indirect or cumulative impacts to vegetation resources.

GENERAL WILDLIFE

Affected Environment

Only a few vertebrates are closely tied to Great Basin conifer woodlands. These include species such as the pinyon mouse (*Peromyscus truei*), pinyon jay (*Gymnorhinus cyanocephalus*) and gray flycatcher (*Empidonax wrightii*). Others have the centers of their range in this community such as the bushy-tailed woodrat (*Neotoma cinerea arizonae*), gray vireo (*vireo vicinior*), black-throated gray warbler (*Dendroica nigrescens*), Scott’s oriole (*Icterus parisorum*) and Plateau whiptail (*Cnemidophorus veloxi*). A larger number of more widely distributed and adaptable species may be found in these woodlands. They also are important in providing seasonal habitat for many montane and subalpine animals. For example pinyon- juniper woodlands provide important winter habitat for elk and mule deer in many parts of the southwest (Brown 1994).

Those species that are not considered special status species, but for which there is interest and concern for their populations on the South Rim, are listed in Table 5 and discussed briefly below. This list was developed based on input from biologists from the park, Arizona Game and Fish Department (AGFD), and USFWS.

Table 5. Wildlife Species of Interest, South Rim

Common Name	Scientific Name
Mule deer	<i>Odocoileus hemionus</i>
Desert bighorn	<i>Ovis canadensis</i>
Mountain lion	<i>Felis concolor</i>
Rocky Mountain elk	<i>Cervus elaphus nelsoni</i>
Breeding birds	Various species, see below

The project area is habitat suitable for all of these species. Mule deer occupy a variety of habitats, but tend to avoid large openings and mature forest with a closed canopy. Mule deer depend on highly digestible, succulent forage and prefer forbs, new shoots and fruits of shrubs, if available (Hoffmeister 1986). South Rim provides winter and summer range for mule deer, and they have been observed often in the project area.

Desert Bighorn prefer rough, rocky and sparsely vegetated habitat characterized by steep slopes, canyons and washes, typically not venturing more than a few miles from perennial water. Little is known about the population status of park bighorn, although they are commonly seen along the Colorado River corridor and along inner canyon trails. They are also frequently observed in the project area.

Mountain lions occur throughout Arizona with home ranges varying in size from 25- to 100-square miles, depending on gender, time of year and prey availability. They prey mostly on mule deer and elk. Mountain lions occur on both North and South Rim, but population estimates are not available. Park mountain lion studies were initiated in 2000 and are on- going, recording information on use areas and behavior.

Elk occur throughout northern and eastern Arizona. Resident elk herds occur on South Rim, occupying both ponderosa pine and pinyon- juniper woodland habitat, as well as residential areas of Grand Canyon Village. Elk prefer grasses, sedges and forbs but will also browse on shrubs (such as mountain mahogany and silk tassel) and needles of various conifers and oaks (Hoffmeister 1986). Elk are commonly seen in the project area year- round.

Breeding Birds The Arizona Working Group of Partners in Flight developed a Bird Conservation Plan (Latta et al. 1999) as part of a national effort to address concern for the future of migratory and resident birds. The Conservation Plan lists priority bird species by habitat type and identifies management actions that will benefit those species. As many as 73 bird species have been reported to use pinyon- juniper habitat (Balda and Masters 1980). The Conservation Plan identifies five priority species in this habitat type: gray flycatcher, pinyon jay, gray vireo, black- throated gray warbler and juniper titmouse. Management habitat recommendations for the gray flycatcher include discouraging clearing of large mature tracts of woodland habitat, managing for small- scale openings and restricting cutting of large pinyon pines and junipers. Recommendations for the pinyon jay include maintaining large cone- bearing pinyon pine and encourage small- scale openings. Recommendations for gray vireo are specific to fire management and brown- headed cowbird parasitism. Recommendations for black- throated gray warblers and juniper titmice include discouraging clearing of large mature habitat tracts and encouraging small- scale openings.

Environmental Consequences

Methodology

Baseline information used to assess impacts to general wildlife populations is described in the methodology section at the beginning of this chapter and includes park staff knowledge of the resources and site; review of existing literature and park studies; information provided by specialists within the National Park Service and other agencies and professional judgment. Detailed information on natural and cultural resources in Grand Canyon National Park summarized in the 1995 GMP and EIS was specifically referenced for information on affected resources in the project area. Additional wildlife information sources used for this evaluation are as described above in the affected environment section.

The thresholds of change for the intensity of an impact on general wildlife populations are defined as follows:

Negligible Impacts to wildlife and/or habitat would not be perceptible or measurable; Impacts would not be of any measurable or perceptible consequence to wildlife populations or the ecosystems supporting them

Minor Impacts to wildlife and/or habitat would be perceptible or measurable, but the severity and timing of changes to parameter measurements would not be expected to be

outside the natural variability and would not be expected to have effects on wildlife populations or ecosystems. Population numbers, population structure, genetic variability and other demographic factors for species might have slight changes but characteristics would remain stable. Key ecosystem processes might have slight disruptions that are within natural variability, and habitat for all species would remain functional.

Moderate Breeding animals of concern are present and would be impacted; animals are present during particularly vulnerable life stages. Impacts to wildlife and/or habitat would be perceptible and measurable and the severity and timing of changes to parameter measurements would be expected to be sometimes outside of the natural variability, and changes within the natural variability might be long- term or permanent. Population numbers, population structure, genetic variability, and other demographic factors for species would have measurable changes creating declines, which could be from displacement, but would be expected to rebound to pre- impact numbers. No species would be at risk of being extirpated from the park, key ecosystem processes might have slight disruptions that would be outside natural variability (but would be expected to return to natural variability) and habitat for all species would remain functional.

Major Impacts to wildlife and/or habitat would be perceptible and measurable, and the severity and timing of changes to parameter measurements would be outside of the natural variability for long time periods, and changes within the natural variability might be long-term or permanent. Population numbers, population structure, genetic variability, and other demographic factors for species might have large, short- term declines with long- term population numbers considerably depressed. In extreme cases, species might be extirpated from the park, key ecosystem processes like nutrient cycling might be disrupted, or habitat for any species may be rendered not functional.

Nature of the Impact Adverse impacts would result from those actions that result in habitat loss, mortality, displacement of individuals due to human- caused disturbance (like construction noise), or habitat fragmentation.

Duration Short- term impacts would result in less than or equal to five years following implementation and long- term impacts would result greater than five years following implementation.

Alternative A – No Action

Direct/Indirect Impacts. The no action alternative would maintain the project area in its current state and would continue to provide habitat in the project area for many wildlife species. The project area provides high- quality habitat for many species due to the lack of development south of Hermit Road and the large expanse of pinyon- juniper woodland and ponderosa pine habitat with little fragmentation. Without a change in vegetation or human use in the project area, wildlife populations would generally remain the same. Continued use of existing developments (road and other developments such as Hermits Rest and various overlooks and viewpoints) would not impact any sensitive wildlife habitat requirements such as nesting and/or roosting sites, key foraging areas, key calving or fawning areas, or primary wildlife travel corridors. Selection of the no action alternative would therefore have negligible, local, long-term adverse impacts to general wildlife populations and species of interest listed above.

However, short- term impacts are possible due to the construction activity required under Alternative A to widen the road to its historic width. While this would not disturb existing vegetation or result in any long- term changes to wildlife habitat, short- term disturbance due to increased noise levels and activity in the project area from construction activities would result. These would be short- term, lasting only the duration of the construction period, but could result in changes in the way that species use the area and alterations in their patterns of use. No sensitive nesting, fawning or calving areas are documented in the vicinity of the road, but it is possible that adverse impacts could result. These impacts are considered minor due to the concentration of the activities along the existing disturbed road corridor and the availability of similar habitats nearby.

Cumulative Impacts. As described in the watershed values and vegetation sections of this Chapter, modification of habitat in the watershed subunits has occurred as a result of past and present activities and modification would result from implementation of future projects, primarily within the Bright Angel Wash watershed subunit. In the Hermit Creek watershed, past development has been quite minimal and no new development is planned. Much of this provides essentially undisturbed wildlife habitat within the natural zone south of Hermit Road and would continue to provide high quality habitat for a variety of wildlife species. Prescribed burning that is planned, while it can result in short- term displacement or injury to wildlife, would not result in long- term adverse impacts, as the fire is intended to improve forest conditions and return the natural variability of these ecosystems, all benefits to native wildlife populations.

Bright Angel Wash Watershed Subunit: Past development has resulted in disturbance to 689 acres within the watershed subunit, with approximately 15 acres of recently implemented or planned new development. Few of the recently implemented or in- progress projects in this watershed required tree removal, except for a few projects as listed and described in the vegetation section under Alternative A. Cumulative impacts of these new developments and tree removal include decreased wildlife security, disturbance to adjacent habitat, and fragmentation. However, this disturbance to vegetation and wildlife habitat through planned projects and associated tree removal would occur within the existing developed area of the South Rim where development already exists and visitation levels are high during peak season. These local, short- and long- term, adverse impacts would be minor to moderate, because of the widespread availability of pinyon- juniper woodland with the Bright Angel Wash watershed subunit and the concentration of the disturbance in a relatively small area associated with Grand Canyon Village. Loss of wildlife habitat and reduced habitat quality in areas developed would have minor to moderate adverse, local, long- term impacts on wildlife populations.

Effects of the Long Jim III wildfire, planned prescribed burns and WUI treatments are as described under the vegetation cumulative impacts section of Alternative A. These efforts, while they typically can result in short- term disturbance to wildlife due to reduced cover, changes in foraging habitat and direct disturbance during the activity, are typically beneficial to the quality of the area as wildlife habitat over the long term. They provide structural and species diversity, with the intent of reducing large- scale wildfire and attempt to introduce the natural variability in these stands. These are beneficial impacts to wildlife populations in the area.

Impairment. Direct, indirect, and cumulative impacts to the wildlife resource would be negligible to minor as a result of implementing Alternative A. These impacts would not result in

impairment. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park's wildlife resources or park values.

Conclusion: Alternative A would result in long- term, negligible, adverse, direct and indirect impacts to general wildlife populations, short- term, minor adverse impacts during the road widening and minor adverse cumulative impacts. No impairment of wildlife resources would result from implementing Alternative A.

Alternative B – Widen for Safe Bus Access

Direct/Indirect Impacts. Implementing Alternative B and widening Hermit Road to 24 feet would result in approximately 11 acres of vegetation disturbance along the road edge. Based on aerial photo interpretation and the methods described in the Vegetation Methodology section above, the project area is classified as old- growth pinyon- juniper woodland. Within this area adjacent to the roadway, up to approximately 1,400 – 1,450 trees of all size classes would be removed within these 11 acres along the road. Tree removal would occur in existing developed areas of the South Rim and would not occur in areas of continuous, undisturbed forest. Compared to the availability of pinyon- juniper woodland on the South Rim, much of which meets the criteria for old- growth as used for this analysis, and the concentration of this tree removal adjacent to the existing road and other developed areas along the roadway, these impacts to wildlife habitat are lessened. These areas are currently on the edge of developed and undisturbed land and are used as such by wildlife populations. Widening the road, but keeping the same corridor, simply creates a wider disturbed corridor where the current edge would no longer be available and would create a new edge slightly further from the road. This represents a loss of habitat for a variety of species. Due to the calculated acreage of the habitat loss, it is likely that direct mortality to mammalian prey species could result and multiple bird territories would be lost.

A review of avifauna studies of pinyon- juniper woodland in northern Arizona, Utah and Colorado indicate that there are between 60 and 190 bird territories per 40 hectares in this habitat type (Dickson and Ward 2000; Larue 1994; O'Meara et al.; 1981 Balda and Masters 1980; Masters 1979; Grue 1977). Larue (1994) determined that the number of territories on Black Mesa Arizona was positively correlated with the increasing density of the pinyon- juniper stand. As the pinyon- juniper vegetation type along the Hermit Road corridor is relatively undisturbed and quite dense, the higher estimates for avifauna territories are probably more applicable to this area and are estimated to be between 150 and 190 per 40 hectares, or between 1.5 and 2 territories per acre. Therefore, removal of 11 acres of this habitat type for this alternative will probably result in the permanent destruction of between 16 and 22 bird territories and a degradation of a similar number of territories which will now be closer to the disturbed area.

There are relatively few studies which provide absolute density estimates for small mammals in the pinyon- juniper habitat type. Wide fluctuations in numbers have been consistently noted and are most often correlated with precipitation. In general, the studies show densities in normal years of between 10 and 30 small mammals per acre in this habitat type. Preliminary analysis of data collected in Grand Canyon suggests that the approximate density in pinyon- juniper habitat is on the order of 15 to 20 small mammals per acre (Lawes and Ward 2006, in

prep.). Therefore, removal of 11 acres of this habitat type will result in destruction of habitat supporting between 165 and 220 small mammals.

It is obvious that small mammal and bird species have smaller home ranges and more limited habitat requirements than larger species, such as deer, elk, big horn sheep, mountain lion and raptors and therefore, have a higher potential to be directly impacted during construction activities and direct removal of existing habitat. However, while short- term losses are expected, wildlife populations are not expected to be substantially impacted adversely in the long- term due to the availability of adjacent undisturbed habitat, species mobility and the implementation of mitigation measures to reduce the spread of exotic species, revegetate disturbed areas, reduce runoff and create vehicle fuel leakage and spill plans.

In addition to loss of habitat, impacts of implementing the action alternatives would include decreased wildlife security and increased disturbance to adjacent habitat. However, these adverse, long- term, local impacts would be minor because they would occur in areas currently degraded because of high disturbance levels from existing developments, roads, utility corridors, and human use. Mitigation measures developed for minimizing impacts to soils and vegetation from soil erosion, loss of trees, replanting areas with native species, etc., as described in Chapter 2) would also aide in minimizing the indirect impacts of actions on the quality of wildlife habitat.

Other aspects of Alternative B (West Rim Trail and unpaved rim trail improvements, construction of the connector trail and improvements to overlooks) would result in some new ground disturbance, although tree removal would likely be minimal. These project components are smaller in scale, localized and would occur in or adjacent to existing developments. For these reasons, adverse impacts to wildlife are minimized. In addition, the improvements to trails are intended to minimize extensive social trailing throughout portions of the project area, which would have a beneficial impact on habitat quality in the area.

The implementation of either option 1 or option 2 for the Maricopa Point improvements would not result in any appreciable change in wildlife in the project area, either adverse or beneficial. While option 1 would go farther in alleviating social trailing and restoring more area for native species establishment (which can benefit wildlife habitat quality), this is a small area when compared to the project area as a whole, is adjacent to the roadway and existing visitor use areas and therefore is not expected to alter wildlife use in the area.

Short- term impacts to wildlife due to increased noise and activity in the project area during the construction period are similar to those described for Alternative A. The options for road closure during the construction period (Option 1, 2 or 3) would also result in different impacts to wildlife. Construction activities would be noisy and quite disruptive to wildlife populations in the area. Under any option construction would occur within the spring and summer months, overlapping with the sensitive breeding season for many species. Option 3, however, would require two full seasons to complete, which would result in moderate adverse impacts to wildlife species in the area. Breeding activities would be disrupted and wildlife movements in the project area would be affected by construction activities. Limiting the construction season to only one season (Option 1 or 2) would result in less impact to wildlife populations. From a wildlife standpoint, the preferred option to minimize adverse impacts is Option 1 or 2.

The use of staging areas identified and the establishment of a batch plant have no potential for impacts to wildlife, beyond those described as part of construction activity noise disturbance, as these sites are already disturbed and mitigations are in place to minimize any off- site impacts. Salvage and revegetation components of the action alternatives can be ground- disturbing but are not expected to result in any additional impacts beyond those described for construction actions. Obviously the trees selected for salvage would have been lost during construction so no additional tree removal would result from these actions. Salvage and then revegetation actions are designed to minimize the impacts of construction activities by replanting disturbed sites and providing wildlife habitat in the future. While short- term impacts during the use of salvage and revegetation are possible (use of a backhoe and other equipment off established roads) these impacts are negligible over the long- term. Treating slash as described in actions common to all alternatives has the potential to disturb wildlife use patterns in the area, but these impacts would be short- term, lasting only the duration of the slash removal.

For these reasons, Alternative B would result in direct and indirect, minor adverse long- term impacts and moderate, adverse short- term impacts to wildlife.

Cumulative Impacts. As described in the watershed values and vegetation sections of this Chapter, modification of habitat in the watershed subunits has occurred as a result of past and present activities and modification would result from implementation of future projects, primarily within the Bright Angel Wash watershed subunit. In the Hermit Creek watershed, past development has been quite minimal and no new development is planned. Much of this provides essentially undisturbed wildlife habitat within the natural zone south of Hermit Road and would continue to provide high quality habitat for a variety of wildlife species, even with the implementation of Alternative B. Since actions are confined to the road corridor and adjacent developed areas, long- term impacts to wildlife are reduced and no fragmentation would occur. Prescribed burning that is planned, while it can result in short- term displacement or injury to wildlife, would not result in long- term adverse impacts, as the fire is intended to improve forest conditions and return the natural variability of these ecosystems, all benefits to native wildlife populations.

Bright Angel Wash Watershed Subunit: Past development has resulted in a reduction in available wildlife habitat. Combining implementation of Alternative B with the approximately 15 acres of recently implemented or planned new development would result in additional disturbance. Cumulative impacts of these new developments and tree removal include decreased wildlife security, disturbance to adjacent habitat, and fragmentation. However, this disturbance to vegetation and wildlife habitat through planned projects and associated tree removal would occur within the existing developed area of the South Rim where development already exists and visitation levels are high during peak season. These local, short- and long- term, adverse impacts would be minor to moderate, because of the widespread availability of pinyon- juniper woodland with the Bright Angel Wash watershed subunit and the concentration of the disturbance in a relatively small area associated with Grand Canyon Village. Loss of wildlife habitat and reduced habitat quality in areas developed would have minor to moderate adverse, local, long- term impacts on wildlife populations.

Effects of past and planned fire activities on wildlife are as described for Alternative A and would not result in long- term adverse impacts.

Impairment. Direct and indirect adverse impacts to wildlife under Alternative B would result in minor long- term impacts and moderate short- term impacts, and cumulative impacts that would be adverse and minor to moderate. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or (3) identified as a goal in the park’s general management plan or other relevant NPS planning documents, there would be no impairment of the park’s wildlife resources.

Conclusion: Alternative B would result in long- term adverse, minor, direct and indirect impacts to wildlife and short- term moderate adverse impacts during the construction period. Cumulative impacts would be minor to moderate and there would be no impairment of park resources. Implementing Option 1 or Option 2 (preferred) for road closure during construction would result in less impact to wildlife than implementing the option 3.

Alternative C - Greenway

Direct/Indirect Impacts. Impacts to wildlife from road widening to 24 feet, construction of the connector trail, unpaved trail improvements, West Rim Trail improvements and overlook and parking area improvements are as previously described for Alternative B. Actions common to all action alternatives (such as staging areas, batch plant, salvage and revegetation, and slash treatment) are as described for Alternative B. The analysis for Alternative C, then, focuses on the additional disturbance created by the construction of the greenway trail. As displayed in Table 1, Alternative C would result in approximately 65 acres of total disturbance, 27 acres of which would be new ground disturbance. Approximately 14 acres of this would be a result of greenway trail construction. Under Alternative C, approximately 3,950 – 4,000 trees would be removed within the area of road construction and greenway trail construction. As described for Alternative B, vegetation, the level of new ground disturbance and tree removal would be minimized as much as possible through implementation of mitigation measures, but this level of tree removal is substantial and would result in wildlife habitat fragmentation. The “island” of habitat that would result between the road and the proposed greenway trail would become less desirable to many wildlife species. It has been estimated that approximately 45 acres of these habitat islands would be created as a result of Alternative C (assuming an average of 50 feet between the roadway and the greenway). These islands would have decreased habitat value due to increased solar radiation, wind and vehicle, bicycle and pedestrian disturbance along both corridors.

In addition to the indirect effect of fragmentation of habitat, a direct loss of habitat due to the construction of the trail would occur, and this loss is greater for Alternative C than for Alternative B. Due to the calculated acreage of the habitat loss, it is likely that direct mortality to bird and mammal territories would result, as described under Alternative B, but at a higher level with Alternative C than with Alternative B. Approximately 27 acres of vegetation removal is estimated for Alternative C and this would result in the loss of an estimated 40 to 54 bird territories and 405 to 540 small mammal territories, based on the same criteria described above for Alternative B. It is obvious that small mammal and bird species have smaller home ranges and more limited habitat requirements than larger species, such as deer, elk, big horn sheep, mountain lion and raptors and therefore, have a higher potential to be directly impacted during construction activities and direct removal of existing habitat. However, while short- term losses are expected, wildlife populations are not expected to be substantially impacted adversely in the

long- term due to the availability of adjacent undisturbed habitat, species mobility and the implementation of mitigation measures to reduce the spread of exotic species, revegetate disturbed areas, reduce runoff and create vehicle fuel leakage and spill plans.

However, recognizing that tree removal would occur within 75 feet of the existing road, and would not occur in areas of continuous, undisturbed forest would reduce somewhat the intensity of the impact to wildlife populations. Compared to the availability of pinyon- juniper woodland on the South Rim, much of which meets the criteria for old- growth as used for this analysis, and the concentration of this tree removal adjacent to the existing road and other developed areas along the roadway, these impacts are lessened. However, tree removal estimates for Alternative C as compared to Alternative B are almost three times higher due to the length of the greenway trail through woodland habitat. While the path chosen for the trail would use as many existing roads and trails as much as possible, there are areas of dense vegetation that would require extensive tree removal.

Impacts from implementing Maricopa Point and road closure options during the construction period are the same as those described for Alternative B.

The direct disturbance to habitat from both road widening and trail construction, then, coupled with the estimates for fragmented habitat between the roadway and the proposed trail would result in long- term moderate adverse impacts to wildlife populations.

Cumulative Impacts. The cumulative impacts of implementing Alternative C are very similar to those described for Alternative B, except that additional disturbance would be created as a result of greenway trail construction. These impacts are minimized in the Hermit Creek watershed area due to the lack of other disturbed areas and development in the area and minimize the impacts to wildlife over time due to past, current and future projects. In the Bright Angel watershed area impacts are more pronounced when coupled with past and planned actions. It is likely that changes in the way in which wildlife use this area have occurred based on past actions. Implementation of Alternative C combined with future actions is not expected to appreciably change this fact over the long- term. Actions continue to be concentrated in existing developed areas, reducing their attractiveness to many wildlife species, and this would continue with future project implementation.

For these reasons, Alternative C would result in moderate, adverse, cumulative impacts to wildlife and these impacts would primarily occur within the Bright Angel Wash watershed subunit.

Impairment. Direct and indirect adverse impacts under Alternative C would be both short- and long- term and moderate and cumulative impacts would also be adverse and moderate. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the Park or to opportunities for enjoyment of the Park; or (3) identified as a goal in the Park's general management plan or other relevant NPS planning documents, there would be no impairment of the Park's wildlife resources.

Conclusion: Implementation of Alternative C, combined with past, on- going and foreseeable future actions would result in moderate, adverse impacts to wildlife, minimized through the implementation of integral design features and mitigation measures. Implementing either

Option 1 or Option 2 (preferred) for road closure during construction would result in less impact to wildlife than implementing the option 3.

Alternative D - Preferred

Direct/Indirect Impacts. Impacts to vegetation from road widening to 24 feet, construction of the connector trail, unpaved trail improvements, West Rim Trail improvements and overlook and parking area improvements are as previously described for Alternative B. Actions common to all action alternatives (such as staging areas, batch plant, salvage and revegetation, and slash treatment) are as described for Alternative B. The analysis for Alternative D, then, focuses on the additional disturbance created by the construction of the greenway trail from the Abyss to Hermits Rest. This is similar to the analysis for the greenway trail presented under Alternative C except that there would be less new disturbance and tree removal from the shorter greenway proposed under Alternative D than what is proposed under Alternative C.

As displayed in Table 1, Alternative D would result in approximately 53 acres of total disturbance, 15 acres of which would be new ground disturbance. Approximately 1- 2 acres of this would be a result of greenway trail construction and would require some tree removal but this would be minimized by following the existing 1912 road in this area. However, tree removal and wildlife habitat disturbance cannot be avoided during construction and impacts would result, but these would be substantially less than that created by Alternative C. While it is possible that areas of habitat islands would be created between the road and the greenway, this is much reduced over Alternative D by the shorter distance of proposed trail, the existing presence of the 1912 road as a disturbed corridor and the use that it currently receives by visitors. Visitors walk this alignment now and following the existing disturbed corridor to do so, for the majority of the length between the Abyss and Hermits Rest. It can be argued that the area between the road and the disturbed corridor then are already fragmented and provides habitat of less value than undisturbed areas. However, paving the trail, widening it and then marketing it as a multi- use trail would likely result in increased use by visitors, over the existing condition. This would result in decreased habitat value and disturbance to wildlife using the area. These islands would have decreased habitat value due to increased solar radiation, wind and vehicle, bicycle and pedestrian disturbance along both corridors.

In addition to the indirect effect of fragmentation of habitat, a direct loss of habitat due to the construction of the trail and road would occur, but this loss is much less than that anticipated for Alternative C and would be more similar to Alternative B. Due to the calculated acreage of the habitat loss, it is likely that direct mortality to bird and mammal territories would result, as described under Alternative B and C, but at a lower level with Alternative D than with Alternative C. Approximately 15 acres of vegetation removal is estimated for Alternative D and this would result in the loss of an estimated 22 to 30 bird territories and 225 to 300 small mammal territories, based on the same criteria described above for Alternative B and C. It is obvious that small mammal and bird species have smaller home ranges and more limited habitat requirements than larger species, such as deer, elk, big horn sheep, mountain lion and raptors and therefore, have a higher potential to be directly impacted during construction activities and direct removal of existing habitat. However, while short- term losses are expected, wildlife populations are not expected to be substantially impacted adversely in the long- term due to the availability of adjacent undisturbed habitat, species mobility and the implementation of mitigation measures to reduce the spread of exotic species, revegetate disturbed areas, reduce runoff and create vehicle fuel leakage and spill plans.

Impacts from implementing Maricopa Point and road closure options during the construction period are the same as those described for Alternative B.

The direct disturbance to habitat from both road widening and trail construction, then, coupled with the estimates for fragmented habitat between the roadway and the proposed trail would result in long- term minor adverse impacts to wildlife populations.

Cumulative Impacts. The cumulative impacts of implementing Alternative D are very similar to those described for Alternative B, except that additional disturbance would be created as a result of greenway trail construction. These impacts are minimized in the Hermit Creek watershed area due to the lack of other disturbed areas and development in the area which has minimized the impacts to wildlife over time due to past, current and future projects. The proposed greenway under Alternative D does not occur in the Bright Angel Wash watershed and therefore, cumulative impacts for Alternative D in this watershed are the same as those described for Alternative C. Implementation of Alternative D combined with future actions is not expected to appreciably change the use of the project area by wildlife over the long- term. Actions continue to be concentrated in existing developed areas, reducing their attractiveness to many wildlife species, and this would continue with future project implementation. For these reasons, Alternative D would result in moderate, adverse, cumulative impacts to wildlife.

Impairment. Direct and indirect long- term adverse impacts under Alternative D would be minor and short- term adverse impacts would be moderate; cumulative impacts would also be adverse and moderate. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the Park or to opportunities for enjoyment of the Park; or (3) identified as a goal in the Park's general management plan or other relevant NPS planning documents, there would be no impairment of the Park's wildlife resources.

Conclusion: Implementation of Alternative D, combined with past, on- going and foreseeable future actions would result in long- term minor adverse impacts to wildlife, minimized through the implementation of integral design features and mitigation measures. Moderate short- term adverse impacts during the construction period are anticipated. Implementing either Option 1 or Option 2 (preferred) for road closure during construction would result in less impact to wildlife than implementing the option 3.

Temporal Road Closure

Direct/Indirect: Implementation of this option would not result in any new ground disturbance or vegetation removal. During the closure period to vehicles, visitors would be allowed to hike or bike the existing road, in addition to using the unpaved rim trail or greenway (if Alternative C or D were also implemented). This option would therefore not result in any additional direct impacts to wildlife if implemented with any one of the other alternatives. Proposed actions under a temporal road closure would therefore result in no change to wildlife habitat, no potential for habitat fragmentation and no displacement of individuals or direct mortality due to habitat loss. There is the potential under this option, however, for changes to occur in the way that visitors use the project area during the vehicle closure period, but it is expected that most visitors will simply walk or bike the road to access overlooks, view points and Hermits Rest. Increased social trailing is not expected. However, it is expected that a negligible to minor

beneficial impact to wildlife populations would result due to the decreased traffic and vehicle noise on the roadway during the daily closure period. This would be a short- term effect lasting only the duration of the daily closure, but would benefit wildlife species in the area. Therefore, implementation of a temporal road closure would have no additional adverse impacts to wildlife if implemented with one of the other action alternatives, but is expected to result in negligible to minor beneficial impacts in the short- term during the closure period.

Cumulative Impacts. Combining the impacts of implementing this option with past, on- going and future projects, would not result in any additional adverse impacts to wildlife beyond those described for the other alternatives. Because no new ground disturbance or changes to visitor use patterns off of established corridors are expected under this option, cumulative impacts would be similar to those expected for the other alternatives, as described above.

Impairment. No additional adverse, direct, indirect, and cumulative impacts to wildlife would result from implementing the temporal road closure option, although a negligible to minor beneficial short- term impact is expected during the daily closure period. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park's wildlife resources.

Conclusion: Implementing a temporal road closure would not result in any additional adverse direct, indirect or cumulative impacts to wildlife but a short- term beneficial effect would be expected due to decreased traffic and vehicle noise in the project area during the daily closure period.

SPECIAL STATUS SPECIES

Affected Environment

Table 6 includes a list of threatened, endangered, proposed and species of concern pertinent to the Hermit Road project, based on known occurrences or habitat preferences. In- depth discussion of Federally listed species issues in the analysis area is the subject of a separate Biological Assessment. Of the ten Federally listed wildlife and plant species known to occur or likely to occur in Grand Canyon National Park, three occur in or near the project area. Occurrence potential for these species in the project area is included in Table 6 below. Detailed descriptions of special status species, including a brief species description, habitat requirements legal status and data sources used for the analysis is included in Appendix D.

The list in Table 6 was developed from personal knowledge of the area by park biologists, park records, the AGFD Heritage Nongame Data Management System database (2003), and AGFD and USFWS biologists.

Environmental Consequences

Methodology

Baseline information used to assess impacts to special status species is described in the methodology section at the beginning of this chapter and includes park staff knowledge of the resources and site; review of existing literature and park studies; information provided by

Table 6. Special status species known to occur, or having the potential to occur, in the vicinity of Hermit Road, South Rim, Grand Canyon National Park.

