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**CHAPTER 3. AFFECTED  
ENVIRONMENT AND  
ENVIRONMENTAL  
CONSEQUENCES**

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# INTRODUCTION

This chapter describes the present condition — the affected environment — within the project area and the changes — the environmental consequences — that can be expected from implementing the action alternatives or taking no action at this time. The National Environmental Policy Act requires that environmental documents disclose the environmental impacts of a proposed federal action, reasonable alternatives to that action, and any adverse environmental effects that cannot be avoided should the proposed action be implemented.

The no-action alternative sets the environmental baseline for comparing effects of the other alternatives. The impact topics (see page 18) 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 impact, mitigation measures, and cumulative effects.

## **METHODOLOGY**

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To determine impacts, methodologies were identified to measure the change in park resources that would occur with the implementation of the alternatives. These impacts 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 (Are the effects negligible, minor, moderate, or major?). Intensities, or impact thresholds, were established for each impact topic to help understand the severity and magnitude of changes in resource conditions, both adverse and beneficial, of the various management alternatives. Impacts were also identified for construction, where relevant, and for ongoing actions under each alternative.

Impacts were also considered in the context of whether they were local, regional, or widespread. For this analysis, local impacts would include the area of proposed construction or greater, including the South Rim, the Tusayan area, and other gateway communities such as Cameron. Regional impacts would be noticeable in Coconino and Mohave counties and would extend as far as Flagstaff to the south; to Las Vegas, Nevada, to the west; and into southwest Utah on the north. Widespread impacts would apply to the entire southwestern United States or even other areas of the country.

Certain assumptions were made in analyzing environmental impacts because of the nature of the alternatives. As previously described, each alternative would be implemented in phases over time. Initially those physical improvements that would address the most pressing transportation-related needs would be implemented, while concurrently investing in operational strategies that support the plan's objectives. The National Park Service would closely monitor and evaluate the effects of the initial actions and make adjustments as deemed necessary in advance of proceeding with the next set of actions. Because of this adaptive management process, alternative actions may or may not be implemented prior to the 2020 planning horizon; and, if implemented, the timing of the action is currently unknown. As a result, impacts for each alternative were determined assuming that all phases of the alternative were fully executed. All impacts are fully reported using this process, but they may not be realized, depending on decisions made as the proposed transportation program is adaptively managed over time.

Table 16 shows the number of acres that would be disturbed and possibly restored under each alternative. These acreages are referred to throughout the impact analysis. Table 17 summarizes impacts to vegetation,

TABLE 16. DISTURBANCE AND RESTORATION AREA MATRIX

	Total Area of Construction (acres)	Net New Disturbance (acres)	Area of Previously Developed Land Restored (acres)
<b>Alternative B — Preferred Alternative</b>			
Canyon View Information Plaza <sup>1</sup>	26.0	24.0	6.0
New Bus Stops	1.0	1.0	0.0
South Entrance Station <sup>2</sup>	3.0	3.0	0.0
Greenway Trail (park boundary to roundabout)	3.0	3.0	0.0
Tusayan	10.0	10.0	0.0
Parking Lot D	2.0	0.0	0.0
<b>Total Disturbance Area<sup>3</sup></b>	<b>45.0</b>	<b>41.0</b>	<b>6.0</b>
<b>Alternative C — Tusayan Parking Emphasis</b>			
Canyon View Information Plaza <sup>1</sup>	15.0	15.0	1.0
New Bus Stops	1.0	1.0	0.0
South Entrance Station <sup>2</sup>	2.0	2.0	0.0
Greenway Trail (park boundary to roundabout)	3.0	3.0	0.0
Tusayan	17.0	17.0	0.0
Parking Lot D	2.0	0.0	0.0
<b>Total Disturbance Area<sup>3</sup></b>	<b>40.0</b>	<b>38.0</b>	<b>1.0</b>
<b>Alternative D — Canyon View Information Plaza Parking Emphasis</b>			
Canyon View Information Plaza <sup>1</sup>	30.0	26.0	5.0
New Bus Stops	1.0	1.0	0.0
South Entrance Station <sup>2</sup>	3.0	3.0	0.0
Greenway Trail (park boundary to roundabout)	3.0	3.0	0.0
Parking Lot D	2.0	0.0	0.0
<b>Total Disturbance Area<sup>3</sup></b>	<b>39.0</b>	<b>33.0</b>	<b>5.0</b>

## Notes:

The estimated disturbance for each area is rounded up to the next whole number of acres.

The area of disturbance for the maintenance facility is not included because this development was cleared in a separate NEPA document.

1. The total area of construction for Canyon View Information Plaza includes 1 acre for detention ponds.

2. The total area of construction for the South Entrance Station includes the fee administration building, along with its access drive and parking lot.

3. The total area of construction for each alternative includes a 20' construction buffer.

wildlife habitat, and birds/small mammals as described in the analyses for the action alternatives (B, C, and D).

## CUMULATIVE IMPACTS

CEQ regulations to implement the National Environmental Policy Act require the assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions” (40 CFR 1508.7). Cumulative impacts can result from individually minor, but collectively significant actions, taking place over a period of time. Cumulative impacts are considered for all alternatives, including the no-action alternative. Therefore,

it is necessary to identify other ongoing or foreseeable future actions within the vicinity of the project area.

NPS projects on the South Rim that have recently been completed or are underway are related to transportation, visitor services, construction, and fire management. The National Park Service has analyzed these projects in accordance with the requirements of the National Environmental Policy Act and/or the National Historic Preservation Act. Projects within Tusayan and the Tusayan Ranger District of Kaibab National Forest were also considered if they were recently completed or are currently being implemented. Projects were included if they were located in the vicinity of areas included within the South Rim visitor transportation plan or were linked in some way with operations or activities taking place in these areas. A list of projects is provided in Appendix D.

**TABLE 17. IMPACT MATRIX FOR VEGETATION, WILDLIFE HABITAT, BIRDS AND SMALL MAMMALS**

	Net New Disturbance (acres)	Tree Removal	New Edge Habitat Created (linear feet)	Bird Territories Lost <sup>1</sup>	Small Mammals Affected by Habitat Loss
<b>Alternative B — Preferred Alternative</b>					
Canyon View Information Plaza	24.0	2,975	15,065	48	480
New Bus Stops <sup>2</sup>	1.0	Unknown	0	Unknown	Unknown
South Entrance Station	3.0	714	4,075	Unknown	45
Greenway Trail (park boundary to roundabout)	3.0	412	12,500	Unknown	45
Tusayan	10.0	363	4,475	Unknown	150
Parking Lot D	0.0	0	0	0	0
<b>Estimated Totals<sup>3</sup></b>	<b>41.0</b>	<b>4,464</b>	<b>36,115</b>	<b>48</b>	<b>720</b>
<b>Alternative C — Tusayan Parking Emphasis</b>					
Canyon View Information Plaza	15.0	1,860	9,725	30	300
New Bus Stops <sup>2</sup>	1.0	Unknown	0	Unknown	Unknown
South Entrance Station	2.0	476	2,350	Unknown	30
Greenway Trail (park boundary to roundabout)	3.0	412	12,500	Unknown	45
Tusayan	17.0	617	7,070	Unknown	255
Parking Lot D	0.0	0	0	0	0
<b>Estimated Totals<sup>3</sup></b>	<b>38.0</b>	<b>3,365</b>	<b>31,645</b>	<b>30</b>	<b>630</b>
<b>Alternative D — Canyon View Information Plaza Parking Emphasis</b>					
Canyon View Information Plaza	26.0	3,223	15,370	52	520
New Bus Stops <sup>2</sup>	1.0	Unknown	0	Unknown	Unknown
South Entrance Station	3.0	714	4,075	Unknown	45
Greenway Trail (park boundary to roundabout)	3.0	412	12,500	Unknown	45
Parking Lot D	0.0	0	0	0	0
<b>Estimated Totals<sup>3</sup></b>	<b>33.0</b>	<b>4,449</b>	<b>31,945</b>	<b>52</b>	<b>610</b>

NOTES: Tree removals, bird territories lost, and small mammals affected shown in this table represent the high end of the range presented in the discussion for each site under each alternative.

The estimated edge habitat created for each area is rounded up to the nearest 5.

1. Data are unavailable for bird territories per acre in the Rocky Mountain montane conifer forest.
2. Actual tree removal at the bus stops will be determined during design, with steps taken to avoid mature trees. The number of bird territories and small mammals affected by the bus stops has not been estimated due to the limited extent of impacts (1 acre) over multiple areas.
3. Estimated totals include only known disturbances as reported in this table. Actual totals could be different depending on the site-specific conditions.

Foreseeable future NPS actions related to transportation, visitor services, construction, or fire management were considered to be actions that could occur within the next five years and currently have funding or for which funding is actively being sought. Foreseeable future projects within Tusayan and the Tusayan Ranger District of Kaibab National Forest were also included if implementation is anticipated in the near future or actions were outlined in active planning or compliance documents. Projects were included if they met the same criteria as the above (Appendix D).

A cumulative impact analysis was conducted for the full implementation of the *General Management Plan* and is documented in the *Final Environmental Impact Statement*. Because the *General Management Plan* was a conceptual plan and because it required that site-specific analyses be conducted for pro-

jects identified in the plan, a cumulative effects analysis that is more specific to impact topics pertaining to the South Rim visitor transportation plan is needed.

## IMPAIRMENT

In addition to determining the environmental consequences of implementing the alternatives, *NPS Management Policies 2006* require the analysis of potential effects to determine whether actions would impair park resources (NPS 2006d).

The fundamental purpose of the national park system, established by the 1916 Organic Act and reaffirmed by the General Authorities Act of 1970, 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. Nevertheless, 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 might 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 NPS activities in managing the park, visitor activities, or activities undertaken by concessioners, contractors, and others operating in the park. The potential for impairment is discussed in the conclusion section of each natural and cultural resource impact topic. If the impact to a resource is moderate, a paragraph summarizing the conclusions of this evaluation is included following the cumulative impact analysis. If the impact is minor or negligible, the results are provided in the conclusion statement at the end of the environmental consequences section for each applicable resource in this chapter.

## UNACCEPTABLE IMPACTS

The impact threshold at which impairment occurs is not always readily apparent. Therefore, the National Park Service will apply a standard that offers greater assurance that impairment will not occur. The National Park Service will do this by avoiding impacts that it determines to be unacceptable. These are impacts that fall short of impairment, but are still not acceptable within a particular park's environment. Park managers must not allow uses that would cause unacceptable impacts; they must evaluate existing or proposed uses and determine whether the associated impacts on park resources and values are acceptable.

Virtually every form of human activity that takes place within a park has some degree of effect on park resources or values, but that does not mean the impact is unacceptable or that a particular use must be disallowed. Therefore, for the purposes of these policies, unacceptable impacts are impacts that, individually or cumulatively, would be inconsistent with a park's purposes or values; or

- impede the attainment of a park's desired future conditions for natural and cultural resources as identified through the park's planning process; or
- create an unsafe or unhealthful environment for visitors or employees; or
- diminish opportunities for current or future generations to enjoy, learn about, or be inspired by park resources or values, or unreasonably interfere with park programs or activities, or an appropriate use, or the atmosphere of peace and tranquility, or the natural soundscape maintained in wilderness and natural, historic, or commemorative locations within the park, or NPS concessioner or contractor operations or services.

In accordance with *Management Policies 2006*, park managers must not allow uses that would cause unacceptable impacts to park resources. To determine if unacceptable impact could

occur to the resources and values of Grand Canyon National Park, the impacts of proposed actions in this environmental assessment have been evaluated based on the above criteria. A determination on unacceptable impacts is made in the Conclusion section for each of the resource topics carried forward in this chapter.

## **FUTURE NEPA COMPLIANCE**

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This environmental assessment describes the impacts associated with the Grand Canyon South Rim visitor transportation plan. As elements of the plan are implemented, the environmental analysis will be reviewed to determine that (1) all impact topics were analyzed in site-specific detail, (2) there are no changes to the proposal, (3) there are no changes in affected environment (e.g., new listed threatened or endangered species, or listing of a resource on the National Register of Historic Places), and (4) there are no changes to impacts to environmental resources. If all of these criteria apply, a memo-to-files will be used to document site-specific compliance with the National Environmental Policy Act. If changes have occurred or if the site-specific detail is insufficient, additional compliance documentation will be required.

## **ASSESSMENT OF EFFECT UNDER SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT**

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Federal actions that have the potential to affect cultural resources are subject to various laws. The National Historic Preservation Act of 1966, as amended, is the principal legislative authority for managing cultural resources associated with NPS projects. Generally, section 106 of the act requires all federal agencies to consider the effects of their actions on cultural resources listed on and/or determined eligible for listing on the National Register of Historic Places. An assessment of effect for each alternative that summarizes the project's potential effects on cultural resources is

included at the end of the “Cultural Resources” section.

The assessment of impacts on cultural resources for this project was made in accordance with regulations of the Advisory Council on Historic Preservation (ACHP) for implementing section 106 of the National Historic Preservation Act (36 CFR 800). The project is being reviewed in accordance with the 1995 “Nationwide Programmatic Agreement between the National Park Service, the Advisory Council on Historic Preservation, and the National Council of Historic Preservation Officers,” and the 1995 “Programmatic Agreement between the Arizona State Historic Preservation Officer and the Advisory Council on Historic Preservation” that is specific to the *Final General Management Plan and Environmental Impact Statement* for Grand Canyon National Park (see Chapter 4). This programmatic agreement is limited in scope to those activities described in the *Final General Management Plan and Environmental Impact Statement*. It allows for some project planning and implementation to proceed with internal park management, but it stipulates that Section 106 compliance will be undertaken for all major planning efforts and will be in accordance with the servicewide programmatic agreement mentioned above.

Under the regulations of the Advisory Council on Historic Preservation, a determination of either *adverse effect* or *no adverse effect* must be made for affected resources listed on or eligible for listing on the National Register of Historic Places. An *adverse effect* occurs when an undertaking may alter any of the characteristics of a historic property that qualify it for inclusion in the National Register. Cultural resources are nonrenewable resources and adverse effects generally consume, diminish, or destroy the historic materials or form, resulting in a loss in the integrity of the property's location, design, setting, materials, workmanship feeling or association. A determination of *no adverse effect* means there is an effect, but the effect would not diminish the characteristics of the

cultural resource that qualify it for inclusion on the national register.

### Area of Potential Effect

The ACHP regulations that implement section 106 require that impacts to historic resources be identified and evaluated by determining the area of potential effects and by identifying cultural resources present in the area of potential effect that are either listed on or eligible for listing on the national register (36 CFR Part 800, “Protection of Historic Properties”). The area of potential effect is the geographic area or areas within which an undertaking may directly or indirectly cause alterations to the character or use of historic properties, and it is influenced by the scale and nature of an undertaking. The area of potential effect for the South Rim visitor transportation plan includes those locations that are within the project site boundaries on both national park system and national forest system lands where direct impacts could occur from proposed actions; it also encompasses a larger area, as described below, to include resources where potential indirect impacts may occur (such as changed viewsheds, which introduce new elements into a historic setting).

The project is within the boundaries of Grand Canyon National Park and Kaibab National Forest. The area of potential effect for cultural resources encompasses both those areas where proposed actions might occur that would directly impact cultural resources, as well as adjacent areas that contain resources that might be indirectly affected. Therefore, the area of potential effect for this undertaking includes the following:

- Grand Canyon Village National Historic Landmark District, the Grand Canyon Depot National Historic Landmark, the Moqui Ranger Station, and Mather Point, which may be eligible for listing on the National Register of Historic Places

- for roadway corridors, the roadway, shoulders, plus 20 feet on either side
- for existing parking areas, a 20-foot perimeter from the finished edge
- for trails, a 20-foot corridor on either side of the trail where work may occur
- for areas of new construction and landscaping, a 20-foot perimeter from the area of disturbance
- for areas of natural resource enhancement and restoration, the specific site

### Methodology

The general methodology for assessing impacts to cultural resources is described here because the approach is the same under section 106 for each cultural resource topic. Cultural resources were identified and evaluated by

- (1) determining the area of potential effects;
- (2) identifying cultural resources present in the area of potential effects that are either listed on, or eligible for listing on, the National Register of Historic Places
- (3) applying the criteria of adverse effect to affected cultural resources that are listed on or eligible for listing on the national register
- (4) considering ways to avoid, minimize, or mitigate adverse effects

Cultural resources that could be affected under this project were identified by consulting with park cultural resources staff, reviewing previous studies and reports, reviewing site inventories and maps, conducting field visits to sites where actions may occur, and overlaying proposed actions on top of maps of known resources to identify potential direct and indirect impacts. Where impacts were identified, either adjustments were made in the alternative and/or appropriate mitigation measures were identified.

CEQ regulations and *DO #12* also call for a discussion of mitigation, as well as an analysis

of how effective the mitigation would be in reducing the intensity of a potential impact (e.g., reducing the intensity of an impact from major to moderate or minor). Any resultant reduction in intensity of impact due to mitigation, however, is an estimate of the effectiveness of mitigation only under the National

Environmental Policy Act. It does not suggest that the level of effect as defined by section 106 is similarly reduced.. Therefore, although actions determined to have an *adverse effect* under Section 106 might be mitigated, the effect remains adverse.

# CULTURAL RESOURCES

## ARCHEOLOGICAL RESOURCES

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### Affected Environment

Limited archeological evidence suggests that people have used and/or inhabited the Grand Canyon area since the terminal Pleistocene, approximately 11,000 to 10,500 years ago.

Evidence is based on the discovery of several projectile type points. Although archeological evidence for the Paleoindian period is rare, the potential for future discovery is probable (Moffitt and Moffitt 1998). 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 (NPS 2007c) suggest 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 (NPS 2007c).

Formal settlement of the canyon by the Kayenta and Virgin people (Ancestral Puebloans) appears to have ended by the 13th century (Gilpin 2004). The end of the formal settlement of canyon areas by Ancestral Puebloans did not mean the end of canyon use by descendants of these people. For example, the Hopi continued to travel to the area

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\* The terms used in this section are archeological constructs. They do not represent the names people would have called themselves, and they are not the names modern day descendants use to refer to ancestors. They are devices archeologists use as tools for scientific discussion.

during the Protohistoric and Historic periods. 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. Use of the canyon by the Havasupai, Hualapai, and Southern Paiute becomes visible archeologically during the Protohistoric period. These groups, in conjunction with the Hopi, Zuni, Navajo, Yavapai, and White Mountain Apache, have maintained close ties to the canyon into the present.