Species	Scientific Name	Status	Occurrence in Project Area
Mexican Spotted Owl	<i>Strix occidentalis lucida</i>	T, WC ⁵	Protected activity centers established near extreme east and west ends of project area.
California Condor	<i>Gymnogyps californicus</i>	T*, WC	Foraging and roosting potential; 1 previously used nest site within 0.5 miles of project area
Peregrine Falcon	<i>Falco peregrinus anatum</i>	delisted	Aeries occur at Hopi and Pima Points
Northern Goshawk	<i>Accipiter gentilis</i>	WC	Foraging habitat potential and some limited nesting potential in the southeast end of project area
Sentry milkvetch	<i>Astragalus cremnophylax</i> Barneby var. <i>cremnophylax</i> Barneby	E	Occupied habitat at Maricopa Point; potential and suitable habitat identified in three other areas
Tusayan flameflower	<i>Talinum validulum</i> E. L. Green	WC	Habitat potential exists throughout project area; three areas specifically identified for avoidance
Allen's lappet-browed bat	<i>Idionycteris phyllotis</i>	SC	Foraging and roosting potential exists in project area; no documented occurrences
Long- legged myotis	<i>Myotis volans</i>	SC	Foraging and roosting potential exists in project area; no documented occurrences
Pale Townsend's big- eared bat	<i>Corynorhinus townsendii</i>	SC	Foraging and roosting potential exists in project area; no documented occurrences

specialists within the National Park Service and other agencies and professional judgment. Detailed information on natural and cultural resources in Grand Canyon National Park is summarized in the 1995 GMP and EIS was specifically referenced for information on affected resources in the project area. Additional special status species information sources used for this evaluation are described in the affected environment section.

⁵ **Key:** T=Federally listed as threatened under the Endangered Species Act (ESA); T*=Federally listed as an experimental non- essential population in Arizona, but in national parks the species is considered Federally listed as threatened under ESA; E=Federally listed as endangered under the ESA; WC=Wildlife species of special concern in Arizona (AFGD, 1996); SC=Species of Concern. Some information showing vulnerability or threat, but not enough to support listing under ESA. These species are former USFWS Category 1, 2, and 3 species (Note: the Southwest Region of the USFWS no longer maintains a list of these Category 1, 2 and 3 species)

The thresholds of change for the intensity of an impact on special status species are defined as follows:

Negligible Special status species would not be affected, or the effects would be at or below the level of detection. A negligible effect would equate with a “no effect” determination under section 7 of the Endangered Species Act regulations for threatened or endangered species

Minor Impacts to special status species would be perceptible or measurable, but the severity and timing of changes to parameter measurements are not expected to be outside natural variability and are not expected to have effects on populations of special status species. Impacts would be outside critical periods. A minor effect would equate with a determination of “likely to adversely affect” or “not likely to adversely affect” under section 7 of the Endangered Species Act regulations for threatened or endangered species.

Moderate Impacts to special status species would be perceptible and measurable, and the severity and timing of changes to parameter measurements are expected to be sometimes outside natural variability, and changes within natural variability might be long term. Populations of special status species might have small to moderate declines, but they are expected to rebound to pre- impact numbers. No species would be at risk of being extirpated from the park. Some impacts might occur during key time periods. A moderate effect would in most cases equate with a determination of “likely to adversely effect” under section 7 of the Endangered Species Act regulations for threatened or endangered species.

Major Impacts to special status species would be measurable, and the severity and timing of changes to parameter measurements are expected to be outside natural variability for long periods of time or even be permanent; changes within natural variability might be long term or permanent. Populations of special status species might have large declines, with population numbers significantly depressed. In extreme cases, a species might be at risk of being extirpated from the park, key ecosystem processes like nutrient cycling might be disrupted, or habitat for any species might be rendered not functional. Substantive impacts would occur during key time periods. Impacts would be long term to permanent. A major effect would equate with an “adverse affect with/without a jeopardy opinion” under section 7 of the Endangered Species Act regulations.

Nature of the Impact Adverse impacts would result from those actions that increase the possibility for “take” under ESA (harm, harass, etc.) for listed species, result in habitat loss, mortality, displacement of individuals due to human- caused disturbance (like construction noise) or habitat fragmentation. Beneficial impacts would result in a decrease in take or result in habitat improvement.

Duration Short- term impacts would generally occur within a year or less following implementation. Long- term impacts would result greater than a year following implementation.

Alternative A – No Action

Direct/Indirect Impacts. The no action alternative would maintain the project area in its current state and would continue to provide habitat in the project area for many wildlife species, although habitat quality in the immediate area would remain relatively low due to the existing level of development and human activity. Without a change in vegetation or human use in the project area, special status populations would generally remain the same. Selection of the no

action alternative would not affect special status species in the project vicinity, or their habitat, beyond the on- going impacts habitat degradation from of visitation and human activity that have been occurring in this area for many years. Impacts specific to each species are included below.

Mexican Spotted Owl: Ongoing activities along Hermit Road create daily disturbance during peak season. Fewer people visit this area in the winter and shuttle buses are not running at this time, but private vehicles, tour buses, hikers, and bicyclists continue to use the project area at reduced levels. This disturbance has decreased the quality of habitat in and around the project area for MSO and would continue under the No- Action Alternative. Although there is roosting, nesting and foraging habitat below the rim in close proximity to the road, it is not possible to determine the extent of current traffic or hiker impacts to Mexican spotted owls as no information is currently available concerning MSO occupation of this area prior to construction of the road. It should be noted, however, that despite numerous surveys no owls have been found below this seven- mile stretch of road yet average spacing of PAC's below Desert View Drive (along the east rim) is two miles. Desert View Drive is generally farther removed from the rim than is Hermit Road.

No vegetation removal would occur under Alternative A, and no new sources of habitat disturbance would be introduced. Surveys of suitable nesting habitat below the canyon for the length of Hermit Road have been conducted for several years and no new owls have been located. There are, however, two established protected activity centers (PAC) outside the project area on both the east and west ends but neither occurs within project boundaries. The west end PAC (Waldron Basin) is within 0.5 miles of a portion of the road and has the potential to be impacted by construction actions to minimally widen the road, but has been unoccupied for four consecutive years. The east end PAC (Bright Angel) nest site is greater than 0.5 miles from the project area and would not be impacted by the construction activities under Alternative A. Therefore, adverse impacts to MSO from implementation of Alternative A would be negligible, provided that the Waldron Basin PAC continues to remain unoccupied during the construction period. Monitoring of the PAC would continue through the construction period.

California Condor: Existing developments at the South Rim and along Hermit Road create year- round human presence in the vicinity. Human presence creates the possibility for condor/human interactions. Condors are monitored daily via radio telemetry, and any condors that land in the project area now are hazed by permitted park employees to ensure condors do not become habituated to humans. Current park policies and activities would be continued under Alternative A, and adverse impacts to condors would be negligible, long-term, and local. No vegetation manipulation is proposed under Alternative A and there would be no disturbance to any potential nesting, roosting or foraging areas for condors as a result of this alternative. However, construction actions to minimally widen the road have the potential to attract condors due to increased activity, equipment and human presence in the area. Mitigation measures have been developed to minimize the likelihood of impacts to condors during construction activities (Chapter 2). There are no active condor nests within 0.5 miles of the project area and only the Salt Creek nest was less than 0.5 miles from the project site. Therefore, the No- Action Alternative would have no additional effects on California condors.

Northern Goshawk: Goshawks primarily occupy ponderosa pine forests on the South Rim. Suitable nesting and foraging habitat exists south of the project area in ponderosa pine forests, and pine stringers within the project area, but no nest sites are known within 1 mile of the project area. Existing developments along Hermit Road and in Grand Canyon Village have resulted in the removal or modification of potential foraging and to a limited extent, nesting habitat for the northern goshawk. Human activity at the South Rim also reduces the suitability of the area for nesting and foraging by goshawks. Existing development and human activity could have adverse, local, long- term impacts to goshawks but this is expected to be negligible to minor. No additional habitat would be modified under the No-Action Alternative. Construction actions to minimally widen the road would not result in impacts to goshawks due to the fact that known nests are greater than one mile from the road. Therefore, this alternative would not have any additional effects on northern goshawks.

Peregrine Falcon: The construction of existing developments along Hermit Road and on the South Rim has affected potential habitat for peregrine prey. This local, adverse, long- term impact is negligible because the amount of habitat affected is negligible compared to the amount of available habitat. Noise from year- round activities at the South Rim has the potential to affect peregrines, but seems not to be a substantial adverse impact due to the observation that many nearby areas of high- use visitor activity are continually occupied and produce young. There are two eyries in the project area that could be impacted in the short-term (construction period only) by noise from construction actions to minimally widen the road. These potential impacts are considered minor due to the fact that these eyries are already adjacent to visitor destinations. No foraging habitat or nesting/roosting habitat would be removed as a result of Alternative A. This, coupled with the impacts of the continuation of current park policies for peregrine falcons would be adverse, minor, local, and long- term.

Sentry Milk Vetch: It is likely that the construction of the original Hermit Road, overlooks, parking areas and the West Rim Trail negatively affected the occurrence of milk vetch along the western rim to Hermits Rest. It is likely that previously occupied habitat once existed at other overlooks with similar exposure and substrate to Maricopa Point. This impact from past activities has been adverse and moderate, and is considered at least one of the causes of a substantial reduction in once- suitable habitat for this endangered species in this portion of the South Rim. However, implementing Alternative A would not result in any additional impacts to this species beyond the habitat degradation already occurring from existing uses; no habitat disturbance is planned for areas currently occupied or areas identified as potential habitat. However, under Alternative A, no improvements would be made to Maricopa Point to enhance the protection of the population. For these reasons, Alternative A would result in adverse, minor to moderate, long- term impacts to sentry milk vetch.

Tusayan Flame Flower: It is likely that the construction of the original Hermit Road, overlooks, parking areas and the West Rim Trail negatively affected the occurrence of flame flower along the western rim to Hermits Rest. It is likely that previously occupied habitat once existed in other areas with similar habitat types. This impact from past activities has been adverse and minor to moderate. However, implementing Alternative A would not result in any additional impacts to this species beyond that already occurring from existing uses; no habitat disturbance is planned for areas currently occupied or areas identified as

potential habitat. However, under Alternative A, no improvements would be made to Maricopa Point to enhance the protection of the sentry milk vetch and, as this area is also occupied by Tusayan flame flower, no improvements to habitat for this species would be realized either. For these reasons, Alternative A would not result in any new impacts to this species, but no habitat improvements would be realized.

Bats (Allen's Lappet-browed, Long-legged Myotis, and Pale Townsend's big-eared):

Because it is unclear whether these species occur in the project area, and there is relatively little known about specific habitat requirements for foraging and roosting, it is difficult to determine to what extent past actions and existing development may have had on this species. It is, like other wildlife species, likely that past activities in the area (developments and visitor use and increased human activity) have adversely impacted habitat for these species. Under Alternative A, no new vegetation disturbance is proposed and therefore no additional impacts to habitat for any of these species are expected. No roost sites are known from the project area, minimizing the likelihood of noise disturbance during the construction period to minimally widen the road. Therefore, no additional impacts to these sensitive bats would occur from implementation of Alternative A.

Cumulative Impacts. As described in the watershed values and vegetation sections of this Chapter, modification of habitat in the watershed subunits has occurred as a result of past and present activities and modification would result from implementation of future projects, primarily within the Bright Angel Wash watershed subunit. Much of these areas provides essentially undisturbed wildlife habitat within the natural zone south of Hermit Road and would continue to provide high quality habitat for goshawks, bats and Tusayan flame flower, and foraging habitat for peregrines and condors. Prescribed burning that is planned, while it can result in short-term displacement or injury to these species would not result in long-term adverse impacts, as the fire is intended to improve forest conditions and return the natural variability of these ecosystems, all benefits to special status species. The exception to this is sentry milk vetch where barren limestone substrate is preferred. Few of the recently implemented or in-progress projects in the Bright Angel watershed required tree removal, except for a few projects as listed and described in the vegetation section under Alternative A. This disturbance to vegetation and wildlife habitat through planned projects and associated tree removal would occur within the existing developed area of the South Rim where development already exists and visitation levels are high during peak season.

Prior to the implementation of any prescribed burn or other fire or construction action, special status species are considered and impacts evaluated. As necessary, modifications to the proposal would occur to minimize the potential for impact (for instance, distance to nearest known goshawk, MSO or peregrine nests or known occurrences for milk vetch or flame flower would be used in the evaluation of a planned project and protective measures taken to avoid impacts). None of these actions are expected to affect MSO as there is no suitable habitat in the area nor is the area likely to be used for foraging. Peregrines are also unlikely to be affected as there is no suitable nesting habitat in these areas and foraging habitat would remain unchanged. Bats, goshawks, milk vetch and Tusayan flame flower have a greater potential for impact due to potential habitat in future projects areas, but this would be minimized through the careful planning for special status species, as mentioned above. For these reasons, implementation of Alternative A would result in adverse, minor impacts to special status species.

Impairment. Direct, indirect, and cumulative impacts to the special status species would be negligible to minor as a result of implementing Alternative A. These impacts would not result in impairment. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park's special status species.

Conclusion: Alternative A would result in long- term, negligible to minor , adverse, direct and indirect impacts to special status species, short- term, minor adverse impacts during the road widening and minor adverse cumulative impacts. No impairment of special status species would result from implementing Alternative A.

Alternative B – Widen for Safe Bus Access

Direct/Indirect Impacts. Implementing Alternative B and widening Hermit Road to 24 feet would result in approximately 11 acres of vegetation disturbance along the road edge, with up to approximately 1,400 – 1,450 trees of all size classes being removed. This represents a loss of habitat for a variety of species; potential impacts to special status species are discussed below. Other aspects of Alternative B (West Rim Trail and unpaved rim trail improvements, construction of the connector trail, improvements to overlooks, batch plant, salvage and revegetation activities) would result in some new ground disturbance, although tree removal would likely be minimal. These project components are smaller in scale, localized and would occur in or adjacent to existing developments. For these reasons, adverse impacts to special status species are minimized. If any impacts are expected from these actions, they are discussed below for each individual species. The use of staging areas identified and establishment of a batch plant have no potential for impacts to special status species, beyond those described as part of construction activity noise disturbance, as these sites are already disturbed and mitigations are in place to minimize any off- site impacts. Salvage and revegetation components of the action alternatives can be ground- disturbing but are not expected to result in any additional impacts beyond those described for construction actions. Implementation of Road Closure Option 1 or 2 would result in a shorter construction season that would benefit all special status species by reducing the duration of noise disturbance and allowing for a quicker vegetative recovery of the areas disturbed.

Mexican Spotted Owl: There is no suitable nesting or roosting habitat within the project area and the project area is not designated as critical habitat for MSO. It is also unlikely that the project area provides foraging habitat for MSO due to its location above the canyon rim and the existing pinyon- juniper woodland vegetation type. Therefore, actions proposed under Alternative B with the potential for impact to MSO are limited to short- term noise disturbance during construction to known PACs. This impact, as well, is minimized by the fact that the Bright Angel PAC nest site is greater than 0.5 miles from the project area and the Waldron Basin PAC has been successively unoccupied for several years. For these reasons, implementation of Alternative B would result in negligible to minor adverse impacts to MSO.

California Condor: There is no suitable nesting or roosting habitat within the project area for condors. It is possible that the area is used as foraging habitat but the suitability of the area for this use would remain unchanged if Alternative B were implemented. Therefore,

actions proposed under Alternative B with the potential for impact to condors are limited to short- term noise disturbance during construction to possible nest sites and the potential to attract condors due to increased activity, equipment and human presence in the area during construction. Mitigation measures have been developed to minimize the likelihood of impacts to condors during construction activities (Chapter 2). There are no active condor nests within 0.5 miles of the project area and only the Salt Creek nest was within 0.5 miles of the project site. Therefore, Alternative B would result in negligible to minor adverse impacts to California condors.

Northern Goshawk: While there is potential nesting habitat for goshawks in the project area, no known nest sites occur within 1 mile of the project area. Vegetation disturbance estimated for Alternative B would primarily be pinyon and juniper and associated shrubs along the road edge and would not result in substantial loss of ponderosa pine, a preferred species for goshawk nesting. While it is possible that tree removal along the roadway could impact the suitability of the area for foraging or affect prey species habitat, this is minimized by the fact that this habitat is already adjacent to the roadway and does not provide high- quality habitat due to the proximity to the noisy roadway. However, as described under general wildlife, mammalian prey species and breeding birds would be lost with the level of tree removal expected under Alternative B. For these reasons, goshawk foraging potential would be adversely impacted. Noise associated with construction actions is not expected to disturb breeding activities for goshawks due to known nest sites being greater than 1 mile from the project area. Therefore, this alternative would result in minor adverse short- term impacts to goshawks due to a reduction in prey species and foraging habitat quality.

Peregrine Falcon: There is no suitable nesting or roosting habitat within the project area. While the project area may provide foraging habitat for peregrines, they typically use a wide variety of vegetation types over a large area, minimizing the potential for long- term impacts due to Alternative B actions. As for goshawk, prey species (mammalian and avian) have the potential to be impacted due to the vegetation disturbance required for road widening and this could affect peregrine prey availability. There are two known eyries near the project area, but as described under Alternative A noise from construction actions are not expected to adversely impact these eyries. For these reasons, implementation of Alternative B would result in minor adverse impacts to peregrine falcons.

Sentry Milk Vetch and Tusayan Flame Flower: Implementation of Alternative B has been carefully designed to avoid adverse impacts to this rare plant species. Any potential/suitable habitat would be avoided during road widening efforts. The implementation of Maricopa Option 1 would be much preferred for the enhanced protection of these species at Maricopa Point. While both options provide increased protection through the relocation of the rim trail on the east end to avoid suitable habitat and realignment of trails and the shuttle bus stop away from the species, Option 1 goes farther by removal of the paved parking area and the closure of the area to visitors in private vehicles and tour buses. These actions provide for restoration of habitat adjacent to the occupied habitat, providing a buffer between visitor use areas and occupied habitat. By allowing access by visitors only via shuttle bus and trails (where access to the overlook is easy to recognize and follow) minimizes the likelihood of inadvertent trampling or disturbance to habitat by visitors. The project area has been surveyed for other new occurrences for both species and no other locations have been found, besides those mapped and slated for avoidance. For these reasons, Alternative B

would result in minor to moderate beneficial, long- term impacts to sentry milk vetch and flame flower, enhanced by the implementation of Maricopa Option 1.

Bats (Allen's Lappet- browed, Long- legged Myotis, and Pale Townsend's big- eared):

Because it is unclear whether these species occur in the project area, and there is relatively little known about specific habitat requirements for foraging and roosting, it is difficult to determine to what extent habitat modification and noise disturbance for Alternative B would affect these species. No roost sites are known from the project area, minimizing the likelihood of noise disturbance during the construction period. Construction would be limited to day light hours, minimizing adverse impacts during foraging activities at night. Vegetation removal has the potential to impact insect populations, prey species for these bats, through changes in herbaceous cover and species composition on road edges, but these impacts are expected to be short- term. Therefore, Alternative B would result in minor adverse, short- term impacts to sensitive bats.

Cumulative Impacts. Combining Alternative B to past, current and foreseeable future actions would result in impacts to special status species similar to those described for Alternative A. No special status species occur in project areas for Alternative B that cannot be avoided. Prior to the implementation of any future prescribed burn or other fire or construction action, special status species are considered and impacts evaluated. As necessary, modifications to the proposal would occur to minimize the potential for impact (for instance, distance to nearest known goshawk, MSO or peregrine nests or known occurrences for milk vetch or flame flower would be used in the evaluation of a planned project and protective measures taken to avoid impacts). None of these actions are expected to affect MSO as there is no suitable habitat in the area nor is the area likely to be used for foraging. Peregrines are also unlikely to be affected as there is no suitable nesting habitat in these areas and foraging habitat would remain unchanged. Bats, goshawks, milk vetch and Tusayan flame flower have a greater potential for impact due to potential habitat in future projects areas, but this would be minimized through the careful planning for special status species, as mentioned above. For these reasons, implementation of Alternative B would result in adverse, minor cumulative impacts to special status species.

Impairment. Direct, indirect, and cumulative impacts to the wildlife resource would be negligible to minor as a result of implementing Alternative B. These impacts would not result in impairment. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park's special status species.

Conclusion: Implementation of Alternative B would result in both short- and long- term direct and indirect, adverse impacts that range from negligible to minor and minor cumulative impacts. Minor beneficial impacts are expected for rare plant species due to improvements at Maricopa Point under any action alternative, with moderate beneficial impacts as enhanced by the implementation of Maricopa Option 1. Road Closure Option 1 or 2 is the preferred option to minimize impacts to special status species. No impairment of special status species would result from implementing Alternative B.

Alternative C - Greenway

Direct/Indirect Impacts. Impacts to special status species from road widening to 24 feet, construction of the connector trail, unpaved trail improvements, West Rim Trail improvements and overlook and parking area improvements are as previously described for Alternative B. Actions common to all action alternatives (such as staging areas, batch plant, salvage and revegetation, and slash treatment) are as described for Alternative B. The analysis for Alternative C, then, focuses on the additional disturbance created by the construction of the greenway trail. As displayed in Table 1, Alternative C would result in approximately 65 acres of total disturbance, 27 acres of which would be new ground disturbance. Approximately 14 acres of this would be a result of greenway trail construction. Under Alternative C, approximately 3,950 – 4,000 trees would be removed within the area of road construction and greenway trail construction. These tree removal estimates for Alternative C are almost three times higher than Alternative B due to the length of the greenway trail through woodland habitat; potential impacts to special status species are discussed below.

Impacts from implementing Maricopa Point and road closure options during the construction period are the same as those described for Alternative B.

Mexican Spotted Owl: Impacts are the same as described for Alternative B; while the level of disturbance is higher for Alternative C, none of the area disturbed provides habitat for MSO and there are no occupied nest sites within 0.5 miles of the project area.

California Condor: Impacts are similar to those described for Alternative B; while the level of disturbance is higher for Alternative C, none of the area disturbed provides nesting habitat for condors. Condors are opportunistic foragers, feeding on carrion and changes in forest cover for a trail would not likely impact the way condors forage in the area. However, an indirect effect of the construction of a greenway trail is the way in which visitors might use the area. This would increase human presence and activity south of the road, which has the potential to increase condor curiosity and presence in this area. This might require additional hazing after the project is completed. Alternative C would also result in longer construction duration, requiring at least 2 seasons (3 seasons potentially if Road Closure option 2 were implemented) to complete; this would increase the likelihood for condor hazing and the duration of this effort until the construction was completed. For these reasons, Alternative C would result in minor to moderate adverse long- and short- term impacts to condors.

Northern Goshawk: Impacts are similar to Alternative B; while the level of disturbance is higher for Alternative C, there are no known goshawk nests within a mile of the area. However, prey species would be directly impacted by vegetation disturbance for the trail construction. In the long- term, these species could be affected by the increased visitor use on the trail south of the road and change their use patterns. The fragmentation of habitat between the trail and the roadway would also decrease the suitability of the area between the greenway and road for goshawk nesting or foraging over the long- term. For these reasons, Alternative C would result in minor to moderate adverse long- and short- term adverse impacts to goshawks.

Peregrine Falcon: Impacts are similar to those described for Alternative B; while the level of disturbance is higher for Alternative C, none of the area disturbed provides nesting habitat

for peregrines. Peregrines use large areas of a variety of habitat types for foraging and changes in forest cover for a trail would not likely impact the way peregrines may forage in the area. The proposed trail would be near Pima Point, the site of a confirmed eyrie, this level of visitor use is not expected to substantially affect peregrine breeding or use of the area. This territory is habituated to a long history of visitor use at Pima Point and is not expected to be adversely affected by the use of the trail by visitors over the long- term. Alternative C would also result in longer construction duration, requiring at least 2 seasons (3 seasons potentially if Road Closure option 2 were implemented) to complete; this would increase the likelihood for disturbance to breeding peregrines at known eyries near the project area. For these reasons, Alternative C would result in minor, adverse long- and short- term impacts to peregrines.

Sentry Milk Vetch and Tusayan Flame Flower : Implementation of Alternative C has been carefully designed to avoid adverse impacts to these rare plant species. Any potential/suitable habitat would be avoided during road widening or trail construction efforts. However, a long- term indirect adverse impact is expected with the introduction of the greenway trail due to increased human presence south of the road and the possibility for increased social trailing between the trail and the rim. While known habitat for these species would be avoided during construction, it is likely that indirect effects from added social trailing would impact these areas. For these reasons, Alternative B would result in minor, long- term impacts to sentry milk vetch and flame flower.

Bats (Allen's Lappet- browed, Long- legged Myotis, and Pale Townsend's big- eared): Impacts are similar to those described for Alternative B; no roost sites are known from the project area and information on how the area might be used by these species for foraging is limited. However, increased vegetation disturbance over Alternative B would affect insect populations in the short- term. Removal of potential tree roosting habitat for the trail adversely impacts the potential use of this area by bats and introducing more human presence in this area in the long- term reduces the quality of the area for bat activity. These impacts are minimized by the availability of essentially undisturbed habitat south of the road in the natural zone. For these reasons, Alternative C would result in minor to moderate adverse impacts to bat species.

Cumulative Impacts. Combining Alternative C to past, current and foreseeable future actions would result in impacts to special status species similar to those described for Alternative B, except that direct and indirect impacts from Alternative C are expected to be of higher intensity than under Alternative B. No special status species occur in project areas for Alternative C that cannot be avoided. Prior to the implementation of any future prescribed burn or other fire or construction action, special status species are considered and impacts evaluated. As necessary, modifications to the proposal would occur to minimize the potential for impact. None of these actions are expected to affect MSO as there is no suitable habitat in the area nor is the area likely to be used for foraging. Peregrines are also unlikely to be affected as there is no suitable nesting habitat in these areas and foraging habitat would remain unchanged. Bats, goshawks, milk vetch and Tusayan flame flower have a greater potential for impact due to potential habitat in future projects areas, but this would be minimized through the careful planning for special status species, as mentioned above. For these reasons, implementation of Alternative C would result in adverse, minor impacts to special status species.

Impairment. Direct, indirect, and cumulative impacts to special status species would be minor to moderate as a result of implementing Alternative C. These impacts would not result in impairment. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park's special status species.

Conclusion: Implementation of Alternative C would result in both short- and long- term direct and indirect, adverse impacts that range from minor to moderate and minor cumulative impacts. Moderate beneficial impacts are expected for rare plant species due to improvements at Maricopa Point under any action alternative, enhanced by the implementation of Maricopa Option 1. Road Closure Option 1 or 2 is the preferred option to minimize impacts to special status species. No impairment of special status species would result from implementing Alternative C.

Alternative D - Preferred

Direct/Indirect Impacts. Impacts to special status species from road widening to 24 feet, construction of the connector trail, unpaved trail improvements, West Rim Trail improvements and overlook and parking area improvements are as previously described for Alternative B. Actions common to all action alternatives (such as staging areas, batch plant, salvage and revegetation, and slash treatment) are as described for Alternative B. The analysis for Alternative D, then, focuses on the additional disturbance created by the construction of the greenway trail from the Abyss to Hermits Rest. This is similar to the analysis for the greenway trail presented under Alternative C except that there would be less new disturbance and tree removal from the shorter greenway proposed under Alternative D than what is proposed under Alternative C; potential impacts to special status species are discussed below.

Impacts from implementing Maricopa Point and road closure options during the construction period are the same as those described for Alternative B.

Mexican Spotted Owl: Impacts are the same as described for Alternative B and C; the level of disturbance is more similar to Alternative B than C and none of the area disturbed provides habitat for MSO; there are no nest sites within 0.5 miles of the project area.

California Condor: Impacts are similar to those described for Alternatives B and C; while the level of disturbance is higher for Alternative D than B (but much less than that estimated for Alternative C), none of the area disturbed provides nesting habitat for condors and foraging habitat would not likely be impacted by trail construction. An indirect effect of the construction of a greenway trail is the way in which visitors might use the area. This would increase human presence and activity in this area between the Abyss and Hermits Rest, which has the potential to increase condor curiosity and presence in this area. This might require additional hazing after the project is completed. However, this effect is considered less for Alternative B than C due to the shorter distance of the greenway and the fact that visitors are using the existing 1912 road currently. For these reasons, Alternative D would result in minor adverse long- and short- term impacts to condors.

Northern Goshawk: Impacts are similar to Alternative B; while the level of disturbance is somewhat higher than B, there are no known goshawk nests within a mile of the area. However, prey species would be directly impacted by vegetation disturbance for the trail construction. In the long- term, these species could be affected by the increased visitor use on the trail north of the road and change their use patterns. However, the use of the area north of the road between the Abyss and Hermits Rest is less likely than the areas of ponderosa pine stringers available south of the road. Therefore, the impacts of trail construction, using an existing disturbed corridor, for Alternative D would result in much less potential for impact to goshawks. For these reasons, Alternative D would result in minor adverse long- and short- term adverse impacts to goshawks.

Peregrine Falcon: Impacts are similar to those described for Alternative B; while the level of disturbance is somewhat higher for Alternative D, none of the area disturbed provides nesting habitat for peregrines. Peregrines use large areas of a variety of habitat types for foraging and changes in forest cover for a trail would not likely impact the way peregrines may forage in the area. The proposed trail would be near Pima Point, the site of a confirmed eyrie, this level of visitor use is not expected to substantially affect peregrine breeding or use of the area. This territory is habituated to a long history of visitor use at Pima Point and is not expected to be adversely affected by the use of the trail by visitors over the long- term. For these reasons, Alternative D would result in minor, adverse long- and short- term impacts to peregrines.

Sentry Milk Vetch and Tusayan Flame Flower : Impacts are the same as described for Alternative B; all occupied and suitable/potential habitat would be avoided during construction and long- term indirect impacts to this habitat are not expected since the greenway would be north of the road and not near any identified habitat for either species.

Bats (Allen's Lappet- browed, Long- legged Myotis, and Pale Townsend's big- eared): Impacts are similar to those described for Alternative B and C; no roost sites are known from the project area and information on how the area might be used by these species for foraging is limited. However, increased vegetation disturbance over Alternative B would affect insect populations in the short- term. Removal of potential tree roosting habitat for the trail adversely impacts the potential use of this area by bats and introducing more human presence in this area in the long- term reduces the quality of the area for bat activity, but is much less than Alternative C. These impacts are minimized by the availability of essentially undisturbed habitat south of the road in the natural zone. For these reasons, Alternative D would result in minor adverse impacts to bat species.

Cumulative Impacts. Combining Alternative D to past, current and foreseeable future actions would result in impacts to special status species similar to those described for Alternative B. No special status species occur in project areas for Alternative D that cannot be avoided. Prior to the implementation of any future prescribed burn or other fire or construction action, special status species are considered and impacts evaluated. As necessary, modifications to the proposal would occur to minimize the potential for impact. None of these actions are expected to affect MSO as there is no suitable habitat in the area nor is the area likely to be used for foraging. Peregrines are also unlikely to be affected as there is no suitable nesting habitat in these areas and foraging habitat would remain unchanged. Bats, goshawks, milk vetch and Tusayan flame flower have a greater potential for impact due to potential habitat in future projects areas, but

this would be minimized through the careful planning for special status species, as mentioned above. For these reasons, implementation of Alternative D would result in adverse, minor impacts to special status species.

Impairment. Direct, indirect, and cumulative impacts to special status species would be negligible to minor as a result of implementing Alternative D. These impacts would not result in impairment. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park's special status species.

Conclusion: Implementation of Alternative D would result in both short- and long- term direct and indirect, adverse impacts that range from negligible to minor. Moderate beneficial impacts are expected for rare plant species due to improvements at Maricopa Point under any action alternative, enhanced by the implementation of Maricopa Option 1. Road Closure Option 1 or 2 is the preferred option to minimize impacts to special status species. No impairment of special status species would result from implementing Alternative D.

Temporal Road Closure

Direct/Indirect Impacts: Implementation of this option would not result in any new ground disturbance or vegetation removal. During the closure period to vehicles, visitors would be allowed to hike or bike the existing road, in addition to using the unpaved rim trail or greenway (if Alternative C or D were also implemented). This option would therefore not result in any additional direct impacts to special status species if implemented with any one of the other alternatives. Proposed actions under a temporal road closure would therefore result in no change to special status species habitat or potential for occurrence in the area. There is the potential under this option, however, for changes to occur in the way that visitors use the project area during the vehicle closure period, but it is expected that most visitors will simply walk or bike the road to access overlooks, view points and Hermits Rest. Increased social trailing is not expected. However, it is expected that a negligible to minor beneficial impact to special status species would result due to the decreased traffic and vehicle noise on the roadway during the daily closure period. This would be a short- term effect lasting only the duration of the daily closure, but would benefit special status species that may occur in the area. Therefore, implementation of a temporal road closure would have no additional adverse impacts to special status species if implemented with one of the other action alternatives, but is expected to result in negligible to minor beneficial impacts in the short- term during the closure period.

Cumulative Impacts. Combining the impacts of implementing this option with past, on- going and future projects, would not result in any additional adverse impacts to special status species beyond those described for the other alternatives. Because no new ground disturbance or changes to visitor use patterns off of established corridors are expected under this option, cumulative impacts would be similar to those expected for the other alternatives, as described above.

Impairment. No additional adverse, direct, indirect, and cumulative impacts to special status species would result from implementing the temporal road closure option, although a negligible to minor beneficial short- term impact is expected during the daily closure period. Because there

would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park's special status species.

Conclusion: Implementing a temporal road closure would not result in any additional adverse direct, indirect or cumulative impacts to special status species, but a short-term beneficial effect would be expected due to decreased traffic and vehicle noise in the project area during the daily closure period.

SOUNDSCAPE

Affected Environment

Natural sounds are intrinsic elements of the environment that are often associated with parks and park purposes. They are inherent components of “the scenery and the natural and historic objects and the wild life” protected by the NPS Organic Act. They are vital to the natural functioning of many parks and may provide valuable indicators of the health of various ecosystems. Intrusive sounds are of concern to the NPS because they can at times impede the Service's ability to accomplish its mission.

The natural soundscape, also referred to as “natural quiet,” is an important park resource and is specifically identified as a resource requiring protection in the following legal and public documents: the 1975 Grand Canyon NP Enlargement Act; 1987 National Parks Overflights Act; the 1995 Grand Canyon NP General Management Plan (GMP); and the National Parks Air Tour Management Act of 2000. One of the vision statements included in the GMP is as follows:

The South Rim should remain the focus for most Park visitors, with diverse opportunities to view the canyon... It should also provide access to areas that allow people to have solitary experiences... Visitors should be able to experience solitude in natural settings as well as social exchange in developed areas. For access to such areas, the West Rim and East Rim Drives should be meandering, rural roads that lead to overlooks where visitors can get away from the more urbanized areas of the Grand Canyon Village.

Under Management Objectives in the GMP it also states:

Protect the natural quiet and solitude of the park, and mitigate or eliminate the effects of activities causing excessive or unnecessary noise in, over, or adjacent to the park.

The Hermit Road area is managed as a less-urbanized and thus quieter area of the developed South Rim. The area is popular for visitor use, and includes a retail operation, restrooms and some limited employee housing at Hermits Rest. Human noise sources are present at Hermits Rest and along the road corridor, and include shuttle bus and tour bus traffic; personal, NPS, and concessionaire vehicle traffic; bicyclists, hikers, and visitors at overlooks and Hermits Rest; and noise from overflights (air tour operators and occasional NPS operations).

Extensive noise measurements have been gathered in the Park and an on- going effort is in place to continue to measure sounds in many park areas. A close approximation of natural quiet is the measured natural ambient sound condition, with all sounds of human origin excluded. The natural ambient data show that Grand Canyon is generally a very quiet place (NPS 1995a).

The decibel (dB) is a standard unit of measurement for sound. Sound measurements are often weighted for human sensitivity in particular frequencies, expressed as dBA. Typical existing ambient levels in Grand Canyon Village are in the 50 to 60 dBA range (Table 7). As a point of reference, a typical conversation between two people is about 60 dBA while busy street traffic is about 70 dBA (NPS 1995a).

Table 7. Ambient Sound Levels at selected areas of Grand Canyon National Park (taken from NPS 1995a).

Location	Ambient Sound Level (dBA)	Range of Ambient Levels (dBA)
Grand Canyon Village	50- 60	NA
Desert View Watchtower Area	34- 48	29- 58
Phantom Ranch Overlook (Bright Angel Creek clearly audible)	41	39- 44
Inner Canyon Locations away from the sound of moving water	22- 28	12- 38

A site- specific sound analysis was conducted in the project area in 2005 (Levy and Falzarano, in pre. 2006). Several sample sites represent the broad range of acoustic experiences available on Hermit Road (Table 8 and Figure 8). Analysis of daytime (7 am to 7 pm) data collected from April through October of 2005 at these sites show that when considering median daytime sound level, site GRCA013 is the quietest and site GRCA012 is the loudest. Loud individual events caused maximum sound levels to be much higher.

Loud events at site GRCA007 are comprised of wind- induced noise through the vegetation, a common natural sound. Loud events at site GRCA012 are primarily from buses, to be expected at a site located near a shuttle bus stop. Loud events recorded at sites GRCA013 and GRCA014 are predominantly natural (wind and thunder).

The percent time audible for human noise sources are displayed in Table 9. Site GRCA007 clearly has much more aircraft noise than vehicle noise. Aircraft noise can be quieter than vehicle noise depending on the distance from the noise source. However, aircraft noise is audible over a larger area and for a longer time due to the altitude above the ground surface. Aircraft noise may be masked by vehicle noise at sites other than GRCA007. Alternatively, the absence of vehicle noise at site GRCA007 may allow for more aircraft to be heard.

Opportunities for solitude and experiencing only natural sounds are limited on Hermit Road during daytime hours. Human noise intrusions during peak visitation hours in the middle of the day are constant. However, the general loudness of Hermit Road, based on these data, seems to be significantly less than Grand Canyon Village. Human noise intrusions are less frequent and

not as loud, allowing for the experience of more natural sounds. In addition, human noise intrusions are limited in early morning and evening hours.

Table 8. Acoustic sample sites for the 2005 Hermit Road project.

Site	Location	Acoustic experience	Median daytime dBA	Maximum daytime dBA
GRCA007	1 mi south of the road near the Abyss	Fewer vehicles but more aircraft noise audible	32	83
GRCA012	50 m south of road near Hopi Point	Noise from shuttle bus stop and popular overlook	35	76
GRCA013	50 m south of road, ¼ mi east of Pima Point	Noise from passing vehicles, bicycles, and pedestrians; noise from air tours in Dragon Corridor nearby	30	93
GRCA014	50 m south of road near the Abyss	Noise from passing vehicles, bicycles, and pedestrians	31	77

Table 9. Percent time human noise sources are audible, 7 am to 7 pm, Hermit Road Study 2005.

Site	% Time Aircraft Audible	% Time Vehicles Audible	% Time Human Noise Audible ⁶
GRCA007	71	2	74
GRCA012	17	72	94
GRCA013	57	33	85
GRCA014	37	21	58

Environmental Consequences

Methodology

The baseline information used to assess impacts to soundscape is as described in the methodology section at the beginning of this chapter and includes park staff knowledge of the resources and site; review of existing literature and park studies; information provided by specialists within the National Park Service and other agencies; and professional judgment.

Detailed information on natural and cultural resources in Grand Canyon National Park that is summarized in the 1995 GMP and associated Environmental Impact Statement (EIS) was specifically referenced for information on affected resources in the project area. Additional sources of information on soundscape used as a basis for this evaluation are as described above in the affected environment section.

⁶ Human-caused sounds other than vehicle and aircraft noise may be included.

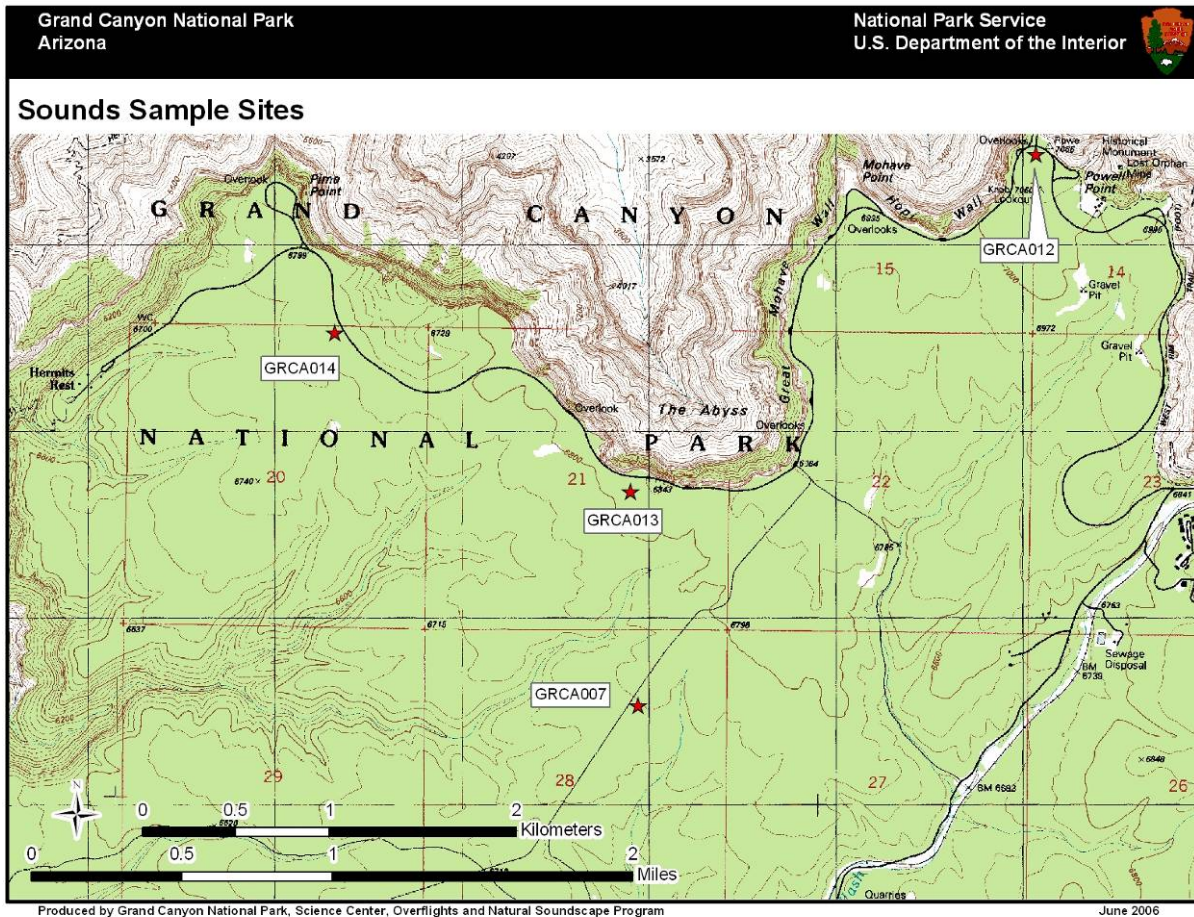


Figure 8. Sound Data Collection Stations along Hermit Road, Hermit Road Study, 2005.

Proposed activities have the potential to impact soundscapes through changes in duration and level of human- caused noise. For a person with normal hearing, a change of 3 dBA is noticeable and a change of 10 dBA is perceived as a doubling of loudness.

While long- term changes in the existing ambient sound levels are not expected as a result of this project, short- term changes are expected due to construction noise. Typical construction equipment noise for a project like this can reach 95 dBA at 50 ft (15 m) for short periods of time (p. 3, Department of Transportation 2006). Point source sounds typically decrease at a rate of 6 dBA per doubling of distance (p. 84, Everest 2001). Therefore, at 50 m, the maximum sound level should be reduced to 75 dBA for the time of operation and in the vicinity of the loudest equipment. Construction noise is localized, and not expected to be across the entire road corridor for the entire daytime period.

Duration: Short- term impacts would occur during the construction period and would end when project implementation is complete. Long- term impacts would occur or continue after the construction period and after the project is complete.

The thresholds of change for the intensity of an impact on soundscapes are defined as follows:

Negligible: Existing ambient sounds dominate the road corridor for a majority of the day, although construction sounds may be evident in areas close to the construction site.

Minor: Existing ambient sounds dominate the road corridor although construction sounds are noticeable and frequent.

Moderate: Construction sounds can be heard for more than half of the day along most of the road corridor and mask most of the existing ambient sounds.

Major: Construction sounds dominate the road corridor for much of the day. Existing ambient sounds are completely masked except for the loudest sounds, or there are only very brief intervals where existing ambient sounds can be heard.

Nature of the Impact: Adverse Impacts could result from construction noise and increased human-generated noise as a result of increased use of the road. Beneficial Impacts would result from reduced vehicle noise with a daily vehicle closure, as proposed in the Temporal Road Closure.

Alternative A – No Action

Direct/Indirect Impacts. Implementation of Alternative A would not result in any changes to the way in which Hermit Road and its associated overlooks and parking areas are used or managed. With minimal widening of the road to its historic width, short-term construction noise would occur but would not result in any long-term changes in the level of existing ambient noise associated with the project area; median daytime existing ambient sound levels over the long-term would remain in the 30- 35 dBA range (Table 8). Short-term increases in sound levels, however, are expected due to construction equipment operating in the area to minimally widen the road. The type of equipment necessary for this type of work would operate in the 60- 70 dBA range, with construction duration of approximately 1 construction season (April – November). The operation of the shuttle bus system for nine months of the year would continue, with a restriction during this time of private vehicle use. No changes in visitor use patterns or frequency of use in the area are expected with taking no action at this time. Widening the road to its historic width would provide some increased level of safety for users on the roadway, but is not expected to increase or decrease the source of human-caused sounds in the project area, over the long-term. Therefore, since there would be no change in the expected duration, level, and affected area of human-caused sounds in the project area over the long-term, Alternative A would result in negligible long-term adverse impacts. Short-term, moderate, adverse impacts are expected due to increased noise during the construction period.

Cumulative Impacts. On-going activities in the Hermit Road area result in existing ambient noise levels as measured at select sample sites in 2005 and as described above in the Affected Environment Section. Human-caused noise sources are audible at most sites for most of the day (Table 9). Existing human-caused noise sources in the vicinity of the road are primarily due to noise from buses and other passing vehicles, bicyclists, pedestrians and aircraft. While human-caused sound is prevalent in the project area during daylight hours, it is reduced during early morning and evening hours, and is substantially less than that experienced in Grand Canyon Village. Hermit Road, then, provides an opportunity for a quieter experience for visitors than the Village, particularly in the early morning and evening hours. Median existing ambient noise levels in the project area range 30 – 35 dBA.

In-progress and reasonably foreseeable future projects (Appendix E) in the area of potential affect (the vicinity of Hermit Road) are limited; they include Hermit's Rest restroom

replacement, Hopi Point vault toilet installation, actions related to implementation of the South Rim Visitor Transportation Plan, installation of a new radio tower at the existing Hopi Point radio site, and the Horsethief prescribed burn. Hermits Rest and Hopi Point restrooms project would result in short- term construction- related noise during project implementation but these increases in noise levels would return to existing levels as soon as construction is complete. These projects would not result in any long- term changes in visitor use patterns or other sources of human- caused noise. It is also likely that the same is true of the actions proposed at the Hopi Point tower site: short- term construction- related noise during implementation that would return to existing levels as soon as construction is complete. A detailed evaluation of this proposal by soundscape staff would occur, as that project is planned, to confirm that no long- term increases in noise levels would result from the new tower. Implementation of the prescribed burn would increase human- caused sounds south of Hermit Road, nearest the GRCA007 sample site due to fire crew activity in the area, fire vehicles in the area and the potential use of aircraft to start and monitor the fire. These actions would be short- term, lasting the duration of the burn (expected for 2 – 7 days) and would be sporadic throughout the duration of the burn. Long- term changes in existing noise levels would not occur. Changes to the Hermit Road area proposed as part of the South Rim Transportation Plan are not specifically known at this time, but may include changes in proposed shuttle bus routes and frequencies and tour bus operational changes which could result in long- term impacts to soundscape. However, soundscape is a resource being carefully evaluated as a part of that planning process and any proposed changes in transportation systems used on Hermit Road as a part of the project would be considered. At this stage of planning, implementation of small changes in frequency of shuttle bus or tour bus operations as part of that process are expected to result in minor long- term changes in existing ambient sound levels in the project area.

For these reasons, implementation of Alternative A, combined with past and reasonably foreseeable future actions would result in minor short- and long- term adverse impacts to soundscape along Hermit Road.

Impairment. Direct, indirect, and cumulative impacts to soundscape would be negligible to minor as a result of implementing Alternative A, with short- term moderate, adverse impacts expected during the construction period. These impacts would not result in impairment. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park's soundscape.

Conclusion: Alternative A would result in long- term, negligible, adverse, direct and indirect impacts, minor, adverse cumulative impacts and direct, short- term moderate, adverse impacts during the construction period for minimally widening the road. No impairment of soundscape would result from implementing Alternative A.

Alternative B – Widen for Safe Bus Access

Direct/Indirect Impacts. Implementation of Alternative B would not result in any changes to the way in which Hermit Road and its associated overlooks and parking areas are used or managed. With widening of the road to 24 feet, improving overlooks and parking areas, making

improvements to the West Rim Trail and unpaved rim trail, and construction of the connector trail, short- term construction- related noise would occur throughout the project area, but would not result in any long- term changes in the level of existing ambient noise associated with the project area; median daytime ambient sound levels over the long- term would remain in the 30- 35 dBA range (Table 8). Short- term increases in ambient sounds levels, however, are expected due to construction equipment operating, primarily for the road construction. The type of equipment necessary for this type of work would operate in the 60- 70 dBA range, with a construction duration of approximately 1 construction season (April – November). Equipment necessary for other aspects of the project like trail work and overlook improvements would use smaller equipment (backhoes and bobcats, for instance) and hand tools and so would result in less noise for a shorter duration than the road construction work.

Implementation of Maricopa Point option 1 or 2 would not likely result in measurable changes in existing ambient noise levels, although it is possible that a small reduction in noise near this overlook would result from option 1 since it would no longer allow tour buses or private vehicles to park here. These changes are positive from a soundscape perspective but may not be detectable over the project area as a whole.

Implementation of the Road Closure options would result in very different impacts to soundscape. Option 1 or 2 would result in construction duration of one season, while Option 3 would require at least 2 seasons. Construction actions would result in higher dBA levels in the project and would be moderate and adverse, as described for Alternative A. Option 3 would result in this higher level of human- caused noise twice as long as Option 1 or 2. From a soundscape perspective, implementation of Option 1 or 2 is preferred.

The use of a batch plant would not result in any changes to noise levels in the project area, but would result in increased noise in the vicinity of the Village. Because existing ambient noise levels in the Village are relatively high and in the 50 – 60 dBA range (Table 7), batch plant operation would not result in noise generation above this level at distances of 150 feet or more from the operation.

As stated in Chapter 2, Actions Common to All Action Alternatives, it is assumed that a small increase in shuttle bus operation may be necessary to respond to changes in visitation that are likely over the long- term on this route. This small increase in visitation, combined with use of new buses that have slightly less capacity (see Chapter 2) would likely result in the addition of two to three shuttle buses to this route. This small increase has the potential to result in changes to existing ambient soundscape in the project area, but would be negligible. No changes would occur in the time of operation, no changes would occur to the season of operation and the noise produced by these newer buses is assumed to be similar to existing buses. For these reasons, detectable changes would likely not result from this foreseen change.

Implementation of Alternative B is not expected to result in changes in the operation of the shuttle bus system for nine months of the year. No changes in visitor use patterns or frequency of use in the area are expected with Alternative B; while improvements would be made to the road, overlooks and trails, these improvements are all in areas of existing use and simply provide safer and more accessible options for visitors to access and move through these areas. Minimization of social trailing could slightly decrease the area affected by human- caused sound. None of these actions, however, are expected to measurably increase or decrease the

source of human- caused sounds in the project area, over the long- term. Therefore, since there would be no change in the expected duration, level, and affected area of human- caused sounds in the project area over the long- term, Alternative B would result in negligible long- term adverse impacts. Short- term, moderate, adverse impacts are expected due to increased noise during the construction period.

Cumulative Impacts. Past and reasonably foreseeable future actions are as described under Alternative A. Because direct and indirect long- term impacts from Alternative B are the same as those expected for Alternative A, cumulative impacts are the same as those described previously for Alternative A. Implementation of Alternative B, combined with past and reasonably foreseeable future actions would result in minor short- and long- term adverse impacts to soundscape along Hermit Road.

Impairment. Direct, indirect, and cumulative impacts to soundscape would be negligible to minor as a result of implementing Alternative B, with short- term moderate, adverse impacts expected during the construction period. These impacts would not result in impairment. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park's soundscape.

Conclusion: Alternative B would result in long- term, negligible, adverse, direct and indirect impacts, minor, adverse cumulative impacts and direct, short- term moderate, adverse impacts during the construction period for widening the road and implementing other improvements. No impairment of soundscape would result from implementing Alternative B.

Alternative C - Greenway

Direct/Indirect Impacts. Impacts to soundscape from Alternative C are similar to that described under Alternative B, except that this alternative includes the construction of a greenway trail from the Village to Hermits Rest. Widening the road, implementing improvements to overlooks and parking areas, and trail improvements are as previously described for Alternative B and are not expected to result in any changes to the way in which Hermit Road and its associated overlooks and parking areas are used or managed. However, implementation of the greenway would result in increased visitor use on this new corridor, primarily south of the road. This is not expected to result in any change in the expected duration of human- caused sounds in the project area or a measurable change in the level of human- caused sounds but would result in a slight increase in the area affected. This impact is minimized by the close proximity of the trail to the roadway (less than 75 feet away).

Road widening and overlook/trail improvements, in addition to the construction of the greenway trail would result in short- term construction- related noise throughout the project area. Short- term increases in existing ambient sounds levels would be a result of construction equipment operating, primarily for the road construction. The type of equipment necessary for this type of work would operate in the 60- 70 dBA range, with construction duration of approximately 1 construction season (April – November). Equipment necessary for other aspects of the project like trail work and overlook improvements would use smaller equipment (backhoes and bobcats, for instance) and hand tools and so would result in less noise for a

shorter duration than the road construction work. However, Alternative C differs from Alternative B in the estimated length of the construction period. It is likely that two full construction seasons would be necessary to complete the project under Alternative C due to the added length of the greenway.

Implementation of Maricopa Point option 1 or 2 would not likely result in measurable changes in existing ambient noise levels, as described for Alternative B.

Implementation of Road Closure options would result in different impacts to soundscape under Alternative C. Option 1 or 2 would result in construction duration of up to two seasons, while Option 3 may require up to 2- 3 seasons due to the additional construction necessary for the greenway. Construction actions would result in higher dBA levels in the project area and would be moderate and adverse. However, the additional length of construction time would be primarily for the greenway trail, which would not require the same type of heavy construction equipment or construction methods as would the road construction. Still, Option 3 would result in a higher level of human- caused noise for approximately 1 year longer than Option 1 or 2 for this alternative. From a soundscape perspective, implementation of Option 1 or 2 is preferred.

The use of a batch plant would not result in any changes to noise levels in the project area, as described for Alternative B.

An expected small increase in shuttle bus operation, as stated in Chapter 2, Actions Common to All Action Alternatives, would result in negligible adverse impacts to soundscape and is the same as that described for Alternative B.

Therefore, implementation of Alternative C is not expected to result in changes in the operation of the shuttle bus system for nine months of the year. Improvements made to the road, overlooks, West Rim and unpaved trails are all in areas of existing use and simply provide safer and more accessible options for visitors to access and move through these areas but are not expected to change visitor use patterns. Minimization of social trailing could slightly decrease the area affected by human- caused sound. None of these actions, however, are expected to measurably increase or decrease the source of human- caused sounds in the project area, over the long- term. The greenway, however, does have the potential to increase the presence of human- caused noise south of Hermit Road that would be outside the area currently producing human- caused sounds in the project. This is a slight change in the area affected and is expected to result in a minor adverse, long- term impact to soundscape in the project area. Short- term, moderate, adverse impacts are expected due to increased noise during the construction period.

Cumulative Impacts. Past and reasonably foreseeable future actions are as described under Alternative A. Direct and indirect long- term impacts from Alternative C are somewhat higher for Alternative C than B, due to the greenway trail. However, this change in area affected, combined with past and reasonably foreseeable future actions would not result in more than minor short- and long- term adverse impacts to soundscape along Hermit Road. A long- term change of greater than 5 dBA to existing ambient sound levels along the Hermit Road corridor is not expected.

Impairment. Direct, indirect, and cumulative impacts to soundscape would be minor as a result of implementing Alternative C, with short- term moderate, adverse impacts expected during the

construction period. These impacts would not result in impairment. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park's soundscape.

Conclusion: Alternative C would result in long- term, minor, adverse, direct and indirect impacts, minor, adverse cumulative impacts and direct, short- term moderate, adverse impacts during the construction period for widening the road, constructing the greenway and implementing other improvements. No impairment of soundscape would result from implementing Alternative C.

Alternative D - Preferred

Direct/Indirect Impacts. Impacts from implementation of Alternative D are very similar to those expected from Alternative B. While greenway construction is a component of this alternative, it is a shorter segment, using an existing disturbed corridor. This means that the duration of the construction period is the same as that described for Alternative B and would take one season under Road Closure option 1 or 2 or two seasons under Road Closure option 3. The impacts of this short- term adverse impact are the same as described for Alternative B.

Although increased visitor use is expected along the proposed greenway trail corridor under this alternative, it is not expected to result in a measurable change in the area affected by human noise. The greenway alignment for this alternative is entirely north of the road and is already receiving pedestrian use (visitors walking the 1912 road corridor between overlooks). While this increased use may result in more noise in this area from pedestrians and bicyclists, it would not be detectable as a change in dBA, over the course of a day. The area is between the road and the rim, with the popular Abyss overlook, Pima Point and Hermits Rest nearby. Small changes in the noise levels created by increased pedestrian or bicycle use would be masked by the existing noise levels from the road and these popular overlooks.

The use of a batch plant would not result in any changes to noise levels in the project area, as described for Alternative B.

An expected small increase in shuttle bus operation, as stated in Chapter 2, Actions Common to All Action Alternatives, would result in negligible adverse impacts to soundscape and is the same as that described for Alternative B.

As described for the other alternatives, implementation of Alternative D is not expected to result in changes in the operation of the shuttle bus system for nine months of the year. Improvements made to the road, overlooks, West Rim and unpaved trails are all in areas of existing use and simply provide safer and more accessible options for visitors to access and move through these areas but are not expected to change visitor use patterns. Minimization of social trailing could slightly decrease the area affected by human- caused sound. None of these actions, however, are expected to measurably increase or decrease the source of human- caused sounds in the project area, over the long- term.

Therefore, since there would be no change in the expected duration, level, and little measurable change in the affected area of human- caused sounds in the project area over the long- term, Alternative D would result in negligible to minor long- term adverse impacts. Short- term, moderate, adverse impacts are expected due to increased noise during the construction period.

Cumulative Impacts. Past and reasonably foreseeable future actions are as described under Alternative A. Direct and indirect long- term impacts from Alternative D are somewhat higher than Alternative B, due to the greenway trail, but somewhat less than that described for Alternative C. However, this change in area affected, combined with past and reasonably foreseeable future actions would not result in more than negligible to minor short- and long- term adverse impacts to soundscape along Hermit Road. A long- term change of greater than 5 dBA to existing ambient sound levels along the Hermit Road corridor is not expected.

Impairment. Direct, indirect, and cumulative impacts to soundscape would be negligible to minor as a result of implementing Alternative D, with short- term moderate, adverse impacts expected during the construction period. These impacts would not result in impairment. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park's soundscape.

Conclusion: Alternative D would result in long- term, negligible to minor, adverse, direct and indirect impacts, minor, adverse cumulative impacts and direct, short- term moderate, adverse impacts during the construction period for widening the road, constructing the greenway and implementing other improvements. No impairment of soundscape would result from implementing Alternative D.

Temporal Road Closure

Direct/Indirect Impacts. Implementing this daily closure to vehicles would have a beneficial impact to soundscape along the Hermit Road corridor. During the road closure from March – November, 7 am to 10 am daily, the level (dBA) of human- caused noise would decrease due to the exclusion of vehicles. The types of noticeable human- caused noise would change; it is likely that more aircraft would be heard because vehicle noise would not be masking it. Because of that, the duration of human- caused noise may stay the same. If a temporal road closure was implemented with any one of the action alternatives, a long- term moderate beneficial impact would be realized.

Cumulative Impacts. Past and reasonably foreseeable future actions are as described under Alternative A. Direct and indirect long- term impacts from implementing a temporal road closure would be moderate and beneficial. This change, combined with past and reasonably foreseeable future actions would result in a cumulative impact that is beneficial and minor to moderate. The future action that has the potential to create a minor long- term adverse impact to soundscape is potential increases in shuttle bus and/or tour bus operation as part of the transportation plan (see cumulative impact discussion for other alternatives above). These minor adverse impacts would be outweighed by a temporal road closure. In other words, if a daily vehicle closure were implemented for the road for the long- term, any minor increases in bus noise would be undetectable over the course of a day if the temporal closure option were in

place. Therefore, cumulative impacts from implementing a temporal road closure with foreseeable future projects would be beneficial, minor to moderate, and long- term.

Impairment. Direct, indirect, and cumulative impacts to soundscape would be minor to moderate and beneficial if the temporal road closure option was implemented. These impacts would not result in impairment. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park’s general management plan or other relevant National Park Service planning documents, there would be no impairment of Grand Canyon National Park’s soundscape.

Conclusion: Implementing a temporal road closure option would result in long- term, moderate, direct and indirect beneficial impacts, and minor to moderate beneficial cumulative impacts to soundscape. No impairment of soundscape would result from implementing a temporal road closure option.

VISUAL/SCENIC RESOURCES

Affected Environment

Conserving national park scenery and providing for visitor enjoyment are elemental purposes of the NPS according to the 1916 Organic Act. Grand Canyon was designated a national park in 1919 and a World Heritage Site in 1979, in large part because of its “exceptional natural beauty” and its “aesthetic importance.” (World Heritage Committee 2004). Best known of the park’s scenic qualities are the expansive views of Grand Canyon from the rims. On clear days, a deeply eroded landscape of canyons, buttes and cliffs may be visible for 160 miles or more from many overlooks on both the North and South Rims. The Colorado River, flowing a mile below in the Inner gorge, can be glimpsed from vantage points. For visitors on the South Rim looking directly across the canyon, the high, forested Kaibab Plateau can be seen on the North Rim, over ten miles away.