The historic period begins with the first contact and written documentation of contact between the Spanish and American Indian groups inhabiting the Grand Canyon area in AD 1540. 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). Tourists began visiting the Grand Canyon in the 1880s, often staying at miners' camps, some arriving by stagecoach, and many using established trails to access the inner canyon. Hundreds of historic Anglo and American Indian sites have been documented in the inner corridor and both rims of Grand Canyon (Moffitt and Moffitt 1998).

The following is a description of known archeological resources within the study area, organized by geographical area. However, because the park has had over 11,000 years of human occupation, resulting in an extensive archeological record, it should be noted that the potential exists for archeological discoveries to be made in the study area during project implementation.

### ***Canyon View Information Plaza / Mather Point***

The project area for Canyon View Information Plaza was originally surveyed in 1973 (Moffitt and Moffitt 2004). A portion of this same area was resurveyed in 1991 by a park archeologist in advance of a prescribed fire

project. In 1995 park archeologists conducted an intensive systematic survey and inventory of 490 acres encompassing the proposed project area for Canyon View Information Plaza and associated developments at Mather Point. From this work archeologists concluded that Mather Point appears to have undergone extensive and severe deflation and erosion as the result of several environmental conditions, including fire, overgrazing, logging, and visitation. As a result, prehistoric artifacts have become widely dispersed across the landscape (Moffitt and Moffitt 2004).

In 1995 a total of 67 sites were inventoried at Mather Point by Grand Canyon archeologists in anticipation of the Canyon View Information Plaza project. In advance of construction, park planners identified 23 sites that would potentially be impacted, and they developed recommendations to mitigate adverse impacts to significant properties. In 1996 and 1997, 16 of these sites were subjected to in-depth evaluation through testing or mitigation. These sites required mitigation before construction began. Of the 16 sites, 6 would have been directly impacted by the construction project and 4 indirectly impacted. During the summer of 1998, these 10 sites were mitigated for direct and indirect impacts as described in the “Mather Point Orientation Center Supplemental Mitigation Plan” (Moffitt and Moffitt 1998). In addition, three other sites were mitigated as part of the Grand Canyon Village trail enhancement project in 2000 (Moffitt and Moffitt 2004).

Within the study area for this document, a total of seven sites that have been mitigated for adverse impacts, and eight sites that have been surveyed and/or tested in the Canyon View Information Plaza and Mather Point areas could be directly or indirectly impacted by proposed actions of the alternatives. The sites are shown in Table 18.

**South Entrance Station**

Park archeologists conducted an intensive pedestrian survey of park lands adjacent to the

**TABLE 18. ARCHEOLOGICAL SITES THAT COULD BE IMPACTED — CANYON VIEW INFORMATION PLAZA AND MATHER POINT**

Site Number	Cultural Affiliation	Date	Type
<b>Mitigated Sites</b>			
AZ:B:16:442	Cohonina	AD 850–1100	Short-term, seasonal occupancy
AZ:B:16:436	Unknown	unknown	Lithic scatter, seasonal camp
AZ:B:16:457	Navajo	Post-1882	Brush hogan
AZ:B:16:458	Puebloan Navajo	AD 1150–80 AD 1700–1800	Seasonal camp, processing; Seasonal piñon-gathering camp
AZ:B:16:459	Unknown	Possibly Archaic period	Short-term seasonal camp; light lithic scatter
AZ:B:16:460	Possible Pai (Hualapai, Havasupai, or Yavapai)	AD 1300	Seasonal processing, light lithic scatter
AZ:B:16:461	Navajo or Havasupai	Post-1830	Short-term seasonal camp, seed processing
<b>Surveyed / Tested Sites</b>			
AZ:B:16:216	Cohonina	Early Pueblo, AD 900–1000	Lithic scatter, maybe subsurface pit structures
AZ:B:16:437	Unknown	Archaic period	Lithic scatter
AZ:B:16:438	Possible Cohonina	AD 700–1200	Prehistoric lithic scatter, minor historic component
AZ:B:16:439	Unknown	Unknown	Lithic scatter
AZ:B:16:440	Navajo	Historic	Temporary camp site
AZ:B:16:435	Unknown	Historic, ca. 1915	Historic artifacts and logs
AZ:B:16:455	Navajo or Havasupai	1920–70	Brush shelter
AZ:B:16:456	Navajo or Havasupai	1910–30	Brush/log structure, historic artifacts

NOTE: To ensure protection of the sites, the site numbers have been deleted

South Entrance Station in August 2006 in the area of potential effect for modifications to this entrance area. Previous cultural resources studies, primarily the light-rail corridor project survey in 1997, identified 14 archeological sites within this area, on both the east and west sides of SR 64 near the park entrance. Archeologists inventoried a total of

300 acres. No previously unidentified sites were encountered. The survey was conducted as part of the South Rim transportation planning effort and the Systemwide Archeological Inventory Program (NPS 2006e). The resultant report describes the sites and isolated occurrences, site conditions, management recommendations, and suggestions for future research (NPS 2006e).

The *Environmental Assessment / Assessment of Effects for the South Entrance Road Improvements* (NPS 2007c) proposes modifications to the South Entrance area. In support of this effort, the 2006 survey work was reviewed and a more specific project area was surveyed again in June 2007. Four sites were identified in the vicinity of the project. The *Environmental Assessment* states that all sites would be avoided during project implementation. It is not anticipated that any of these sites would be affected by proposed South Rim transportation modifications analyzed in this document.

### **Grand Canyon Railway**

The area around parking lot D has been in the center of Euro-American development for the past 100 years. A number of historic features are adjacent to the parking lot, and there is the potential for buried historic archeological sites.

### **National Forest System Lands**

Cultural resource surveys were conducted on national forest system land as part of the data collection efforts for the *Tusayan Growth Environmental Impact Statement* (USFS 1999). At that time, four cultural resource sites were found on national forest system land and all were considered eligible for the National Register of Historic Places. Three known archeological sites are within the area of potential effect.

One site (AR-03-07-04-988), a lithic (stone artifact) scatter site, is near the Tusayan project area, in the vicinity of the National Geographic Visitor Center. The other two (AR-03-07-04-83, AR-03-07-04-87) are

prehistoric scatter sites in the vicinity of the proposed Greenway Trail corridor area, east of SR 64. One site is just south of the park boundary and may have been a habitation site. The other, a lithic scatter site, is immediately adjacent to the highway and has probably been impacted by associated roadway disturbance over the years since it was last surveyed.

## **Environmental Consequences**

### **Methodology and Assumptions**

In this environmental assessment impacts to archeological resources are described in terms of type, context, duration, and intensity, consistent with the CEQ regulations. These impact analyses are intended to comply with the requirements of both the National Environmental Policy Act and section 106 of the National Historic Preservation Act.

As noted at the beginning of the chapter, the Advisory Council on Historic Preservation's regulations that implement section 106 of the National Historic Preservation Act require that impacts to historic properties be identified and evaluated by determining the area of potential effect and identifying cultural resources present in this area that are either listed on or eligible for listing on the National Register of Historic Places. Other important laws and regulations designed to protect cultural resources are as follows:

- Native American Graves Protection and Repatriation Act, 1990
- American Indian Religious Freedom Act, 1978
- Archeological Resources Protection Act, 1979
- Executive Order 11593, "Protection and Enhancement of the Cultural Environment," 1971

Archeological resources that could be affected by transportation proposals were identified by consulting with park cultural resource staff and specialists from other agencies, reviewing existing studies and reports, reviewing site inventories and maps, conducting field visits

to sites where actions may occur, and overlaying proposed actions on top of maps of known resources to identify potential direct and indirect impacts. For the action alternatives, archeological resources with the potential to be impacted by actions were identified in the “Affected Environment” section above. These areas include Canyon View Information Plaza and Mather Point, the South Entrance Station, and national forest system lands in Kaibab National Forest near Tusayan.

Under alternatives B, C, and D, several project actions would result in ground disturbance at specific construction sites within the project area. Ground disturbance can often result in direct and indirect impacts to archeological resources. For example, sites could be more vulnerable to indirect impacts during construction as the result of vegetation removal and changes to runoff with soil disturbance. However, mitigation measures would be employed to avoid or minimize impacts to known archeological sites during construction (see page 112). In addition, mitigation measures have been developed to minimize the possibility of adverse impacts if any previously undocumented sites are discovered during the course of project implementation.

#### Impact Analysis Area

The project is within the boundaries of Grand Canyon National Park and Kaibab National Forest. The impact analysis area (essentially the area of potential effect) for archeological resources encompasses areas where proposed actions might occur that would directly impact archeological resources, as well as adjacent areas that contain resources that might be indirectly impacted.

#### Impact Thresholds

Both the National Environmental Policy Act and the National Historic Preservation Act consider an effect to be adverse when it diminishes the significant characteristics of a property — those attributes that qualify a resource for listing on the National Register of Historic Places. To provide consistency with NEPA requirements, the effects on archeo-

logical resources are also described in terminology intended to convey the duration, intensity, and beneficial or adverse nature of potential impacts. Consideration was given both to the effects anticipated at the same time and place of the undertaking, and to those effects potentially occurring indirectly at a later time and distance. For purposes of analyzing impacts on archeological resources, the level of impact of a proposed action is related to the potential of the site to yield information important in prehistory or history, as well as the probable historic context of the affected site. 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.

- *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 eligibility for the National Register of Historic Places. Negligible impacts would be barely perceptible and would 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.

For the purposes of the National Historic Preservation Act section 106, the determination of effect would be *no adverse effect*.

- *Minor*

Adverse Impact: 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 the character-defining features or

aspects of integrity that contribute to eligibility for the National Register of Historic Places. Depletion or displacement of artifacts (determined by baseline documentation) would not affect research potential or national register eligibility.

For purposes of the National Historic Preservation Act section 106, the determination of effect would be *no adverse effect*.

**Beneficial Impact:** Archeological sites would be maintained and preserved. Effects would be measurable and localized.

For purposes of the National Historic Preservation Act section 106, the determination of effect would be *no adverse effect*.

- *Moderate*

**Adverse Impact:** Disturbance of a site or sites would result in the loss of overall integrity, which would jeopardize a site's eligibility for listing on the National Register of Historic Places. Impacts would include measurable change to character-defining elements and would contribute to increased instability of site landscape.

For purposes of the National Historic Preservation Act section 106, the determination of effect would be *adverse effect*. It would 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 agreement to minimize or mitigate adverse impacts would reduce the intensity of impact under the National Environmental Policy Act from moderate to minor.

**Beneficial Impact:** Effects would be measurable and would contribute to the overall stability of the site. Active inter-

vention would be undertaken to preserve the site.

For purposes of the National Historic Preservation Act section 106, the determination of effect would be *no adverse effect*.

- *Major*

**Adverse Impact:** 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 the resource would no longer be eligible for listing on the National Register of Historic Places. Impacts would include destabilization of structures or cultural contexts, depletion or displacement of artifact assemblages (determined from baseline information), an increase in exposure or vulnerability to natural elements, and compromising of research potential.

For purposes of the National Historic Preservation Act section 106, the determination of effect would be *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 agreement to minimize or mitigate adverse impacts would reduce the intensity of impact under the National Environmental Policy Act from major to moderate or minor.

**Beneficial Impact:** Active intervention would be undertaken to preserve the site. Effects would be measurable and would contribute to the overall stability of the site landscape.

For purposes of the National Historic Preservation Act section 106, the determination of effect would be *no adverse effect*.

**Nature of Impact**

**Adverse Impact.** An adverse impact would result from the disruption of resources as a result of earthmoving activities, soil compaction, potential for unauthorized surface collection, or vandalism.

**Beneficial Impact.** A beneficial impact would result when the resource condition improved as a consequence of changes, such as patterns of visitor use, management action, water diversion, or reduction in soil erosion.

**Duration**

**Short-term Impact.** A short-term impact would no longer be detectable within five years because the resource would return to its predisturbance condition or appearance (e.g., trash and other items had been removed, or vegetation that had been trampled, but had not been removed).

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

**Timing.** Archeological site visibility and vulnerability might be more pronounced during the spring growing season, as the trampling of young vegetation may lead to increased trampling and soil compaction, and heavy rains can directly impact erosion of a site.

**Alternative A: No Action****Direct / Indirect Impacts**

Under alternative A known archeological resources would not be impacted as there would be no known ground disturbance related to ongoing transportation activities in the project area. Additional impacts related to social trailing or natural processes to known sites within the project area would not likely occur. Changes in current patterns of use or development that could affect archeological resources would not occur under alternative

A. Therefore, no impacts on known archeological resources would result from the no-action alternative within the project area.

**Cumulative Impacts**

Because no direct or indirect impacts would occur to archeological resources under alternative A, there would be no cumulative impacts when combined with other projects.

**Conclusion**

No direct, indirect, or cumulative impacts to known archeological resources would result under alternative A. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of archeological resources.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would be no unacceptable impacts on archeological resources under alternative A.

**Alternative B: Preferred Alternative****Direct / Indirect Impacts**

Mitigation measures incorporated into the project would ensure the avoidance and protection of most archeological sites both during and after construction. For example, as part of the design development phase, known sites would be surveyed by an archeologist and their boundaries would be flagged and mapped so that they would be avoided by construction disturbance. However, for one known archeological site that would be

directly impacted, a memorandum of agreement, as describe below, would be prepared to outline the terms and conditions to mitigate adverse effects.

**Canyon View Information Plaza and Mather Point.** The project area for Canyon View Information Plaza and Mather Point has been surveyed for archeological sites in conjunction with the proposed construction. As a result of past surveys and projects, several sites within the project area have been mitigated and other known sites have been surveyed and tested. Proposed actions under alternative B (roadway realignment and construction of new parking) would be designed so as to avoid direct impacts to most of these known archeological resources.

However, one known archeological site (AZ:B:16:437) would be directly impacted by the construction of new parking or other amenities to the northwest of the information plaza. A memorandum of agreement among the National Park Service, the Arizona State Historic Preservation Office, and any interested tribes would be prepared to outline the terms and conditions to mitigate adverse effects to this site.

Proposed activities at Canyon View Information Plaza and Mather Point would result in 24 acres of new ground disturbance and could indirectly impact two known archeological sites that have either been tested or surveyed but not mitigated. Indirect impacts could occur as a result of social trailing or vegetation removal, soil disturbance, or changes in runoff that would expose sites to natural elements. Post-construction monitoring of these sites by the park staff would ensure that indirect impacts would be avoided or minimized to the greatest extent feasible. Alternative B would have a local, long-term, moderate, adverse effect on one archeological site, as well as local, short- and long-term, minor, adverse, indirect effects on identified archeological resources within the Canyon View Information Plaza and Mather Point project area.

**South Entrance Station.** As noted in the “Affected Environment” section, the project area has been surveyed by park archeologists, and four known sites were identified and documented as part of the NEPA documentation for the South Entrance Road improvements (NPS 2007c). Under alternative B an additional entrance lane and a new fee administration building, along with associated access drive and parking to the east of the bypass lane, would be constructed, resulting in approximately 3 acres of new ground disturbance. These additions would be designed to avoid direct impacts to known archeological resources, and mitigation measures, such as surveying and flagging the boundaries of the known sites and setting up a protective barrier such as fencing during construction, would be applied to avoid direct and indirect impacts to these resources as well.

**Grand Canyon Railway.** Under alternative B lot D would be removed and a new access drive would be constructed on the south side of the railroad tracks north of Bright Angel Wash. These activities would result in some ground disturbance and could impact unknown archeological resources. There would be potential for disturbing buried historic archeological sites at the time of construction, and this would result in short- and long-term, minor, adverse impacts. To mitigate this potential impact, an archeologist would monitor ground-disturbing activity in the lot D area to ensure the avoidance and protection of archeological resources that could be discovered.

**Tusayan and Greenway Trail.** Three archeological sites are known within the project area in Kaibab National Forest. Two sites are in the vicinity of the proposed Greenway Trail between the park boundary and Tusayan, and one site is in the vicinity of the proposed construction area for a shuttle staging and parking complex near the National Geographic Visitor Center. The Greenway Trail would be designed to avoid direct impacts to known archeological sites, and mitigation measures, such as monitoring ground-disturbing activities in the vicinity of known archeological resources and minimizing

erosion and run-off in sensitive areas, would reduce the indirect impact to archeological resources. The area of disturbance would be 1.2 mile long and 12–14 feet wide, for a total of 3 acres of new ground disturbance. Areas that could experience heavy runoff could be paved to prevent erosion. The incorporation of mitigation measures into the design should ensure no direct or indirect impacts would occur to archeological resources.

The area of new ground disturbance at the Tusayan site would be approximately 10 acres, but the proposed development would be designed to avoid direct impacts to the known archeological site. The proposed construction areas would be at least 200 feet away and downslope from these sites to avoid indirect impacts. Measures would be taken to minimize any impacts that would include site monitoring during and after construction and site protection through the use of flagging and fencing the area during construction. Therefore, potential impacts to archeological resources on national forest system lands would be both short- and long-term, local, negligible, and indirect.

#### Cumulative Impacts

Some archeological resources at the South Rim and throughout Grand Canyon National Park have been adversely impacted by past construction projects as well as through exposure of sites, which can lead to increased deterioration. Visitor use patterns, such as increased use in specific areas, have also contributed to past archeological impacts. Loss or disturbance of archeological sites on the South Rim (in conjunction with previous losses and prevailing threats to finite numbers of archeological resources throughout the region) incrementally diminishes the overall understanding of Grand Canyon's cultural history. These past impacts are local, long-term, moderate, and adverse.

Most of the recently implemented, present, and foreseeable future projects that could affect archeological resources have been reviewed by park cultural resource staff, and all efforts to document archeological re-

sources and avoid them during project design would be implemented, including the widening of SR 64 and the addition of the bypass lane at the South Entrance Station (see NPS 2007c). If adverse impacts could not be avoided, park staff would undertake data recovery excavations or other appropriate mitigation measures. Consultation with the state historic preservation officer and other parties during the planning and design for future projects would help ensure that any adverse effects of future projects on archeological resources would be negligible to minor. Therefore, these impacts when combined with the local, short- and long-term, negligible to moderate, adverse impacts of alternative B would result in local, long-term, negligible to moderate, adverse cumulative impacts to archeological resources. Alternative B would only marginally contribute to cumulative impacts.