Hermit Road was constructed originally between 1934 and 1936 to be a 20- foot wide paved road, widened at the curves, with three- foot wide shoulders on each side. Loops and spurs were designed for speeds not to exceed 15 miles per hour (Anderson and Brennan 2006). Some road cuts through the Kaibab Limestone were necessary to lessen grades especially in the Hopi Hill area and this exposed the underlying native rock. Other areas were filled in to create a stable platform for the roadbed (Milner 2004). Construction specifications reflect the interest of landscape architects to hide roadways within, and to protect, the nearby environment. NPS personnel and Civilian Conservation Corps (CCC) crews cleared area vegetation to a width sufficient for construction activities only, and were directed to cover exposed embankments with topsoil for revegetation (Anderson and Brennan 2006). The road meanders through the topography between the interchange near the Village and its end at Hermits Rest with only a few straight sections. This meandering creates visual intrigue as visitors round each bend in the road to see what is revealed next. Adding to this effect, vegetation that lines the road frames its narrowness and helps to define the corridor, giving it a rural character with few interruptions. One long straight section exists just at the end of the road where it terminates into the Hermits Rest parking area. The road stays as close as possible to the rim providing partial canyon views and consequently a visual connection with it. Overlooks provide an opportunity for visitors to

stop and investigate the panoramic canyon views and also provide a separation from the road and traffic; changes to overlooks can impact landscape character of these areas.

Hermit Road's rural character (its meandering and narrow alignment and vegetation along road edges) is an important aspect of the visual resource in the project area. It is also considered an important aspect of the cultural landscape, as discussed briefly in the cultural resource section of this chapter. For purposes of this analysis, road character will be analyzed as part of the Visual/Scenic Resource.

Views along the road change and include views of pinyon- juniper forest on both sides, partial views through it to the canyon, and full canyon views in a few places. The changing views provide more interest from the visitor's perspective. The pinyon- juniper forest is a continuously repeated monotypic landscape and would be less interesting without the sporadic canyon views along the road. Visitors' attention is mostly directed toward the canyon because of its scenic complexity, intrigue and changing form. Although the pinyon- juniper forest contributes to the landscape character's high quality, it is the canyon that provides significant interest. However, the consistent view of the woodland on the south side of the road is a character- defining element of the road. For these reasons, views off the road to the south have a lower interest value than views to the north. In those places where there aren't canyon views to the north the viewing interest is similar to the viewing interest to the south. The forest vegetation, however, also provides screening of overlook entrances, overlooks, shuttle bus stop elements, the Orphan Mine gates, overhead power lines and signs. It provides a necessary function that aids in obscuring improvements made along the road over the years.

Based on these factors, landscape character to the north of the road has more visual/scenic interest and draws the visitor, whereas landscape character to the south draws less interest and has less complexity in its landscape character. Actions associated with the landscape south of the road, therefore, will have less of a visual/scenic impact than actions proposed on the north side, between the road and canyon rim.

Fencing

At Maricopa Point, log post and rail fencing with wire mesh was constructed in 1990 to cordon off sentry milk vetch habitat and existing plants. This fencing was not part of the existing landscape character when the road was constructed and is also on the north side of the road, an area of high scenic interest. It introduces materials and structures in the landscape that are not indicative of a natural landscape and are not consistent with the rock structures at the overlooks. For these reasons it creates a moderate adverse impact on the visual/scenic resources at this location. No other areas along Hermit Road have this fencing so it still supports a minor adverse existing condition for the project area as a whole. Cumulatively, the introduction of fencing in areas of the South Rim has created an adverse effect on visual and scenic resources. Fencing as a tool should only be used when other types of barriers for limiting access will not meet the desired objective. Fencing to limit the extent of parking and to minimize social trailing through vegetated areas west of Mather Point along South Entrance Road is example of this type of impact. Whenever possible, fencing has been removed when it is no longer necessary, e.g. along a segment of greenway trail across from Park Headquarters.

Methodology

Baseline information used to assess impacts to visual resources is described in the methodology section at the beginning of this chapter and includes park staff knowledge of the resources and site; review of existing literature and park studies; information provided by specialists within the National Park Service and other agencies and professional judgment. Detailed information on visual resources in Grand Canyon National Park that is summarized in the 1995 GMP and EIS was specifically referenced for information on affected resources in the project area. Additional visual resources information sources used for this evaluation are as described above in the affected environment section.

Proposed activities have the potential to impact visual resources through alteration of landscape character of the road corridor, overlooks and adjacent views. The magnitude is based on the amount of change to these elements and their relative value.

The thresholds of change for the intensity of an impact on visual resources are defined as follows:

Negligible Retains the landscape character and adjacent views.

Minor Most of the original landscape character is retained with small elements altered. Adjacent views are generally retained with a few views partially retained.

Moderate Some modification of the original landscape character is evident. Most of the adjacent views have been altered however most partially retain the original views.

Major Modifies the original landscape character to a degree where no retention is achieved and most of the original adjacent views are not maintained.

Nature of the Impact Beneficial impacts: retain and/or enhance original landscape character. Improve and manage adjacent views to retain their function. Adverse impacts Alters or modifies landscape character and/or adjacent views.

Duration A short- term impact would be short- lived or temporary due to construction, activities and moderate term revegetation efforts, and long- term impact would be permanent and continual.

Alternative A – No Action

Direct/Indirect Impacts. Minimally widening the road to its historic width would not require removal of vegetation along the roadside and would not change the vertical or horizontal alignment of the roadway. Work would occur within the existing roadbed and the adjacent road shoulder. Since there are no other improvements proposed for Alternative A, implementation of this alternative would not result in changes to road character (meandering and narrow alignment of the roadway and the vegetation along road edges) or to landscape character of adjacent views (views of the canyon to the north side of the road or views of pinyon- juniper forest to the south of the road). For these reasons, implementation of Alternative A would not result in any direct or indirect adverse impacts to visual resources over the long- term. Short-term impacts during the construction period are expected due to the equipment, construction fencing and increased personnel and vehicles in the project area. These impacts, however, would be minor and would last only the duration of the construction period. These impacts

would be associated with road closure Option 3 because visitors would be experiencing the road with construction activities within the viewed areas.

Cumulative Impacts. Past actions and on- going actions on the South Rim have affected the scenic quality of surrounding areas, particularly in Grand Canyon Village and associated developments where buildings, roads, trails, and other facilities have removed native vegetation and, in some cases, impeded canyon views and vistas. Along Hermit Road, however, this has been limited to the construction of the 1912 road and its associated overlooks, parking areas and trails, construction of Hermits Rest, the establishment of a shuttle bus system and its associated buses, the development of the Orphan Mine and fencing at Maricopa Point. Foreseeable future projects along Hermit Road (and within the West Rim Drive, Overlooks and Trail cultural landscape) are relatively minor and would not substantially affect the road character or the landscape character of adjacent views. The Hermits Rest and Hopi Point vault toilet installations are being constructed on the site of existing restrooms and these would simply replace them with more visually- pleasing models, designed carefully to be subordinate to the sites and to blend into the surrounding landscape. The improvements proposed at the Hopi Point fire tower would occur within an existing disturbed area, generally hidden from view when traveling Hermit Road. The impact of any new antennas or towers for this proposed project are being carefully evaluated for impacts to visual resources and cultural landscapes. For these reasons, combining implementation of Alternative A with past, on- going and foreseeable future actions would result in minor, adverse impacts to visual resources along Hermit Road.

Impairment: Long- term adverse impacts to visual resources would be negligible under Alternative A. Short- term impacts during the construction period would moderate and adverse, and cumulative impacts would be adverse and minor. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of the park's visual resources.

Conclusion: The No- Action Alternative would result in no additional long- term, direct or indirect adverse impacts to visual resources, but short- term impacts are expected to be adverse and moderate during the construction period and cumulative impacts would be adverse and minor. There would be no impairment of park resources.

Alternative B – Widen for Safe Bus Access

Direct/Indirect Impacts. Alternative B includes several components with the potential to impact visual resources. The primary ones are the overall road widening, widening at five pinch points, and minor road realignment between Mohave and the Abyss shuttle stop. Other aspects of this alternative have less potential for impact to road character or landscape character, but are discussed below.

Road Widening, pinch points and minor road realignment: Widening the road to 24 feet would require removal of vegetation along road edges. NPS recognizes the importance of maintaining the vegetation along the roadside as a character- defining feature of the historic roadway and minimizing the level of removal is an integral component of all action alternatives. Mitigation measures and integral design features have been developed to address the desire to maintain

existing vegetation when it is safe to do so and can be accommodated with varying slope width and steepness from the road (Chapter 2). Salvaging of existing vegetation and revegetation of disturbed areas along road edges is also integral to the project and would be conducted in suitable areas along the roadside following construction activities. No changes would be made to the vertical or horizontal alignment of Hermit Road under any of the action alternatives, so that the road would retain its meandering and rural character. Uniformly widening the road an additional 4 – 6 feet is not expected to be a recognizable change to visitors in vehicles, bicyclists or hiking the area, over the long- term, although short- term visibility of new pavements, new paint and enhanced road shoulders would be noticeable for a year following completion. As new pavement surfaces and striping fades and vegetation grows back in to fill disturbed areas along the roadside, any short- term noticeable changes to road character would be reduced.

Under all action alternatives, Hermit Road would be widened an additional 4 feet (to a total of 28 feet) in five locations (pinch points) between Hopi Point and the west end of the Abyss (Figure 6) to provide a pedestrian area between existing pull- out walls and vehicle traffic lanes. These areas have been evaluated on site for any potential impacts to road character or adjacent landscape views. The length of the widening in these small areas would not be extensive and they are expected to blend into the surrounding curvature of the road so that the small extent of widening would not be visually noticeable to visitors traveling the roadway either by vehicle, bicycle or hiking.

Realigning the road approximately six feet to the south in three relatively short sections between Mohave and Abyss is also a component of all action alternatives. This is necessary due to the steepness of the terrain on the north side of the road and the close proximity of Hermit Road to the rim edge in these areas. Realigning the road slightly in these areas would meet current safety standards without having to construct guardwalls or guardrails in these areas. NPS carefully evaluated these three sites and determined that minimally shifting the roadway to the south would be a much less impacting action to the character of the road than the construction of new, non- contributing features like guardwalls. Realigning in these areas would not disturb any additional culverts or headwalls and would not create any noticeable change to the meandering nature of the roadway or to landscape character.

Overlook improvements and trail improvements: Overlook actions are designed to improve these areas for visitors by making them more accessible and to address safety concerns. Trail improvements would be relatively minimal and would improve the condition of West Rim Trail and the usefulness of the unpaved rim trail, but would not result in any substantial changes to any of these areas. By delineating one primary path and minimizing social trailing, improvements to the unpaved rim trail would reduce its impact on the landscape character. Little vegetation would be removed and no substantial changes in important landscape features would occur. Proposed improvements, then, would not result in any changes to landscape character and would not impact the views of the canyon to the north or to the south of the road.

The implementation of Maricopa Option 1 would remove the large parking area and, over time this area would be revegetated. The removal of the parking area would, over a long period of time, result in a more natural landscape character with fewer human improvements in it. The rim trail connecting the overlooks in this area would be circulating through this more natural landscape and would generally have more visual appeal, although, since this is a change from the historic condition, it would not improve the historic visual environment. This would decrease

the level of social trailing and the denuding of vegetation in this area. How these areas are revegetated and the methods used to restrict visitor access to areas near the sensitive plant populations (boulders, landscaping, fencing) could result in impacts to the visual quality of the area and could add non- historic features to the landscape (e.g. fencing). Although the addition of fencing to cordon off habitat for the sentry milk vetch is not included in each alternative there may be a possibility of its use in the future if other measures do not prove successful in protecting the plant populations. The introduction of fencing on the north side of the road would create a moderate adverse affect on the visual/scenic resources and landscape character in that localized section of the rim. If this practice continues in other areas along the rim area it could adversely affect the entire rim corridor. The use of fencing on the south side of the road would create a minor to moderate adverse impact, of course depending upon extent. The elimination of the parking lot at Maricopa Point lessens the adverse impact of the existing fencing along its edge because it would then be viewed only from the road or rim trail. The park's landscape architect would review all design plans for both road rehabilitation and overlook improvements, including those proposed for Maricopa Point under either Option 1 or Option 2 (see measures at the end of Chapter 2), minimizing the potential for adverse impacts due to implementing these options.

The proposed new shuttle stop created under Option 1 would affect the roadway. Construction of a new pull- in/pull- out style shuttle stop along the roadway, similar in size and design to the Abyss shuttle stop, for instance, would add a new non- contributing feature to the cultural landscape. How the new stop would be designed and the details of materials used, etc. would need to be carefully evaluated by a landscape architect and cultural resource staff to ensure the potential for adverse impacts are minimized. The creation of a new bus stop in this location, which would replace the two existing road intersections at Maricopa Point would not be out of character with the roadway, as several pull- outs already occur in various locations along the 7-mile road. However, the added curbing and walkway needed from the bus stop would be a change in historic landscape character.

Areas selected for construction staging would not affect visual resources. These areas are existing disturbed areas or existing overlook parking areas that would return to their previous use and function when construction was complete. Establishment of an asphalt batch plant in the dry dump site near the Village would also not affect visual resources as the area is already disturbed and is used for existing utilitarian functions. Vegetation salvage as part of this project and its subsequent revegetation of disturbed areas after construction is complete are important aspects of the project and would be beneficial actions to mitigate any long- term adverse impacts from road construction. Revegetation of areas impacted by existing social trailing would benefit vegetation and the landscape character in these areas. Careful selection of grasses, shrubs and trees for use along the newly- widened roadway and the selection of the most suitable locations for planting in these areas is important and would be determined with the input of the park's landscape architect and cultural resource staff, in addition to vegetation personnel.

Options for road closure during the construction period and the potential for impacts to visual resources are the same as those described for Alternative A. None of the options would result in any long- term adverse impacts to the visual resources. None of the options would alter landscape character or road character.

Slash removal – Chipping is the preferred method from a visual resources standpoint. If material is chipped and spread in the project area or removed, no impacts would result. If material is piled and burned, temporary scars on the ground from hot spots would alter the landscape character for the moderate- term.

For all of the above reasons, Alternative B would result in minor, adverse, moderate- and long-term adverse impacts to visual resources, primarily due to road widening, additional road widening at pinch points and minor road realignment. These impacts would be lessened over the long- term by natural establishment and revegetation efforts along disturbed road edges, and the implementation of mitigation measures.

Cumulative Impacts. Effects of past actions, on- going actions and foreseeable future actions are the same as that described for Alternative A. Combining these impacts with the implementation of Alternative B would result in minor, adverse impacts to visual resources along Hermit Road. This is due to the fact that no other projects would alter the existing landscape character (adjacent views of the canyon on the north side of the road, or to a lesser extent, the expanse of vegetation to the south of the road) and that road width changes as a result of any action alternative would be minimized over time by natural encroachment of vegetation and revegetation efforts along road edges.

Impairment: Long- term adverse impacts to visual resources would be minor under Alternative B. Short- term impacts during the construction period would be moderate and adverse, and cumulative impacts would be adverse and minor. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of the park's visual resources.

Conclusion: Alternative B would result in minor, adverse, moderate- and long- term adverse impacts to visual resources, primarily due to road widening, additional road widening at pinch points and minor road realignment. These impacts would be lessened over the long- term by natural encroachment and revegetation efforts along disturbed road edges, and the implementation of mitigation measures. Short- term impacts are expected to be adverse and moderate during the construction period and cumulative impacts would be adverse and minor. There would be no impairment of park resources.

Alternative C - Greenway

Direct/Indirect Impacts. Impacts of road widening, minor road realignment, road widening at pinch points, overlook and trail improvements, slash treatments and salvage and revegetation components are the same as those described for Alternative B. The difference between Alternative C and B is in the construction of the greenway trail for the full- length of the roadway from the Village to Hermits Rest and changes proposed at Hopi Point and Hopi Overlook.

Greenway between the Village and just west of the Abyss: The greenway would be constructed on the south side of the road for approximately two- thirds of its length (about 5.5 miles) to Hermits Rest. Most of the distance between the Village and just west of the Abyss, the trail

would be located within an average of 35- 75 feet from the roadway on the south side. Between Maricopa Point and Powell Point, the trail would be on the north side of the road, where adequate room exists between the road and the rim. After the Abyss, the greenway would primarily follow the 1912 road corridor on the north side of the road to Hermits Rest for approximately 2 miles. Because most of the trail alignment would be south of the road, it would not impede the more important canyon views to the north of the road. The trail, in many areas, would be visible from the roadway but there would, in most areas, be a vegetated buffer between the roadway and the trail to obscure its view from the road. The trail would be designed to meander through the landscape (while still generally following the roadway) so as to take advantage of existing openings in the vegetation, minimize tree removal, avoid sensitive plant locations and to avoid impacts to cultural resources.

The trail would be separate from the roadway and so would not result in any additional impacts to the meandering character of the roadway or to the narrowness of the vegetation along the road edge, but would require up to 14- 21 road crossings. These crossings would be necessary when the trail was on the south side of the road so that trail users could access overlooks and viewpoints on the north side of the roadway. These crossings would add non- contributing features to the cultural landscape through additional signage, pavement markings and possible striping and would noticeably change the rural character of the roadway. The frequency of the crossings would result in an increased level of urbanization of the roadway. These impacts could be minimized somewhat by selection of appropriate signage and limiting painting or other pavements markings, but could not be avoided.

Because the trail would be visible to the south of the roadway in many places, the views of undisturbed continuous pinyon- juniper woodland from the roadway would be altered. The overall impact of this alteration of the view is lessened by the fact that the view to the north is more important than the view to the south because views to the north provide canyon views. Views of the pinyon- juniper woodland south of the road are valuable and are part of the landscape character Hermit Road but changes to this view are not as significant to the visual resource as changes to canyon views. Alternative C would alter this view to the south in some areas but would not substantially change the view for the length of Hermit Road; even with construction of the greenway trail, there would continue to be many opportunities along the 7.5 mile roadway to view undisturbed woodland south of the roadway.

Greenway just west of the Abyss to Hermits Rest: The approximately 3- mile long portion of the greenway that would be on the north side of the road, just west of the Abyss to Hermits Rest, would generally not be visible from Hermit Road for most of its length. The trail would primarily follow the alignment of the 1912 road, minimizing the need for new ground disturbance or vegetation removal. For most of the distance, the trail would meander through the woodland area away from the road, sometimes close to the rim and sometimes between the road and rim. Because most of the trail alignment would not be visible from the roadway, it would not impede any existing views of vegetation and occasional canyon views from the roadway to the north. This applies to most sections of the trail, except a portion near Pima Point and a section nearest Hermits Rest where the distance between the roadway and rim is relatively narrow and the trail would need to be adjacent to the roadway on the north side.

Near Pima Point, a small section of Hermit Road and a portion of the access road into Pima Point (Figure 8) would be widened to accommodate the greenway trail on the north side of the

road. Hermit Road would be widened up to a maximum of 30- 32 feet in an approximately 300-foot section near the entrance to Pima Point. This widening is necessary to accommodate the greenway adjacent to the road to avoid having to disturb historic stone walls at the nearby pull-out. The widening of the Pima Point access road would accommodate an 8- foot- wide greenway on the north side of the road, so the road would be widened a total of 10 feet in this area (2 feet necessary for adequate bus travel lanes, described under overlook improvements common to all action alternatives in Chapter 2) and 8 feet for the greenway. While this proposed widening would affect the road and landscape character, it is minimized by the fact that this section of Hermit Road is on a curve and would not be noticeable from any other location on the road. It is a small stretch near an existing overlook access road and allows for nearby historic features to remain intact.

In this small section near Hermits Rest (approximately 1/3 of a mile) the trail width would narrow from 8 feet down to 5 feet so it could be more appropriately constructed in the relatively steep and narrow terrain to the north side of the road. The trail at this point would be for pedestrians only and bicyclists would share the roadway with vehicles. Vegetation would need to be removed in some areas. Although the intent would be to retain a vegetated buffer between the road and the trail wherever possible, it is likely that in some small stretches this may not be possible due to the terrain. This would result in a change to the road character for this short distance by reducing the amount of vegetation between the roadway and the rim over the long-term and by creating a more urban “feel” due to the nearness of the trail to the roadway. Canyon views from the roadway, however, would possibly improve due to the lack of vegetation adjacent to the road that currently blocks some views.

Improvements proposed at Hopi Overlook to provide for safety and accessibility for shuttle bus users would result in impacts to the landscape character in this area. Due to the relatively confined area at this pull- out, changes necessary, such as concrete braking pads, pedestrian surfaces, curbing and a barrier along the vegetated island near the shuttle stop, would modify the landscape and create a more urban feel in this area. Removal of vegetation in the existing small island would also result in adverse impacts to the landscape character of the roadway and overlook in this area.

For these reasons, implementation of Alternative C would result in minor to moderate adverse, moderate- and long- term impacts to visual resources. This is primarily due to the impacts from road widening in combination with the construction of a greenway trail adjacent to Hermit Road and the large number of road crossings that would be required to accommodate the greenway trail. These adverse impacts would be minimized through the reduction of clearing limits to the minimum needed (see mitigation measures at the end of Chapter 2), the implementation of integral design features (listed in Chapter 2 for Alternative C) for greenway trail design, and the natural encroachment of vegetation along the roadside over time.

Cumulative Impacts. Effects of past actions, on- going actions and foreseeable future actions are the same as that described for Alternative A. Combining these impacts with the implementation of Alternative C would result in minor to moderate cumulative adverse impacts to visual resources along Hermit Road. This is due to the fact that no other projects would alter the existing landscape character (adjacent views of the canyon on the north side of the road, or to a lesser extent, the expanse of vegetation to the south of the road) and that road width changes as

a result of any action alternative would be minimized over time by natural encroachment of vegetation and revegetation efforts along road edges.

Impairment: Long- term adverse impacts to visual resources would be minor to moderate under Alternative C. Short- term impacts during the construction period would be moderate and adverse and cumulative impacts would be adverse and minor to moderate. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or (3) identified as a goal in the park’s general management plan or other relevant NPS planning documents, there would be no impairment of the park’s visual resources.

Conclusion: Alternative C would result in minor to moderate, adverse, moderate- and long-term adverse impacts to visual resources, lessened over the long- term. Short- term impacts are expected to be adverse and moderate during the construction period and cumulative impacts would be adverse and minor to moderate. There would be no impairment of park resources.

Alternative D - Preferred

Direct/Indirect Impacts. Alternative D incorporates all aspects of Alternative B with a portion of Alternative C. The preferred alternative reduces the length of greenway trail proposed in Alternative C to an approximately 3- mile long greenway segment just west of the Abyss to Hermits Rest. This segment is evaluated in detail under Alternative C (see above under Alternative C, section titled ‘greenway just west of the Abyss to Hermits Rest’). Impacts of road widening, minor road realignment, road widening at pinch points, overlook and trail improvements, slash treatments and salvage and revegetation components are the same as those described for Alternative B. The only aspect of Alternative D with the potential for impact to visual resources, that is not already evaluated under Alternatives B or C, is the proposed new shuttle stop at the beginning of the greenway just west of the Abyss.

West Abyss Shuttle Stop: A new outbound shuttle bus stop would be created using an existing historic pull- out near the location of the 1912 road intersection with Hermit Road, at the beginning of the greenway trail. This would allow visitors to directly access the greenway trail from shuttle buses. Creation of a bus stop in this location would require removal of a small section of historic wall (approximately 8 feet wide) to accommodate the greenway trail and some other minor improvements for accessibility and safety, as described in Chapter 2 for Alternative D. Using an existing pull- out for the new shuttle stop minimizes the likelihood of impacts to visual resources. It would not result in substantial changes to landscape character in the area. Vegetation would not be removed for the stop and no changes would be necessary in the existing length or width of the pull- out, but additional curbing and new surfaces would alter the existing condition. Historic walls would be minimally impacted to accommodate the greenway and accessibility improvements, as described in the historic resources and cultural landscape evaluation of Alternative D previously in this chapter. While these modifications would result in changes to landscape character in this area, a shuttle stop is in keeping with the current use of the road and the historic use of the pull- out for vehicles.

For these reasons, implementation of Alternative D would result in minor, adverse, moderate – and long- term impact to visual resources. This is primarily due to the impacts from road widening. While the construction of a greenway is a part of Alternative D, it is for a much

shorter distance than Alternative C, is on the north side of the road where it does not require any road crossings, and is generally not visible from Hermit Road for most of its length. While some impacts to road character are expected under Alternative D due to additional widening at Pima Point, the creation of a new shuttle stop, and the proximity of the trail to the road near Hermit's Reset, these are minimized by the curvature of the road near Pima Point and the implementation of integral design features and mitigation measures described in Chapter 2.

Cumulative Impacts. Effects of past actions, on- going actions and foreseeable future actions are the same as that described for Alternative A. Combining these impacts with the implementation of Alternative D would result in minor, adverse impacts to visual resources along Hermit Road. This is due to the fact that no other projects would alter the existing landscape character (adjacent views of the canyon on the north side of the road, or to a lesser extent, the expanse of vegetation to the south of the road) and that road width changes as a result of any action alternative would be minimized over time by natural encroachment of vegetation and revegetation efforts along road edges.

Impairment: Long- term adverse impacts to visual resources would be minor under Alternative D. Short- term impacts during the construction period would be adverse and moderate and cumulative impacts would be adverse and minor. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of the park's visual resources.

Conclusion: Alternative D would result in minor, adverse, moderate- and long- term adverse impacts to visual resources, lessened over the long- term. Short- term impacts are expected to be adverse and moderate during the construction period and cumulative impacts would be adverse and minor. There would be no impairment of park resources.

Temporal Road Closure

Direct/Indirect Impacts. Implementation of a temporal road closure would not result in any additional alteration to visual resources through impacts to the road corridor to the landscape character of adjacent views. No changes would be made to the road or its overlooks or parking areas if this option were implemented and would only result in a different use pattern for visitors. This would not result in any impacts to visual resources. However, it would be important to consider visual resource impacts when determining the need for additional signage. Additional signage would be kept to a minimum and their appearance and location would be reviewed by the park's landscape architect.

Cumulative Impacts. No cumulative impacts to visual resources would result from implementation of a temporal road closure option.

Impairment: There would be no additional impacts to visual resources from implementation of a temporal road closure option. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Grand Canyon National Park; (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or (3) identified as

a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of the park's visual resources.

Conclusion: There would be no additional impacts to visual resources from implementation of a temporal road closure option and thus there would be no impairment of park resources.

SOCIAL RESOURCES

VISITOR EXPERIENCE AND SAFETY

Affected Environment

Visitor Use

Visitor access to Hermit Road is primarily by free shuttle bus service provided by the park through Paul Revere Transportation (via the Hermits Rest Route) and by tour bus. The Hermits Rest Route operates daily March 1 to November 30 annually. Private vehicles are generally not allowed on the road during this time, except with an accessibility parking permit or a Backcountry Use Permit that includes Hermit Trail. The majority of visitors, then, must either ride the shuttle bus, hike or bicycle to access Hermit Road most of the year. Conflicts exist between bicyclists, buses and pedestrians on the roadway. All of these user groups share the road in many places, creating safety concerns.

Ridership for the Hermits Rest Route has greatly increased since 1974 when shuttles first began operating on Hermit Road. In 1974, annual ridership⁷ on this route was estimated at 371,839; in 2004, annual ridership on this route was estimated at 2,418,496. Since 1998, annual ridership on the Hermits Rest Route has consistently remained above two million (NPS 2005b). There are consistently long waiting times for visitors wanting to board the Hermits Rest Route. During peak season, visitors typically wait for two- to three buses to load before being able to access a bus and begin the route. Backcountry visitors also use the shuttle system and are included in the annual ridership estimates discussed in this paragraph. Shuttle buses run one hour before sunset to one hour after sunset, averaging every fifteen minutes. The route is approximately 75- minutes long, round trip. Westbound (outward from the Village to Hermits Rest) buses stop at eight locations during the route. These include

- Trailview Overlook
- Maricopa Point
- Powell Point
- Hopi Point
- Mohave Point
- The Abyss
- Pima Point
- Hermits Rest

Eastbound (inbound from Hermits Rest to the Village) buses provide a semi- express return service, stopping only at Mohave Point and Hopi Point (NPS 2005b).

⁷ Summer 2003 survey reported that the average rider boarded 4.5 times during their visit; numbers reported here are total boardings.

In a visitor study conducted in 1991, visitors exiting the park in automobiles and tour buses were asked which locations they visited during their park trip. Of those in cars, 45% said that they had visited Hermit Road: close to 25% of this total had visited Hermits Rest during their stay with close to 20% who visited Hermit Road but did not go all the way to Hermits Rest. Of tour bus riders, 45% said that they had visited Hermit Road as well; approximately 19% of this total had visited Hermits Rest and close to 26% had visited Hermit Road but did not go all the way to Hermits Rest. In comparison, over 65% of visitors in cars and 71% of visitors on tour buses had visited Grand Canyon Village. Visitors were asked to give an overall rating of their park visit. Approximately 94% of visitors surveyed in cars and 90% of visitors on tour buses gave ratings between very good, excellent and perfect (Albrecht, no date)

To elicit project- area specific visitor- use patterns, an exploratory study of rim hikers, bicyclists and shuttle bus riders was conducted during August and September 2005 (Weber 2005a). Study goals were to count the number of shuttle bus passengers loading and unloading at each bus stop along Hermit Road and to count the number of rim hikers and bicyclists, and their direction of travel, at several points along the road. Total numbers of off- boardings during a two- week (eight days total) sampling period in August are displayed in Table 10.

Table 10. Shuttle Bus Off- Loadings by Location, Number and Rank Order, Hermit Road Visitor Use Study, 2005.

Shuttle Stop	Off- Loadings	Rank (from highest use to lowest use)
Hopi Point	387	1
Pima Point	383	2
Mohave Point	282	3
Maricopa Point	251	4
Powell Point	245	5
Trailview	206	6
Abyss	196	7

Rim hikers and bicyclists were also counted during the study. Table 11 displays the peak number of visitors in each group by location surveyed during the August sampling period. At Hermits Rest rim hiker counts were of those visitors observed hiking the rim traveling in either a westerly or easterly direction from Pima Point, as shown in Table 11. No effort was made as part of this study to determine if these hikers might also be headed to, or returning from, the Hermit Trailhead. These totals, then, might also include some portion of visitors with backcountry permits.

The key findings from this limited study are the following (Weber 2005a):

- Visitor use patterns in the project area show considerable variability by time of day, with activity levels generally increasing earlier in the eastern end of the project area (nearest the Village) than in the western end (nearest Hermits Rest).
- Visitor use tends to be highest at the road ends. For example visitor counts and shuttle bus off- loadings were lowest at The Abyss (in the center of the project area) and higher at the other sites sampled.

Table II. Peak Number of Rim Hikers and Total Number of Bicyclists Observed During a Half- hour Period during August Sampling Period, Hermit Road Visitor Use Study, 2005

Location	Rim Hikers (1/2 hour daily peak)		Bicyclists (12 day total)	
	Traveling west	Traveling east	Traveling west	Traveling east
Trailview	50 at 1:30 – 2:00 p.m.	22 at 6:00 – 6:30 p.m.	21	22
Hopi	36 at 1:00 – 1:30 p.m.	26 at 1:00 – 1:30 p.m.	18	22
Abyss	12 at 1:00 – 1:30 p.m.	10 at 4:30 – 5:00 p.m.	9	10
Hermits Rest	39 at 2:30 – 3:00 p.m.	28 at 9:30 – 10:00 a.m.	10	10

- Visitors who began as rim hikers may ride the shuttle between stops and return on the shuttle, and people who began as riders may hike between shuttle stops.
- The number of bicyclists using the road is low.
- Shuttle buses at the Interchange are typically operating at 90- 100% capacity by mid- morning on a peak August day; this suggests that demand for seats exceeds supply. Visitors waiting in line at the bus stop have to wait for the second or third bus before boarding.