#### Conclusion

Alternative B would result in local, short- and long-term, negligible to moderate, direct and indirect, adverse impacts to archeological resources. Impacts would be minimized through the execution of a memorandum of agreement with the state historic preservation officer and tribes and through the implementation of integral design features and mitigation measures to protect archeological resources. Cumulative impacts would be local, long-term, negligible to moderate, and adverse. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of archeological resources.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe

environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would be no unacceptable impacts on archeological resources under alternative B.

### **Alternative C: Tusayan Parking Emphasis**

#### ***Direct / Indirect Impacts***

Similar to alternative B, the proposed actions under alternative C (roadway realignment and construction of new parking) would be designed so as to avoid direct impacts to known archeological resources. Several mitigation measures would be incorporated into the project to ensure the avoidance and protection of known archeological sites both during and after construction. For example, as part of the design development phase, known sites would be surveyed by an archeologist and their boundaries would be flagged and mapped so that the proposed areas of construction disturbance would avoid these areas.

**Canyon View Information Plaza and Mather Point.** Proposed actions at Canyon View Information Plaza and Mather Point would result in impacts similar to those described under alternative B, except the area of new disturbance would be smaller, only about 15 acres instead of 24 acres, because of fewer parking spaces. Unlike alternative B, known archeological site AZ:B:16:437 would not be directly impacted under alternative C. Mitigation and monitoring would be implemented as described in alternative B to ensure that indirect impacts to the two known archeological sites would be avoided or minimized. Therefore, alternative C would have local, short- and long-term, negligible to minor, adverse, indirect impacts on archeological resources within the Canyon View Information Plaza and Mather Point project area.

**South Entrance Station.** The construction of a new fee administration building and associated access drive and parking to the west of the bypass lane would result in approximately 2 acres of new ground disturbance. These

additions would be designed to avoid direct impacts to known archeological resources, and mitigation measures would be applied to avoid indirect impacts to these resources as well.

**Grand Canyon Railway.** The impacts would be the same as under alternative B. Proposed actions could result in some ground disturbance that could impact unknown archeological resources, resulting in short- and long-term, minor, adverse impacts. To mitigate this potential impact, an archeologist would monitor ground-disturbing activity in the lot D area to ensure the avoidance and protection of archeological resources that may be discovered.

**Tusayan and Greenway Trail.** For national forest system lands within the project area, the impacts to the two known archeological sites in the vicinity of the proposed Greenway Trail extension would be the same as in alternative B. Proposed construction of a shuttle bus staging area and parking near the National Geographic Visitor Center complex at full build out would result in approximately 17 acres of new ground disturbance, which is more than in alternative B. Proposed development would be designed to avoid direct impacts to the known archeological site. Construction activities would be kept at least 200 feet away and downslope from the known archeological site to avoid indirect impacts. As a result, the potential impact to archeological resources on national forest system lands would be local, short- and long-term, negligible to minor, adverse, and indirect.

#### ***Cumulative Impacts***

Impacts related to past, present, and reasonably foreseeable future actions that would affect archeological resources would be the same as those described for alternative B. Over time some archeological resources at the South Rim and throughout Grand Canyon National Park have been adversely impacted by past construction disturbances as well as the exposure of sites, which can lead to increased deterioration. These past impacts

are local, long-term, moderate, adverse, and local.

Most of the recently implemented, present, and reasonably foreseeable 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, including the planned improvements at the South Entrance Station. Consultation with the state historic preservation officer and other parties during the planning and design for future projects would help ensure that any adverse effects of future projects on archeological resources would be negligible to minor. Therefore, these impacts in combination with the local, short- and long-term, negligible to minor, adverse impact of alternative C would result in local, long-term, negligible to moderate, adverse cumulative impacts to archeological resources. Alternative C would only marginally contribute to cumulative impacts, if at all.

### Conclusion

Alternative C would result in local, short- and long-term, negligible to minor, adverse, indirect impacts to archeological resources. Impacts would be minimized through mitigation measures. Cumulative impacts would be local, long-term, negligible to moderate, and adverse. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of archeological resources.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere

with park programs or activities, an appropriate use, or concessioner or contractor operations, there would not be unacceptable impacts on archeological resources under alternative C.

### **Alternative D: Canyon View Information Plaza Parking Emphasis**

#### Direct / Indirect Impacts

Similar to alternative B, the proposed actions under alternative D (roadway realignment and construction of new parking) would be designed to avoid direct impacts to known archeological resources. Several mitigation measures would be incorporated into the project to ensure avoidance and protection of known archeological sites both during and after construction. For example, as part of the design development phase, known sites would be surveyed by an archeologist, and their boundaries would be flagged and mapped so that the proposed areas of construction would avoid these areas.

**Canyon View Information Plaza and Mather Point.** The proposed activities at Canyon View Information Plaza and Mather Point would result in approximately 26 acres of new ground disturbance, slightly more than under alternative B. However, this alternative could indirectly impact five known archeological sites that have either been tested or surveyed but not mitigated, compared to two sites in alternative B. Under alternative D archeological site AZ:B:16:437 would not be directly impacted through development and construction because new parking would be farther toward the south, away from this site. Up to 1,190 parking spaces could result in additional indirect impacts to known archeological sites. Indirect impacts could occur because of social trailing or vegetation removal, soil disturbance or changes in runoff. Post-construction monitoring by park staff would ensure that indirect impacts would be avoided or minimized and that adverse impacts would be avoided to the greatest extent feasible. Alternative D would have local, short- and long-term, minor, adverse,

indirect effects on archeological resources within the Canyon View Information Plaza and Mather Point project area.

**South Entrance Station.** Improvements at the South Entrance Station would result in the same impacts as described in alternative B. Construction of one additional entrance lane and a new fee administration building, with associated access drive and parking to the west of the bypass lane, would result in approximately 3 acres of new ground disturbance. These additions would be designed to avoid direct impacts to known archeological resources, and mitigation measures would be applied to avoid indirect impacts to these resources as well.

**Grand Canyon Railway.** The impacts under alternative D would be the same as under alternative B. Proposed actions could result in some ground disturbance that could impact unknown archeological resources that would result in short- and long-term, minor, adverse impacts. To mitigate this potential impact, an archeologist would monitor ground-disturbing activity in the lot D area to ensure the avoidance and protection of archeological resources that might be discovered.

**Greenway Trail.** The only project action on national forest system lands under alternative D that could impact archeological resources would be construction of the Greenway Trail between the park boundary and Tusayan. There are two known archeological sites in this area. The trail route would be designed to avoid direct and indirect impacts to these known resources, and the resulting impacts would be the same as alternative B. The potential impact to archeological resources on national forest system lands would be local, short- and long-term, negligible, adverse, and indirect.

#### Cumulative Impacts

Impacts related to past, present, and reasonably foreseeable actions that could affect archeological resources would be the same as those described for alternatives B and C. Over time some archeological resources at the

South Rim and throughout Grand Canyon National Park have been adversely impacted from past construction disturbances as well as exposure of sites, which can lead to increased deterioration. These past impacts have been long-term, moderate, adverse, and local. Most of the recently implemented, present, and reasonably foreseeable projects that could affect archeological resources have been reviewed by park cultural resources staff, and all efforts to document such resources and avoid them during project design would be implemented, including the additional improvements at the South Entrance Station.

Consultation with the state historic preservation officer and other parties during project planning and design would help ensure that any adverse effects of future projects on archeological resources would be negligible to minor. Therefore, these impacts in combination with the local, short- and long-term, negligible, adverse impacts of alternative D would result in local, long-term, negligible to moderate, adverse cumulative impacts to archeological resources. Alternative D would contribute marginally to cumulative impacts, if at all.

#### Conclusion

Alternative D would result in local, short- and long-term, negligible to minor, adverse, indirect impacts to archeological resources. Impacts would be minimized through mitigation measures. Cumulative impacts would be local, long-term, negligible to moderate, and adverse. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of archeological resources.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and

cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would be no unacceptable impacts on archeological resources under alternative D.

## **HISTORIC STRUCTURES AND DISTRICTS AND CULTURAL LANDSCAPES**

### **Affected Environment**

The project area includes two national historic landmarks — Grand Canyon Village and the Grand Canyon Railroad Depot. Two historic districts are also listed on or eligible for listing on the National Register of Historic Places — the Moqui Ranger Station (listed), and Mather Point (potentially eligible for listing, as determined by park staff).

#### ***Mather Point***

The present-day South Entrance Road was built in 1953–54 as a replacement for the 1928 park entrance road. The new road went to Mather Point, then continued to Grand Canyon Village. The period of significance for Mather Point is 1954 to 1962, which includes completion of the road and modifications and additions made during the early years of Mission ‘66. The National Park Service prepared an analysis of criteria for eligibility of the South Entrance Road and transmitted this to the Arizona State Historic Preservation Office for review and concurrence. The National Park Service determined that the road is not eligible for listing on the National Register of Historic Places, and the state historic preservation officer concurred with this finding. In the absence of a formal evaluation, the National Park Service considers features at Mather Point to be eligible for listing on the national register.

The only viewpoint developed during the South Entrance Road project, Mather Point has been the place for more than 50 years

where most South Rim visitors get their first glimpse of the Grand Canyon. Although the area is a mixture of elements dating from the 1950s up to the present, it retains the original setting, feeling, and association, as well as most original elements. As identified by park resource specialists, contributing features to Mather Point’s historic character include:

- the curved stanchion railings along portions of the canyon rim adjacent to the Rim Trail and on the primary and secondary overlooks
- the rim path’s stone edging, aggregate surface material and alignment in proximity to the canyon rim
- split log benches along the rim path
- vegetated islands between the existing parking area and the rim, which help provide a framed view of the canyon and screen the road and parking area from pedestrian areas
- the 1962 information kiosk
- the Stephen Mather commemorative stone (moved from Yavapai Point in 1953)

#### ***Grand Canyon Village National Historic Landmark District***

This document proposes changes to visitor access and transportation within the Grand Canyon Village National Historic Landmark District. The following discussion focuses on those areas and resources where proposed changes or modifications could affect contributing resources.

The Village Historic District is adjacent to the South Rim, approximately 5 miles north of the park’s southern boundary. The historic district was first listed on the National Register of Historic Places in 1975; the nomination was amended in 1982 and again in 1995 when the boundaries were enlarged to encompass the entire historic village area. The district includes an extensive collection of buildings, structures, landscape features, and sites that mostly date to the 1920s and 1930s. The period of significance is from 1897 to 1942. The

district possesses a high degree of integrity relative to the original street plan, organization of developed areas, and overall setting, and it retains a strong sense of architectural unity (NPS 1997d). Most of the district's structures are built in a park rustic style that incorporated native building materials, primarily wood and stone. The district also includes individually listed properties, such as the 1910 Grand Canyon Depot. While there have been changes in the district, no changes have caused a substantial loss of integrity or affected its landmark status.

Contributing structures to the Village Historic District, as identified in the 1995 nomination amendment, and that could be affected by proposed actions:

- railroad tracks and grades along Bright Angel Wash
- concrete railroad platforms
- stone curbing, metal fence, and gate at the depot
- Village Loop Drive stone retaining wall, stair, and sidewalk
- Bright Angel Wash channel
- historic footpaths
- historic streetlamps

### ***Grand Canyon Depot National Historic Landmark***

Constructed in 1909–10, the Grand Canyon Depot is the only remaining structural log railroad depot in the country. Built for the Atchison, Topeka and Santa Fe Railroad, it helped establish the rustic sense of place for the Grand Canyon by being the first building that railway passengers saw as they arrived at the park. First listed on the National Register of Historic Places in 1974, the depot was designated a national historic landmark in 1987. The east boundary of this historic property is the bridge connecting the North and South Loop Drives, the south boundary is the north edge of South Village Loop Drive, the west boundary is a north-south line 200 feet west of the western edge of the waiting platform and

running from the north to the south boundary, and the north boundary is the south edge of North Village Loop Drive. What remains of the track, platforms, and passenger yard are an essential part of the depot's historic scene, for the depot could not have functioned without them (1986 nomination).

### ***Grand Canyon Village National Historic Landmark District Cultural Landscape Report***

In 2004 the National Park Service prepared a *Cultural Landscape Report* for the national historic landmark (NPS 2004a). The purposes of the report were to provide a landscape history for the area; to document and evaluate the significance, integrity, and condition of existing cultural landscape characteristics, including the identification and description of contributing and non-contributing characteristics; and to develop a preservation strategy for the long-term management of the cultural landscape. The need for this report arose from the 1995 *General Management Plan's* identification of proposed projects that could alter the existing landscape and its associated resources. The information in the *Cultural Landscape Report* and in the "National Register of Historic Places Nomination Form" (NPS 1986) is being used by the National Park Service in developing proposed actions for the district and to aid in the determination of effects on the historic district and cultural landscape in accordance with the National Environmental Policy Act and the National Historic Preservation Act, section 106.



The railroad tracks have not been moved since the period of significance and retain their historic integrity.

The *Cultural Landscape Report's* recommendations and guidelines provide a preservation strategy for the long-term management of landscape areas, based on an understanding of the significance, integrity, and condition of surviving landscape features. The report makes recommendations for the district as a whole and for nine landscape character areas within the district. The following are the treatment recommendations for the entire national historic landmark district:

- Retain the overall pattern of spatial organization and circulation created by the layout of streets, vegetation, and topography.
- Assess the presence of nonnative and invasive vegetation, remove areas of nonnative and invasive vegetation that are detrimental to contributing and native vegetation, and revegetate disturbed areas with native vegetation.
- Maintain the historic zoning and separation of land uses within the district.
- Retain all contributing buildings and structures.
- Document all features prior to their alteration or removal.
- Assess the potential national register eligibility for features within and adjacent to the district that postdate the period of significance.
- Minimize new construction as much as possible, and if necessary, site new facilities in previously developed or disturbed locations.
- Sensitively site new accessibility features in order to retain the historic character of the district.
- Refer to the *Grand Canyon National Park Architectural Character Guidelines* (NPS 1994a) for guidance.
- Perform maintenance on all features.

Under the current transportation planning effort, physical modifications are proposed for the area south of the Grand Canyon Depot. The proposed modifications could

affect features within the cultural landscape character areas. The following is a discussion of the contributing landscape features in this area and the *Cultural Landscape Report's* treatment recommendations.

For the railroad area, the railroad tracks have not been moved since the period of significance and retain their historic integrity as a contributing resource. The node at the east end by the depot, the track terminus, and associated features have existed since the period of significance. Historically there were several railroad-related buildings and structures throughout the area, but they no longer exist. The number of tracks has been reduced as well, and the amount of parking has increased over time. Historically, parking (which still exists) was only available adjacent to the depot, but a larger gravel parking lot has been added along the southern boundary of the railroad area and east of the powerhouse. The ditch within the wash has remained in its same location since the period of significance; however, it has undergone alterations in width and depth and is now more eroded, narrower, and shallower than it was historically. The long views through the wash and down the railroad tracks have not changed much over time because of the lack of development and construction in the character area.

Ponderosa pine and other native vegetation still exist along the Bright Angel Wash slopes and are scattered throughout the area; in addition, the landscape between the railroad tracks and Village Loop Drive was historically heavily wooded and remains so today. Relevant treatment recommendations in the *Cultural Landscape Report* for the railroad area are:

- Remove the gravel parking lot (lot D) south of the tracks, because it is not historic and detracts from the character of the area.
- Retain all contributing vegetation, particularly south of the railroad tracks.
- Retain the railroad tracks and parking near the depot, the asphalt path along the southern edge of the area, and the median.

- Maintain and protect the slopes of the Bright Angel Wash.
- Assess the ditch for its ability to accommodate current drainage needs, the potential need for dredging and/or slope stabilization; and avoid removing, channelizing, or filling in the ditch.
- Retain and maintain stone headwalls, bridges, steps, and stone-faced culverts.

### ***Moqui Ranger Station***

Known more recently as the Tusayan Ranger Station, the Moqui Ranger Station is on national forest system land in the Kaibab National Forest, and was listed on the National Register of Historic Places in 1993 as part of a multiple property listing for Depression era Forest Service administrative complexes in Arizona (USFS 1993). The ranger station complex is adjacent to Grand Canyon National Park's south boundary, just north of the community of Tusayan and east of SR 64. It is still used as an administrative and residential area by the U.S. Forest Service. The complex is accessed by a drive off of SR 64 and the district boundary includes only those buildings that date to the historic period of significance and their immediate setting. Ponderosa pine is the predominant vegetation type, with scattered oak and juniper.

The historic administrative complex consists of six historic buildings constructed by the Civilian Conservation Corps (CCC) in the 1930s. The buildings, which reflect a rustic park architectural style, include a dwelling and associated cistern/shed, an office, a barn and corral, a garage, and a seed house. New developments have occurred over time but are away from the historic district, are visually screened, and do not detract from the historic setting. None of the historic buildings have had exterior modifications. The buildings and the entire site retain a high degree of integrity from the historic period (1939 to 1942) and are one of the finest examples of U.S. Forest Service Depression-era architecture in the nation (USFS 1989).

## **Environmental Consequences**

### ***Methodology and Assumptions***

Impacts to historic structures and districts and cultural landscapes are described in terms of type, context, duration, and intensity, consistent with the CEQ regulations. These impact analyses are intended to comply with the requirements of both the National Environmental Policy Act and section 106 of the National Historic Preservation Act.

Historic structures and districts and cultural landscapes that could be affected by proposed actions were identified by consulting with NPS and USFS cultural resource staff; reviewing previous studies, reports, inventories and maps; reviewing National Register of Historic Places nomination forms and determinations of eligibility; conducting field visits to sites where actions may occur, and overlaying proposed actions on top of maps of known resources to identify potential direct and indirect impacts. Additional information sources on historic resources used for this evaluation are described in the preceding "Affected Environment" section.

In addition, the Advisory Council on Historic Preservation's regulations that implement section 106 of the National Historic Preservation Act require that impacts to historic properties be identified and evaluated by determining the area of potential effect and identifying cultural resources present in that area that are either listed on or eligible for listing on the National Register of Historic Places. Other important laws and regulations designed to protect cultural resources include the following:

- Native American Graves Protection and Repatriation Act, 1990
- American Indian Religious Freedom Act, 1978
- Archeological Resources Protection Act, 1979
- Executive Order 11593, "Protection and Enhancement of the Cultural Environment," 1971

**Impact Analysis Area**

The project is within the boundaries of Grand Canyon National Park and Kaibab National Forest. The impact analysis area (essentially the area of potential effect) for cultural resources encompasses those areas where proposed actions could directly impact historic structures and districts and cultural landscapes, as well as adjacent areas that contain resources that might be indirectly impacted.

**Impact Thresholds**

Effects under both the National Environmental Policy Act and the National Historic Preservation Act are considered adverse when they diminish the significant characteristics of a property — those attributes that qualify the resources for inclusion on the National Register of Historic Places. To provide consistency with NEPA requirements, the effects on historic districts and cultural landscapes are also described in terminology intended to convey the duration, intensity, and beneficial or adverse nature of potential impacts. Both the effects anticipated at the same time and place of the undertaking, and those potentially occurring indirectly at a later time and distance, were considered. The character-defining features of a historic district and cultural landscape include spatial organization and land patterns; topography; vegetation; circulation patterns; and structures, building, site furnishings and objects. For purposes of analyzing potential impacts on historic structures and districts and cultural landscapes, the thresholds of change for the intensity of impact considers the physical changes to resource characteristics, the integrity of the resource, and/or its setting.

- *Negligible*

Negligible impacts would be at the lowest levels of detection, with neither adverse nor beneficial consequences; historic structures, districts, and cultural landscapes would receive barely perceptible changes to the character-defining features that contribute to eligibility for the National Register of Historic Places.

For purposes of the National Historic Preservation Act section 106, the determination of effect would be *no adverse effect*.

- *Minor*

**Adverse Impact:** The impact would not affect the character-defining features of a historic structure, district, or cultural landscape.

For purposes of the National Historic Preservation Act section 106, the determination of effect would be *no adverse effect*.

**Beneficial Impact:** Historic features and patterns of the structure, district, or landscape would be stabilized and preserved in accordance with the Secretary of the Interior’s *Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes*, thus maintaining the integrity of the resource.

For purposes of the National Historic Preservation Act section 106, the determination of effect would be *no adverse effect*.

- *Moderate*

**Adverse Impact:** Moderate impacts would alter a character-defining feature or features of a historic structure, district, or cultural landscape; would result in measurable changes; and could diminish the overall integrity of the resource to the extent that its eligibility for the National Register of Historic Places would be jeopardized.

For purposes of the National Historic Preservation Act section 106, the determination of effect would be *adverse effect*.

**Beneficial Impact:** Preservation and rehabilitation of the historic structure, district, or cultural landscape and its contributing features would be in accordance with the *Secretary of the Interior’s Standards for Treatment of Historic*

*Properties with Guidelines for the Treatment of Cultural Landscapes.*

For purposes of the National Historic Preservation Act section 106, the determination of effect would be *no adverse effect*.

- *Major*

**Adverse Impact:** Major impacts would result from substantial and highly noticeable changes that would alter the character-defining features of a historic structure, district, or cultural landscape. These impacts would diminish the overall integrity of the resource to the extent that it would no longer be eligible to be listed on the National Register of Historic Places.

For purposes of the National Historic Preservation Act section 106, the determination of effect would be *adverse effect*.

**Beneficial Impact:** The patterns and/or features of a historic structure, district, or cultural landscape would be maintained and restored in accordance with the *Secretary of the Interior's Standards*.

For purposes of the National Historic Preservation Act section 106, the determination of effect would be *no adverse effect*.

**Nature of Impacts**

**Adverse Impact.** An adverse impact would result from the modification or removal of a significant characteristic of a historic structure or landscape resource, or the resource itself; the addition of new, incompatible facilities; changes in historic vegetation; or the continued deterioration of historic structures, resulting from changes in visitor use patterns or management.

**Beneficial Impact.** A beneficial impact would result from the restoration or rehabilitation of resources, or the removal of incompatible or noncontributing facilities.

**Duration**

**Short-term Impact.** Impacts to a contributing feature(s) or pattern would be temporary, transitional, or construction related. Within five years effects would no longer be detectable, and the resource would be returned to its predisturbance condition or appearance.

**Long-term Impact.** Impacts would last longer than five years or would be permanent.

**Alternative A: No Action**

**Direct / Indirect Impacts**

Alternative A would result in no change to contributing features of historic structures, districts, or cultural landscapes within the project area. The existing appearance and character of these resources would remain the same.

**Cumulative Impacts**

Because no direct or indirect impacts would occur to contributing features of historic structures, districts, or cultural landscapes within the project area, there would be no cumulative impacts when combined with other projects.

**Conclusion**

No impacts (direct, indirect, or cumulative) to historic structures and districts or cultural landscapes would occur under alternative A. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of historic structures or districts or cultural landscapes.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe

environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would be no unacceptable impacts on historic structures and districts or cultural landscapes under alternative A.

### **Alternative B: Preferred Alternative**

#### Direct / Indirect Impacts

Historic resources with the potential to be impacted by actions under alternative B include Mather Point, Grand Canyon Village National Historic Landmark District, the Grand Canyon Depot National Historic Landmark, and the Moqui Ranger Station District.

**Mather Point.** Several modifications would occur in the Mather Point overlook area, including the removal of a segment of the South Entrance Road, the removal of the parking lot and associated vegetated island, and the introduction of new features such as site furnishings and additional pathways. Realignment of the South Entrance Road to loop around Canyon View Information Plaza would result in a change to the historic arrival sequence at Mather Point. Visitors would now arrive at the Mather Point overlook area by pathway or by shuttle bus rather than in personal vehicles.

Mather Point overlook would be rehabilitated to provide a safe and accessible canyon viewing opportunity for visitors, including those with disabilities. An accessible trail would be constructed from the canyon rim to the primary easternmost overlook, which would require some rock removal, areas of fill, construction of retaining walls or other structural supports, and the addition of walls, guardrails, and/or handrails as needed, along with modifications to the base of the existing stairway. To the extent possible, contributing small-scale features would be preserved and left in place, and their treatment would be in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Prop-*

*erties*. Log benches, a contributing small-scale feature, would be repaired and retained in place or relocated within the Mather Point area. The 1962 information kiosk and the Stephen Mather commemorative plaque, both contributing features, would be retained in place. Existing curved stanchion railings would be maintained in place wherever possible. Where new safety railings were necessary, their design would be compatible with the historic railings; new railings would be curvilinear, replicate the natural form of the observation points, and adjust to the topography in a manner similar to the historic railings. Rim trail stone edging would be maintained where possible or replaced in-kind.

Some vegetation would be removed to accommodate the new trail as well as to enhance view corridors where the vegetation has impeded views since the original construction of Mather Point. The vegetated islands between the parking lot and the canyon rim would also be modified or removed to accommodate more pedestrians in the area, which would be an adverse impact to this feature. However, vegetated islands would continue to be an important part of the design for the area and would help separate the more urban use areas (i.e., shuttle bus or tour bus loading and unloading areas) from the more contemplative uses such as the rim experience. This would be consistent with the original design intent and would also help frame canyon views. The use of natural vegetation would continue to be a prominent feature of the design. These modifications to small-scale features at Mather Point would result in some change to individual features at the overlook, but the overall character, setting, and feeling of the Mather Point overlook would not be diminished. There would be a continuity of historic use by retaining and enhancing the overlook and making it fully accessible to all park visitors.

Other new elements proposed for this area include a new canyon viewing area that would be established on an existing small rock outcropping east of the overlook; visitor amenities, such as a sign, seating, picnic tables, shelters, and trash receptacles; a new tour bus

drop-off near the rim; and new double vault restroom near the tour bus drop-off. To reduce impacts to the historic setting, these noncontributing small-scale features would be kept to a minimum as much as practicable while still meeting the needs of this popular visitor destination. When necessary, these features would be designed and sited so as to be compatible with the setting and scale of the area and of appropriate material, color, and style. The new restroom would be similar in design and materials to other restrooms currently being installed at other park overlooks. The National Park Service would ensure that the design was in keeping with the *Secretary's Standards for the Treatment of Historic Properties* and was compatible with the area and its contributing features. These new features would not be concentrated together near the historic Mather Point, but rather would be sited in a manner so as to accommodate visitation needs and not distract from the historic setting of the overlook area.

The specific design details for the Mather Point rehabilitation would be determined at future design phases for this project, in close consultation with the state historic preservation officer and any interested tribes. Consultation would ensure that the design was in keeping with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* and would not result in substantial alteration of eligible character-defining features. These proposed modifications would result in a long-term, minor, adverse impact to the historic structures / cultural landscape at this site.

**Grand Canyon Village National Historic Landmark District and Grand Canyon Depot National Historic Landmark.** Proposed modifications within the Grand Canyon Village that could affect historic resources would largely occur within the Bright Angel Wash by the railroad tracks. Proposed changes to the east end of the railyard would involve the removal of lot D, the potential exposure of railroad tracks 5 and 6, modifications to the railroad platforms for loading and

unloading passengers, and a new access drive for tour buses. The *Cultural Landscape Report* for Grand Canyon Village calls for the removal of lot D and the retention of the railroad tracks, so the proposed changes to lot D would be consistent with these recommendations, resulting in a beneficial effect. A new access road and tour bus loading/unloading area would be constructed on the south side of track 6, over a portion of track 7, north of the Bright Angel Wash. Track 7 would be left in place. As needed, a new passenger platform compatibly designed to fit with the historic setting would be provided between the tracks as well as between the bus loading area and track. A portion of the stone masonry wall on the east side of the railyard would need to be removed to build this paved access road.

Overall, these modifications would be noticeable and would result in a visual change to the area. Although they would result in an adverse effect on individual contributing features, taken together they would not result in an adverse effect on the integrity of either national historic landmark. Modifications to the adjacent area would follow the *Secretary of the Interior's Standards for the Treatment of Historic Properties, with Guidelines for the Treatment of Cultural Landscapes* so as to minimize adverse impacts to the historic landscape and features. As part of a memorandum of agreement developed between the National Park Service, the state historic preservation officer, and interested tribes, provisions for review and comment on design details for the proposed improvements at Grand Canyon Railway yard would be outlined. The agreement would describe steps for future consultation for these proposed actions. The impact to these historic resources under this alternative would be long-term, minor, and adverse.

**Moqui Ranger Station.** Proposed actions under alternative B as well as the other action alternatives that could impact the Moqui Ranger Station include the construction of the Greenway Trail from the South Entrance Station area to Tusayan. The trail would be routed near the historic ranger station, but it

would not directly traverse the historic property, and it would not alter the overall historic character and setting. Even though the trail might be visible from the ranger station area, and likewise the ranger station might be visible from the trail, the two would be adequately separated so as to not result in an adverse impact on this national register property.

### Cumulative Impacts

Past, present, and reasonably foreseeable future projects that could affect historic districts and cultural landscapes include rehabilitating viewpoints along Hermit Road and Desert View Drive, rehabilitating the historic Grand Canyon Depot, improving restrooms park-wide, rehabilitating Bright Angel Lodge and cabins, improving the Bright Angel trailhead, constructing the village interpretive center, developing the Trail of Time along the Rim Trail, and rehabilitating Hermit Road and Desert View Drive. Many of these projects are within the Village Historic District. Over time historic districts and cultural landscapes have sustained previous impacts as the result of modifications to buildings, landscapes, road features, overlooks, and trails. Modern interventions have intruded on the historic setting and adversely impacted structures and districts; conversely, some resources have had or are undergoing preservation treatments such as rehabilitation and stabilization that have a beneficial effect. Thus, these past impacts are long-term, moderate, and adverse, but local. Most of the recently implemented, in-progress, and foreseeable projects that could affect historic resources have been discussed with the state historic preservation officer to ensure that any adverse effects of future projects on historic districts and cultural landscapes would be minimized to the greatest extent possible. Many of these project impacts are located in the Village Historic District, which when combined with the long-term, minor, adverse impacts under alternative B would result in long-term, minor to moderate, adverse cumulative impacts. Only a small portion of cumulative impacts would be attributable to alternative B.

### Conclusion

Alternative B would result in local, long-term, minor, adverse impacts to historic structures and historic districts/cultural landscapes. Impacts would be minimized by implementing mitigation measures. Cumulative impacts would be local, long-term, minor to moderate, adverse, and beneficial. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of historic structures and districts and cultural landscapes.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would be no unacceptable impacts on historic structures and districts or cultural landscapes under alternative B.

### ***Alternative C: Tusayan Parking Emphasis***

#### Direct / Indirect Impacts

Historic resources with the potential to be impacted by actions under alternative C would be the same as in alternative B (Mather Point, Grand Canyon Village, Grand Canyon Depot, and the Moqui Ranger Station).

**Mather Point.** A portion of the South Entrance Road in the vicinity of Mather Point would be removed and realigned to the south and west of Canyon View Information Plaza, and the Mather Point parking lot would be retained for use by persons with disabilities and as a shuttle bus turnaround. A separate and shorter segment of the South Entrance

Road at the west end of Mather Point would also be removed to allow for a new intersection between the rerouted road and the Mather Point parking lot. Similar to alternative B, removing these segments of the South Entrance Road would change the historic arrival sequence for visitors to Mather Point.

Under alternative C the Mather Point parking area, the vegetated island, curbing, and other small-scale features would be retained and preserved. Modifications to Mather Point overlook would be the similar to those described under alternative B to rehabilitate the overlook to be fully accessible. At the west end of the parking lot a new shuttle bus shelter similar in style and design as those at other park shuttle bus stops would be constructed. Under alternative C the existing tour bus parking lot would be expanded for 40 buses and would include a drop-off area for passengers. No new restroom facility would be constructed because one already exists in the tour bus parking vicinity.

The construction of new elements at Mather Point would be in keeping with the *Secretary of the Interior's Standards for the Treatment of Historic Properties, with Guidelines for the Treatment of Historic Landscapes* so as to minimize adverse impacts to the historic landscape. With mitigation measures, there would be long-term, minor, adverse impacts to historic features.

**Grand Canyon Village National Historic Landmark District and Grand Canyon Depot National Historic Landmark.** Under alternative C proposed modifications within the Village Historic District that could affect historic resources would be the same as described under alternative B. These would include removing parking lot D, constructing a new access drive on the south side of the tracks north of the wash, rehabilitating tracks 5 and 6, and constructing additional passenger platforms. Modifications to lot D and the adjacent area would follow the *Secretary of the Interior's Standards for the Treatment of Historic Properties, with Guidelines for the Treatment of Historic Landscapes* so as to

minimize adverse impacts to the historic landscape. Overall, these modifications would not result in an adverse effect on the integrity of either national historic landmark. The impact to these historic resources would be long-term, minor, and adverse.

**Moqui Ranger Station.** Proposed actions under alternative C would be the same as those described under alternative B for the Moqui Ranger Station. These actions would involve constructing the Greenway Trail from the South Entrance Station area to Tusayan, which would be in the vicinity of the historic ranger station. There would be adequate separation between the two so as to not result in an adverse impact on the national register property.

#### Cumulative Impacts

Impacts related to past, present, and reasonably foreseeable actions that would affect historic districts and cultural landscapes would be the same as those under alternative B. Over time, historic districts and cultural landscapes have sustained some impacts as the result of modifications to buildings, landscapes, road features, overlooks, and trails. Modern interventions have intruded on the historic setting and adversely impacted structures and districts; conversely, some resources have had or are undergoing preservation treatments such as rehabilitation and stabilization that have a beneficial effect. Thus, these past impacts were long-term, localized, and ranged from moderate adverse to moderate beneficial. Many of these projects were in the Village Historic District, and when combined with the long-term, minor, adverse impacts of actions under alternative C would result in long-term, minor to moderate, adverse and beneficial cumulative impacts. Only a small portion of cumulative impacts would be attributable to alternative C.

#### Conclusion

Alternative C would result in local, long-term, minor, adverse impacts on historic structures and districts and cultural landscapes. Impacts would be minimized through mitigation mea-

asures. Cumulative impacts would be local, long-term, minor to moderate, and adverse and beneficial. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of historic structures or districts or cultural landscapes.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would be no unacceptable impacts on historic structures and districts or cultural landscapes under alternative C.

#### **Alternative D: Canyon View Information Plaza Parking Emphasis**

##### Direct / Indirect Impacts

Historic resources with the potential to be impacted by actions under alternative D would be the same as in alternatives B and C (Mather Point, Grand Canyon Village, Grand Canyon Depot, and Moqui Ranger Station).

**Mather Point.** The treatment of the Mather Point area would be similar to alternative B. The South Entrance Road pavement and Mather Point parking lot would be removed, and the Mather Point overlook would be rehabilitated to be fully accessible to visitors with disabilities. The realignment of the South Entrance Road to loop around Canyon View Information Plaza would result in a change to the historic arrival sequence at Mather Point as described in alternative B.

Improvements at Mather Point overlook would be the same as those under alternative B. The overlook would be rehabilitated to provide a safe and accessible canyon viewing opportunity for visitors, including those with disabilities. To the extent possible, contributing small-scale features would be preserved, and some vegetation would be removed to accommodate the new trail and to enhance view corridors where the vegetation has filled in since the overlook's original construction. The vegetated islands between the parking lot and the canyon rim would also be modified or removed to accommodate more pedestrians in the area, which would be an adverse impact to this feature. However, as described in alternative B, vegetated islands would continue to be an important part of the design for the area and would be consistent with the original design intent. The use of natural vegetation would continue to be a prominent feature of the design.

The addition of new visitor amenities and small-scale features would be similar to those under alternative B, although no new tour bus drop-off and no new restroom facility would be constructed. When necessary, new features would be designed and sited to be compatible with the setting and scale of the area and would be compatible through elements of material, color, and style. These modifications to small-scale features at Mather Point would result in some change to individual features at the overlook, but the overlook's overall character, setting, and feeling would not be diminished. There would be a continuity of historic use by retaining and enhancing the overlook and making it fully accessible to all park visitors.

The specific design details for the Mather Point rehabilitation would be determined at future design phases for this project, in close consultation with the state historic preservation officer and any interested tribes. Consultation would ensure that the design was in keeping with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* and would not result in substantial alteration of eligible character-defining

features. These proposed modifications would result in a long-term, minor, adverse impact to the historic structures / cultural landscape at this site.