Visitor Facilities

Hermits Rest is located at the Hermit Road terminus. Hermits Rest provides a gift shop, snack bar, restrooms and seating, and is operated by the park concessionaire, Xanterra Parks and Resorts. There is a private- vehicle parking lot with limited accommodation for tour and shuttle buses. The Hermit Trail and trailhead area is west of Hermits Rest. This area includes an unpaved parking lot and information kiosk. Use of this area is limited to overnight backcountry users and day hikers.

Other overlook parking areas along Hermit Road provide parking for private vehicles and most are also designated shuttle bus stops (see listing of shuttle stops above).

The West Rim Trail is a paved for pedestrian use between the Interchange and Maricopa Point. After this point, pedestrians walk between overlooks via a relatively well- worn unpaved social trail along the rim. This unpaved trail is not maintained and is steep and narrow in many places, often following the edge closely. It is not easily maneuvered by wheelchairs or strollers and is often not wide enough for more than a single person going in one direction. The exception to this is the 1912 road corridor just west of The Abyss to near Hermits Rest. In this area, visitors often walk the old road alignment which is generally wide (six- to- ten feet or greater in places) and flat. Social trailing is very common in many areas between Hermit Road and the rim, as described in Chapter 1. Visitors choose to walk on the road in some locations either because there is no trail (the road is too close to the rim), or the unpaved rim trail is undesirable (unsafe or unusable, more difficult to maneuver, etc.).

Public Health and Safety

The safety of the public and employees is a focal point of the proposed road rehabilitation. NPS recognizes the road's poor condition (and thus unsafe nature) as a driving force in initiating road rehabilitation.

As summarized in Chapter I, a 2001 traffic engineering study documented a total of 63 accidents along Hermit Road from 1988 to 1999, including eight injury accidents, three of which involved pedestrians (USDOT 2001). A recent compilation of NPS and Paul Revere Transportation records on incidents related to Hermit Road and its associated shuttle bus stops since 1994, revealed that 20 incidents have been recorded on the road in the last 11 years. Three of these involved a shuttle bus and either a pedestrian or bicyclist and resulted in minor injuries. The remainder were primarily shuttle buses running into a sign or wall. A few documented two buses hitting mirrors while passing (Tuck and Lutch 2005). These records do not include near-misses.

NPS initiated a survey of shuttle bus drivers in 2005 to elicit drivers' observations and opinions on Hermit Road safety conditions. Questions were crafted to determine drivers' opinions regarding hazardous conditions or areas where special driver caution was warranted (Weber 2005b). General patterns from a compilation of responses include:

- The number of potentially hazardous encounters between either shuttle buses and pedestrians or bicyclists increases with the number of pedestrians and bicyclists using the area.
- Most responses from shuttle bus drivers indicated they needed to be especially cautious all along the road or at every curve and were not willing to highlight any particular stretch.
- Shuttle bus drivers would prefer to separate vehicular traffic from pedestrian and bicycle traffic.

NPS generally recognizes that due to the road's poor condition; the unraveling shoulders or lack of a shoulder in many places; the steep and loosely graveled shoulders that create unsteady footing and the lack of an easily-identifiable pedestrian path for the road length creates an unsafe environment for pedestrians and bicyclists on the road.

Environmental Consequences

Methodology

Baseline information used to assess impacts to visitor experience is described in the methodology section at the beginning of this chapter and includes park staff knowledge of the resources and site; review of existing literature and park studies; information provided by specialists within the National Park Service and other agencies and professional judgment. Detailed information on natural and cultural resources in Grand Canyon National Park summarized in the 1995 GMP and EIS was specifically referenced for information on affected resources in the project area. Additional visitor experience information sources used for this evaluation are as described above in the affected environment section.

Proposed activities have potential to impact visitor experience through:

- Visitors' ability to experience Hermit Road's resources and their natural and cultural resource settings (vistas, natural sounds and smells and wildlife viewing)
- Access and quality of movement through the project area (level of freedom, spontaneity, level of universal access)
- Access to high quality recreation opportunities (diverse recreation opportunities, tranquil/contemplative environments, social interactions with family/friends, bicycling, rim-hiking and access to backcountry areas)

- Visitors' potential for vehicle/pedestrian collisions, vehicle/bicycle collisions, vehicle/vehicle collisions and the potential for trips, falls, and injuries while hiking, especially near the rim

The thresholds of change for the intensity of an impact on visitor experience are defined as follows:

Negligible Visitors would likely be unaware of any effects associated with alternative implementation. No measurable change in the factors and conditions influencing potential number of vehicle, bicycle and pedestrian collisions or near misses along Hermit Road and in the number of trips, falls and near misses on trails along Hermit Road.

Minor Change in visitor use and/or experience would be slight but detectable, would affect few visitors and would not appreciably limit or enhance experiences identified as fundamental to the park's purpose and significance. There would be limited but identifiable changes in factors and conditions influencing potential number of vehicle, bicycle and pedestrian collisions or near misses along Hermit Road and in the number of trips, falls and near misses on trails along Hermit Road.

Moderate Some characteristics of visitor use and/or experience would change, and many visitors would likely be aware of effects associated with alternative implementation; some changes to experiences identified as fundamental to the park's purpose and significance would be apparent. There would be readily identifiable changes in several areas of the park in the factors and conditions influencing the potential number of vehicle, bicycle and pedestrian collisions or near misses along Hermit Road and in the number of trips, falls and near misses on trails along Hermit Road.

Major Multiple characteristics of visitor experience would change, including experiences identified as fundamental to park purpose or significance; most visitors would be aware of effects associated with alternative implementation. There would be clear and widespread changes throughout the project area in factors and conditions influencing number of vehicle, bicycle and pedestrian collisions or near misses along Hermit Road and in the number of trips, falls and near misses on trails along Hermit Road.

Duration Short-term during construction period. Long-term after construction complete.

Nature of Impact Beneficial reduction in potential number of collisions or near misses between vehicles, bicyclists and pedestrians; reduction in potential number of trips, falls and near misses on trails. Adverse potential number of collisions or near misses between vehicles, bicyclists and pedestrians; stays the same or increases; potential number of trips, falls and near misses on trails stays the same or increases

Alternative A – No Action

Direct/Indirect Impacts: Under the No- Action Alternative, existing facilities would remain in place, in essentially their current condition. No substantial changes would occur to Hermit Road, Hermits Rest, the West Rim Trail, the unpaved rim trail or overlooks and parking areas along the roadway. Minimally widening the road to its historic width would not result in any

measurable long- or short- term changes to the overall experience of visitors to the area, with two minor exceptions: the slightly wider road and improved road surface would provide a safer experience for pedestrians and bicyclists on the roadway by providing somewhat more room to move out of the travel lane when vehicles approach, and provide a more adequate surface to do this on; the slightly wider and improved road surface would provide a smoother surface and a somewhat wider travel lane for visitors in private vehicles, shuttles or tour buses. However, the road would still not meet current safety standards for bus traffic, so improvements in these experiences would be minimal and are considered beneficial, but negligible. No improvements would be made to trails; visitors would continue to have to make their way along multiple social trails between Maricopa Point and Hermits Rest and negotiate the poor asphalt surface of West Rim Trail between the interchange and Maricopa Point. No changes would be made to the pinch points where inadequate room exists between the roadway and the rim for visitors hiking the rim trail, so that pedestrians would share the narrow roadway in places with vehicle traffic. Overlook parking areas and pullouts would not be resurfaced and no other improvements for accessibility or safety would be made, so that existing inefficiencies in these areas would not be corrected. No changes would be made at Maricopa Point or to the access provided for rim hikers around the Orphan Mine, continuing the existing level of confusion in this area and the level of social trailing that exists.

Short- term moderate, adverse impacts to visitor experience are expected during the construction period, affected substantially by which road closure option (option 1, 2 or 3) is implemented. Implementation of option 1 or 2 would completely close the road past Mohave Point during the construction period and would restrict all access to Hermit Road by visitors (shuttle buses, tour buses, backcountry hikers wanting to access Hermit Trail, rim hikers and bicyclists). All these user groups would be required to use other areas of the park during the construction season (April – November) until construction was complete, or to limit their activities to that portion of the road before Mohave Point. This would eliminate any safety concerns with visitors in the construction zone during operations and would greatly reduce visitor exposure to loud construction noise, traffic delays, and temporary adverse impacts to the scenic quality of the area while construction was in progress.

For backcountry hikers wanting to access the Hermit Trail during the construction period under Options 1 or 2, they would be required to use alternative access to the Hermit Trail via the Waldron Trailhead; users would travel on maintained and unmaintained gravel roads to access the remote trailhead. The Waldron trailhead is located within recommended wilderness. Currently, approximately 2 – 3 miles of the access “road” to the trailhead are within the wilderness. This portion of the road has been signed closed to vehicular traffic due to its location within recommended wilderness. Users would be required to park their vehicles and walk the remainder of the distance to the trailhead from the wilderness boundary. If Road Closure Option 1 or 2 was implemented, the access to the Waldron Trail via this alternate route would need to be addressed. The road is not clearly signed as the designated access to the trail (so improvements to signage may be necessary) and it would require visitors having to hike an additional 2- 3 miles to access the trail, in addition to the additional distance required to travel by vehicle, compared to the existing level of access provided by the Hermit Trailhead at Hermits Rest.

It is expected that, while some overnight backcountry users and to a limited extent, day hikers, would choose to use alternate means of getting to the Hermit Trail (and Hermit Creek and

Monument Creek) via the Waldron Trailhead (as described above), many may choose to go to other areas of the backcountry instead. The Hermit Creek and Monument Creek designated campsite use areas, now primarily accessed via the Hermit Trailhead at Hermits Rest, are managed as “threshold” use areas and provide toilets and a natural water source. To displace backcountry users from this area to other areas of the backcountry managed as “primitive” could result in some safety issues for individuals with a lower degree of skill and knowledge. This possible displacement would also likely result in adverse impacts to the larger population of backpackers who would be competing for the same limited number of backcountry permits. Conversely, however, the potentially lower level of use in the Hermit Creek and Monument Creek areas during the construction period would have beneficial effects to those visitors traveling in the Hermit basin area due to experiencing fewer encounters (e.g. enhanced opportunity for solitude) in an area that typically receives moderate to high levels of use in the spring, fall and winter months.

Implementation of option 3, keeping limited visitor access to the project area during construction, would provide continued opportunity to all user groups to have access to the area and to the backcountry Hermit Trailhead (a positive result) but would provide a diminished quality of experience for a longer period of time (2 construction seasons over two peak visitor use seasons). Visitors would experience traffic delays (no longer than 15 minutes), exposure to construction noise and activities, and adverse impacts to the scenic quality of the area due to construction fencing, equipment and increased personnel in the area. The safety of visitors in the construction area would be a priority for project management, but visitors would be exposed to a less safe experience along Hermit Road under option 3 than if they were not allowed in the area at all.

Therefore, continuation of existing conditions under Alternative A would not change the long-term (once construction was complete) ability for visitors to experience Hermit Road’s resources; would not change visitors’ access and movement through the area, or access to high quality recreation opportunities; and would not change the existing level of vehicle/pedestrian, vehicle/bicycle, or vehicle/vehicle collisions or the potential for trips, falls or injuries while hiking. Alternative A would result in negligible, long- term beneficial impacts to visitor experience on Hermit Road. Short- term adverse impacts resulting from implementation of road closure option 1 would be moderate and adverse and option 2 would result in minor to moderate, adverse short- term impacts to visitor experience.

Cumulative Impacts: Many of the recently implemented and in- progress projects (Appendix E) improve visitor experience on the South Rim, some along Hermit Road as well, such as the improved restroom facilities at Hermits Rest and Hopi Point and South Rim viewpoint rehabilitation. The completion of Market Plaza shuttle bus stop, improved visitor facilities along shuttle bus routes and completion of other greenway trail segments (like greenway III) improve experiences park- wide for pedestrians and bicyclists. Future actions such as the South Rim Transportation Plan, Bright Angel Trailhead area design plan and greenway V trail would all benefit visitor experience on the South Rim by providing more varied experiences for all user groups (pedestrians, bicyclists, shuttle bus and tour bus riders). Implementation of these planned projects without taking action at this time to improve the experience and safety of visitors along Hermit Road would result in long- term cumulative adverse impacts to visitors by allowing inadequate services along Hermit Road to continue, but these would be minor, as many

other improvements in other areas of the South Rim would be implemented and would benefit visitors.

Conclusion: Implementation of Alternative A would result in negligible, long- term beneficial impacts to visitor experience on Hermit Road. Short- term adverse impacts resulting from implementation of road closure option 1 or 2 would be moderate and adverse and option 3 would result in minor to moderate, adverse short- term impacts to visitor experience. Cumulative impacts would be minor and adverse.

Alternative B – Widen for Safe Bus Access

Direct/Indirect Impacts. Widening the road to 24 feet would provide improved safety for visitors in all user groups and an improved visitor experience. The other aspects of Alternative B (overlook parking area improvements, trail improvements) would also benefit visitors using the Hermit Road corridor. Expected impacts to visitor experience, including public health and safety is described below.

Public health and safety: Alternative B does not completely separate user groups (bus riders, rim hikers, and bicyclists) but does make improvements over the existing condition. By widening the road, improving the road surface and providing a paved shoulder, the road would meet current safety standards for bus traffic. Bus riders would experience a smoother ride and less conflict between bicyclists and pedestrians on the roadway because of the increased width of the road and shoulder and the improved ability for pedestrians and bicyclists to safely move out of the travel lane when a bus is passing. In addition, widening of the roadway at pinch points would provide adequate width for pedestrians and bicyclists to move out of travel lanes when buses are approaching in these tight spots. Improvements to the West Rim Trail and the unpaved rim trail so that these are easier to follow and safer to use for pedestrians would reduce the attractiveness of walking on the roadway.

Improvements to overlooks and parking areas would provide a safer experience for visitors in these areas by delineating accessible shuttle bus loading and unloading areas, creating more even surfaces and improving wayfinding to nearby viewpoints. Alternative B would therefore result in reduced potential, over Alternative A, for vehicle/pedestrian, vehicle/bicycle, or vehicle/vehicle collisions or the potential for trips, falls or injuries while hiking.

Implementation of either Maricopa option 1 or 2 would provide a safer experience for visitors to this area. Both provide an improved trail network connecting pedestrians and shuttle bus riders to the rim trail east of Maricopa, the trail out to the overlook and the connector trail around Orphan Mine to Powell Point. Option 1 goes further in designating use areas and these trail connections by removal of the parking area and the closure of the parking area. This would restrict access to just shuttle riders and rim hikers. Bicyclists would continue to have access but would have to dismount from their bikes at the shuttle stop and walk to the overlook or to the connector trails east or west. Therefore, although there are some slight indirect consequences to visitor safety from these Maricopa options, both improve the safety of visitors and the differences between them would not be measurable.

Visitor safety would be affected by implementation of either road closure option 1, 2 or 3. The differences are as described for Alternative A and include an increased potential for safety risk, under option 3, associated with mixing traffic, pedestrians and bicyclists with construction

activities and traffic on a narrow roadway. If option 1 or 2 were implemented, visitors would not be put at risk within construction zones.

Visitor experience: Alternative B improves the existing situation for visitors in this area to experience the natural and cultural resources along Hermit Road, their access to, and quality of movement through, the area, and their access to high- quality recreation opportunities. These improvements are primarily through improvements at overlook parking areas and along existing trails. Overlook improvements are designed to provide universal accessibility for visitors in these areas and enhanced wayfinding. Trail improvements are designed to provide a trail network that is easier to follow and maneuver for visitors of varying ability levels while still providing a rural, rim- side experience. While Alternative B does not provide a universally accessible trail system, it does improve the existing condition so that the West Rim Trail and the unpaved rim trail would be free of substantial barriers and easier to find and follow. Widening and resurfacing the road improves the quality of the experience for visitors in vehicles by providing a smoother ride and less conflict with other users on the roadway.

Moving the shuttle stop from Hopi Overlook to the nearby Hopi Point would result in short-term adverse impacts to visitors due to the temporary confusion this might create, as it would be a change from the current shuttle stop. This change would be short- term and would be remedied by new signage and park publications documenting the changes.

Therefore, implementation of Alternative B would result in long- term minor beneficial impacts to visitor experience, including public health and safety, by road widening and improvements to overlooks and trails. As also described under Alternative A, moderate, short- term, adverse impacts would result from implementation of road closure option 1 due to restricted access to all visitors during the construction period. Option 2 would result in minor to moderate, adverse short- term impacts due to increased safety risk in construction zones during the construction period, but continued access to the project area. The experience for visitors in the construction zone would be adversely impacted by the increased noise and dust under option 2.

Cumulative Impacts: Many of the recently implemented and in- progress projects (Appendix E) improve visitor experience on the South Rim, some along Hermit Road as well, such as the improved restroom facilities at Hermits Rest and Hopi Point and South Rim viewpoint rehabilitation. The completion of Market Plaza shuttle bus stop, improved visitor facilities along shuttle bus routes and completion of other greenway trail segments (like greenway III) improve experiences park- wide for pedestrians and bicyclists. Future actions such as the South Rim Transportation Plan, Bright Angel Trailhead area design plan and greenway V trail would all benefit visitor experience on the South Rim by providing more varied experiences for all user groups (pedestrians, bicyclists, shuttle bus and tour bus riders). Implementation of these planned projects, combined with the implementation of Alternative B would result in long- term cumulative beneficial impacts to visitors by improving visitor access and the quality of their experiences throughout the South Rim. These beneficial impacts would be minor to moderate and long- term.

Conclusion: Implementation of Alternative B would result in long- term minor beneficial impacts to visitor experience, including visitor safety, by road widening and improvements to overlooks and trails. Short- term adverse impacts resulting from implementation of road closure option 1 would be moderate and adverse and option 2 would result in minor to moderate,

adverse short- term impacts to visitor experience. Cumulative impacts would be minor and beneficial.

Alternative C - Greenway

Direct/Indirect Impacts. Alternative C goes the furthest out of all alternatives in separating user groups throughout the project area and providing for a wider range of opportunities for pedestrians and bicyclists over a greater extent of the Hermit Road corridor. By providing for a full- length multi- use greenway trail between the Village and Hermits Rest, bicyclists would be able to ride, separated from vehicles on the roadway. Expected impacts to visitor experience and visitor safety are described below.

Public health and safety: Alternative C provides separation of user groups (bus riders, rim hikers, and bicyclists) but provides the most noticeable change over the existing condition of all alternatives. The road would meet current safety standards for bus traffic and bus riders would experience a smoother ride and less conflict between bicyclists and pedestrians on the roadway. With the increased width of the roadway and shoulder and the improved ability for pedestrians and bicyclists to safely move out of the travel lane when a bus is passing, beneficial impacts are realized. With the creation of a separated, fully accessible greenway trail, most bicyclists would likely use this separate path, thereby minimizing any continued conflict between buses and bicyclists on the roadway. Pedestrians may also choose to use greenway, especially family groups with strollers and young children. Improvements to the West Rim Trail and the unpaved rim trail so that these are easier to follow and safer to use for pedestrians would reduce the attractiveness of walking on the roadway. It is expected that the majority of pedestrians would continue to use the rim- side pedestrian trails instead of the greenway, although pedestrians in wheelchairs and other visitors who may simply prefer a wider, paved, accessible path, would use the greenway. As for Alternative B, improvements to overlooks and parking areas would provide a safer experience for visitors in these areas by delineating accessible shuttle bus loading and unloading areas, creating more even surfaces and improving wayfinding to nearby viewpoints. Alternative C would therefore result in a substantially reduced potential, over Alternative A or B, for vehicle/pedestrian, vehicle/bicycle, or vehicle/vehicle collisions. There would also be a reduced potential for trips, falls or injuries while hiking due to the greenway implementation and the improvements made to the West Rim and unpaved rim trails. It is possible, however, that Alternative C would result in slightly higher potential for pedestrian/bicyclist collisions due to both user groups on the greenway traveling in both directions and for pedestrian and bicycle conflicts with vehicles, due to the high number of greenway crossings on the roadway.

Implementation of Maricopa Point options is the same as that described for Alternative B.

Implementation of Road Closure options would be similar to that described for Alternative A and B, with one exception: Implementation of Alternative C, due to the construction of the greenway trail, would require up to two construction seasons to implement. This would likely not require a road closure during the second season, but perhaps periodic road delays during construction of portions of the greenway nearest road crossings. There is an increased safety risk associated with continued construction for the second season, but this would not be substantial as most of the work would be south of Hermit Road in an area not often frequented by visitors.

Visitor experience: Alternative C improves the existing situation for visitors in this area to experience the natural and cultural resources along Hermit Road, their access and quality of movement through the area, and their access to high- quality recreation opportunities. These improvements are primarily through the construction of a full- length multi- use greenway trail and improvements at overlook parking areas and along existing trails. Visitors (bicyclists, rim hikers and backcountry hikers) would be provided the opportunity, under Alternative C, to use the multi- use greenway to move through the project and to access Hermits Rest and the Hermit Trailhead, or to choose to use the unpaved rim trail or the roadway. Users of the greenway would be provided with a quieter experience than those using the roadway, through separation from vehicular traffic. However, access to rim views would be less than that provided by the unpaved, rim- side trail and greenway users would have to cross Hermit Road in several places to access overlooks and viewpoints. The segment of the greenway west of the Abyss to Hermits Rest, however, is north of the road and provides an enhanced experience for all greenway users for solitude and rim views away from vehicular traffic and noise.

Hopi Point would be closed to shuttle buses, tour buses, and other vehicles under Alternative C so that this overlook would only be accessed by bicyclists and pedestrians using the rim trail or the greenway. This would create an improved experience for bicyclists and pedestrians by limiting conflicts at this overlook with vehicles and providing a quieter and less congested experience. Visitors on shuttle buses would be able to access Hopi Overlook, a nearby overlook that is within easy walking distance of Hopi Point.

The benefits to visitor experience from overlook improvements and other trail improvements are the same as those described for Alternative B.

Therefore, implementation of Alternative C would result in long- term, moderate, beneficial impacts to visitor experience, including visitor safety, by road widening, construction of a separated greenway trail for the full- length of Hermit Road, and improvements to overlooks and trails. As also described under Alternative A and B, moderate, short- term, adverse impacts would result from implementation of road closure option 1 or 2 due to restricted access to all visitors during the construction period. Option 3 would result in minor to moderate, adverse short- term impacts due to increased safety risk in construction zones during the construction period. The experience for visitors in the construction zone would be adversely impacted by the increased noise and dust under option 3.

Cumulative Impacts: Many of the recently implemented and in- progress projects (Appendix E) improve visitor experience on the South Rim, some along Hermit Road as well, such as the improved restroom facilities at Hermits Rest and Hopi Point and South Rim viewpoint rehabilitation. The completion of Market Plaza shuttle bus stop, improved visitor facilities along shuttle bus routes and completion of other greenway trail segments (like greenway III) improve experiences park- wide for pedestrians and bicyclists. Future actions such as the South Rim Transportation Plan, Bright Angel Trailhead area design plan and greenway V trail would all benefit visitor experience on the South Rim by providing more varied experiences for all user groups (pedestrians, bicyclists, shuttle bus and tour bus riders). Implementation of these planned projects, combined with the implementation of Alternative C would result in long- term cumulative beneficial impacts to visitors by improving visitor access and the quality of their experiences throughout the South Rim. These beneficial impacts would be moderate and long- term. The completion of other segments of the greenway trail, in combination with the

construction of a greenway segment along Hermit Road to Hermits Rest would greatly enhance the opportunities for non- vehicular access to many parts of the South Rim, as envisioned in the 1995 GMP.

Conclusion: Implementation of Alternative C would result in long- term moderate, beneficial impacts to visitor experience, including visitor safety, by road widening, greenway trail construction and improvements to overlooks and trails. Short- term adverse impacts resulting from implementation of road closure option 1 or 2 would be moderate and adverse and option 3 would result in minor to moderate, adverse short- term impacts to visitor experience. Cumulative impacts would be moderate and beneficial.

Alternative D - Preferred

Direct/Indirect Impacts. Alternative D is very similar to Alternative C except that the length of the greenway trail is reduced and it does not follow the full length of Hermit Road, but provides a separated trail only from just west of the Abyss to Hermits Rest. The analysis presented below for both visitor safety and experience, focuses on this difference. The other aspects of Alternative D (trail improvements, overlook improvements and road widening) are the same as those described for Alternatives B and C.

Public health and safety: Alternative D provides separation of user groups (bus riders, pedestrians, and bicyclists) for approximately the last one- third of the roadway distance from the Village to Hermits Rest. With the creation of a separated, fully accessible greenway trail in this area, bicyclists would likely use this separate path, thereby minimizing any continued conflict between buses and bicyclists on the roadway, for this segment. However, bicyclists would continue to share the roadway with vehicles for the first two- thirds of Hermit Road. Pedestrians would likely choose to use the greenway after the Abyss also, as it is rim- side and provides an opportunity to move away from vehicular traffic on the road. Alternative D would therefore result in a somewhat reduced potential, over Alternative A or B, for vehicle/pedestrian, vehicle/bicycle, or vehicle/vehicle collisions, but would not go as far as Alternative C in reducing this potential since the greenway would occur for only approximately one- third of the distance. There would also be a reduced potential for trips, falls or injuries while hiking due to the greenway implementation and the improvements made to the West Rim and unpaved rim trails, more than for Alternatives A or B, but less than that expected for Alternative C. It is possible, however, that Alternative D would result in slightly higher potential for pedestrian/bicyclist collisions due to both user groups on the greenway traveling in both directions. This is possible, although considered negligible.

Implementation of Maricopa Point options is the same as that described for Alternative A and B.

Implementation of Road Closure options would be the same as described for Alternative B; Alternative D would take one construction season to implement under option 1, the same as that described for Alternative B.

Visitor experience: Alternative D improves the existing situation for visitors in this area to experience the natural and cultural resources along Hermit Road, their access and quality of movement through the area, and their access to high- quality recreation opportunities. These improvements would be more pronounced than Alternatives A and B because of the greenway trail construction, but less than that for Alternative C since the greenway would only be for a

portion of the distance to Hermits Rest. The greenway under Alternative D is entirely on the north side of the road and provides an enhanced experience for all greenway users for solitude and rim views away from vehicular traffic and noise.

A new outbound shuttle bus stop would be created, using an existing pullout, at the start of the greenway trail. This would provide easy access to the greenway for all users, including those with accessibility needs using the shuttle system. It would allow bicyclists who want to use the shuttle system to put their bicycles on the bike rack on the shuttle buses and get off with their bikes at the start of the greenway. It would allow rim hikers and other visitors with young children or other particular needs to ride the shuttle bus to the greenway start and then use the greenway to get to either Pima Point or to Hermits Rest (both with shuttle stops). A new inbound shuttle stop would be added to Pima Point to provide easy accommodation to all greenway users of all ability levels to access the shuttle system at logical points along the 3- mile greenway segment under Alternative D.

Moving the shuttle stop from Hopi Overlook to the nearby Hopi Point would result in short-term adverse impacts to visitors due to the temporary confusion this might create, as it would be a change from the current shuttle stop. This change would be short- term and would be remedied by new signage and park publications documenting the changes.

The greenway under Alternative D would not require any road crossings, as the entire length of the trail would be on the north side of Hermit Road. This would result in less potential for pedestrian/bicyclist conflicts with vehicles compared to Alternative C.

The benefits to visitor experience from overlook improvements and other trail improvements are the same as those described for Alternative B and C.

Therefore, implementation of Alternative D would result in long- term, minor to moderate, beneficial impacts to visitor experience, including visitor safety, by road widening, construction of a separated greenway trail for a portion of Hermit Road, and improvements to overlooks and trails. As also described under Alternative A and B, moderate, short- term, adverse impacts would result from implementation of road closure option 1 due to restricted access to all visitors during the construction period. Option 2 would provide continued access up to Mohave Point for several additional months, reducing the level of adverse impact expected with Option 1. Option 3 would result in minor to moderate, adverse short- term impacts due to increased safety risk in construction zones, but continued access during the construction period. The experience for visitors in the construction zone would be adversely impacted by the increased noise and dust under option 3.

Cumulative Impacts: Many of the recently implemented and in- progress projects (Appendix E) improve visitor experience on the South Rim, some along Hermit Road as well, such as the improved restroom facilities at Hermits Rest and Hopi Point and South Rim viewpoint rehabilitation. The completion of Market Plaza shuttle bus stop, improved visitor facilities along shuttle bus routes and completion of other greenway trail segments (like greenway III) improve experiences park- wide for pedestrians and bicyclists. Future actions such as the South Rim Transportation Plan, Bright Angel Trailhead area design plan and greenway V trail would all benefit visitor experience on the South Rim by providing more varied experiences for all user groups (pedestrians, bicyclists, shuttle bus and tour bus riders). Implementation of these

planned projects, combined with the implementation of Alternative D would result in long-term cumulative beneficial impacts to visitors by improving visitor access and the quality of their experiences throughout the South Rim. These beneficial impacts would be minor to moderate and long-term. The completion of other segments of the greenway trail, in combination with the construction of a greenway segment under Alternative D would enhance the opportunities for non-vehicular access to many parts of the South Rim, as envisioned in the 1995 GMP.

Conclusion: Implementation of Alternative D would result in long-term, minor to moderate, beneficial impacts to visitor experience, including visitor safety, by road widening, greenway trail construction and improvements to overlooks and trails. Short-term adverse impacts resulting from implementation of road closure option 1 or 2 would be moderate and adverse. Option 3 would result in minor to moderate, adverse short-term impacts to visitor experience. Cumulative impacts would be minor to moderate and beneficial.

Temporal Road Closure

Direct/Indirect Impacts. Implementing this daily closure to vehicles would have a beneficial impact to pedestrians and bicyclists along the Hermit Road corridor. Closing the road to vehicles March – November, 7 am to 10 am daily, would substantially decrease vehicle noise and vehicle/pedestrian and vehicle/bicycle conflicts and the potential for collisions between these user groups for the closure period during the 9 month period. Hermit Road would be vehicle-free for this daily closure period, allowing all other non-motorized users full access to the roadway, overlooks and parking areas and trails without vehicle traffic (although exceptions would be made for emergency vehicle access).

Visitors using shuttle buses or tour buses would not be allowed access to Hermit Road beyond Mohave Point for the daily closure period, March – November. This would adversely impact these visitor groups by restricting their access to the entire road and to Hermit's Rest. However, this impact is minimized by continuing to allow shuttle and tour bus access to overlooks and viewpoints prior to Mohave (approximately one-third of the road's distance) and allowing shuttle and tour bus access prior to 10 am and from 10 am to sunset, daily. Shuttles running in the summer and shoulder seasons typically begin as early as 4 am and accommodate early morning hikers and this would not change with the implementation of the temporal closure. The temporal road closure option provides for a greater variety of experiences for a greater number of users and therefore would result in a moderate beneficial impact to visitor experience, if implemented with any one of the other alternatives.

A daily road closure to vehicles would likely work best with implementation of Alternative A or B where it would provide for a temporal separation between pedestrians/bicyclists and vehicles instead of a physical one, as is done through Alternative C, and to a lesser extent, with Alternative D. Implementation of Alternative C or D would not preclude the use of a temporal road closure if selected for implementation, just would not result in as notable a benefit if implemented with Alternative A or B.