**Grand Canyon Village National Historic Landmark District and Grand Canyon Depot National Historic Landmark.** Under alternative D proposed modifications within the historic Grand Canyon Village that could affect historic resources would be the same as under alternatives B and C. Proposed modifications would include removing parking lot D, constructing a new access drive on the south side of the tracks north of the wash, potentially rehabilitating tracks 5 and 6, and constructing additional passenger platforms. Changes to lot D and the adjacent area would follow the *Secretary of the Interior's Standards for the Treatment of Historic Properties, with Guidelines for the Treatment of Historic Landscapes* so as to minimize adverse impacts to historic features. Overall, these modifications would not result in an adverse effect on the integrity of either national historic landmark. The impact to these historic resources would be long-term, minor, and adverse.

**Moqui Ranger Station.** Proposed actions under alternative D would be the same as those described under alternative B for the Moqui Ranger Station. The Greenway Trail would be routed near the historic ranger station, but it would not directly traverse the historic property and would not alter the overall historic character and setting. Even though the trail might be visible from the ranger station area, and likewise the ranger station might be visible from the trail, the two would be adequately separated so as to not result in an adverse impact on this national register property.

#### Cumulative Impacts

Impacts related to past, present, and reasonably foreseeable actions that would affect historic districts and cultural landscapes would be the same as those under alternatives B and C. Over time, historic districts and cultural landscapes have sustained previous impacts as the result of modifications to

buildings, landscapes, road features, overlooks, and trails. Modern interventions have intruded on the historic setting and adversely impacted structures and districts; conversely, some resources have had or are undergoing preservation treatments such as rehabilitation and stabilization with a beneficial effect. Thus, these past impacts are long-term, localized and range from moderate adverse to moderate beneficial. Many of these projects were in the Village Historic District, and when combined with the long-term, minor, adverse impacts of actions under alternative D would result in long-term, minor to moderate, adverse and beneficial cumulative impacts. Only a small portion of cumulative impacts would be attributable to alternative D.

#### Conclusion

Alternative D would result in local, long-term, minor, adverse impacts on historic structures and historic districts and cultural landscapes. Impacts would be minimized through mitigation measures. Cumulative impacts would be local, long-term, minor to moderate, and adverse and beneficial. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of historic structures and districts and cultural landscapes.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would be no unacceptable impacts on historic structures and districts or cultural landscapes under alternative D.

## ETHNOGRAPHIC RESOURCES

### Affected Environment

Ethnographic resources are defined 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” (NPS 1998d). The lands of Grand Canyon National Park are traditionally associated with 10 Native American tribes — Havasupai, Hopi, Hualapai, Kaibab Band of Paiute Indians, Navajo Nation, Paiute Indian Tribe of Utah, White Mountain Apache Tribe, Yavapai-Apache Nation, San Juan Southern Paiute Tribe, and Pueblo of Zuni (NPS 2006b). In addition, the Moapa Band of Paiute Indians and Las Vegas Paiute Tribe also claim association with the park. Therefore, the park consults with a total of 12 associated Native American tribes. The Tusayan Ranger District in Kaibab National Forest typically consults with the Havasupai, Hualapai, Hopi, Navajo, Yavapai-Prescott, and Zuni. Associated Native American tribes 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 (NPS 1998b). Like other cultural resources, traditional cultural properties are given consideration under section 106 of the National Historic Preservation Act.

Studies of the tribes of the Colorado River corridor (SWCA Environmental Consultants 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 lines, natural landmarks, minerals, plants, animals and water (including springs). Grand Canyon has long been of importance to native cultures, and it figures prominently in the origin/religious beliefs and ceremonial practices of many groups. For example, traditional Hopi and Zuni beliefs hold the Grand Canyon

as the sacred place from which their ancestors emerged to the present world (NPS 2006e). The Havasupai still live within the Grand Canyon and claim a connection to the project area.

Wikatata, as the Havasupai people call the Grand Canyon (Sinyella 1964), has been home to the Havasupai and their ancestors for at least 1,400 years, and possibly as long as 4,000 years (Atencio 1996). It is common knowledge to members of the tribe that the area of the South Rim now known as Grand Canyon Village has been one of their many residence areas and has been important to them for various traditional activities over that period. The Havasupai’s historic and prehistoric use of the village area has also been well-documented by a wide variety of travelers and researchers during the last 120 years. Havasupai means “People of the Blue Green Water,” referring to the waters of Havasu Creek along which most of the tribe lives today; however, their traditional range includes not only Grand Canyon Village, but a territory extending from their current reservation at least as far south as Bill Williams Mountain and the San Francisco Peaks and as far east as the Little Colorado River and Moenkopi Wash (Ruppert 1996).

Archeological research clearly indicates a continuous Havasupai presence along the South Rim between Grand Canyon Village and Desert View for at least the last 200 years (Julien 1994), with numerous sites pre-dating the Havasupai (Pilles et al. 1973). Oral history and common knowledge from tribal members corroborate a long historic occupation along the rim, and along the Tonto Plateau within the canyon, between Hermits Rest and Desert View (Jack, pers. comm. 1976; Sinyella 1964). Havasupai informants at the end of the 19th century knew which Havasupai families had built and “owned” most of the trails in the canyon. These trails are still used today, but they were already well established by that time (James 1903).

The attachment of religious significance to all of their traditional lands along the South Rim

and throughout the Coconino Plateau attests to the Havasupai's long connection to the area. Havasupai consultants consistently describe the importance of these lands in religious terms. As such, the lands along the South Rim of the canyon are considered sacred by the Havasupai and are integral to their beliefs and stories about their creation (Bryant, pers. comm. 1946; Krakow, pers. comm. 1992; NPS 1996b).

In an effort to assess the potential impact on Havasupai cultural resources, park staff consulted with Havasupai tribal representatives and tribal elders between May and September of 1996 during the preparation of the *Environmental Assessment, Mather Point Orientation / Transit Center and Transit System* (NPS 1997a) (now known as Canyon View Information Plaza). These meetings involved representatives that the tribe identified as knowledgeable about Havasupai traditional use of the areas to be impacted. The primary purpose of these meetings was to interview tribal elders to determine if the project locations or the planned activity at these sites posed the potential for significant impact on areas considered to be of cultural importance to the Havasupai.

The Havasupai consultants provided place names for specific locations along the South Rim reflecting Havasupai traditional cultural activity in this area, stories of past lives and events, and the statement that Havasupai are buried along the rim (Ruppert 1996). Additional features identified in this area included abandoned temporary campsites, primarily consisting of tree branches used as temporary wickiups or lean-tos. While general comments focused on the importance of much of the canyon rim as a place where relatives and ancestors lived and subsisted, there was no indication that Mather Point specifically served as an area of unique or outstanding ethnographic importance (Ruppert 1996). To the extent that there are places in the areas of development that would or could be considered traditional cultural properties, little information was provided through these consultations that indicated such (Ruppert 1996).

Other Native American tribes that have interest in the study area include the Navajo Nation, Hopi, Zuni, Hualapai, and various bands of Paiute. The Hopi and Zuni view the prehistoric western Puebloan archeological sites as a physical record of their migrations throughout the current manifestation of life on Earth, and the sites are extremely important in their religious and cultural traditions (NPS 1997a). According to the Hopi, the Grand Canyon was one of the resting places of several of the clans during migration (USFS 1999). The Hopi still use the canyon's resources and trails to the area for ceremonial purposes. Traditional Navajo people from neighboring communities continue to use the Grand Canyon and surrounding areas in a traditional manner for offering, prayers, and ceremonies (USFS 1999).

For this transportation project, the park initiated formal consultation with associated Native American tribes in March 2006. In July 2007 the park conducted meetings with several tribal representatives to discuss this and other projects. No specific locations were identified by the tribes. Although ethnographic resources significant to associated Native American tribes are present in the vicinity of the South Entrance Station, no ethnographic resources have been specifically identified.

The U.S. Forest Service conducts regular meetings with associated tribes to apprise the tribes of upcoming and ongoing projects in Kaibab National Forest. The Tusayan Ranger District conducts quarterly meetings or other scheduled meetings with interested tribes for updates and consultation on U.S. Forest Service projects.

## **Environmental Consequences**

### ***Methodology and Assumptions***

Impacts to ethnographic resources are described in terms of type, context, duration, and intensity, consistent with the CEQ regulations. These impact analyses are intended, however, to comply with the requirements of both the National Environ-

mental Policy Act and section 106 of the National Historic Preservation Act.

Ethnographic resources that could be affected under this project were identified by consulting with park cultural resource staff and specialists from other agencies, reviewing existing studies and reports, reviewing site inventories and maps, conducting field visits to sites where actions might occur, and consulting with associated Native American tribes on locations of sites, structures, objects, landscapes, or natural resource features to identify potential direct and indirect impacts. Sources of information on ethnographic resources used as a basis for this evaluation are described in the “Affected Environment” section above.

In addition, the Advisory Council on Historic Preservation’s regulations that implement section 106 of the National Historic Preservation Act require that impacts to historic properties (includes ethnographic resources and traditional cultural properties) be identified and evaluated by determining the area of potential effect and identifying cultural resources present in the area that are either listed on or eligible for listing on the National Register of Historic Places. Other important laws and regulations designed to protect cultural resources are:

- Native American Graves Protection and Repatriation Act, 1990
- American Indian Religious Freedom Act, 1978
- Archeological Resources Protection Act, 1979
- Executive Order 11593, “Enhancement and Protection of the Cultural Environment,” 1971

Copies of this environmental assessment / assessment of effect will be forwarded to each associated Native American tribe for review and comment. If the tribes subsequently identify the presence of additional ethnographic resources within the project areas, appropriate mitigation measures would be undertaken in consultation with the tribes. The location of

any ethnographic resource sites would not be made public.

#### Impact Analysis Area

The impact analysis area, or area of potential effect, for ethnographic resources extends across a broad area, generally along the South Rim of the canyon between Hopi Point on the west and Yaki Point on the east and south to Tusayan. The reason for this is that ethnographic resources, as defined below, can cover landforms, natural areas, and intangible items that may not be tied to specific points on a map. It encompasses both those areas where proposed actions might occur that would directly impact ethnographic resources, as well as adjacent areas that contain resources that might be indirectly impacted.

#### Impact Thresholds

The National Park Service defines ethnographic resources as cultural or natural features within the park that are sites, structures, objects, landscapes, or natural features of traditional importance to a contemporary cultural group. For purposes of analyzing impacts on ethnographic resources, the thresholds of change consider a group’s traditional use of and access to sites, preservation of sites, and the relationship between an associated tribe’s practices and beliefs. To provide consistency with requirements of the National Environmental Policy Act, the effects on ethnographic resources are also described in terminology intended to convey the duration, intensity, and beneficial or adverse nature of potential impacts. Consideration was given both to the effects anticipated at the same time and place of the undertaking, and to those potentially occurring indirectly at a later time and distance.

- *Negligible*

Negligible impacts would be at the lowest levels of detection and barely perceptible. Impacts would neither alter resource conditions, such as traditional access or site preservation, nor alter the relationship between the resource and

the affiliated group's body of practices and beliefs.

For purposes of the National Historic Preservation Act section 106, the determination of effect on ethnographic resources would be *no adverse effect*.

- *Minor*

Adverse Impact: Minor impacts would be slight but noticeable and would neither appreciably alter resource conditions, such as traditional access or site preservation, nor alter the relationship between the resource and the group's body of beliefs and practices.

For purposes of the National Historic Preservation Act section 106, the determination of effect would be *no adverse effect*.

Beneficial Impact: Impacts would allow access to and/or accommodate a group's traditional practices or beliefs.

For purposes of the National Historic Preservation Act section 106, the determination of effect would be *no adverse effect*.

- *Moderate*

Adverse Impact: Moderate impacts would alter resource conditions, such as traditional access or site preservation, or alter the relationship between the resource and the group's body of beliefs and practices.

For purposes of the National Historic Preservation Act section 106, the determination of effect would be *adverse effect*. It would 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 agreement to minimize or mitigate adverse impacts would reduce the intensity of impact

under the National Environmental Policy Act from moderate to minor.

Beneficial Impact: Impacts would allow access to and/or accommodate a group's traditional practices or beliefs.

For purposes of the National Historic Preservation Act section 106, the determination of effect would be *no adverse effect*.

- *Major*

Adverse Impact: Major impacts would result from substantial and highly noticeable changes that would alter resource conditions, such as traditional access or site preservation, or alter the relationship between the resource and the group's body of beliefs and practices. These impacts would degrade or prevent traditional access or site preservation, or alter the relationship between the resource and the group's body of beliefs and practices.

For purposes of the National Historic Preservation Act section 106, the determination of effect would be *adverse effect*. 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 agreement to minimize or mitigate adverse impacts might or might not reduce the intensity of impact under the National Environmental Policy Act from major to moderate.

Beneficial Impact: Impacts would allow access to and/or accommodate a group's traditional practices or beliefs.

For purposes of the National Historic Preservation Act section 106, the determination of effect would be *no adverse effect*.

### Nature of Impact

**Adverse Impact.** Adverse impacts would result from physical changes to a traditionally used resource or its setting that would degrade the resource itself, or degrades access to or use of a resource.

**Beneficial Impact.** Beneficial impacts would include removing intrusive facilities, or visitor or management activities from a traditional use area; improving ecological conditions at a gathering area such that the traditionally used resource would be enhanced, or access for American Indian people would be enhanced.

### Duration

**Short-term Impact.** Short-term impacts to a contributing feature(s) or pattern would be temporary, transitional, or construction-related. Within five years effects would no longer be detectable, and the resource would be returned to its predisturbance condition or appearance.

**Long-term Impacts.** Impacts would last longer than five years or would be permanent.

### **Alternative A: No Action**

#### Direct / Indirect Impacts

While ethnographic resources of importance to Native American tribes may be present in the vicinity of the study area (from Canyon View Information Plaza to the South Entrance Station, and Grand Canyon Village to Desert View), no specific ethnographic resources or traditional cultural properties have been identified. All associated tribes have been contacted for any concerns they might have. General concerns related to ethnographic resources, such as development on the South Rim, traditional plant collection areas, and possible human burials, have been identified; however, no specific locations have been identified. The no-action alternative would not result in any changes to existing uses and conditions of roadways, vehicle parking, tour bus parking and drop-off, other aspects of transportation management, overlooks and trails, or visitor services. Therefore, the no-

action alternative would result in only local, long-term, negligible, adverse 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 Canyon View Information Plaza, the South Entrance Station, and areas in Grand Canyon Village. Past park facility development has likely 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) has incrementally diminished the overall understanding of Grand Canyon's ethnographic history. These past impacts are generally long-term, moderate, and adverse.

Most of the recently implemented, in-progress, and reasonably foreseeable projects that could affect ethnographic resources have been discussed with the tribal groups. Consultation with associated tribes as the basis for future projects would ensure that any adverse effects of future projects on ethnographic resources would be long-term and negligible to minor. Therefore, these impacts in combination with the long-term, negligible, adverse impacts of alternative A would result in local, long-term, moderate, adverse cumulative impacts. Alternative A would only marginally contribute to total cumulative impacts.

### Conclusion

Alternative A would result in local, long-term, negligible, adverse impacts to ethnographic resources. Cumulative impacts would be local, long-term, moderate, and adverse. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of ethnographic resources.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would be no unacceptable impacts on ethnographic resources under alternative A.

### ***Alternative B: Preferred Alternative***

#### ***Direct / Indirect Impacts***

While ethnographic resources of importance to Native American tribes may be present in the project area, no specific ethnographic resources or traditional cultural properties have been identified within the park or Kaibab National Forest near Tusayan. All associated tribes have been contacted for any concerns they have with the implementation of this project; general concerns related to ethnographic resources, such as development on the South Rim, traditional plant collection areas, and possible human burials, have been identified. The development of up to 900 spaces for visitor parking, tour bus parking and drop offs, and realignment of the South Entrance Road at and around Canyon View Information Plaza; changes at Mather Point; the fee collection facility and new service lane at South Entrance Station; and up to 400 spaces for visitor parking at Tusayan could have long-term, minor, adverse impacts to general areas of concern identified by Native American tribes. For example, traditional plant gathering areas and purported human burials could be disturbed by heavy equipment and construction activities. Native American tribes may consider more development along the South Rim as negatively impacting the spiritual quality of sacred sites, natural landmarks, and ceremonial practice

sites. Mitigation measures, such as frequent consultation with tribes to identify culturally or ethnographically sensitive areas, and design elements to prevent visitors from social trailing across unknown ethnographic sites, would be implemented. However, because no specific locations have been identified, it is expected that alternative B would result in local, long-term, negligible to minor, adverse impacts to ethnographic resources.

#### ***Cumulative Impacts***

Because no specific locations of ethnographic resources are known to occur in the project area, cumulative impacts would be similar to those described under alternative A. Past impacts have generally been long-term, moderate, and adverse. Most of the recently implemented, in-progress, and foreseeable projects that could affect ethnographic resources have been discussed with the tribal groups. Consultation with associated tribes as the basis for future projects would ensure that any adverse effects on ethnographic resources would be negligible to minor. Therefore, these impacts in combination with the local, long-term, negligible to minor, adverse impacts of alternative B would result in local, long-term, moderate, adverse cumulative impacts. Alternative B would only marginally contribute to cumulative impacts.

#### ***Conclusion***

Alternative B would result in long-term, negligible to minor, adverse impacts and local, long-term, moderate, adverse cumulative impacts. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of ethnographic resources.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment

of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would be no unacceptable impacts on ethnographic resources under alternative B.