Cumulative Impacts. Past and reasonably foreseeable future actions are as described under Alternatives A - D. Direct and indirect long-term impacts from implementing a temporal road closure would be moderate and beneficial. This change, combined with past and reasonably foreseeable future actions would result in a cumulative impact that is beneficial and minor to moderate, very similar to those impacts described for Alternative C and D. Therefore,

cumulative impacts from implementing a temporal road closure with foreseeable future projects would be beneficial, moderate, and long- term.

Conclusion: Implementing a temporal road closure option would result in long- term, moderate, direct and indirect beneficial impacts, and moderate beneficial cumulative impacts to visitor experience.

PARK OPERATIONS

Affected Environment

Park operations refer to the adequacy of staffing levels and the quality and effectiveness of park infrastructure in protecting and preserving vital resources and providing for effective visitor experience. Infrastructure facilities include roads providing access to and within the park (both administrative and visitor use), housing for staff required to work and live in the park, visitor orientation facilities (visitor centers, developed and interpreted sites and other interpretive features), administrative buildings (park staff office and workspace), management- support facilities (garages, shops, storage buildings and yards used to house and store maintenance equipment, tools and materials) and utilities such as phones, sewer, water and electric. For this project, infrastructure with potential to be affected includes the road itself, associated parking areas and Hermits Rest.

The Grand Canyon National Park superintendent is ultimately responsible for park operations management. In 2003, the park employed 462 full- time staff (NPS 2006c) to manage operations including visitor services and facilities, resource management and preservation, planning and environmental compliance, emergency medical services, law enforcement, search and rescue operations, fire center operations, air operations, facilities management and maintenance and administrative duties. The divisions with responsibility over Hermit Road and visitor and employee area use are the Facilities Management Division (road, trail and restroom maintenance); Visitor and Resource Protection (visitor safety); Visitor Education and Interpretation (wayfinding and interpretive programs at some overlooks, at Hermits Rest and along the 1912 corridor near Pima Point); Science Center (resource protection) and Concessions Management (administration of contracts with concessionaires and transportation partners).

An air quality monitoring station occurs in the project area, approximately 0.15 miles south of Hermit Road at an old quarry site. It houses expensive scientific collecting equipment and has been collecting long- term air quality data. No actions currently proposed have potential to impact the site nor would result in any changes in the station's ability to collect data. The NPS also maintains the Hermit Trailhead parking area. No actions currently proposed have potential to impact this area, although construction activities resulting in restrictions or road closures may affect the park's ability to access this area for maintenance or visitor protection activities.

Paul Revere Transportation is under contract with the park to operate the shuttle bus system, including the Hermits Rest Route. Xanterra Parks and Resorts is the current concessionaire under park contract to operate bus tours on Hermit Road. Xanterra also operates the gift shop and snack bar at Hermits Rest.

Environmental Consequences

Methodology

Baseline information used to assess impacts to park operations is described in the methodology section at the beginning of this chapter and includes park staff knowledge of the resources and site; review of existing literature and park studies; information provided by specialists within the National Park Service and other agencies and professional judgment. Detailed information on natural and cultural resources in Grand Canyon National Park summarized in the 1995 GMP and EIS was specifically referenced for information on affected resources in the project area. Additional park operations information sources used for this evaluation are as described above in the affected environment section.

Proposed activities have the potential to impact park operations through:

- ❑ Shuttle bus and tour bus operations (Paul Revere Transportation and Xanterra Parks and Resorts)
- ❑ Concessionaire facility operations (Xanterra Parks and Resorts)
- ❑ Long- term maintenance and operational efficiency (NPS).

The thresholds of change for the intensity of an impact on park operations are defined as follows:

Negligible a change in operations that is not measurable or perceptible.

Minor a change in operations that is slight and localized with few measurable consequences.

Moderate readily apparent changes to park operations with measurable consequences.

Major a severely adverse or exceptionally beneficial change in park operations.

Duration Short- term during construction period. Long- term after construction complete.

Alternative A – No Action

Long- term Direct/Indirect Impacts, After Construction is Complete: NPS maintenance and operational efficiency: Minimally widening the road and resurfacing would result in a slight decrease in overall road maintenance for the first five years or more following construction. This is a positive change, compared to the existing condition. However, because Alternative A only includes a partial replacement of the base course and essentially maintains the existing narrowness of the road, unraveling of the road edge is expected over time due to the continued use by large buses. Pothole formation may also occur sooner under this alternative than with the action alternatives. Alternative A does not include improvements to any other trails or parking areas so that these areas would continue to require on- going, long- term maintenance of these facilities.

Minimally improving the road condition has the potential to reduce the number of accidents, requiring somewhat fewer responses from NPS visitor and resource protection personnel than

the existing condition. However, these improvements would be slight and would not result in any measurable changes in NPS operational efficiency.

Shuttle and tour bus operations and concessionaire facilities: The road surface would be improved under this alternative which is expected to reduce damage to shuttle buses and tour buses and would improve safety issues related to the existing unraveling road edges. While the slightly wider and uniform width to 20 feet would be an improvement over the existing condition, it would still remain too narrow to meet current safety standards for bus traffic. Alternative A would not result in any changes to the maintenance or operation of the Hermits Rest gift shop.

For these reasons, the long- term impacts to park operations from implementing Alternative A would be beneficial, but negligible to minor. While some improvement in road condition would result in slightly improved safety conditions and somewhat less maintenance over time, it would result in few measurable changes over the existing condition, in the long- term.

Short- term Direct/Indirect Impacts (During Construction Period): The implementation of either Option 1, 2 or 3 during the construction period would result in differences in NPS maintenance and operational efficiency.

NPS maintenance and operational efficiency: If Option 1 were selected, park maintenance (trash pick- up, restroom cleaning and vault pumping, snow removal) would not be necessary during the one- season construction period and emergency/visitor protection operations on the roadway would be minimal during the closure period. Access to the air quality monitoring station (weekly trips are necessary year- round as well as other occasional visits for maintenance, repair, calibration of equipment, etc.) would be affected and would be required to use dirt roads south of Hermit Road, as passable, during the construction period. If Option 2 were selected, some maintenance would need to occur on the eastern portion of the road and additional portable toilets would need to be placed and maintained at Mohave Point, but maintenance needs are not expected to be more than current operations. Emergency/visitor protection operations would still need to occur on the east portion of the road, when open and would be similar to Option 1. Access to the air quality monitoring station would be restricted as under Option 1. If Option 3 were selected, necessary maintenance would need to occur all along the road corridor, the same as current operations, but would need to account for traffic delays along the roadway. Emergency/visitor protection operations have the potential to increase due to the higher potential for accidents during the construction period (conflicts with construction activities and visitors for two full seasons). Response time during an emergency situation could be hindered by construction activities. Access to the air quality monitoring station would not change with implementation of Option 3.

Shuttle and tour bus operations and concessionaire facilities: Option 1 would result in a substantial loss of revenue to the shuttle bus operator (Paul Revere Transportation) due to a cut back in the level of shuttle bus service on the Hermits Rest Route for an entire year (the existing 3- month winter closure period to shuttles, in addition to the 9- month construction season). This could potentially be minimized by offering a higher level of service on other existing shuttle bus routes, such as the Village and Kaibab Trail routes. Option 1 would also result in loss of revenue for up to 9 months for concessionaire tour bus operations (Grand Canyon Railway and Xanterra Parks and Resorts) and for the concessionaire operation at Hermits Rest for up to 9

month. Hermits Rest residents, concessionaire employees, would be displaced during the construction period as well. It is possible that, to mitigate the loss of revenue to tour bus operations, alternative tour locations in other areas of the South Rim could be provided during the closure period.

Like Option 1, Option 2 would result in loss of revenue at Hermits Rest for the full 9- month closure period, but revenue losses for tour buses would only last approximately 5 months, since tours could continue to use the eastern portion of the road for 4 months. Hermits Rest residents would be displaced. Shuttle operations could continue on the eastern portion of the road for 4 months but would need to shut down for the remainder of the construction period (5 months), resulting in a loss of revenue. Like Option 1, this impact could be minimized by offering a higher level of service to other existing shuttle routes in the park. Impacts to park emergency/visitor protection operations would be similar to Option 1 but operations would continue, as necessary, on the east portion of the road for 4 months.

Option 3, keeping the road open during the construction period, would result in construction duration twice as long as Option 1 or 2. However, it would allow shuttle and tour bus operations to continue, Hermits Rest to remain open and Hermits Rest residents to remain in their homes. However, it is expected that some reduction in revenue at Hermits Rest would result due to the inconvenience to visitors from traveling through the construction zone to get to Hermits Rest. Because there would be periodic traffic delays, tour bus routes may need to be altered somewhat to accommodate longer route times and shuttle bus routes would also need to accommodate delays into their schedules. Continued operation of the shuttle system on Hermit Road during two construction seasons would substantially increase safety risks and substantially reduce the quality of experience for shuttle riders, as described in the visitor experience section of this chapter.

For these reasons, the short- term impacts to park operations during the construction period would be adverse and moderate, regardless of the option selected for road closure during the construction period. Adverse impacts to operations would be readily apparent and would have measurable consequences. Differences are apparent when comparing shuttle bus operations, tour operations, concessionaire facilities, maintenance operations, and park emergency/visitor protection operations for each option, but taken as a whole, the effects would be moderate. All park operations components considered, Option 2 would result in a compromise between Option 1 and 3 so that some level of service (shuttle and tour bus) for the eastern portion of the road could be continued for almost half of the construction period and still allows for a one year construction season, so that Option 2 is the preferred option from a park operations standpoint.

Cumulative Impacts. Combining implementation of past, present and reasonably foreseeable future actions with implementation of Alternative A would result in beneficial impacts to park operations. The benefits of improved park facilities that have resulted from past and current actions as well as those planned would likely outweigh the long- term adverse impact of only minimally repairing Hermit Road. While Hermit Road would continue to need improvement and require chip sealing and some repair, this would be overshadowed by other areas of the park that have been improved and now require less maintenance. These cumulative impacts to park operations would be minor to moderate and beneficial.

Conclusion: Implementation of Alternative A would result in negligible to minor, long- term impacts to park operations. While some improvement in road condition would result in slightly improved safety conditions and somewhat less maintenance over time, it would result in few measurable changes over the existing condition, in the long- term. Short- term adverse impacts during the construction period would be adverse. All aspects of park operations considered, Road Closure Option 2 is preferred for implementation during the construction period.

Alternative B – Widen for Safe Bus Access

Long- term Direct/Indirect Impacts, After Construction is Complete: NPS maintenance and operational efficiency: Widening the road to 24 feet, adequate subgrade replacement and the other improvements to the road and to overlooks and trails to improve safety and accessibility would result in beneficial impacts to park operations. There would be a decrease in overall road maintenance for the first five years or more following construction and the additional width would result in less likelihood for road edge unraveling over time. There would be a decrease in maintenance needs for existing trails due to rebuilding of the West Rim Trail and minor improvements to the unpaved rim trail. Widening the road and improving the road condition has the potential to reduce the number of accidents, requiring somewhat fewer responses from NPS visitor and resource protection personnel than the existing condition. Operational efficiency is expected to improve with implementation of Alternative B, over the existing condition.

Shuttle and tour bus operations and concessionaire facilities: The road surface and width would be improved under this alternative which would provide enhanced safety for all road users, as adequate space is provided for passing and other routine shuttle and tour bus operations. Improvements at overlooks to better accommodate shuttle bus and tour bus use (concrete braking pads, improved walkways, accommodations for better bus turning radii and maneuverability, enhanced signage, etc.) would benefit the operational efficiency of bus operations and would improve the experience of bus passengers. However, Alternative B would not separate user groups (buses, bicyclists and pedestrians); bicyclists would continue to share the roadway with buses and pedestrians would continue to use the roadway in some areas. While improvements would be made to the West Rim Trail and the unpaved rim trail, these trails would not be universally accessible, would not accommodate persons with disabilities and may not be desirable for families with small children or others with special needs. For these reasons, these users may continue to walk the road in many places. This situation would be ameliorated by widening the road at pinch points and providing a wider road in this area for pedestrians. Bicyclists would continue to use the road. It is likely that bicyclists would use the paved shoulder provided under Alternative B, which would provide more distance between a passing bus and a bicyclist, but it would not meet the requirements of a standard bicycle lane. Alternative B would not result in any changes to the maintenance or operation of the Hermits Rest gift shop.

Implementation of either Option 1 or 2 for Maricopa Point would result in beneficial impacts to park operations by improving surfaces, signage and walkways. Option 1, removal of the parking area and creation of a new shuttle bus adjacent to the roadway would result in slight benefits to shuttle bus operations by providing easier and faster access to the bus stop than Option 2, where buses would continue to access the parking area, drop passengers off and then exit the parking area using the existing access roads. Option 1 also restricts access to tour buses and other private vehicles, resulting in less potential for shuttle bus conflicts with other large buses or private

vehicles. While either option would improve the existing condition and would provide an adequate shuttle bus stop, Option 1 goes somewhat further in reducing the potential for accidents and improving operational efficiency. For these reasons, the long-term impacts to park operations from implementing Alternative B would be beneficial and minor to moderate, primarily due to the improvements in road condition resulting in safer bus operations and somewhat reduced maintenance needs.

Changing the shuttle stops from Hopi Overlook to Hopi Point would result in a slight increase in route times for shuttle buses due to the longer distance into and out of Hopi Point.

For these reasons, the long-term impacts to park operations from implementing Alternative B would be beneficial, but minor. While some improvement in road condition would result in improved safety conditions, improved bus facilities at overlooks and parking areas, and somewhat less maintenance over time, it would not completely address the fact that pedestrians and bicyclists would still share the road with buses which creates safety risks.

Short-term Direct/Indirect Impacts (During Construction Period): The impacts of road closure options during the construction period are the same as those described for Alternative A.

Cumulative Impacts. Combining implementation of past, present and reasonably foreseeable future actions with implementation of Alternative B would result in beneficial impacts to park operations. The benefits of improved park facilities that have resulted from past and current actions as well as those planned, in combination with improvements along Hermit Road as part of this alternative, would improve park operations. This cumulative impact to park operations would be minor to moderate and beneficial.

Conclusion: Implementation of Alternative B would result in minor, long-term beneficial impacts to park operations. While some improvement in road condition would result in improved safety conditions, improved bus facilities at overlooks and parking areas, and somewhat less maintenance over time, it would not, however, completely address the situation that pedestrians and bicyclists would still share the road with buses which creates some safety risk. Short-term adverse impacts during the construction period would be adverse. All aspects of park operations considered, Road Closure Option 2 is preferred for implementation during the construction period.

Alternative C - Greenway

Long-term Direct/Indirect Impacts, After Construction is Complete: NPS maintenance and operational efficiency: Widening the road to 24 feet, adequate subgrade replacement and the other improvements to the road and to overlooks and trails to improve safety and accessibility (actions common to Alternatives B, C and D) would result in beneficial impacts to park operations, and are as previously described for Alternative B. The construction of a 7.5 mile long greenway trail under Alternative C is the difference between Alternative C and B and provides for separation of buses and bicyclists/pedestrians for the entire distance from the Village to Hermits Rest. From an NPS operational standpoint, this would result in 7.5 miles of additional paved trails to maintain over the long-term and an approximately 0.2 full-time employee to be responsible for the intermittent maintenance necessary for this addition to park facilities (snow removal, vegetation clearing, etc.)

Shuttle and tour bus operations and concessionaire facilities: Widening the road to 24 feet, adequate subgrade replacement and the other improvements to the road and to overlooks and trails to improve safety and accessibility (actions common to Alternatives B, C and D) would result in beneficial impacts to shuttle and tour bus operation, and are as previously described for Alternative B. The construction of a 7.5 mile long greenway trail under Alternative C is the difference between Alternative C and B and provides for separation of buses and bicyclists/pedestrians for the entire distance from the Village to Hermits Rest. Providing a trail for bicyclists and pedestrians separated from the roadway allows for a safer situation for these users but also for those operating shuttle buses. Having fewer pedestrians and bicyclists sharing the roadway would result in less distraction for bus drivers, allowing them to focus on their primary duties. Alternative C may also result in an increase in activity at Hermits Rest (and the gift shop) by increasing the ease of walking and cycling to this area. However, approximately 14- 21 crossings would be necessary along the roadway to accommodate greenway users accessing viewpoints and overlooks on the north side of the road. Shuttle and tour bus operators would need to be cognizant of these frequent crossings on the roadway.

Implementation of Maricopa Point Option 1 or 2 is the same as that described for Alternative B.

Under Alternative C, Hopi Point would be closed to shuttle buses and tour buses and would only be accessed by greenway users and rim trail users, as described in the 1995 GMP. Shuttle buses would continue to stop at Hopi Overlook, where visitors would be able to access Hopi Point by walking a short distance between the two points. Shuttles currently use Hopi Point as a stop only during sunset, for which it is quite popular, with several buses accommodating the large groups of people who want to return to the Village after sunset from this point. With a vehicle closure, the current shuttle operation would shift to Hopi Overlook. Tour buses use Hopi Point at all times of the day and this operation would also shift to Hopi Overlook.

An air quality monitoring station occurs south of the road and would be within approximately 0.15 miles of the greenway trail under Alternative C. While this proximity would not result in any direct impact to the way in which data are collected or the overall operation and function of the station, it may be necessary to fence the area, as the greenway would cross the access road into the site and may result in some visitors exploring in this area. An integral design feature of Alternative C (as listed in Chapter 2) is the consideration of fencing or other barriers to this important park facility, if disturbance to the site is likely.

For these reasons, the long- term impacts to park operations from implementing Alternative C would be beneficial, and minor to moderate. The improvement in road condition would result in improved safety conditions, improved bus facilities at overlooks and parking areas, and somewhat less maintenance (of existing facilities) over time. It also provides for a separation of bicyclists and pedestrians from the roadway, providing enhanced safety and efficiency of the shuttle and tour bus operation. It would, however, result in the need for more long- term maintenance by adding an additional 7.5 miles of paved trail to the park's facilities, requiring an estimated 0.2 full time employees for the intermittent maintenance needs.

Short- term Direct/Indirect Impacts (During Construction Period): The impacts of road closure options during the construction period are the same as those described for Alternative A and B, except that with Alternative C the construction period is twice as long as with either Alternative A, B or D. By having to construct a greenway for the full length of Hermit Road, it would require

two full construction seasons to implement with either Road Closure Option 1 or 2. For Road Closure Option 3, it would likely require at least 3 construction seasons to implement. For these reasons, implementation of Option 1 or 2 would be the most preferred from a park operations standpoint, so that the construction would not need to occur for a third season.

Cumulative Impacts. Combining implementation of past, present and reasonably foreseeable future actions with implementation of Alternative C would result in beneficial impacts to park operations. The benefits of improved park facilities that have resulted from past and current actions as well as those planned, in combination with improvements along Hermit Road, including the greenway trail, as part of this alternative, would improve park operations. This cumulative impact to park operations would be minor to moderate and beneficial.

Conclusion: Implementation of Alternative C would result in minor to moderate, long- term beneficial impacts to park operations. The improvement in road condition would result in improved safety conditions, improved bus facilities at overlooks and parking areas, and somewhat less maintenance (of existing facilities) over time. It also provides for a separation of bicyclists and pedestrians from the roadway, providing enhanced safety and efficiency of the shuttle and tour bus operation. It would, however, result in the need for more long- term maintenance by adding an additional 7.5 miles of paved trail to the park's facilities, requiring the estimated addition of 0.2 full time employees for intermittent maintenance needs. Short- term adverse impacts during the construction period would be adverse. All aspects of park operations considered, Road Closure Option 1 or 2 is preferred for implementation during the construction period, both of which would still require two construction seasons to implement, due to the additional construction necessary for the greenway trail.

Alternative D - Preferred

Long- term Direct/Indirect Impacts, After Construction is Complete: NPS maintenance and operational efficiency: Widening the road to 24 feet, adequate subgrade replacement and the other improvements to the road and to overlooks and trails to improve safety and accessibility (actions common to Alternatives B, C and D) would result in beneficial impacts to park operations, and are as previously described for Alternative B. Impacts from greenway trail construction are similar to those described for Alternative C except that the length of the greenway would be less for Alternative D. Alternative D proposes an approximately 2 mile long greenway segment, starting just west of the Abyss. This provides for separation of buses and bicyclists/pedestrians for a portion of the road, starting about mid- way between the Village and Hermits Rest. From an NPS operational standpoint, this would result in 2 miles of additional trails to maintain over the long- term. It is unlikely this would require the programming for additional full time staff, it would be an added responsibility to the facilities management division and the intermittent maintenance necessary for this addition to park facilities (snow removal, vegetation clearing, etc.) would need to be programmed into annual work schedules. Alternative D would also require the addition of a new shuttle bus stop (West Abyss Shuttle Stop) at the beginning of the greenway. This would add an additional location along Hermit Road where trash cans would need to be emptied and signs and other amenities would require periodic maintenance.

Shuttle and tour bus operations and concessionaire facilities: Widening the road to 24 feet, adequate subgrade replacement and the other improvements to the road and to overlooks and trails to improve safety and accessibility (actions common to Alternatives B, C and D) would

result in beneficial impacts to shuttle and tour bus operation, and are as previously described for Alternative B. Alternative D proposes an approximately 2 mile long greenway segment, starting just west of the Abyss. This provides for separation of buses and bicyclists/pedestrians for a portion of the road, starting about mid- way between the Village and Hermits Rest. Providing a trail for bicyclists and pedestrians separated from the roadway allows for a safer situation for these users but also for those operating shuttle buses. Having fewer pedestrians and bicyclists sharing the roadway would result in less distraction for bus drivers, allowing them to focus on their primary duties. However, this separation would only occur for the last approximately one-third of the distance to Hermits Rest, resulting in benefits that, overall, are more similar to those described for Alternative B than C. Alternative D would not require any greenway trail crossings of Hermit Road. Alternative D may also result in an increase in activity at Hermits Rest (and the gift shop) by increasing the ease of walking and cycling to this area, but this potential is considered less for Alternative D than that expected for Alternative C.

A new shuttle bus stop (West Abyss Shuttle Stop) would be constructed, using an existing pullout, at the beginning of the greenway trail. This would add an additional location along Hermit Road where shuttles would be required to stop on the outbound route (shuttles currently make 8 stops on their way to Hermits Rest) and may add some additional time to the length of the route. Alternative D also includes the addition of an inbound shuttle stop at Pima Point, to facilitate greenway users who may want to return to the Village without having to hike to Hermits Rest. This would also add additional time the length of the return route (shuttles buses, upon leaving Hermits Rest, only stop at two locations; Mohave and Hopi Point on their semi- express route to the Village).

Implementation of Maricopa Point Option 1 or 2 is the same as that described for Alternative B.

Changing the shuttle stops from Hopi Overlook to Hopi Point would result in a slight increase in route times for shuttle buses due to the longer distance into and out of Hopi Point.

For these reasons, the long- term impacts to park operations from implementing Alternative D would be beneficial, and minor to moderate. The improvement in road condition would result in improved safety conditions, improved bus facilities at overlooks and parking areas, and somewhat less maintenance (of existing facilities) over time. It also provides for a separation of bicyclists and pedestrians from the roadway, but for a substantially shorter distance than that provided under Alternative C. It would result in the addition of one new inbound shuttle stop and an outbound stop (using an existing stop) and would require some additional long- term maintenance above the existing condition.

Short- term Direct/Indirect Impacts (During Construction Period): The impacts of road closure options during the construction period are the same as those described for Alternative A and B.

Cumulative Impacts. Combining implementation of past, present and reasonably foreseeable future actions with implementation of Alternative D would result in beneficial impacts to park operations. The benefits of improved park facilities that have resulted from past and current actions as well as those planned, in combination with improvements along Hermit Road, including the greenway trail, as part of this alternative, would improve park operations. This cumulative impact to park operations would be minor to moderate and beneficial.

Conclusion: Implementation of Alternative D would result in minor to moderate, long-term beneficial impacts to park operations. The improvement in road condition would result in improved safety conditions, improved bus facilities at overlooks and parking areas, and somewhat less maintenance (of existing facilities) over time. It also provides for some separation of bicyclists and pedestrians from the roadway, providing enhanced safety and efficiency of the shuttle and tour bus operation. It would, however, result in the need for some additional long-term maintenance by adding an additional 2 miles of trail and a new shuttle bus stop to the park's facilities. Short-term adverse impacts during the construction period would be adverse. All aspects of park operations considered, Road Closure Option 2 is preferred for implementation during the construction period.

Temporal Road Closure

NPS maintenance and operational efficiency: Implementing a daily vehicle closure would not require changes to the roadway nor any substantial changes to infrastructure or facilities. It would require additional patrols by NPS emergency/visitor protection personnel prior to each daily closure and assistance in implementing gate closures and openings, 7 days a week for 9 months of the year. It would not require any additional maintenance, although scheduled maintenance on the roadway (trash removal, trail work, snow removal, etc.) would need to be coordinated with the daily closure period.

Shuttle and tour bus operations and concessionaire facilities: Implementing a 3 hour long, daily vehicle closure during the existing shuttle bus season (March – November) would require modification of the contract that is currently in place for shuttle operations and tour operations to reduce the number of operational hours on Hermit Road. The closure is likely to cause some level of visitor confusion, at least at its initiation, resulting in shuttle bus and tour bus operators, in addition to park staff, having to answer questions and provide assistance as necessary. Hermits Rest gift shop and snack bar would likely show a reduction in sales as fewer visitors during the daily closure period would reach the end of Hermit Road. This impact is minimized by the closure period ending at 10 am daily, prior to the peak use period for shuttle buses and tour buses.

For these reasons, implementation of a temporal road closure would result in minor adverse impacts to park operations.

Cumulative Impacts. Combining implementation of past, present and reasonably foreseeable future actions with implementation of a temporal road closure would result in beneficial impacts to park operations. The benefits of improved park facilities that have resulted from past and current actions as well as those planned, in combination with improvements along Hermit Road, under any action alternative, and implementation of a temporal road closure would improve park operations. While this temporal road closure option would result in a minor adverse impact, it would be outweighed by the beneficial impacts realized by other past, current and future projects. This cumulative impact to park operations would be minor to moderate and beneficial.

Conclusion: Implementation of a temporal road closure, in combination with any of the action alternatives, would result in minor adverse impacts to park operations, due to a reduction in shuttle and tour operations, a possible reduction in revenue at the Hermits Rest gift shop and snack bar and some increased patrol by NPS visitor protection personnel.

Chapter 4 Consultation and Coordination

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Agency Consultation & Public Involvement

NPS began the public scoping process in June 2004 with the distribution of a general scoping letter describing several preliminary alternatives under consideration for Hermit Road rehabilitation. This letter was distributed to the park's approximately 280- person compliance mailing list, which includes state and Federal agencies and Native American tribes, was posted on the park's website and was included in a press release. Recipients were asked to respond with issues or concerns with the alternatives described, and with whether they wished to receive a copy of the Environmental Assessment when distributed for public review. The twenty- three letters and e- mails received are briefly described in Chapter 1.

NPS used this scoping response, in combination with other input from the project IDT and other NPS staff to re- evaluate the project's purpose, need and objectives. Based on this, NPS developed a preliminary project proposal designed to best meet the purpose and need for taking action and the specific project objectives identified. This preliminary project proposal was described in a second public scoping letter in June 2005 requesting issues and concerns. This letter was sent to the same mailing list used for the initial 2004 scoping. Fourteen letters and e- mails were received and are listed in Chapter 1. Comments are summarized in Appendix B.

As part of the effort to solicit input, NPS coordinated closely with Xanterra Parks and Resorts, Inc., the concessionaire that operates Hermits Rest Gift Shop and commercial bus tours on Hermit Road, and with Paul Revere Transportation, the company under park contract to operate the shuttle bus system.

State Historic Preservation Office NPS initiated consultation with SHPO and requested comments on several preliminary alternatives under consideration, and input on the framework for consultation under Section 106 of NHPA in June 2004, in a letter distributed during the first public scoping period. In response, SHPO sent a letter dated 1 July 2004 commenting on the process to document findings under Section 106 and requesting more information on the expected level of effect before commenting further. NPS sent a letter dated 5 August 2005 continuing the dialog under Section 106 consultation and requesting comments on the latest set of alternatives. A conference call with SHPO was held on 23 August 2005 to discuss the project, and SHPO made several recommendations regarding maintaining a representative sample of historic culverts and headwalls, the importance of leaving ample vegetation along the roadway and a recommendation to prepare a Memorandum of Agreement for the project. Preliminary construction documents were sent to SHPO on 31 August 2005, and a draft MOA and archeological treatment plan were sent on 2 May 2005.

Native American Tribes NPS initiated consultation with all affiliated tribes (Havasupai, Hopi, Hualapai, Kaibab Band of Paiute Indians, Navajo, Paiute Indian Tribe of Utah, White Mountain Apache, Yavapai Apache, San Juan Southern Paiute, and Pueblo of Zuni) and requested comments on several preliminary alternatives in June 2004 in a letter distributed during the first public scoping period. In response the Hopi Tribe sent a letter dated 29 June 2004 requesting the NPS identify and avoid archeological sites, continue consultation with the tribe, and send a copy of the cultural resource survey when complete. During the second scoping effort in August 2005, NPS received one response from the Zuni Tribe requesting to be kept informed. On 28 April 2005 a letter to all tribes was sent notifying them of the park's intention to enter into a MOA with the SHPO for this project and asking if they wished to be a concurring party. The Kaibab Paiute Tribe and the Navajo Nation responded. Neither tribe has asked to be a concurring party to the MOA. The archeological survey report was sent to the Hopi Tribe on 4 August 2006 and a copy of the EA was distributed to all affiliated tribes for their review and comment.

U.S. Fish and Wildlife Service NPS requested comments on several preliminary alternatives and a list of Federally listed species in the project area in June 2004, in a letter distributed during the first public scoping period. USFWS sent several comments in a letter to the park dated 29 July 2004. These comments included: 1) review the Batch construction consultation conservation measures for applicability to this project; 2) address possible effects of noise disturbance and habitat alteration to Mexican spotted owl, as appropriate, and the applicability of critical habitat evaluation; 3) impacts the project may have on sentry milkvetch and the need for additional surveys; and 4) consider Mexican spotted owl, California condor and Sentry milkvetch in the Biological Assessment (NPS 2002). The park sent another letter during the second scoping period in July 2005 to update USFWS and request any additional comments on the preliminary project proposal. NPS met with USFWS on 18 October 2005 to specifically discuss alternatives under consideration, including potential options for Maricopa Point. The park sent preliminary options for Maricopa Point to USFWS for review and comment on 18 July 2006 prior to the preparation of the project's Biological Assessment.

Arizona Department of Environmental Quality The ADEQ responded to a letter distributed during the second public scoping period in July 2005. ADEQ responded in a letter dated 29 August 2005 stating that the project is not expected to result in any air quality violations, but that actions may increase ambient particulate matter (dust), and suggested mitigation measures. These were reviewed by the park's air quality specialist and determined to be consistent with measures the park currently incorporates, and have been added to the list of mitigation measures in Chapter 2.

EA Review

A printed copy of the EA will be sent to those persons who responded to either the 2004 or 2005 scoping efforts and to those that specifically requested a copy. A printed copy of the EA will also be sent to affiliated tribes, Xanterra Parks and Resorts, Paul Revere Transportation, FHWA, and USFWS. A press release will announce the availability of the EA during the public review period, along with a brief project description. The EA will be posted on the park's website and to the planning, environment and public comment NPS site, where the public can make comments via the website.