### **Alternative C: Tusayan Parking Emphasis**

#### Direct / Indirect Impacts

As described in alternative B, although ethnographic resources of importance to Native American tribes may be present in the vicinity of the project area, no specific ethnographic resources or traditional cultural properties have been identified in the park or Kaibab National Forest near Tusayan. Among other actions, the development of 400 spaces for visitor parking, tour bus parking and drop offs, and realignment of the South Entrance Road at and around Canyon View Information Plaza; the fee collection facility at the South Entrance Station; and up to 920 spaces for visitor parking at Tusayan could have long-term, minor, adverse impacts to general areas of concern identified by Native American tribes. Traditional plant gathering areas and purported human burials could be disturbed by soil displacement and construction/paving. However, the majority of areas of concern identified by Native American tribes, such as the spiritual connection to the Grand Canyon, are closer to the actual rim of the canyon. Mitigation measures, such as frequent consultation with tribes to identify culturally or ethnographically sensitive areas, and design elements to prevent visitors from social trailing across unknown ethnographic sites, would be implemented. Therefore, even though more ground disturbance would occur at Tusayan than in the park under alternative C, this alternative would potentially have fewer adverse impacts to ethnographic resources than alternative B. Because no specific locations have been identified, it is expected that alternative C

would have local, long-term, negligible, adverse impacts to ethnographic resources.

#### Cumulative Impacts

Because no specific locations of ethnographic resources are known to occur in the project area, cumulative impacts would be similar to those described under alternatives A and B. Past impacts have generally been long-term, moderate, and adverse. Most of the recently implemented, in-progress, and foreseeable projects that have the potential to affect ethnographic resources have been discussed with the tribal groups. Consultation with associated tribes as the basis for future projects would ensure that any adverse effects on ethnographic resources would be negligible to minor. Therefore, these impacts in combination with the local, long-term, negligible, adverse impacts of alternative C would result in local, long-term, moderate, adverse cumulative effects. Alternative C would only marginally contribute to cumulative impacts.

#### Conclusion

Alternative C would result in local, long-term, negligible, adverse impacts and local, long-term, moderate, adverse cumulative impacts. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of ethnographic resources.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there

would be no unacceptable impacts on ethnographic resources under alternative C.

***Alternative D: Canyon View Information Plaza Parking Emphasis***

***Direct / Indirect Impacts***

As described in alternatives B and C, although ethnographic resources of importance to Native American tribes may be present in the vicinity of the project area, no specific ethnographic resources or traditional cultural properties have been identified. Among other actions, the development of up to 1,190 spaces for visitor parking, tour bus parking and drop offs, and realignment of the South Entrance Road at and around Canyon View Information Plaza; changes at Mather Point; and a fee collection facility and additional service lane at the South Entrance Station could have long-term, minor, adverse impacts to general areas of concern identified by Native American tribes. As with alternative B, traditional plant gathering areas and purported human burials could be disturbed by construction, particularly soil displacement by heavy equipment. The majority of areas of concern identified by Native American tribes are close to the actual rim of the canyon. The spiritual connection to the canyon, combined with respect for sacred sites and natural landmarks, would be negatively impacted. Mitigation measures, such as frequent consultation with tribes to identify culturally or ethnographically sensitive areas, and design elements to prevent visitors from social trailing across unknown ethnographic sites, would be implemented. Therefore, because of the increased size of the parking facilities at Canyon View Information Plaza compared to the other alternatives, impacts to ethnographic resources would be local, long-term, minor, and adverse.

***Cumulative Impacts***

Because no specific locations of ethnographic resources are known to occur in the project area, cumulative impacts would be similar to those described under alternatives A, B, and C. Past impacts have generally been long-term, moderate, and adverse. Most of the recently

implemented, in-progress, and foreseeable future projects that have the potential to affect ethnographic resources have been discussed with the tribal groups. Consultation with associated tribes as the basis for future projects would ensure that any adverse effects on ethnographic resources would be negligible to minor. Therefore, these impacts in combination with the local, long-term, minor, adverse impacts of alternative D would result in long-term, moderate, adverse cumulative effects. Alternative D would only marginally contribute to cumulative impacts.

***Conclusion***

Alternative D would result in local, long-term, minor, adverse impacts to ethnographic resources and local, long-term, moderate, adverse cumulative impacts. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of ethnographic resources.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would be no unacceptable impacts on ethnographic resources under alternative D.

**SECTION 106 ASSESSMENT OF EFFECT**

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After applying the Advisory Council on Historic Preservation's criteria of adverse effects (36 CFR Part 800.5, Assessment of Adverse Effects), the National Park Service

TABLE 19. SECTION 106 ASSESSMENT OF EFFECT SUMMARY BY ALTERNATIVE

Topic	Alternative A: No Action	Alternative B: Preferred Alternative	Alternative C: Tusayan Parking Emphasis	Alternative D: Canyon View Information Plaza Parking Emphasis
Archeological Resources	<i>No adverse effect.</i>	<i>Adverse effect.</i>	<i>No adverse effect.</i>	<i>No adverse effect.</i>
Historic Districts and Cultural Landscapes	<i>No adverse effect.</i>	<i>No adverse effect on either national historic landmark (Grand Canyon Village or Grand Canyon Depot). No adverse effect on the historic Moqui Ranger Station. No adverse effect on cultural landscape in the Mather Point area.</i>	<i>No adverse effect on either national historic landmark (Grand Canyon Village or Grand Canyon Depot). No adverse effect on the historic Moqui Ranger Station. No adverse effect on cultural landscape in the Mather Point area.</i>	<i>No adverse effect on either national historic landmark (Grand Canyon Village or Grand Canyon Depot). No adverse effect on the historic Moqui Ranger Station. No adverse effect on cultural landscape in the Mather Point area..</i>
Ethnographic Resources	<i>No adverse effect.</i>	<i>No adverse effect.</i>	<i>No adverse effect.</i>	<i>No adverse effect.</i>

has concluded the following assessment of effect for all alternatives. Table 19 summarizes the assessment of effects by alternative.

#### **Alternative A: No Action**

Alternative A would have *no adverse effect* on archeological resources, historic structures and historic districts/cultural landscapes, or ethnographic resources within the area of potential effect, as there would be no modifications, ground-disturbing activities, or alterations to known archeological resources, or contributing historic resources.

#### **Alternative B: Preferred Alternative**

One known archeological site (AZ:B:16:437) would be directly impacted by the proposed construction of new facilities northwest of Canyon View Information Plaza. The assessment of the impacts for alternative B suggests that impacts to archeological resources would be long-term, moderate, and adverse on one archeological site and direct and indirect, short- and long-term, negligible to minor, and adverse on all other known sites. The National Park Service has determined that alternative B would have an *adverse effect* on archeological resources. Therefore, a memorandum of agreement among the National Park Service, the Arizona state historic preservation officer, and any

interested tribes would be prepared to outline the terms and conditions agreed upon to mitigate adverse effects to this one known archeological site.

Modifications to contributing features of the Grand Canyon Village National Historic Landmark District, while they may be adverse to individual character-defining features, when considered together in the context of the entire historic district, would result in *no adverse effect* on the integrity of either the village or the Grand Canyon Depot. There would be *no adverse effect* on the historic Moqui Ranger Station property on national forest system land north of Tusayan.

Most of the modifications to the historic features in the project area under alternative B would have long-term, minor, adverse impacts. More specifically, modifications to the Mather Point overlook area would have long-term, minor, adverse impacts. As much as possible, historic features such as the log benches and curved stanchion railings would be preserved and rehabilitated for continued use. The details of the rehabilitation of Mather Point would be determined at a future design stage. However, a memorandum of agreement among the National Park Service, the Arizona state historic preservation officer, and affected tribes would be developed as required by section 106 of the National Historic Preser-

vation Act. As part of the agreement, the National Park Service would outline provisions for state review and comment on design details as they were developed for Mather Point, as well as at Grand Canyon Railway / parking lot D. With the incorporation of mitigation measures, these proposed modifications would result in long-term, minor, adverse impacts and a finding of *no adverse effect* to historic features.

Impacts to archeological resources and historic districts and cultural landscapes would be minimized through the implementation of mitigation measures.

Because no specific locations of ethnographic resources have been identified in the study area, alternative B would have *no adverse effect* on ethnographic resources.

### **Alternative C: Tusayan Parking Emphasis**

The assessment of the impacts for alternative C suggests that impacts to archeological resources would be indirect, short- and long-term, negligible to minor, and adverse. The National Park Service has determined that alternative C would have a *no adverse effect* on archeological resources.

Modifications to contributing features of the Grand Canyon Village National Historic Landmark District, while they might be adverse to individual character-defining features, when considered together in the context of the entire historic district would result in a *no adverse effect* on the integrity of the village or the Grand Canyon Depot. There would be *no adverse effect* on the historic Moqui Ranger Station property on national forest system land.

The assessment of impacts reveals that most of the modifications to the historic features and cultural landscapes in the project area under alternative C would have long-term, minor, adverse effects. With the incorporation of mitigation measures, impacts on historic features would be long-term, minor, and adverse. While modifications to the Mather

Point overlook would introduce modern elements and features into the setting, the overall integrity of design, setting, and feeling would not be diminished. The proposed modifications would result in a finding of *no adverse effect* on historic structures and districts and cultural landscapes.

Impacts to archeological resources and historic structures and districts and cultural landscapes would be minimized through the implementation of mitigation measures.

Because no specific locations of ethnographic resources have been identified in the study area, alternative C would have *no adverse effect* on ethnographic resources.

### **Alternative D: Canyon View Information Plaza Parking Emphasis**

The assessment of the impacts for alternative D suggests that impacts to archeological resources would be indirect, short- and long-term, negligible to minor, and adverse. The National Park Service has determined that alternative D would have a *no adverse effect* on archeological resources.

Modifications to contributing features of the Grand Canyon Village National Historic Landmark District, while they might be adverse to individual character-defining features, when considered together in the context of the entire historic district would result in a *no adverse effect* on the integrity of either the village or the Grand Canyon Depot. There would be no adverse effect on the historic Moqui Ranger Station property on national forest system land.

Most of the modifications to the historic features in the project area under alternative D would have long-term, minor, adverse impacts. More specifically, modifications to the Mather Point overlook area would have long-term, minor, adverse impacts. As much as possible, historic features such as the log benches and curved stanchion railings would be preserved and rehabilitated for continued use. The details of the rehabilitation of Mather Point would be determined at a future design

stage. With the incorporation of mitigation measures, these proposed modifications would result in long-term, minor, adverse impacts and a finding of *no adverse effect* to historic features.

Impacts to archeological resources and historic districts and cultural landscapes would be minimized through the implementation of mitigation measures.

Because no specific locations of ethnographic resources have been identified in the study area, alternative D would have *no adverse effect* on ethnographic resources.

### Summary

In summary, as shown in Table 19, alternative A would have *no adverse effect* on cultural resources because there would be no modifications, ground-disturbing activities, or alterations to known archeological resources, contributing historic resources, or known ethnographic resource locations.

Alternative B would have an *adverse effect* on archeological resources resulting from the direct impact on an archeological site near

Canyon View Information Plaza. The potential for impacts to other cultural resources as a result of implementing alternative B were also considered. While impacts could occur, they would not diminish the overall integrity of the resources; the degradation or displacement of features would be localized and would not result in changes to defining elements; and impacts would not jeopardize aspects of integrity that contribute to eligibility for listing on the National Register of Historic Places.

Alternative C would have *no adverse effect* on cultural resources because no known archeological sites would be directly impacted; alterations to historic features would retain the overall design, setting, and feeling of the feature or district; and no locations of ethnographic resources have been identified.

As with alternative C, alternative D would have *no adverse effect* on cultural resources because no known archeological sites would be directly impacted; alterations to historic features would retain the overall design, setting, and feeling of the feature or district; and no locations of ethnographic resources have been identified.

# NATURAL RESOURCES

## VEGETATION

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### **Affected Environment**

A 2007 vegetation survey conducted by park staff for this transportation plan documented 86 native plant species and 31 nonnative plant species at Canyon View Information Plaza and Mather Point, 47 native and 9 nonnative species at the South Entrance Station, and 79 native and 19 nonnative species at Tusayan (Busco and Boyter 2007). The two plant communities identified in this survey are described further below. Great Basin desert scrub communities occur below the South Rim of the Grand Canyon (D. E. Brown 1982); however, they would not be impacted and are not discussed further.

### ***Great Basin Conifer Woodland***

The principal plant community on the South Rim of the Grand Canyon is the Great Basin conifer woodland. It typically occurs from 4,200 feet up to 6,200 feet. This community type is also the most common type in the Southwest (D. E. Brown 1994). The Great Basin conifer woodland community is dominated by two conifer species: piñon pine and Utah juniper. The piñon/juniper community has an understory of woody shrub species and herbaceous vegetation. Woody shrubs include big sagebrush and cliffrose. Other shrubby species in this woodland include mountain joint fir, mountain mahogany, apache plume, winterfat, and snakeweed. Two yucca species are common: narrowleaf yucca and banana yucca. The common grasses include Indian ricegrass, dropseeds, and needlegrass (D. E. Brown 1994). Based on recent NPS surveys, this plant community type is found at Canyon View Information Plaza and Mather Point, as well as in some parts of the South Entrance Station (Busco and Boyter 2007). It is also known to occur at Grand Canyon Village, Yavapai Observation Station, Yaki Point, and the East Entrance Station.

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 on the South Rim exhibit typical characteristics of a mature and potentially an old-growth woodland community (Floyd 2003). The 2007 NPS vegetation survey indicated that the piñon/juniper woodland at Canyon View Information Plaza/Mather Point exhibited these characteristics, which includes diversity in tree species, as well as horizontal and vertical structure (Busco and Boyter 2007). The NPS vegetation survey did not provide data for age class or diversity in the other areas that are dominated by piñon/ juniper forest (i.e., Yavapai Observation Station, Yaki Point, or the East Entrance Station).

Deer goldenbush, a park endemic species, is known to occur within this plant community in the vicinity of Mather Point. The plant, which flowers in September and October, is found almost exclusively in a narrow zone of hard limestone outcrops at and below the rim. Surveys by NPS biologists have determined exact locations, and 29 deer goldenbush plants have been documented near Mather Point (Busco and Boyter 2007).

### ***Rocky Mountain Montane Conifer Forest***

The Rocky Mountain montane conifer forest can be divided into two major communities: the ponderosa pine forest and a mixed conifer forest (D. E. Brown 1982). In Grand Canyon National Park the mixed conifer stand is found on the North Rim, while the South Rim is characterized by the ponderosa pine community. This community type is found at elevations between 6,500 and 8,200 feet, higher than the Great Basin conifer woodland. Other typical plants in this community are Gambel oak, New Mexico locust, elderberry, creeping mahonia, and fescue (D. E. Brown 1994). According to a recent vegetation

survey, this community type is found in the Tusayan area. In addition, the north and east parts of the South Entrance Station lie in a transition zone to this woodland (Busco and Boyter 2007). Ponderosa pine communities are also known to occur along the Greenway Trail that would connect Tusayan with the south boundary of the park, and in the vicinity of the Grand Canyon Depot.

### ***Nonnative Species***

According to a 2007 survey, nonnative species of most concern at Canyon View Information Plaza/Mather Point included cheatgrass, bull thistle, foxtail barley, and Dalmatian toadflax (Busco and Boyter 2007). The nonnative species survey for the South Entrance Station identified field bindweed, foxtail barley, and prickly lettuce, which are not of major concern to the park. At Tusayan the primary plant species of concern include Dalmatian toadflax and diffuse knapweed (Busco and Boyter 2007).

## **Environmental Consequences**

### ***Methodology and Assumptions***

Impacts to vegetation may result from the direct removal of vegetation, degradation of existing vegetation, and the potential for nonnative species to invade areas of native vegetation in disturbed areas. Direct, indirect and cumulative impacts are assessed for the characteristic vegetation at each project area (e.g., mature piñon pine and Utah juniper woodland at the Canyon View Information Plaza, and ponderosa pine forest near Tusayan).

Geographic Information System (GIS) aerial photography was used to calculate project footprints for construction (including a 20-foot buffer) and staging areas. Overlays were then used to calculate total acreage of vegetation disturbance by community type. This method was also used to calculate the creation of new edges, providing one means for assessing the potential for invasion of a site by noxious weeds.

The total tree removal estimates were calculated by a botanist using aerial photo interpretation. Preliminary design drawings for each alternative showing predicted disturbance areas for roads, parking lots, 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 on the aerial overlays and then counted. Due to the resolution limits of the aerial photography young trees and larger shrubs could not be distinguished, so both were included in the tree counts. Tree counts are presented as a range of values to account for possible over or under counting of trees.

### ***Impact Analysis Area***

The area analyzed for vegetation impacts includes Canyon View Information Plaza and Mather Point, South Entrance Station, Greenway Trail, lot D, and Tusayan.

There would be no impacts to vegetation at the Yavapai Observation Station, Yaki Point, or the East Entrance Station, so these project areas are not discussed further in the analysis.

### ***Impact Thresholds***

Impact thresholds for the vegetation resource are as follows:

- *Negligible* — No native vegetation would be affected, or some individual native plants could be affected, but a change to a biotic community would not be measurable or perceptible.
- *Minor* — The action would result in a measurable or perceptible, small, localized change to a biotic community. The change would be of little consequence.
- *Moderate* — The action would result in an impact to a biotic community that would be measurable and of consequence, but would remain localized.
- *Major* — The action would result in a measurable change to a biotic community. The change would be large and/or

widespread and could have serious consequences for the species or natural community.

#### Nature of Impacts

**Adverse Impact.** An adverse impact would result from the removal of native vegetation, the creation of disturbed ground prone to nonnative species establishment, the importing of nonnative plant species on machinery or in fill material, the removal of forest and woodland habitat, or the loss of ponderosa pine and piñon/juniper community.

**Beneficial Impact.** A beneficial impact would result from reduced foot traffic and subsequent recruitment of native plant species into denuded areas and social trails.

#### Duration

**Short-term Impact.** A short-term impact would be apparent for five years or less following implementation.

**Long-term Impact.** A long-term impact would be apparent for longer than five years after implementation.

#### **Alternative A: No Action**

##### Direct / Indirect Impacts

Current conditions, including facilities, management strategies, and visitor services, would continue. This would include maintaining existing roads and providing no visitor parking at Canyon View Information Plaza. Parking and roads at Mather Point would remain in their current configuration, as would parking in Grand Canyon Village. There would be no change at the South Entrance Station. Current parking availability at lodging and other commercial locations in Tusayan would continue. Tour and shuttle bus operations would remain unchanged.

Vehicles parked along roadsides near Mather Point would continue to adversely affect vegetation. These impacts include vegetation loss due to trampling and soil compaction, and introduction of nonnative species with

the potential to compete with natives. Social trailing in the vicinity of informal parking areas would continue to cause similar impacts, which could worsen over time under this alternative. This would affect individual plants and could degrade their habitat in these areas, but would have little effects on the overall composition of the plant community found at Mather Point. As a result, the no-action alternative would have long-term, negligible to minor, adverse impacts on vegetation.

##### Cumulative Impacts

Recently completed, in-progress, or reasonably foreseeable trail and road projects could result in cumulative impacts on vegetation resources in the impact analysis area under alternative A. Trail projects include the Greenway Trail phase III and V, the Tusayan bike trail, the Trail of Time, and the Tusayan multi-use path enhancement. Trail development would require vegetation removal, and they would tend to increase habitat fragmentation throughout the areas that they cross. Trails would be less of a wildlife obstacle than roads carrying motorized traffic, but nevertheless they would result in long-term, minor, adverse impacts to vegetation.

In-progress or reasonably foreseeable roadway projects, both inside and outside the park, include the Hermit Road rehabilitation, South Entrance Road improvements, and Tusayan road improvements. During construction some native vegetation could be removed from the project rights-of-way, and nonnative species could spread through newly disturbed areas. This would result in long-term, minor to moderate, adverse impacts to native vegetation. Impacts could be partially mitigated by rapidly revegetating new roadsides and applying aggressive weed management plans.

The implementation of plans that could have a cumulative effect in conjunction with the no-action alternative include the *Backcountry Management Plan*, the *Fire Management Plan*, the amended *Kaibab National Forest Land and Resource Management Plan*, the *Tusayan Community Wildfire Protection Plan*, and the

Tusayan District Travel Analysis Process. These plans and projects collectively should provide long-term, moderate, beneficial impacts to the vegetation resources of Grand Canyon National Park, Kaibab National Forest, and Tusayan. Actions taken by Grand Canyon National Park would need to consider consistency with adjacent land use plans and actions.

Several projects would upgrade, maintain, demolish, or otherwise alter facilities in or near the project area. These projects include rehabilitating South Rim viewpoints, developing a Market Plaza shuttle bus stop, rehabilitating the Grand Canyon Depot, rehabilitating Bright Angel Lodge and cabins, establishing a village interpretive center, improving restrooms throughout the park, repairing/rehabilitating the historic powerhouse, relocating the power substation, moving concessioner operations from the historic powerhouse building to the new warehouse, expanding Grand Canyon National Park Airport and implementing the airport *Master Plan* and capital improvements, constructing Tusayan sewer lines, land conveyance for the Grand Canyon Unified School District, and the *Canyon Uranium Mine Final Environmental Impact Statement*. These projects would result in varying degrees of disturbance and potential removal of native vegetation, resulting in short- and long-term, negligible to moderate, adverse impacts. Salvage and restoration at these sites would lessen the long-term impacts. An aggressive weed control program could limit the spread of nonnative vegetation in these disturbed areas.

The impacts of the above projects in combination with the local, long-term, negligible to minor, adverse impacts of the no-action alternative would cause local, long-term, minor to moderate, adverse cumulative impacts to vegetation resources in the project area. The implementation of various aforementioned plans is expected to result in long-term, minor to moderate, beneficial cumulative impacts to vegetation resources. Incremental

contributions from alternative A to overall cumulative impacts would be marginal.

### Conclusion

Alternative A would result in local, long-term, negligible to minor, adverse impacts to vegetation resources. Cumulative impacts would be local, long-term, minor to moderate, and adverse, as well as long-term, moderate, and beneficial. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of vegetation resources.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would not be unacceptable impacts on vegetation under alternative A.

### **Alternative B: Preferred Alternative**

#### Direct / Indirect Impacts

The majority of impacts discussed below are related to construction activities. Vegetation could also be affected by trampling, soil compaction, and nonnative species introduction due to shifts in the locations and intensity of visitor use under this alternative. Overall, alternative B would result in the loss of approximately 41 acres of vegetation, including some 3,653 to 4,464 trees and the associated understory species. Table 17 (page 145) provides a more detailed summary of vegetation impacts by project site.

As described in the “Mitigation Measures” section of Chapter 2, material storage and equipment staging would occur in previously disturbed areas near the project sites, or in other disturbed areas that best meet project needs and minimize new ground disturbance. A previously disturbed construction staging area between the South Entrance Road and Center Road, approximately 0.25 mile west of the South Entrance Road near Grand Canyon Village, would be used for a diesel-powered asphalt batch plant. As a result, there would be no or minimal loss of vegetation from staging and operation of the batch plant. If there was a need to treat for nonnative vegetation in these areas, it would be considered. All staging areas would be returned to pre-construction conditions or better once construction had been completed.

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 to remove them in the future.

Additionally, construction equipment would access all project sites on existing roads used by visitors. This could cause some visitors to be displaced into other areas on the South Rim during construction, which could increase visitor-related impacts on vegetation in these other areas, including impacts to vegetation associated with social trailing (e.g., trampling and compaction of soils that support plants).

As a result, these activities would contribute to the local, short-term, negligible to minor, construction-related adverse impacts described in the following sections for any of the project sites.

**Canyon View Information Plaza / Mather Point.** New disturbance for construction of the parking area and roadway realignment is estimated at 24 acres. Nonnative species, which have the potential to outcompete native

species and degrade the quality of the plant community at Canyon View Information Plaza and Mather Point, could be inadvertently introduced and spread in construction and staging areas. Removing approximately 6 acres of pavement (e.g., at Mather Point) would also create disturbed conditions that would be susceptible to invasion by nonnative species. Mitigation measures would be used to minimize this potential, including pressure-washing construction equipment that would leave the road to prevent the spread of seeds that could be carried in, and using site-selected native species to revegetate disturbed or restored areas as soon as possible after construction. These areas would be monitored for nonnative species for two to three years, and control would be implemented as necessary in accordance with the revegetation plan. This would minimize competition between native and nonnative species, as well as the potential for nonnatives to become established. As a result, there would be local, short-term, minor adverse impacts during construction from the potential introduction of nonnative plants.

Based on an analysis of aerial photographs for this area, approximately 2,434 to 2,975 piñon/juniper trees lie within the 24-acre footprint of alternative B. The majority of these trees and the associated vegetation would be lost, but large islands of vegetation would be retained. Although the Great Basin conifer forest community is relatively common on the South Rim, the diversity of tree species, structure, and age class in these forests are characteristics essential to old-growth ecosystems (Busco and Boyter 2007). There would also be a direct loss of understory vegetation (shrubs and herbaceous vegetation) in the vicinity of the Canyon View Information Plaza/Mather Point project area.

To mitigate some loss of vegetation, construction and staging would be minimized in areas of structural diversity and mature tree stands. In addition, as many of the younger trees, shrubs, grasses, and forbs in construction areas as practical would be salvaged and used to revegetate disturbed and restored areas.

This alternative would also create approximately 15,064 linear feet of new edge habitat, which could facilitate the establishment of nonnative species. However, best management practices described for other disturbed areas would be used to mitigate adverse impacts associated with the potential for competition between native and nonnative species, and the potential for nonnatives to become established, in this new edge habitat.

Cryptobiotic soils, which are important for both soil nutrient enhancement and soil stabilization, would be trampled during construction, which affects the structure and function of these soils. These areas would be avoided to the extent possible, but some cryptobiotic soils would be lost.

The loss of 29 acres of vegetation under alternative B at Canyon View Information Plaza, coupled with the potential for the introduction and spread of nonnative species in new edge habitat and the impacts to cryptobiotic soils, would have local, long-term, moderate, adverse impacts to vegetation in the vicinity of Canyon View Information Plaza and Mather Point.

Most of the 29 documented deer goldenbush individuals near Mather Point, as well as any other individuals located in the project area, could be avoided during construction activities. Fencing would be used to protect as many individuals as possible, but it is expected that there would be some mortality of individual plants during construction. To offset some of these impacts, the park's vegetation staff would identify locations in the vegetated islands at Canyon View Information Plaza and Mather Point where nursery-grown deer goldenbush could be planted and interpreted for visitors. Less than 1 acre of deer goldenbush habitat would be affected by the construction footprint. As a result, impacts to deer goldenbush would be primarily limited to the loss of individual plants, as the loss of habitat would have little consequence on the population at Mather Point. Therefore, alternative B would have local, long-term,

negligible to minor, adverse impacts on this species.

Alternative B would also be expected to reduce impacts to vegetation from vehicle parking along roadsides near Mather Point and the associated social trailing described for alternative. This would have local, long-term, negligible to minor, beneficial effects to vegetation in the Mather Point area. Restoring and revegetating approximately 6 acres of previously developed land would contribute to these long-term, beneficial effects. Revegetating restored areas to standards of natural conditions would not be completed until after the life of this plan due to the arid climate and soil conditions on the South Rim. Fencing of deer goldenbush, as well as re-planting and interpreting the importance of this native species, would also contribute to the beneficial effects on vegetation under this alternative by minimizing the potential for trampling by visitors.

**Grand Canyon Village.** Converting private vehicle parking spaces to tour bus loading and potentially restoring the railroad tracks now lying beneath lot D adjacent to the Grand Canyon Depot would have no impacts on vegetation as all construction-related activities would occur within the existing disturbed area.

Constructing new shuttle bus stops would result in the loss of approximately 1 acre of Rocky Mountain montane conifer forest; however, there would be limited potential for the introduction of nonnative species given the minimal area disturbed and the mitigation measures described for Canyon View Information Plaza and Mather Point (e.g., pressure-washing construction equipment, revegetating disturbed areas using site-selected native species as soon as possible after construction; and monitoring/controlling nonnatives). As a result, local, short-term, negligible adverse impacts would occur during construction from the potential for the introduction of nonnatives species.

Ultimately, most mature trees could be avoided, and the number of trees to be removed would be minimal. As much native vegetation as practical would be retained in the 1-acre construction footprint, although some cryptobiotic soils would be lost.

This loss of vegetation would primarily affect individual plants and would have little consequence to the plant communities found on the South Rim. Therefore, alternative B would have local, long-term, negligible to minor, adverse impacts to vegetation in the vicinity of Grand Canyon Village.

**South Entrance Station.** Construction associated with a new inbound lane at the South Entrance Station, as well as the new fee administration building and the associated access drive and parking lot would result in the loss of approximately 3 acres of Rocky Mountain montane conifer forest vegetation. As described for Canyon View Information Plaza / Mather Point, nonnative species could be inadvertently introduced and spread in construction and staging areas. However, the same mitigation measures (e.g., pressure-washing construction equipment, revegetating disturbed areas using site-selected native species as soon as possible after construction; and monitoring/controlling nonnatives) would be used to minimize this potential, as well as the potential for nonnatives to out-compete natives and reduce species diversity in the vicinity of the South Entrance Station. Given the limited disturbance area that would be susceptible to invasion, there would be local, short-term, negligible adverse impacts during construction from the potential introduction of nonnative plants during construction.

Based on an analysis of aerial photographs for this area, approximately 585 to 714 piñon pine, Utah juniper, and ponderosa pine trees lie within the 3-acre South Entrance Station project footprint. The majority of these trees and associated vegetation would be lost. To mitigate some loss of vegetation, construction and staging would be minimized in areas of

structural diversity and mature tree stands. In addition, as many of the younger trees, shrubs, grasses, and forbs in construction areas as practical would be salvaged and used to revegetate disturbed areas.

Under this alternative approximately 4,076 linear feet of new edge areas would be created at the South Entrance Station, which could facilitate the establishment of nonnative species. However, best management practices described for other disturbed areas would be used to mitigate adverse impacts associated with the potential for competition between native and nonnative species, and the potential for nonnatives to become established, in this new edge habitat.

Cryptobiotic soils, which are important for both soil nutrient enhancement and soil stabilization, would be trampled during construction, which affects the structure and function of these soils. These areas would be avoided to the extent possible, but some cryptobiotic soils would be lost.

The loss of 3 acres of vegetation in the vicinity of the South Entrance Station under alternative B, coupled with the potential for the introduction and spread of nonnative species in new edge habitat and the impacts to cryptobiotic soils, would have local, long-term, negligible to minor, adverse impacts to vegetation at this project site.

**Greenway Trail.** Construction activities for the new Greenway Trail from the park boundary to Tusayan would disturb 3 acres of Rocky Mountain montane conifer forest. As previously described, nonnative species could be inadvertently introduced and spread in construction and staging areas, and they could outcompete native species as well as reduce species diversity in the vicinity of the trail. However, the same mitigation measures (e.g., pressure-washing construction equipment, revegetating disturbed areas using site-selected native species as soon as possible after construction; and monitoring/controlling nonnatives) would be used to minimize this potential. Given the limited disturbance area

that would be susceptible to invasion, there would be local, short-term, negligible, adverse impacts during construction from the potential introduction of nonnative plants during construction.

Based on aerial photographs, approximately 337 to 412 ponderosa pine trees lie within the 3-acre trail footprint of alternative B. The linear nature of the trail would make it possible to avoid many of these trees during design. To mitigate some loss of vegetation, construction and staging would be minimized in areas of structural diversity and mature tree stands. In addition, as many of the younger trees, shrubs, grasses, and forbs in construction areas as practical would be salvaged and used to revegetate disturbed areas. Approximately 12,500 linear feet of new edge habitat would be created along the trail and would be susceptible to the introduction and spread of nonnative species. However, best management practices described for other disturbed areas would be used to mitigate adverse impacts associated with the potential for competition between native and nonnative species, and the potential for nonnatives to become established, in this new edge habitat.

Cryptobiotic soils, which are important for both soil nutrient enhancement and soil stabilization, would be trampled during construction, which affects the structure and function of these soils. These areas would be avoided to the extent possible, but some cryptobiotic soils would be lost. The loss of 3 acres of vegetation in the vicinity of the Greenway Trail under alternative B, coupled with the potential for the introduction and spread of nonnative species in new edge habitat and the impacts to cryptobiotic soils, would have long-term, negligible to minor, adverse impacts to vegetation at this project site.

**Tusayan.** Construction activities associated with the parking and shuttle bus transfer facility would result in the loss of a total of 10 acres of Rocky Mountain montane conifer forest. Nonnative species could be inadver-

tently introduced and spread in construction and staging areas; however, the same mitigation measures described previously (e.g., pressure-washing construction equipment, revegetating disturbed areas using site-selected native species as soon as possible after construction; and monitoring/controlling nonnatives) would be used to minimize this potential as well as the potential for nonnative species to outcompete natives and reduce species diversity in the vicinity of the project site. As a result, there would be local, short-term, negligible to minor adverse impacts during construction from the potential introduction of nonnative plants.

Based on aerial photographs, approximately 297 to 363 ponderosa pine trees lie within the 10-acre construction footprint. The majority of these trees and the associated vegetation would be lost, but large islands of vegetation would be retained. There would also be a direct loss of understory shrubs and herbaceous vegetation. To mitigate some loss of vegetation, construction and staging would be minimized in areas of structural diversity and mature tree stands. In addition, as many of the younger trees, shrubs, grasses, and forbs in construction areas as practical would be salvaged and used to revegetate disturbed areas.

Approximately 4,476 linear feet of new edge areas would be created under this alternative. As previously discussed, best management practices would be used to mitigate adverse impacts associated with the potential for competition between native and nonnative species, as well as the potential for nonnatives to become established.

Cryptobiotic soils, which are important for both soil nutrient enhancement and soil stabilization, would be trampled during construction, which affects the structure and function of these soils. These areas would be avoided to the extent possible, but some cryptobiotic soils would be lost.

The loss of 10 acres of vegetation in the vicinity of the Tusayan project area under alternative B, coupled with the potential for the

introduction and spread of nonnative species in new edge habitat and the impacts to cryptobiotic soils, would have local, long-term, minor to moderate, adverse impacts to vegetation at this project site.

### Cumulative Impacts

Past, present, and reasonably foreseeable actions with the potential to have cumulative impacts to vegetation include those described for alternative A. Trail and road projects, as well as facility upgrades, maintenance, and demolition, would have long-term, negligible to moderate, adverse impacts. The implementation of various aforementioned plans and projects, including fire management actions, would have local, long-term, moderate, beneficial effects to vegetation.

These impacts in combination with the local, long-term, negligible to moderate, adverse impacts under alternative B would result in local, long-term, minor to moderate, adverse cumulative impacts to vegetation. Incremental contributions from alternative B to overall cumulative impacts would be substantial.

### Conclusion

Alternative B would result in local, short- and long-term, negligible to moderate, adverse impacts to the vegetation resources, including cryptobiotic soils, at Canyon View Information Plaza / Mather Point, the South Entrance Station, along the Greenway Trail, in Grand Canyon Village, and in Tusayan. There would also be local, long-term, negligible to minor, beneficial effects from limiting roadside parking and the associated social trailing, as well as restoration of natural conditions and protection of deer goldenbush near Mather Point. Cumulative impacts would be local, long-term, minor to moderate, and adverse. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of vegetation resources.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would not be unacceptable impacts on vegetation under alternative B.

### **Alternative C: Tusayan Parking Emphasis**

#### Direct / Indirect Impacts

General impacts on vegetation from construction activities would be the same as described for alternative B. Vegetation could also be affected by trampling, soil compaction, and nonnative species introduction due to shifts in the location and intensity of visitor use. Overall, alternative C would result in the loss of approximately 38 acres of vegetation, including approximately 2753 to 3,364 trees and the associated understory species. Table 17 (page 145) provides a more detailed summary of the vegetation impacts by project site.

As described in the "Mitigation Measures" section of Chapter 2, material storage and equipment staging would occur in previously disturbed areas near the project sites, or in other disturbed areas that best meet project needs and minimize new ground disturbance. A previously disturbed construction staging area between the South Entrance Road and Center Road, approximately 0.25 mile west of the South Entrance Road near Grand Canyon Village, would be used for a diesel-powered asphalt batch plant. As a result, there would be no or minimal loss of vegetation from staging and operation of the batch plant. If there was a need to treat for nonnative vegetation in these areas, it would be considered. All staging areas would be returned to pre-construction

conditions or better once construction had been completed.

Damage to tree root systems, which can sometimes result in tree mortality within 5–10 years, would create the potential for hazard trees adjacent to the project area over time and the need to remove them in the future.

Additionally, construction equipment would access all project sites on existing roads used by visitors. This could cause some visitors to be displaced into other areas on the South Rim during construction activities, which could increase visitor-related impacts on vegetation in these other areas, including impacts to vegetation associated with social trailing (e.g., trampling and compaction of soils that support plants).