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APPENDIX A

Grand Canyon General Management Plan (1995) Excerpts Pertaining to Hermit Road Rehabilitation

Applicable GMP Objectives, Facility Design (GMP, page 8):

- Ensure that park developments do not adversely affect park resources and environments, except where absolutely necessary to provide reasonable visitor access and experiences.

Applicable GMP South Rim Management Objectives (GMP, page 9):

- Identify and develop an appropriate range of visitor experiences, opportunities, and access that will accommodate a variety of visitor expectations, abilities and commitment levels.
- Provide canyon viewing opportunities, views and trails access, and interpretation and information, recognizing that these are the most important elements of the South Rim visitor experience.
- Maintain South Rim from Hermits Rest to Desert View as the focus of the majority of visitor use, including major visitor facilities and accommodations.
- Use South Rim's extensive cultural resources as a strong component of the interpretive program, including the interpretation of American Indian cultures.
- Develop and promote use of foot trails, bicycle paths, and public transportation to provide convenient and efficient movement of visitors, employees and residents within Grand Canyon Village and between major points of interest.
- Maintain and enhance the meandering, rural character of West Rim and East Rim Drives, including the feeling that one is removed from the developments of Grand Canyon Village and Desert View. Maintain existing large undisturbed areas along West Rim Drive.

Hermit Road is identified as a **Transportation Subzone of the Development Zone** in the GMP (description, GMP, page 16) and is described as:

- *Transportation Subzones* connect development zones and include primarily paved road corridors and rail corridors to a width appropriate for safe travel.
 - o Hermit Road extends from Grand Canyon Village to Hermits Rest, plus existing overlooks, access roads to overlooks, parking areas, and areas immediately adjacent to Hermit Road that would be suitable for a bike/pedestrian trail.
 - o Areas outside of this defined area, between the Village and the park boundary are identified as Nonwilderness Areas within the Natural Zone (GMP, page 14):
 - ...Development within the natural zone will be limited to dispersed recreational and essential management facilities that have no adverse effect on scenic quality and natural processes and that are essential for management, use, and appreciation of natural resources.

GMP Recommendations specific to Hermit Road:

- Automobiles restricted along Hermit Road year- round by 2010 (GMP, page 25, 27).
- Maricopa Point overlook and parking area removed due to proximity of a rare plant population (GMP, page 27).
- Hopi Point overlook redesigned for bike and pedestrian use only (GMP, page 27).

- Visitors with disabilities who cannot be adequately accommodated by public transportation allowed access by private vehicle (GMP, page 27).
- Bikers allowed on all roads (GMP, page 28).
- An off- road bike trail system provided to link Hermits Rest and Desert View (GMP, Greenway, page 28).
- This off- road bike trail system will be used by both bikers and pedestrians (GMP, page 28).
- The trail system will generally be north of the road on the West Rim, so as to avoid road-crossing conflicts, and disturbed areas used whenever possible to limit resource impacts (GMP, page 28).
- A bikeway plan will determine more exact routes, paved and unpaved sections, bike/pedestrian overlooks, and other design details (GMP, page 28).

APPENDIX B

Public Scoping Summary of Comments Identified within Submissions to June 2004 and June 2005 Hermit Road Scoping Letter

Concerns/Comments	NPS Response
Costs	
The cost of greenway construction should be compared to the cost of improvements to the existing rim trail (including the cost of disturbing new areas).	Adverse and beneficial impacts to resources are evaluated in EA; fiscal costs were considered in the Value Analysis/Choosing by Advantages process during alternative development.
greenway trail; Practicality of Use	
If part of the greenway justification is accessibility, will wheelchair users use it? The EA should show that the trail would address the needs of persons with disabilities.	Greenways, Inc., who consider the needs of visitors with disabilities, have evaluated proposed greenway alignments under Alternatives C, D and E. Accessibility needs are included in the EA.
If part of the greenway justification is that hikers will use it, will they? The EA should show that the trail would address the needs of hikers. Hikers we talked to said they would use the rim trail, even if a better trail was provided south of the road. Visitors will not stay on the south side of the road.	NPS expects that many hikers will continue to use the rim trail. The EA addresses visitor experience and user groups in EA.
We support the multi- modal greenway trail. This will serve to reduce traffic congestion and encourage visitors to park their cars and walk or ride bicycles to destinations (air quality benefits, safety, experience).	EA evaluates the impacts of various alternatives on visitor experience.
The greenway is ideal for sport bikers and runners, but pedestrians need a rim trail to Hermits Rest.	NPS expects that many hikers will continue to use the rim trail. EA evaluates the impacts of various alternatives on visitor experience.
greenway trail; Safety	
Bicycles and pedestrians travel at different speeds and move in different ways. Mixing them is unsafe.	If a greenway trail is a part of the alternative ultimately selected for implementation, the trail would be designed as a shared- use trail and would follow standards for mixing user groups using appropriate widths, etc (AASHTO). This greenway concept is in use in other parts of the park and was included in the Draft EIS for the development of the 1995 GMP as a multi- modal trail.
Return bicycle traffic, because of the downhill slope, will reach higher speeds and may be unsafe for other trail users.	See response above – Depending on the alternative ultimately selected, these aspects would be considered during future design.
Visitors walking with strollers and dogs will be a constant safety issue, crossing the road to get to the views.	EA evaluates safety aspects among the various alternatives. NPS agrees that road crossings can be problematic if not properly designed.
greenway trail; Width	
Define the maximum width of the trail in the EA. Any width greater than eight feet should be justified.	EA includes a maximum width of eight feet for all alternatives that contain a greenway component.
greenway trail; Design	
We would like to be included in planning for the trail layout and think our input could contribute greatly to the end-user. Include bicycle organization in trail planning.	It would likely be appropriate after the EA. If the greenway is ultimately selected as part of the preferred alternative, then it would be good to

Concerns/Comments	NPS Response
	invite such users to communicate with us (and/or Grand Canyon National Park Foundation) during design.
The current layout of blue stakes is much too close to the road in many places. greenway users will not want to be breathing car exhaust. It should be moved further from the road.	NPS agrees and the trail as proposed under Alternatives C and E won't be this close; these areas would average 35 - 75 feet from the road.
Natural Resource Protection	
Minimize impacts to park resources and justify all actions that disturb the natural park environment	EA includes a detailed impact analysis for all alternatives.
What is the trade- off between protecting historic roads and historic forest?	EA includes a detailed impact analysis for all alternatives.
A greenway on the south side of the road will damage the park ecosystem due to visitors constantly crossing the road to get to a view.	NPS acknowledges that some vegetation will be lost due to alternative implementation under Alternatives C, D and E and that some social trailing between the greenway and the rim may occur. Efforts would be made during future design phases, depending on the alternative selected, to reduce the likelihood of social trailing. NPS also believes that under these alternative scenarios, many pedestrians would choose to stay on the rim, using the improved rim trail.
NPS should monitor human- caused noises such as helicopters, traffic, car alarms, etc.; they are destroying natural values.	NPS believes this is outside the scope of this project. However, the park has initiated a noise monitoring program as part of a Soundscape Plan for the park
Project not expected to result in any air quality violations, but actions may increase ambient particulate matter (dust); suggest mitigation measures to minimize dust, specifically for roads projects.	EA includes mitigation measures to reduce dust during construction.
Historic Character	
Turnouts have historic character that should be preserved.	EA includes a detailed evaluation of cultural resource impacts for each alternative. Cultural resource protection is a key objective for this project.
Road Width	
Widening three to six feet should be justified and adequate analysis shown for the effect on the natural park environment.	EA includes a detailed impact analysis for all alternatives.
Existing Seasonal Private Vehicles Closure	
We support the continued seasonal road closure to all but bicyclists and shuttle buses (and handicapped drivers and those with overnight backpacking permits for the Hermit Trail).	NPS does not propose any changes to existing seasonal closure.
Suggested Alternatives or Alternative Components	
Add a shoulder to the road in the few areas where the existing trail is forced on the road; use minor changes in masonry walls to accomplish this.	This is included as part of all action alternatives.
In areas where road is very close to the rim, consider	The alternatives include road widening at "pinch

Concerns/Comments	NPS Response
moving the road to the south to provide access for pedestrians between the road and the rim	points” to allow for enough room for pedestrians to walk between the roadway and the rim.
Even if the greenway is constructed, maintain the existing rim trail for hikers.	This is part of all action alternatives.
Do not widen and pave the existing dirt trail between Hopi Point and Hermits Rest. This is a unique hiking experience.	Improvements to the unpaved rim trail are proposed under all action alternatives, but proposed improvements do not pave or widen it.
Do not restrict bicycle use from the roadway under any alternative	NPS does not propose to close the road to bicyclists under any alternative.
If the road is historic and this is worth protecting, then the problem is inappropriate use of non- historic buses on the historic road. Would it be possible to disallow the wide Harvey buses and only use narrower buses?	Narrower buses are not readily available. Buses available on the market today are generally 102 inches wide. The Harvey tour buses are the same width as the shuttle buses used in the park. NPS staff recently attended a Transportation Expo in September 2005 to see what is currently available in mass transit. No buses narrower than 102 inches were available. NPS believes that a reduction in size of the mass transit vehicle (such as using something smaller than our current buses) would not be able to accommodate our current visitation rates and use patterns. A smaller vehicle with less seating would mean NPS would need to run buses more frequently to keep up with visitor demand. To have a steady stream of transit vehicles on Hermit Road would not be consistent with the intent of the nine- month closure to private vehicles. Use of smaller buses is described in the Alternatives Considered but Dismissed section of Chapter 2 in the EA.
If the desire is to maintain the present roadway for historic reasons, consider more appropriate public transportation. Get rid of smoky diesel buses and use buses that are quiet and open (not enclosed).	Grand Canyon National Park is in the process of phasing out all diesel buses and replacing them with quieter and less polluting natural gas buses. NPS does not agree that open buses would be appropriate for the park due to summer monsoon rains and other weather conditions.
Add a bike lane to the existing road and narrow the proposed greenway width	NPS considered an option to widen the road enough to accommodate a designated bike lane but dismissed this from further detailed analysis, as described in Chapter 2 of the EA.
Widen the existing rim trail to accommodate wheelchairs and construct new trail only where needed to connect with this improved rim trail (“hybrid trail”). Construct the greenway on the rim as much as possible.	NPS considered the option to widen and improve the existing rim trail to be universally accessible and dismissed it from detailed study because it is infeasible. West Rim Trail from the interchange up to Trailview I cannot be made accessible due to the steep terrain. Slight widening of the rim trail is considered as part of the rehabilitation of this trail, common to all alternatives, but will be fully evaluated to make

Concerns/Comments	NPS Response
	sure that all rehabilitation actions meet the Secretary of the Interior's Standards for the Treatment of Historic Properties (Weeks and Grimmer 1995)
Add vehicle turn lanes to the entrance and exit to Mohave Point parking area (reduce the size of the island slightly so buses can enter the west entrance from the east and leave again from the east or continue west). This would eliminate the need for shuttles to turn around in the parking area.	NPS agrees this is a suitable solution and this is an action common to alternatives B, C and D in the EA
Make the existing road a one- way road for westbound travel and construct a new eastbound road using existing utility corridors.	NPS previously considered this alternative but dismissed it from detailed study due to resource impacts of construction of a new road through the natural zone (as defined in the 1995 GMP), as described in Chapter 2. A loop road around The Abyss, however, is analyzed as part of Alternative E.
If buses will continue on the present roadway, construct the paved bike trail on fire roads in the forest between Hopi Point and The Abyss. I would rather have a natural experience than an urban experience.	NPS previously considered this alternative but dismissed it from detailed study due to this trail's excessive distance from the rim in many places. As described in Chapter 2, this option was considered to be undesirable to users and would not meet the project's purpose and need, or objectives.
Install signage along the 1912 road west of Pima Point to indicate its place in Grand Canyon history.	NPS agrees this is a good idea and the EA includes interpretive signage under Alternatives C, D and E.
The Hermits Rest road and trail system is perfect as it is – partial 'Greenway,' partial shuttle bus/bicycle road, partial wilderness rim trail (no action).	The EA analyses the beneficial and adverse impacts of the No- Action Alternative.
If greenway is constructed, provide plenty of road crossings and access to rim overlooks. Consider development of turn- offs to scenic views that are not accessible by vehicles so that greenway users get a more unique experience and a "reward" for using the greenway instead of vehicles.	NPS believes that the experience created by the greenway proposal west of The Abyss to Hermits Rest, using the alignment of the 1912 road corridor (Alternatives C, D and E), would provide an experience for greenway users that would not be available to shuttle bus users or other private vehicles. NPS agrees there might be an opportunity to create view point(s) along this section of the greenway and will determine the feasibility. The EA evaluates creation of new viewpoints for greenway users in this area under Alternatives C, D and E.
Clean up the area near the Orphan Mine; there are communication cables on the ground and other litter and debris.	NPS considers this outside the scope of this project. However, NPS has passed this concern on to park staff responsible for this area. NPS is in the process of evaluating the Orphan Mine area for cleanup (the area inside the fenced enclosure).
Construction Timing and Duration	
Keep the road partially open (with restrictions for visitor use) during most of the construction period. Do not close the road to park visitors during construction. Use off- hours	Options for visitor access during the construction period are being carefully evaluated as part of this project, considering impacts to concessionaire

Concerns/Comments	NPS Response
work and extensive traffic controls as alternatives to closing the road completely. Closing the road would seriously disrupt the Hermits Rest Gift Shop operation, commercial bus tours and the daily Grand Canyon Railway passenger tours on West Rim.	operations at Hermits Rest, tour bus operations and the park's shuttle bus system. Xanterra Parks and Resorts will be consulted for input as NPS works through these options.

APPENDIX C

Compliance Summary

The following laws and associated regulations provided direction for the design of project alternatives, the analysis of impacts and the formulation of mitigation/avoidance measures.

National Environmental Policy Act of 1969 (NEPA) (Title 42 U.S. Code Sections 4321 to 4370 [42 USC 4321- 4370]). The purposes of NEPA encourage “harmony between [humans] and their environment and promote efforts which will prevent or eliminate damage to the environment. . .and stimulate the health and welfare of [humanity].” The purposes of NEPA are accomplished by evaluating the effects of Federal actions. The results of these evaluations are presented to the public, Federal agencies and public officials in document format (e.g., environmental assessments and environmental impact statements) for consideration prior to taking official action or making official decisions. Implementing regulations for NEPA are contained in Part 1500 to 1515 of Title 40 of the U.S. Code of Federal Regulations (40 CFR 1500-1515).

Clean Water Act of 1972, as amended (CWA) (33 USC 1251- 1387). The purposes of CWA are to “restore and maintain the chemical, physical, and biological integrity of the Nation's waters.” To enact this goal, the U.S. Army Corps of Engineers has been charged with evaluating Federal actions that result in potential degradation of waters of the U.S. and issuing permits for actions consistent with CWA. The U.S. Environmental Protection Agency also has responsibility for oversight and review of permits and actions, which affect waters of the U.S. Implementing regulations describing the U.S. Army Corps of Engineers CWA program are contained in 33 CFR 320- 330.

Clean Air Act (PL chapter 360, 69 Stat 322, 42 USC 7401 et seq.). The main purpose of this Act is to protect and enhance the nation’s air quality to promote public health and welfare. The Act establishes specific programs that provide special protection for air resources and air quality related values associated with NPS units. The U.S. Environmental Protection Agency is charged with implementing this Act.

Endangered Species Act of 1973, as amended (ESA) (16 USC 1531- 1544). The purposes of the ESA include providing “a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved.” According to the ESA, “all Federal departments and agencies shall seek to conserve endangered species and threatened species,” and “[e]ach Federal agency shall. . .insure that any action authorized, funded, or carried out by such agency. . .is not likely to jeopardize the continued existence of any endangered species or threatened species.” The U.S. Fish and Wildlife Service (non- marine species) and the National Marine Fisheries Service (NMFS) (marine species, including anadromous fish and marine mammals) administer the ESA. The effects of any agency action that may affect endangered, threatened, or proposed species must be evaluated in consultation with either the USFWS or NMFS, as appropriate. Implementing regulations which describe procedures for interagency cooperation to determine the effects of actions on endangered, threatened, or proposed species are contained in 50 CFR 402.

National Historic Preservation Act of 1966, as amended (NHPA) (16 USC 470 *et sequentia*). Congressional policy set forth in NHPA includes preserving “the historical and cultural foundations of the Nation” and preserving irreplaceable examples important to our national heritage to maintain “cultural, educational, aesthetic, inspirational, economic, and energy benefits.” NHPA also established the National Register of Historic Places composed of “districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, engineering, and culture.” NHPA requires that Federal agencies take into account the effects of their actions on properties eligible for or included in the National Register of Historic Places and coordinate such actions with State Historic Preservation Offices (SHPO). NHPA also requires Federal agencies, in consultation with the SHPO, to locate, inventory, and nominate all properties that appear to qualify for the National Register of Historic Places, including National Historic Landmarks. Further, it requires Federal agencies to document those properties in the case of an adverse effect and propose alternatives to those actions, in accordance with the NEPA.

Additional laws, regulations and policies consulted include:

Relevant Laws, Policies, and Regulations		
Law, Policy, or Regulation (by date)	Acronym	Record
Yosemite Act of 1864		13 Stat. 325
General Grant National Park and a portion of Sequoia National Park Act of 1890		26 Stat. 650
Yosemite Act of 1906		34 Stat. 831
Clean Water Act of 1948	CWA	33 U.S.C. 1251 et seq.
Clean Air Act of 1955 as amended 1963	CAA	42 U.S.C. 7401 et seq.
The Wilderness Act of 1964	WA	Public Law 88- 577
National Historic Preservation Act of 1966 and regulations implementing NHPA	NHPA	16 U.S.C. 470 et seq. 36 CFR Part 800 as amended
National Environmental Policy Act of 1969	NEPA	42 U.S.C. 4321 et seq.
Endangered Species Act of 1973	ESA	16 U.S.C. 1531 et seq.
CEQ General Regulations Implementing National Environmental Policy Act of 1978		40 CFR Parts 1500-1508
Archaeological Resources Protection Act of 1979	ARPA	18 U.S.C. 1312
Farmland Protection Policy Act of 1981	FPPA	Public Law 97- 98
Aircraft Overflights in National Parks Act of 1987		Public Law 100- 91
Native American Graves Protection and Repatriation Act of 1990	NAGPRA	25 U.S.C. 3001
Americans with Disabilities Act of 1990	ADA	Public Law 101- 336
Migratory Bird Treaty Act of 2001 (Migratory Bird Guidance)		16 U.S.C. 703- 711
Executive Orders		
Floodplain Management Act of 1977		Executive Order 11988
Protection of Wetlands Act of 1977		Executive Order 11990
Environmental Justice Act of 1994		Executive Order 12898

Indian Sacred Sites Act of 1996		Executive Order 13007
Invasive Species Act of 1999		Executive Order 13112
Consultation and Coordination with Indian Tribal Governments Act of 2000		Executive Order 13175
Migratory Birds		Executive Order 13186
Director's Orders (National Park Service)		
Park Planning	DO- 2	Director's Order #2
Conservation Planning, Environmental Impact Analysis and Decision Making	DO- 12	Director's Order #12
Environmental Management Systems	DO- 13	Director's Order #13
Cultural Resources Management	DO- 28	Director's Order #28
Wilderness Preservation and Management	DO- 41	Director's Order #41
Implementation of the NPS Organic Act	DO- 55	Director's Order #55
Explosives Use and Blasting Safety	DO- 65	Director's Order #65
Natural Resources Protection	DO- 77	Director's Order #77
Wetland Protection	DO- 77- 1	Director's Order #77- 1
Other		
2001	National Park Service Management Policies 2001	
1988	Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices. Office of Water, EPA 832- R 92- 005. Washington, DC.	
1995	Programmatic Agreement among the National Park Service, the Arizona State Historic Preservation Officer, and the Advisory Council on Historic Preservation Regarding the Draft General Management Plan/Environmental Impact Statement, Grand Canyon National Park, Arizona.	
1996	Endangered and Threatened Wildlife and Plants: Establishment of a Nonessential, experimental population of California condors in Northern Arizona. Federal Register, October 16, 1996. Volume 61, Number 201, pages 54043-54060.	
2000	Endangered and Threatened Wildlife and Plants: Proposed Designation of Critical Habitat for the Mexican Spotted owl: Federal Register, July 21, 2000. Volume 65, number 141, pages 45336- 45353.	

APPENDIX D

Wildlife and Plant Species of Special Concern Species Descriptions

Mexican Spotted Owl – Threatened - The Mexican spotted owl (MSO; *Strix occidentalis lucida*) was listed as a threatened species in March 1993, and a recovery plan was issued in 1995. MSO typically breed and roost in deep canyon or diverse forested habitats. They are associated with late seral forests and are generally found in habitat that includes mixed conifer and pine-oak forests, riparian madrean woodland, and sandstone canyonlands (USFWS 1995). However, MSO have been found in relatively open shrub and woodland vegetation communities in arid canyonland habitat (Willey 1995). Nesting habitat is typically in areas with complex forest structure or rocky canyons containing mature or old growth stands that are uneven- aged and multi- storied with high canopy closure. MSO usually nest in abandoned stick nests or in cavities in trees or cliffs. Tree nests can be on platforms such as old raptor nests or witches' brooms formed by dwarf mistletoe (*Arceuthobium* sp.) or in cavities formed by broken- off branches or tree tops. Nests in rock canyon areas are usually in cavities in the rocks or in caves (Ganey and Dick 1995).

The diet of the MSO varies depending on location and habitat. Generally it consists of small and medium- sized mammals such as peromyscid mice, voles (*Microtus* spp.), pocket gophers (*Thomomys* spp.), ground squirrels (*Spermophilus* spp.), and woodrats (*Neotoma* spp.). Woodrats are the most common and important prey item range- wide, as measured in frequency in the owls' diet and in biomass consumed (Ward and Block 1995). Other animals that may occasionally be consumed include small birds (usually Passeriformes), lizards (*Sceloporus* spp.), bats (Chiroptera), beetles (Coleoptera), and rabbits (*Sylvilagus* spp.). MSO use a wider variety of forest conditions when foraging than when nesting or roosting, and a diverse prey base is dependant on the availability and quality of diverse habitats. Spotted owls typically forage at night, although diurnal foraging has also been observed.

Data Sources: The presence of MSO within Grand Canyon National Park was confirmed in 1992 through field surveys of approximately 2,430 ha (6,000 acres) of suitable habitat on the North and South Rims. Additional MSO surveys occurred in 1994 and 1995 along the South Rim and in 1998 and 1999 along the North Rim. These surveys did not detect any spotted owls. In 1999, additional surveys were conducted in side canyon habitat along the Colorado River corridor and responses were received at six locations. Surveys continued along the river corridor in 2001, with new owls located (Willey and Ward, in prep.). An extensive owl survey was initiated in 2001 with crews surveying the inner canyon and river corridor, owl habitat below the North and South Rims, and portions of the North and South Rim plateaus. Surveys have continued regularly in many parts of the park, including canyon habitat below the south and north rims through 2006.

Critical habitat for MSO was designated in 2001 and includes most of the park except the South Rim. Owl habitat in Grand Canyon National Park is cool canyon habitat defined as areas with low thermal intensity, short thermal duration, and steep slopes (Spotskey and Willey 2000). Predicted habitat has been spatially defined through a geographic information system (GIS) model and may or may not include forested habitat; i.e., the coolness and short

thermal duration may be a result of vertical rock faces, cliff walls, and aspect and not necessarily because an area has dense vegetative canopy cover.

The size and extent of the MSO population at Grand Canyon is currently unknown. MSO have been confirmed using rugged canyonland terrain within the Grand Canyon, including the use of small stringers of Douglas- fir trees below the rim. No MSO are known from the plateau areas of the park. The park falls within the Colorado Plateau Recovery Unit. The Mexican Spotted Owl Recovery Plan (USFWS 1995) provides for three levels of habitat management: protected areas, restricted areas, and other forest and woodland types. 41 MSO Protected Activity Centers (PACs) have been designated for known MSO locations in the park as of 2006. Protected habitat in the Colorado Plateau Recovery Unit includes any PACs, designated wilderness areas, and any mixed conifer forests on slopes over 40%. Restricted habitat in the Colorado Plateau Recovery Unit includes mixed conifer forests or riparian habitats that have primary constituent elements. Primary constituent elements in these habitat types include high basal area of trees, uneven- aged structure, and high snag basal area. Primary constituent elements in canyon habitat include cooler and more humid conditions than in the surrounding area; clumps or stringers of trees; canyon walls with crevices, ledges or caves; high percent cover of ground litter or woody debris; and riparian or woody vegetation.

Two MSO Protected Activity Centers occur within the vicinity of Hermit Road; the Waldron Basin PAC (far west end of the project area) and the Bright Angel PAC (far east end of the project area). PAC boundaries are below the canyon rim and do not overlap project sites, but the potential for noise disturbance exists during construction due to project sites being within 0.5 – 1 mile of established PAC or core area boundaries.

Threats. The primary threats cited for the owl in most Recovery Units include large- scale catastrophic wildfire and timber harvest. Potential threats cited specifically for the Colorado Plateau Recovery Unit focus more on recreational impacts, road building, and overgrazing.

California Condor – Threatened – California condors (*Gymnogyps californianus*) are large birds that reach sexual maturity by five to six years of age. They are strict scavengers and rely on finding their food visually, often by investigating the activity of ravens, coyotes, eagles, and other scavengers. Without the guidance of their parents, young inexperienced juveniles may also investigate human activity. As young condors learn and mature this human- directed curiosity diminishes.

The California condor was listed as an endangered species in March 1967. In 1996, the USFWS established a nonessential, experimental population of California condors in northern Arizona. In December 1996 the first condors were released in the Vermillion Cliffs area of Coconino County, Arizona, approximately 48 km (30 miles) north of Grand Canyon National Park. Subsequent releases have occurred in May 1997, November 1997, November 1998, December 1999, February 2002 and December 2002 in the same vicinity and in the Hurricane Cliff area, which is about 96 km (60 miles) west of Vermillion Cliffs. By declaring the population “nonessential, experimental,” the USFWS can treat this population as threatened and develop management regulations less restrictive than mandatory prohibitions covering endangered species. This facilitates efforts to return the condor to the wild by providing increased

opportunities to minimize conflict between management of condors and other activities. Within Grand Canyon National Park, the condor has the full protection of a threatened species.

Nesting habitat for California condors includes various types of rock formations such as crevices, overhung ledges, and potholes. Most California condor foraging occurs in open meadows and throughout the forested areas of the rims. Typical foraging behavior includes long- distance reconnaissance flights, lengthy circling flights over a carcass, and hours of waiting at a roost or on the ground near a carcass. Roost sites include cliffs and tall trees, including snags.

Data Sources. As of April 2006, the population of free- flying condors in Arizona totaled 58. All of the California condors in northern Arizona are fitted with radio transmitters that allow field biologists to monitor the condors' movements. Condors have been observed as far west as the Virgin Mountains near Mesquite, Nevada; south to the San Francisco Peaks outside of Flagstaff, Arizona; north to Zion and Bryce Canyon National Parks and beyond to Minersville, Utah; and east to Mesa Verde, Colorado and the Four Corners region (Peregrine Fund 2000). Monitoring data indicate condors are using habitat throughout Grand Canyon National Park, with concentration areas in Marble Canyon, Desert View to the Village on the South Rim, and the Village to Hermits Rest. The North Kaibab National Forest is also used frequently for perching, roosting and foraging. Potential nesting habitat exists throughout the park. One nesting attempt was documented in the Marble Canyon area in 2001. Two nest sites on the South Rim, one on The Battleship and one on Dana Butte, were initiated in 2002. Both nest sites failed. In 2003, a condor chick hatched in the Salt Creek drainage area, the first condor born in the wild since reintroduction efforts began. In 2005, the Salt Creek nest was active again as was the Vermillion Cliffs nest. A new nest in the King's canyon area of the Kaibab National Forest failed. In 2006, all three nest attempts in Northern Arizona failed.

Threats. The main reason for the decline of condors was an unsustainable mortality rate of free- flying birds combined with a naturally low reproductive rate. Most deaths in recent years have been related to human activity. Shootings, poisonings, lead poisoning and power line collisions are considered the condor's major threats.

Peregrine Falcon (Species of Concern – Delisted) – In the southwest region, peregrines persist mainly on mountain cliffs and river gorges. Eyries exist on dominant cliffs that generally exceed 200 feet in height; nests are usually situated on open ledges. Peregrines formerly nested in nearly all plant communities of the region. Prey abundance and diversity provided by these situations is probably a major factor in eyrie selection. Nest sites are often adjacent to water courses and impoundments because of the abundance of avian prey. Peregrines may travel up to 17 miles from nesting cliffs to hunting areas. Preferred hunting habitats include cropland, meadows, river bottoms, marshes and lakes. Prey species may include, but are not limited to, blackbirds, jays, doves, shorebirds and smaller songbirds. As of 1993, breeding was documented at more than 180 sites in Arizona.

Data Sources. Extensive surveys have been conducted over the years in Grand Canyon National Park by park biologists and U.S. Geological Survey/Biological Resources Division personnel. Grand Canyon provides excellent cliff nesting habitat for peregrines and numerous eyries have been documented within the park. In a Draft Addendum to the Recovery Plan, the Fish and Wildlife Service recommended delisting of the southwestern

regional population because the recovery goals outlined in the 1984 Plan have been met. A monitoring program is being developed by the U.S. Fish and Wildlife Service to guide monitoring activities following delisting. An initial goal of monitoring at least 25 peregrine territories in the Colorado Plateau and adjacent low desert regions is part of this nation-wide effort. Grand Canyon National Park will have two to four territories monitored during this effort. Peregrine eyries are known from below the canyon rim at Pima Point and Hopi Point. Both territories are active in 2006.

Threats. Previous peregrine population declines coincided with the increasing use of DDT, but other limiting factors included availability of cliffs and prey that can limit distribution or numbers of breeding falcons, competition for nesting cliffs with other raptors, and possible predation to eggs and young. Peregrine eyries occur throughout the canyon from remote river locations to cliffs bordering Grand Canyon Village on the South Rim.

Northern Goshawk – Species of Concern - The northern goshawk is holarctic in distribution, occupying boreal and temperate forests of North America, Europe and Asia (63 FR 35183- 35184). It is the largest of the three *Accipiter* species present in North America. There is considerable debate regarding North American subspecies of the northern goshawk. *A. g. atricapillus* is recognized worldwide as occurring over much of Alaska, Canada and forested regions of the western and eastern United States. Two other subspecies are variously recognized: *A. g. laingi*, which occurs on islands off the Canadian Pacific Coast; and *A. g. apache*, which occurs in mountains of the southwestern United States. The USFWS does not currently recognize the *apache* subspecies (63 FR 35183- 35184).

Northern goshawks generally nest in stands of mature trees with a dense canopy. In the Southwest, goshawks most frequently occupy three forest types: ponderosa pine; mixed species (primarily Douglas fir and white fir); and Englemann spruce–sub alpine fir (*Abies lasiocarpa*). Nest sites are typically located on northerly slopes (Reynolds et al. 1992).

Although goshawks typically nest in stands of mature trees, they are forest generalists and use a variety of forest ages and types to meet their life history requirements (Reynolds et al. 1992, 63 FR 35183- 35184). Various studies have shown that the mean size of a goshawk home range is around 5,000 acres (Reynolds et al. 1992), and these home ranges generally contain a mosaic of forest conditions. Goshawks prey opportunistically on a variety of small to mid- sized mammalian and avian species such as squirrels (Sciuridae), blue grouse (*Dendragapus obscurus*), rabbits, woodrats, doves (*Zenaida* spp.), jays (*Cyanocitta* spp.) and woodpeckers (*Picoides* spp.). Foraging habitat is probably as closely related to prey availability as to habitat structure or composition. Many prey species use snags, downed logs, woody debris, large trees, openings and herbaceous and woody understories. Because goshawks are visually limited in habitats with dense understories, an open understory enhances detection and capture of prey (Reynolds et al. 1992).

Data Sources. Goshawk surveys have been conducted in Grand Canyon National Park. South Rim surveys were conducted regularly in 1991, 1992 and 1994- 1996. Sporadic surveys also occurred in 1999 and 2000, and several nests were found. Surveys have also occurred on the North Rim, most recently in 2002 in areas affected by the Outlet Fire. Surveys continued in 2003 in areas on both the North and South Rims. The primary habitat for goshawks within the park is in the mixed conifer and ponderosa pine habitat on the North Rim. There are

approximately ten known goshawks territories in the vicinity of the North Rim developed area, two of which are within the Bright Angel peninsula watershed. This is a small proportion of the over 100 territories on the North Kaibab Plateau. As of 2006, there are no known goshawk nest areas within the vicinity of the project area; most nest sites and territories are greater than one mile south of Hermit Road.

Threats. There is a concern that populations and reproduction of the goshawk are declining in the western United States. These declines may be associated with forest changes caused by timber harvesting, but fire suppression, livestock grazing, drought and toxic chemicals may also be involved (Reynolds et. al 1992).

Allen's Lappet-browed Bat – Species of Concern – This species is most often found in ponderosa pine, pinyon- juniper and riparian habitats in Arizona, but has also been observed in white fir and Mohave desertscrub. Individuals are typically netted along streams or over ponds and roost in caves and abandoned mineshafts. These bats are thought to feed primarily on soft-bodied insects, but beetles, roaches and flying ants have also been documented. Reproduction is poorly known. Females form maternity colonies in early summer and males are thought to roost solitarily during this time. Lactating females have been captured in the vicinity of Flagstaff and maternity roosts have been documented in the Kingman and Aravapai Canyon area in Arizona. Population trends are poorly known for this species. Allen's Lappet-browed bats have not been observed in the project area, nor are any roosts sites known in the vicinity, but the potential exists due to available foraging habitat.

Pale Townsend's Big-eared Bat – Species of Concern – This species is widespread in Arizona. Summer day roosts are found in caves and mines from desertscrub up to woodlands and coniferous forests. Night roosts may often be found in abandoned buildings. In winter, hibernation occurs in cold caves, lava tubes and mines mostly in uplands and mountains from the vicinity of Grand Canyon to the southeastern part of Arizona. These bats typically feed on small moths and they may forage up to four to five miles from a roost site. Females form maternity colonies of 12 to about 200 in the western United States and males are thought to roost solitarily. Pale Townsend's Big-eared bats have not been observed in the project area, nor are any roosts sites known in the vicinity, but the potential exists due to available foraging habitat.

Long-legged Myotis – Species of Concern – This species occurs in forested mountains across the state but appears to be absent from desert and desert mountains of the southwestern part of Arizona. This species uses a variety of roosts including abandoned buildings, cracks in the ground, crevices in cliff faces and spaces behind exfoliating tree bark. Caves and mine tunnels are used as hibernacula. In summer, they apparently do not use caves as daytime roosts. These bats typically feed on moths, are opportunistic, and can pursue prey over long distances around, under and above the forest canopy. These bats have not been observed in the project area, nor are any roosts sites known in the vicinity, but the potential exists due to available foraging habitat.

Sentry Milkvetch - Endangered – This herbaceous perennial is a long-lived mat-forming plant with a thick taproot. The short creeping stems have compound leaves. Whitish or pale purple flowers appear from late April to early May, with seed set in late May – June. It occurs in crevices

and depressions with shallow, well- drained soils or porous limestone pavement in the pinyon-juniper woodland along the canyon's edge. The underlying limestone bedrock stores water and is critical to the growth and development of seeds (Flowers are susceptible to low temperature conditions such as frost, freezing rain, or snow. These conditions often occur simultaneously with flowering (AGFD 2003). It should be noted that seeds are so small that they are not wind or rodent dispersed but instead fall in the mat of the plant. Therefore, the population does not spread and remains isolated (AGFD 2003). This species is endemic to Grand Canyon National Park, and occurs at elevations between 7,000 and 7,100 feet on Kaibab Limestone.

Sentry Milkvetch was listed as a threatened candidate species (Category 1) in 1980 due to its declining status caused by visitor trampling and habitat degradation. It was later determined endangered by the USFWS and was Federally listed without critical habitat in December of 1990 due to previous visitor trampling and degradation of habitat (Brian 2000). A Draft Recovery Plan was released in 2004; the final is expected in 2006. Within Grand Canyon National Park, sentry milkvetch has the full protection of an endangered species.

Data Sources. Sentry milkvetch has been recorded from several locations on the South Rim (Maricopa, Grandview, Lollipop, and points further east), and one location at Cape Final on the North Rim. Of these populations, only Maricopa Point has been verified as *var. cremnophylax*. Since permanent monitoring began in 1988, the Maricopa Point population has fluctuated greatly from stability and growth to decline. Numbers of individual plants have varied from 150 in 1982, a time of heavy trampling, to 683 in 2000 following a ten- year period of recovery post- fencing. The 2005 annual survey reported a total of 507 individuals; a decrease of 26% since 2000.

Although discovered in 1903, this plant was not collected again until 1947 when it was deemed “unquestionably of great rarity.” Since this time, numerous surveys on both North and South Rims have been conducted with limited success in locating additional populations. Through these surveys however, potential reintroduction sites have been identified along the South Rim near Grandview, Maricopa, and Papago Points. Surveys during 2005 along the rim north of Hermit Road revealed no new populations. Continued monitoring and genetic analysis of known populations, and further surveys are recommended.

Tusayan Flame Flower - Species of Special Concern – This perennial herb is endemic to Coconino and Yavapai counties in Arizona and is known from Yaki Point west to Horsethief Tank on the Coconino Plateau, on the South Rim of the park. It occupies rocky, limestone soils in shallow depressions, rocky ridge tops and bedrock outcrops in open, sunny areas in pinyon-juniper woodland.

Uncommon Plant Communities – As described in the Vegetation section of Chapter 3, two locations were found with the following three uncommon species in association. While information is lacking on these species, the following describes what is known about them.

***Lithophragma tenellum* Nutt.**

Lithophragma (Nutt.) Torr. and Gray, is a very small genus of the Saxifragaceae, with just nine species, all endemic to western North America (Holmgren and Holmgren 1997). Three

of these species, including *Lithophragma tenellum* Nutt., have wide ranges; four are restricted to California, and two to California and southwestern Oregon (Holmgren and Holmgren 1997). *Lithophragma tenellum* is a small perennial herb which occurs in rich loamy soils of open meadows, coniferous and deciduous forests, grasslands and shrublands (Klinkenberg 2004). Its distribution includes southern British Columbia, Canada, central and southeast Washington, southern Oregon and Idaho, southwest Montana, central and western Wyoming, northern and southern California, Nevada, Utah, central and northern Arizona and New Mexico (Albertson College, 2006). This species is considered “infrequent” throughout its range, and is ranked S3 or “vulnerable” in both British Columbia and Wyoming (NatureServe 2006). The populations in central Arizona in Coconino and Gila Counties occur from 5,000 to 8,000 feet elevation in pine forests (Kearney and Peebles 1951) and represent the southernmost distribution of this species.

***Delphinium scaposum* Greene**

Delphinium L. is a large genus of roughly 300 species, primarily from the Eastern Hemisphere and the tropics (Warnock 2006). There are 61 species of *Delphinium* listed in the Flora of North America. *Delphinium scaposum* Greene is a small perennial herb occurring in southern Utah, southwestern Colorado, Clark County Nevada, Grand and McKinley counties New Mexico and throughout Arizona (Erwin 1936). The species was first collected in 1888 by Green in New Mexico. By 1910 there was debate about the validity of many of the specimens collected under this name historically and this species may be more restricted than once thought (Greene 1881; Wootton 1910). *Delphinium scaposum* is reported from juniper woodlands, grasslands, deserts, and mesas from 2500 – 7000 feet elevation (Warnock 2006; Phillips and others 1987).

***Calochortus nuttallii* Torr, and Gray**

Calochortus Pursh. is a small genus of roughly 70 species. Fifty- six *Calochortus* species are listed in the *Flora of North America*, with more than half of these occurring only in California; all are endemic to western North America or Central America (Fielder and Zebell, 2006). *Calochortus nuttallii* Torr. is a delicate perennial herb occurring in eastern Montana, western North Dakota, and south to California, northern Arizona and northwestern New Mexico. It occurs on the open sagebrush foothills and valleys, as well as in open ponderosa pine stands from 4500- 8000 feet elevation. Ownbey (1940) states that *C. nuttallii* is “the most widespread species in the genus.” Although *Calochortus nuttallii* is not considered rare, many other species in the genus are Federally listed threatened or endangered due to their frail nature in relation to livestock trampling and due to over-collection from the garden trade (Colorado State University Herbarium 2006; USGS NPWRC 2006). This species is most common in years with high winter precipitation (USGS- NPS 2006).

APPENDIX E

Recently Completed, In- Progress and Foreseeable Future Actions

Hermit Road Rehabilitation

Recently Completed or In- Progress Projects

South Rim Viewpoint Rehabilitation – This project would address the need for maintenance and rehabilitation of approximately 14 viewpoints along Hermit Road and five viewpoints along Desert View Drive. Lack of consistent maintenance combined with heavy visitor use has resulted in deterioration of masonry structures, surface tread and fencing at these viewpoints. This project would repair and repoint historic walls; reset loose railing stanchions and footings; tighten or replace screws and brackets on railing stanchions; repair, replace or remove chain link fencing; stabilize historic and modern rock retaining walls and trail liners; remove vegetation affecting historic features and visitor safety; repair asphalt; rehabilitate and alter walkway at Maricopa Point and remove graffiti. Implementation has begun and is expected to occur through 2008. No new ground disturbance would result in the Bright Angel or Hermit Creek watershed subunits.

Greenway Trail – Phase III – This approximately seven- mile segment of the greenway trail would provide a pedestrian/bicycle/equestrian trail from the future Grand Canyon Transit Center in Tusayan (located near the park boundary) to Canyon View Information Plaza (the new orientation/transportation hub) within Grand Canyon National Park. This trail would provide an alternative means for nonmotorized access into the park. It would also provide a separated experience from the existing road and vehicles entering the park. The trail would be ten- feet wide with a hardened surface and a stabilized shoulder made from a mix of aggregate and topsoil. An area 12 to 14 feet wide would be temporarily disturbed during construction. Design and construction would promote sustainability where possible and would strive to minimize impacts on the land. The trail would provide a possible extension of the Arizona Trail into the park for hikers, cyclists and equestrian users. The trail would become part of the park's overall trail system and would be included in routine patrols by park rangers. Construction on portions of this trail has begun. New ground disturbance is estimated at approximately four acres in the Bright Angel Wash subunit watershed.

Market Plaza Shuttle Bus Stop (Completed)– With the opening of Canyon View Information Plaza and the expansion of shuttle bus operations, the bus stop at Market Plaza has become ineffective. Visitors are confused by the fact that buses are traveling in two directions, but using the same stop. Westbound buses must circle through the entire parking lot in order to enter the bus stop in the proper direction. There are pedestrian/vehicle conflicts causing safety concerns in this congested area. Proposed improvements including repairing curbs, replacing asphalt, installing new benches and replacing the existing shelter. The park also proposes to create a new bus stop across from the Canyon View Information Plaza access road and across from Yavapai Lodge. This new stop would serve westbound bus traffic while the rehabilitated existing stop would then serve only eastbound bus traffic. Construction is complete and disturbance occurred on approximately 0.5 acres within the Bright Angel Wash subunit watershed.

Hermits Rest Restroom Replacement – The existing restroom structure at Hermits Rest consists of a 1960's era block building with non- accessible chemical flush toilets. The chemical waste system is no longer effective, resulting in strong offensive odors and constant

maintenance. All toilets are mounted on a platform with steps, making them inaccessible to many visitors. This project includes demolition of the existing restroom building and associated waste tanks. Improvements include site grading, installation of four, double vault prefabricated concrete buildings, construction of accessible pathways from the shuttle bus stop and Hermits Rest, replacement of the existing roadway adjacent to the new restrooms and replacement of electrical service to the four existing structures at Hermits Rest. Construction began in March 2006 and should be complete by September/October 2006. The area is already disturbed and no new ground disturbance in the Hermit Creek subunit watershed would result.

Hopi Point Vault Toilet Installation - Hopi Point is a primary stop along Hermit road for both tour buses and shuttle buses; many visitors come to this point to watch the sunset. There are currently two portable toilets that have to be pumped frequently and do not meet the capacity for this heavily used site. This project proposes a installation of a double vault prefabricated concrete building, an accessible concrete walk and a pathway through the island to the existing trail east of Hopi Point. Construction is expected to be complete by September/October 2006 and disturbance is estimated at approximately 0.5 acres and does not occur within either watershed subunit.

Fire Management Activities – The Topeka prescribed burn unit was burned in fall 2004 and encompassed approximately 3,920 acres in the Bright Angel Wash subunit watershed. Some of this acreage occurs on the Kaibab National Forest. This burn focused on reducing fuel accumulations in this area south of Grand Canyon Village, creating defensible space near the Wildland Urban Interface around the village. Because prescribed burns are designed to improve forest conditions and do not result in a net loss of habitat, the treatment acreages are not considered ground disturbance and are not factored into the total amount of disturbance estimated for the Bright Angel Wash watershed subunit.

The Long Jim III prescribed burn occurred in spring 2004 and was predominately outside the Bright Angel wash subunit watershed and further to the east. However, a portion of the burn went out of prescription and was then managed as a wildfire and suppressed. The area where suppression actions were taken was approximately 230 acres and occurred within the eastern end of the subunit watershed. Burn severities were generally higher in this area than in the burn unit itself and are therefore calculated as disturbed acres for this analysis. However, this is only for purposes of this particular analysis; burned areas are not equivalent to impermeable paved or hardened surface. This is discussed in more detail in Chapter 3 under cumulative impacts.

Foreseeable Future Actions

South Rim Transportation Plan - The purpose of the South Rim Visitor Transportation Plan is to provide a transportation system that addresses the park's most pressing transportation issues through the year 2020. The plan would accommodate current and anticipated levels of visitation to South Rim, facilitate enhanced visitor experiences and protect park resources. Alternatives under consideration may include new parking areas near Canyon View Information Plaza (CVIP), or outside of the park north of Tusayan; expanded shuttle bus transit from Tusayan to CVIP; expanded shuttle bus transit within the Village and to Hermits Rest; improvements at the South Entrance Station to reduce wait times, such as additional vehicle lanes and tour bus parking/management. The EA is expected to be completed by summer 2007, with implementation occurring from 2008- 2012. Estimates for new ground disturbance are

difficult to make at this time, but for purposes of this analysis, approximately five to ten acres of new ground disturbance would result in the Bright Angel wash subunit watershed.

Bright Angel Trailhead Rehabilitation – This project would rehabilitate the Bright Angel Trailhead area historic landscape, which is used by nearly four million visitors a year. The preliminary proposal includes such things as repair of deteriorated stone walls, rehabilitation of pedestrian walkways, revegetation of denuded areas, and better definition of parking areas and walkways. The need for a restroom in this general area would also be evaluated. A cultural landscape report and preparation of a master concept plan for the area are project components. The project area is on land already disturbed and no new ground disturbance would result.

Greenway V – This project would construct a one- mile paved pedestrian path from Pipe Creek Vista to the South Kaibab Trailhead. This trail segment would connect with an already completed Rim Trail section that extends from Mather Point to Pipe Creek Vista, a shuttle bus stop. This project occurs outside both watershed subunits affected by the Hermit Road rehabilitation project.

Narrowband/Digital Radio Conversion – The park is proposing to convert all radio communications to this new technology, to create more available radio spectrum that will meet the most current privacy and security requirements. Measurable conversion results would improve communications for public safety, meet Federal standards, provide better services to park visitors and improve interoperability between other agencies. In order to do this, additional radio towers would be necessary throughout the park. One of them is in the vicinity of Hermit Road, at the Hopi Point Fire Tower. The proposal for this area is to clean up the site, consolidate all users' antennas onto one tower, replace the existing shelter with a new weather-proof building and install a new 60- foot free- standing tower with multiple antennae attached at different locations on the tower. The site may be fenced for public safety. The project area is already disturbed and no new ground disturbance is estimated.

Fire Management Activities – The 3,920 acre Topeka prescribed burn unit is on a five- year rotation and therefore is likely to be treated with fire again in 2011, and occurs within the Bright Angel Wash subunit watershed. Actions would be similar to those described under past actions above. However, because the same unit is being treated again under a similar prescription with the intent of mimicking a natural fire regime, these acres are not counted again. Under the on-going planning process for the revision of the park's Fire Management Plan, several other areas surrounding Grand Canyon Village are proposed for fuel reduction treatments in the Wildland Urban Interface surrounding the village, over the course of multiple years. Specific treatment areas and acreages are not known at this time and won't be until this planning process is complete, but it can reasonably be expected that some level of fuel reduction treatments (either manual and/or mechanical treatments) would occur in the Bright Angel Wash subunit watershed. For purposes of this analysis, approximately 1,200 acres would be treated, including a powerline corridor between the Orphan Mine south to Bright Angel Wash near Rowe Well Road. These areas would not be treated with prescribed fire, but with other fuel- reduction treatments such as pruning trees, limbing, clearing dead and down woody debris and burning it in piles or removing it from the area and thinning small diameter trees to provide adequate spacing. Work would typically be done with hand tools (axes, hand saws, chainsaws) although the use of mechanized equipment in some areas is currently being evaluated as part of the

ongoing fire management planning effort. Objectives for these treatments include protecting developed areas from wildfire by reducing the level of fire susceptibility.

In the Hermit Creek watershed subunit, approximately 1,000 acres are proposed for prescribed burning as part of the Horsethief unit. This is a ponderosa pine stringer surrounded by pinyon-juniper woodland. As described above, this is an estimate based on preliminary options currently under evaluation as part of the on- going fire management planning process and specific locations, acres and prescriptions could change over time.

Table 12. Disturbance Estimates by Watershed Subunit, for Past and Foreseeable Future Actions.

Disturbance	Hermit Creek Subunit Watershed (7,922 acres)	Bright Angel Wash Subunit Watershed (9,927 acres)
Existing disturbed acreage	13 acres (.16%)	689 (7%)
Disturbance from recently implemented and/or foreseeable future construction-related projects	0	15 acres
Disturbance from recently implemented fire activities	0	230 acres Long Jim Fire 3,920 acres Topeka prescribed burn
Disturbance from foreseeable future fire activities	1,000 acres of prescribed burning south of Hermit Road as part of the Horsethief unit	1,200 acres Wildland Urban Interface treatments surrounding the village
Totals	13 acres disturbance from construction-related projects, or less than 1% of the watershed subunit 1000 acres from prescribed fire activities, or 13%	704 acres from construction- related projects, or 7% of the watershed 5350 acres from fire activities, or 54%

APPENDIX F

Vascular Plants Documented Along Hermit Road, 2005

Species	Life Form	Nativity
<i>Bromus rubens</i> L.	Graminoid	Exotic
<i>Bromus tectorum</i> L.	Graminoid	Exotic
<i>Alyssum minus</i> (L.) Rothm.	Herb	Exotic
<i>Ceratocephala testiculata</i> (Crantz) Bess.	Herb	Exotic
<i>Chorispora tenella</i> (Pallas)	Herb	Exotic
<i>Erodium cicutarium</i> (L.) L 'Hér. Ex Ait.	Herb	Exotic
<i>Lactuca serriola</i> L.	Herb	Exotic
<i>Medicago lupulina</i> L.	Herb	Exotic
<i>Melilotus alba</i> Medikus	Herb	Exotic
<i>Melilotus officinalis</i> (L.) Lam.	Herb	Exotic
<i>Melilotus</i> sp.	Herb	Exotic
<i>Salsola tragus</i> L.	Herb	Exotic
<i>Salvia aethiopsis</i> L.	Herb	Exotic
<i>Sisymbrium irio</i> L.	Herb	Exotic
<i>Taraxacum officinale</i> G.H. Weber ex Wiggers	Herb	Exotic
<i>Tragopogon dubius</i> Scop.	Herb	Exotic
<i>Verbascum thapsus</i> L.	Herb	Exotic
<i>Echinocereus triglochidiatus</i> Engelm.	Cacti	Native
<i>Escobaria vivipara</i> (Nutt.)	Cacti	Native
<i>Opuntia macrorhiza</i> Engelm.	Cacti	Native
<i>Androsace septentrionalis</i> L.	Herb	Native
<i>Arabis perennans</i> S. Wats.	Herb	Native
<i>Arenaria fendleri</i> Gray	Herb	Native
<i>Artemisia ludoviciana</i> Nutt.	Herb	Native
<i>Asclepias subverticillata</i> (Gray) Vail	Herb	Native
<i>Asclepias tuberosa</i> L.	Herb	Native
<i>Astragalus</i> spp.	Herb	Native
<i>Astragalus calycosus</i> Torr. ex S. Wats.	Herb	Native
<i>Astragalus newberryi</i> (Gray)	Herb	Native
<i>Bahia dissecta</i> (Gray) Britt.	Herb	Native
<i>Calochortus nuttallii</i> Torr. & Gray	Herb	Native
<i>Calylophus hartwegii</i> (Benth.) Raven	Herb	Native
<i>Castilleja linariifolia</i> Benth.	Herb	Native
<i>Castilleja</i> sp.	Herb	Native
<i>Chaetopappa ericoides</i> (Torr.) Nesom	Herb	Native
<i>Chamaesyce albomarginata</i> (Torr. & Gray)	Herb	Native
Small		Native
<i>Chenopodium fremontii</i> S. Watts.	Herb	Native
<i>Cirsium arizonicum</i> (Gray) Petrak	Herb	Native
<i>Claytonia perfoliata</i> spp. <i>perfoliata</i> Donn ex Willd.	Herb	Native
<i>Comandra umbellata</i> spp. <i>pallida</i> (D. AC.) Piehl	Herb	Native
<i>Cordylanthus parviflorus</i> (Ferris) Wiggins	Herb	Native

Species	Life Form	Nativity
<i>Cryptantha gracilis</i> Osterhout	Herb	Native
<i>Cryptantha</i> sp.	Herb	Native
<i>Delphinium</i> spp. (<i>D. scaposum</i> Greene and <i>D. nuttallianum</i> Pritz ex Walp.)	Herb	Native
<i>Descurainia pinnata</i> (Walt.) Britt.	Herb	Native
<i>Draba cuneifolia</i> Nutt. ex Torr. & Gray	Herb	Native
<i>Erigeron concinnus</i> (Hook. & Arn.) Torr. & Gray	Herb	Native
<i>Erigeron divergens</i> Torr. & Gray	Herb	Native
<i>Eriogonum alatum</i> Torr.	Herb	Native
<i>Eriogonum cernuum</i> Nutt.	Herb	Native
<i>Eriogonum racemosum</i> Nutt.	Herb	Native
<i>Erysimum</i> sp.	Herb	Native
<i>Frasera albomarginata</i> S. Wats.	Herb	Native
<i>Galium wrightii</i> Gray	Herb	Native
<i>Gayophytum diffusum</i> Torr. & Gray	Herb	Native
<i>Gilia hutchinsifolia</i> Rydb.	Herb	Native
<i>Grindelia</i> sp.	Herb	Native
<i>Hedeoma drummondii</i> Benth.	Herb	Native
<i>Heterotheca villosa</i> (Pursh) Shinnars	Herb	Native
<i>Hymenopappus filifolius</i> var. <i>lugens</i> (Greene) Jepson	Herb	Native
<i>Hymenoxys richardsonii</i> (Hook.) Cockerell	Herb	Native
<i>Ipomopsis aggregata</i> (Pursh) V. Grant	Herb	Native
<i>Lappula occidentalis</i> (S. Wats.) Greene	Herb	Native
<i>Layia glandulosa</i> (Hook.) Hook. & Arn.	Herb	Native
<i>Lesquerella gordonii</i> (Gray) S. Wats.	Herb	Native
<i>Linum aristatum</i> Engelm.	Herb	Native
<i>Lithophragma tenellum</i> Nutt.	Herb	Native
<i>Lomatium foeniculaceum</i> (Nutt.) Coult. & Rose	Herb	Native
<i>Lotus wrightii</i> (Gray) Greene	Herb	Native
<i>Machaeranthera gracilis</i> (Nutt.) Shinnars	Herb	Native
<i>Machaeranthera</i> sp.	Herb	Native
<i>Mimulus rubellus</i> Gray	Herb	Native
<i>Myosurus apetalus</i> C. Gay	Herb	Native
<i>Oenothera caespitosa</i> Nutt.	Herb	Native
<i>Orobanche fasciculata</i> Nutt.	Herb	Native
<i>Packera multilobata</i> (Torr.) & Gray ex Gray) W.A. Weber & A. Löve	Herb	Native
<i>Pedicularis centranthera</i> Gray	Herb	Native
<i>Penstemon barbatus</i> (Cav.) Roth	Herb	Native
<i>Penstemon eatonii</i> Gray	Herb	Native
<i>Penstemon linarioides</i> Gray	Herb	Native
<i>Penstemon pachyphyllus</i> Gray ex Rydb.	Herb	Native
<i>Penstemon rostriflorus</i> Kellogg	Herb	Native
<i>Petrophyton caespitosum</i> (Nutt.) Rydb.	Herb	Native
<i>Phlox austromontana</i> Coville	Herb	Native
<i>Phlox gracilis</i> ssp. <i>gracilis</i> (Hook.) Greene	Herb	Native
<i>Phlox longifolia</i> Nutt.	Herb	Native

Species	Life Form	Nativity
<i>Polygonum douglasii</i> Greene	Herb	Native
<i>Potentilla hippiana</i> Lehm.	Herb	Native
<i>Solidago</i> sp.	Herb	Native
<i>Sphaeralcea ambigua</i> Gray	Herb	Native
<i>Sporobolus</i> sp.	Herb	Native
<i>Stephanomeria exigua</i> Nutt.	Herb	Native
<i>Stevia</i> sp.	Herb	Native
<i>Symphotrichum falcatum</i> (Lindl.) Nesom	Herb	Native
var. <i>commutatum</i> (Torr. & Gray) Nesom		
<i>Talinum validulum</i> Greene	Herb	Native
<i>Tetranneuris acaulis</i> var. <i>acaulis</i> (Pursh)	Herb	
Greene		Native
<i>Thalictrum fendleri</i> Engelm. ex Gray	Herb	Native
<i>Thlaspi montanum</i> L.	Herb	Native
<i>Townsendia exscapa</i> (Richards.) Porter	Herb	Native
<i>Verbena bracteata</i> Lag. & Rodr.	Herb	Native
<i>Achnatherum hymenoides</i> (Roemer & J.A. Schultes) Barkworth	Graminoid	Native
<i>Aristida purpurea</i> Nutt.	Graminoid	Native
<i>Blepharoneuron tricholepis</i> (Torr.) Nash	Graminoid	Native
<i>Bouteloua curtipendula</i> (Michx.) Nutt.	Graminoid	Native
<i>Bouteloua gracilis</i> (Willd. Ex Kunth) Lag. Ex Griffiths	Graminoid	Native
<i>Bromus anomalus</i> Rupr. ex Fourn.	Graminoid	Native
<i>Carex geyeri</i> Boott	Graminoid	Native
<i>Elymus elymoides</i> (Raf.) Swezey	Graminoid	Native
<i>Hesperostipa comata</i> (Trin. & Rupr.) Barkworth	Graminoid	Native
<i>Koeleria macrantha</i> (Ledeb.) J.A. Schultes	Graminoid	Native
<i>Muhlenbergia montana</i> (Nutt.) A.S. Hitchc.	Graminoid	Native
<i>Muhlenbergia wrightii</i> Vasey ex Coult.	Graminoid	Native
<i>Poa fendleriana</i> (Steud.) Vasey	Graminoid	Native
<i>Vulpia octoflora</i> (Walt.) Rydb.	Graminoid	Native
<i>Agave utahensis</i> Engelm.	Shrub	Native
<i>Amelanchier utahensis</i> Koehne	Shrub	Native
<i>Artemisia tridentata</i> Nutt.	Shrub	Native
<i>Atriplex canescens</i> (Pursh) Nutt.	Shrub	Native
<i>Berberis fremontii</i> Torr.	Shrub	Native
<i>Brickellia californica</i> (Torr. & Gray) Gray	Shrub	Native
<i>Chamaebatiaria millefolium</i> (Torr.) Maxim.	Shrub	Native
<i>Ephedra viridis</i> Coville	Shrub	Native
<i>Ericameria nauseosa</i> (Pallus ex Pursh) Nesom & Baird	Shrub	Native
<i>Eriogonum corymbosum</i> Benth.	Shrub	Native
<i>Eriogonum heermannii</i> Dur. & Hilg.	Shrub	Native
<i>Eriogonum umbellatum</i> Torr.	Shrub	Native
<i>Fallugia paradoxa</i> (D. Don) Endl. Ex Torr.	Shrub	Native
<i>Fendlerella utahensis</i> (S. Wats.) Heller	Shrub	Native
<i>Gutierrezia microcephala</i> (DC.) Gray	Shrub	Native
<i>Petradoria pumila</i> (Nutt.) Greene	Shrub	Native

Species	Life Form	Nativity
<i>Purshia mexicana</i> (D. Don) Henrickson	Shrub	Native
<i>Ribes cereum</i> Dougl.	Shrub	Native
<i>Ribes pinetorum</i> Dougl.	Shrub	Native
<i>Symphoricarpos longiflorus</i> Gray	Shrub	Native
<i>Yucca baccata</i> Torr.	Shrub	Native
<i>Juniperus osteosperma</i> (Torr.) Little	Tree Seedling	Native
<i>Pinus edulis</i> Engelm.	Tree Seedling	Native
<i>Pinus ponderosa</i> P.& C. Lawson	Tree Seedling	Native
<i>Quercus gambelii</i> Nutt.	Tree Seedling	Native

List of Abbreviations and Acronyms

AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
ADEQ	Arizona Department of Environmental Quality
AGFD	Arizona Game and Fish Department
BA	Biological Assessment
CCC	Civilian Conservation Corps
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CVIP	Canyon View Information Plaza
CWA	Clean Water Act
dB	Decibels
dBA	Sound measurements weighted for human sensitivity in particular frequencies
DDT	Dichlorodiphenyltrichloroethane
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FHWA	Federal Highways Administration
FR	Federal Register
GIS	Geographic Information System
GMP	General Management Plan
IDT	Interdisciplinary Team
MOU	Memorandum of Understanding
MSO	Mexican Spotted Owl
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
PAC	Protected Activity Centers
SHPO	State Historic Preservation Officer

USFWS
USGS

U.S. Fish and Wildlife Service
U.S. Geological Survey