As a result, these activities would contribute to the local, short-term, negligible to minor, adverse construction-related impacts described in the following sections for the project sites.

**Canyon View Information Plaza / Mather Point.** Construction activities associated with new parking and roadway realignments would result in the disturbance of 15 acres under alternative C. Nonnative species, which have the potential to outcompete native species and degrade the quality of the plant community at Canyon View Information Plaza and Mather Point by decreasing species diversity, could be inadvertently introduced and spread in construction and staging areas. Removing approximately 6 acres of pavement (e.g., at Mather Point) would also create disturbed conditions that would be susceptible to invasion by nonnatives. Mitigation measures would be used to minimize this potential, including pressure-washing construction equipment that would leave the road to prevent the spread of seeds that could be carried in, and using site-selected native species to revegetate disturbed or restored areas as soon as possible after construction. These areas would be monitored for nonnatives for two to three years, and control would be implemented as necessary per the revegetation plan to be developed. This would minimize competition between native and

nonnative species, as well as the potential for nonnatives to become established. As a result, there would be local, short-term, negligible to minor, adverse impacts during construction from the potential introduction of nonnative plants.

Based on aerial photographs, approximately 1,521 to 1,860 piñon/juniper trees lie within the 15-acre construction footprint. The majority of these trees and the associated vegetation would be lost, but large islands of vegetation would be retained. Although the Great Basin conifer woodland is relatively common on the South Rim, the stands that would be affected are relatively mature. There would also be a direct loss of understory vegetation (shrubs and herbaceous vegetation). To mitigate some loss of vegetation, construction and staging would be minimized in areas of structural diversity and mature tree stands. In addition, as many of the younger trees, shrubs, grasses, and forbs in construction areas as practical would be salvaged and used to revegetate disturbed and restored areas.

Approximately 9,722 linear feet of new edge habitat and the restoration of 1 acre of previously disturbed land could create conditions for nonnative species to become established. However, best management practices described for other disturbed areas would be used to mitigate adverse impacts associated with the potential for competition between native and nonnative species, and the potential for nonnatives to become established, in this new edge habitat.

Cryptobiotic soils, which are important for both soil nutrient enhancement and soil stabilization, would be trampled during construction, which affects the structure and function of these soils. These areas would be avoided to the extent possible, but some cryptobiotic soils would be lost.

Considering mitigation measures proposed (including revegetation of restored areas and salvaging trees, understory and cryptobiotic soils), the loss of vegetation (including mature piñon/juniper trees), as well as the potential

for nonnative species to be introduced and adverse effects on cryptobiotic soils, alternative C would have local, long-term, minor to moderate, adverse impacts to vegetation.

The loss of 15 acres of vegetation in the vicinity of Canyon View Information Plaza / Mather Point under alternative C, coupled with the potential for the introduction and spread of nonnative species in new edge habitat and the impacts to cryptobiotic soils, would have local, long-term, minor to moderate, adverse impacts to vegetation in the vicinity of Canyon View Information Plaza / Mather Point.

As with alternative B, most of the deer goldenbush that occurs in the Canyon View Information Plaza / Mather Point project area could be avoided. Fencing would be used to protect as many individuals as possible, and mortality of individual plants during construction would be offset by planting nursery-grown deer goldenbush in the vegetated islands of the project area. The loss of individual plants, as well as the limited loss of habitat (less than 1 acre of deer goldenbush habitat would be affected by the construction footprint in this project area) would have little consequence on the population at Mather Point. Therefore, alternative C would have local, long-term, negligible to minor, adverse impacts on this species.

Alternative C would also be expected to reduce impacts to vegetation from vehicle parking along roadsides near Mather Point and the associated social trailing described for alternative A. This would have local, long-term, negligible to minor, beneficial impacts by minimizing impacts to individual plants and their habitat. Restoring and revegetating approximately 1 acre of previously developed land would contribute minimally to these beneficial effects. The revegetation of restored areas to standards of natural conditions would not be completed until after the life of this plan due to the arid climate and soil conditions on the South Rim. Fencing of deer goldenbush, as well as replanting and inter-

preting the importance of this native species, would also contribute to the beneficial effects on vegetation under this alternative by minimizing the potential for trampling by visitors.

**Grand Canyon Village.** Converting private vehicle parking spaces to tour bus loading and potentially restoring the railroad tracks under lot D adjacent to the Grand Canyon Depot would have no impacts on vegetation because all construction-related activities would occur within the existing disturbed area.

Constructing new shuttle bus stops would result in the loss of approximately 1 acre of Rocky Mountain montane conifer forest; however, there would be limited potential for the introduction and spread of nonnative species given the minimal area disturbed and the mitigation measures described for Canyon View Information Plaza and Mather Point (e.g., pressure-washing construction equipment, revegetating disturbed areas using site-selected native species as soon as possible after construction; and monitoring/controlling nonnatives). As a result, local, short-term, negligible, adverse impacts would occur during construction from the potential for the introduction of nonnative species.

Ultimately, most mature trees could be avoided, and the number of trees to be removed would be minimal. As much of the native vegetation as practical would be retained in the 1-acre construction footprint, although some cryptobiotic soils would be lost.

This loss of vegetation would primarily affect individual plants and would have little consequence to the plant communities on the South Rim. Therefore, alternative C would have local, long-term, negligible to minor, adverse impacts to vegetation in the Grand Canyon Village project area.

**South Entrance Station.** Constructing a new fee administration building and the associated access drive and parking lot would result in the loss of approximately 2 acres of Rocky Mountain montane conifer forest at the South

Entrance Station. As described for Canyon View Information Plaza / Mather Point, nonnative species could be inadvertently introduced and spread in construction and staging areas. However, the same mitigation measures (e.g., pressure-washing construction equipment, revegetating disturbed areas using site-selected native species as soon as possible after construction; and monitoring/controlling nonnatives) would be used to minimize this potential as well as the potential for nonnatives to outcompete native species and to reduce species diversity in the vicinity of the South Entrance Station. Given the limited disturbance area that would be susceptible to invasion, there would be local, short-term, negligible, adverse impacts during construction from the potential introduction of nonnative plants during construction.

Based on aerial photographs, approximately 390 to 476 piñon pine, Utah juniper, and ponderosa pine trees lie within the 2-acre construction footprint. The majority of these trees and associated vegetation would be lost. To mitigate some loss of vegetation, construction and staging would be minimized in areas of structural diversity and mature tree stands. In addition, as many of the younger trees, shrubs, grasses, and forbs in construction areas as practical would be salvaged and used to revegetate disturbed areas.

Approximately 2,349 linear feet of new edge areas would be created at the South Entrance Station under this alternative, which could facilitate the establishment of nonnative species. However, best management practices described for other disturbed areas would be used to mitigate adverse impacts associated with the potential for competition between native and nonnative species, and the potential for nonnatives to become established, in this new edge habitat.

Cryptobiotic soils, which are important for both soil nutrient enhancement and soil stabilization, would be trampled during construction, which affects the structure and function of these soils. These areas would be

avoided to the extent possible, but some cryptobiotic soils would be lost.

The loss of 2 acres of vegetation in the vicinity of the South Entrance Station under alternative C, coupled with the potential for the introduction and spread of nonnative species in new edge habitat and the impacts to cryptobiotic soils, would have long-term, negligible to minor, adverse impacts to vegetation at this project site.

**Greenway Trail.** Greenway Trail construction under alternative C would have the same impacts as alternative B, including the direct loss of approximately 3 acres of Rocky Mountain montane conifer forest. As has been described, mitigation measures would be used to minimize the potential for nonnative species to be inadvertently introduced and spread in construction and staging areas and outcompete native species as well as reduce species diversity in the vicinity of the trail. Given the limited disturbance area that would be susceptible to invasion, there would be local, short-term, negligible, adverse impacts during construction from the potential introduction of nonnative plants during construction.

Approximately 337 to 412 ponderosa pine trees lie within the 3-acre trail footprint. The linear nature of the trail would make it possible to avoid many of these trees during design. To mitigate some loss of vegetation, construction and staging would be minimized in areas of structural diversity and mature tree stands. In addition, as many of the younger trees, shrubs, grasses, and forbs in construction areas as practical would be salvaged and used to revegetate disturbed areas.

Approximately 12,500 linear feet of new edge habitat would be created along the trail and would be susceptible to the introduction and spread of nonnative species. However, best management practices described for other disturbed areas would be used to mitigate adverse impacts associated with the potential for competition between native and nonnative species, and the potential for nonnatives to become established, in this new edge habitat.

Cryptobiotic soils, which are important for both soil nutrient enhancement and soil stabilization, would be trampled during construction, which affects the structure and function of these soils. These areas would be avoided to the extent possible, but some cryptobiotic soils would be lost.

**Tusayan.** Construction activities associated with the parking and shuttle bus transfer facility would result in the loss of a total of 17 acres of Rocky Mountain montane conifer forest under alternative C. Nonnative species could be inadvertently introduced and spread in construction and staging areas; however, the same mitigation measures described previously would be used to minimize this potential (e.g., pressure-washing construction equipment, revegetating disturbed areas using site-selected native species as soon as possible after construction; and monitoring/controlling nonnatives). As a result, there would be local, short-term, negligible to minor, adverse impacts during construction from the potential introduction of nonnative plants.

Approximately 505 to 617 piñon/juniper and ponderosa pine trees lie within the 17-acre construction footprint. The majority of these trees and the associated vegetation would be lost, but large islands of vegetation would be retained. There would also be a direct loss of understory shrubs and herbaceous vegetation. To mitigate some loss of vegetation, construction and staging would be minimized in areas of structural diversity and mature tree stands. In addition, as many of the younger trees, shrubs, grasses, and forbs in construction areas as practical would be salvaged and used to revegetate disturbed areas.

Approximately 7,072 linear feet of new edge areas would be created at Tusayan under this alternative, and these areas would be susceptible to the introduction and spread of nonnative species. However, best management practices described for other disturbed areas would be used to mitigate adverse impacts associated with the potential for competition between native and nonnative species, and the

potential for nonnatives to become established, in this new edge habitat.

Cryptobiotic soils, which are important for both soil nutrient enhancement and soil stabilization, would be trampled during construction, which affects the structure and function of these soils. These areas would be avoided to the extent possible, but some cryptobiotic soils would be lost.

The loss of 17 acres of vegetation in the vicinity of the Tusayan project site under alternative C, coupled with the potential for the introduction and spread of nonnative species in new edge habitat and the impacts to cryptobiotic soils, would have local, long-term, minor to moderate, adverse impacts to vegetation at this project site

#### Cumulative Impacts

Past, present, and reasonably foreseeable actions with the potential to have cumulative impacts to vegetation include those described for alternative A. Trails and road projects, as well as facility upgrades, maintenance, and demolition, would have local, long-term, negligible to moderate, adverse impacts. The implementation of plans and projects, including fire management actions, would have local, long-term, minor, beneficial effects on vegetation.

The impacts of the cumulative actions in combination with the local, long-term, negligible to moderate, adverse impacts and the long-term, negligible to minor, beneficial impacts of restoration in the Mather Point vicinity would result in local, long-term, negligible to moderate, adverse cumulative impacts to vegetation. Incremental contributions from alternative C to overall cumulative impacts would be substantial.

#### Conclusion

Alternative C would result in local, short- and long-term, negligible to moderate, adverse impacts to vegetation resources, including cryptobiotic soils, at Canyon View Information Plaza / Mather Point, the South Entrance

Station, along the Greenway Trail, in Grand Canyon Village, and in Tusayan. There would also be local, long-term, negligible to minor, beneficial impacts from limiting roadside parking and the associated social trailing, as well as restoration of natural conditions and protection of deer goldenbush near Mather Point.. Local, long-term, minor to moderate, adverse cumulative impacts to vegetation are expected. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of vegetation resources.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would not be unacceptable impacts on vegetation under alternative C.

#### ***Alternative D: Canyon View Information Plaza Parking Emphasis***

##### ***Direct / Indirect Impacts***

General impacts on vegetation from construction activities would be the same as described for alternatives B and C. Vegetation could also be affected by trampling, soil compaction, and nonnative species introduction due to shifts in the locations and intensity of visitor use.

Overall, alternative D would result in the loss of approximately 33 acres of vegetation, including approximately 3,558 to 4,349 trees and the associated understory species. Table 17 (page 145) provides a more detailed summary of the vegetation impacts by project site.

As described in the "Mitigation Measures" section of Chapter 2, material storage and equipment staging would occur in previously disturbed areas near the project sites, or in other disturbed areas that best meet project needs and minimize new ground disturbance. A previously disturbed construction staging area between the South Entrance Road and Center Road, approximately 0.25 mile west of the South Entrance Road near Grand Canyon Village, would be used for a diesel-powered asphalt batch plant. As a result, there would be no or minimal loss of vegetation from staging and operation of the batch plant. If there was a need to treat for nonnative vegetation arise in these areas, it would be considered. All staging areas would be returned to pre-construction conditions or better once construction had been completed. Damage to tree root systems, which can sometimes result in tree mortality within 5–10 years, would create the potential for hazard trees adjacent to the project area over time and the need to remove them in the future. This would contribute to the construction-related impacts described for each project site.

Additionally, construction equipment would access all project sites on existing roads used by visitors. This could cause some visitors to be displaced into other areas on the South Rim during construction activities, which could increase visitor-related impacts on vegetation in these other areas, including impacts to vegetation associated with social trailing (e.g., trampling and compaction of soils that support plants).

As a result, these activities would contribute to the local, short-term, negligible to minor, adverse construction-related impacts described in the following sections for the project sites.

**Canyon View Information Plaza / Mather Point.** Construction activities associated with new parking and roadway realignments would result in the net new disturbance of 26 acres. Nonnative species, which have the potential to outcompete native species and degrade the

quality of the plant community at Canyon View Information Plaza and Mather Point by reducing species diversity, could be inadvertently introduced and spread in construction and staging areas. Removing approximately 6 acres of pavement (e.g., at Mather Point) would also create disturbed conditions that would be susceptible to invasion by nonnatives. Mitigation measures would be used to minimize this potential, including pressure-washing construction equipment that would leave the road to prevent the spread of seeds that could be carried in, and using site-selected native species to revegetate disturbed or restored areas as soon as possible after construction. These areas would be monitored for nonnatives for two to three years, and control would be implemented as necessary per the revegetation plan to be developed. This would minimize competition between native and nonnative species, as well as the potential for nonnatives to become established. As a result, there would be local, short-term, minor, adverse impacts during construction from the potential introduction of nonnative plants.

Approximately 2,637 to 3,223 piñon/juniper trees lie within the 26-acre construction footprint of alternative D. The majority of these trees and the associated vegetation would be lost, but large islands of vegetation would be retained. There would also be a direct loss of understory shrubs and herbaceous vegetation. To mitigate some loss of vegetation, construction and staging would be minimized in areas of structural diversity and mature tree stands. In addition, as many of the younger trees, shrubs, grasses, and forbs in construction areas as practical would be salvaged and used to revegetate disturbed areas.

Approximately 15,367 linear feet of edge areas would be created at Canyon View Information Plaza / Mather Point under this alternative, which could facilitate establishment of nonnative species. However, best management practices described for other disturbed areas would be used to mitigate adverse impacts associated with the potential for competition between native and nonnative species, as well

as the potential for nonnatives to become established, in this new edge habitat.

Cryptobiotic soils, which are important for both soil nutrient enhancement and soil stabilization, would be trampled during construction, which affects the structure and function of these soils. These areas would be avoided to the extent possible, but some cryptobiotic soils would be lost.

The loss of 29 acres of vegetation under alternative D at Canyon View Information Plaza, coupled with the potential for the introduction and spread of nonnative species in new edge habitat and the impacts to cryptobiotic soils, would have local, long-term, moderate, adverse impacts to vegetation in the vicinity of Canyon View Information Plaza / Mather Point.

As with alternative B, most of the deer goldenbush that occurs in the Canyon View Information Plaza / Mather Point project area could be avoided. Fencing would be used to protect as many individuals as possible, and mortality of individual plants during construction would be offset by planting nursery-grown deer goldenbush in the vegetated islands of the project area. The loss of individual plants, as well as the limited loss of habitat (less than 1 acre of deer goldenbush habitat would be affected by the construction footprint in this project area) would have little consequence on the population at Mather Point. Therefore, alternative D would have local, long-term, negligible to minor, adverse impacts on this species.

This alternative would also be expected to reduce impacts to vegetation from vehicle parking along roadsides near Mather Point and the associated social trailing as described under alternative A. This would have local, long-term, negligible to minor, beneficial impacts to vegetation in the Mather Point area by minimizing impacts to individual plants and their habitat. Restoring and revegetating approximately 5 acres of previously developed land would contribute to these long-term, beneficial effects. The revegetation of restored

areas to standards of natural conditions would not be completed until after the life of this plan due to the arid climate and soil conditions on the South Rim. Fencing of deer goldenbush, as well as replanting and interpreting the importance of this native species, would also contribute to the beneficial effects on vegetation under this alternative by minimizing the potential for trampling by visitors.

**Grand Canyon Village.** Converting private vehicle parking spaces to tour bus loading and potentially restoring the railroad tracks beneath lot D adjacent to the Grand Canyon Depot would have no impacts on vegetation as all construction-related activities would occur within the existing disturbed area.

Constructing new shuttle bus stops would result in the loss of approximately 1 acre of Rocky Mountain montane conifer forest; however, there would be limited potential for the introduction and spread of nonnative species given the minimal area disturbed and the mitigation measures described for Canyon View Information Plaza / Mather Point (e.g., pressure-washing construction equipment, revegetating disturbed areas using site-selected native species as soon as possible after construction; and monitoring/controlling nonnatives). As a result, local, short-term, negligible, adverse impacts would occur during construction from the potential for the introduction of nonnative species.

Ultimately, most mature trees could be avoided, and the number of trees to be removed would be minimal. As much of the native vegetation as practical would be retained in the 1-acre construction footprint, although some cryptobiotic soils would be lost.

This loss of vegetation would have little consequence to the plant communities found on the South Rim. As a result, alternative D would have local, long-term, negligible to minor, adverse impacts to vegetation in the Grand Canyon Village project area.

**South Entrance Station.** Constructing a new inbound lane, as well as a new fee administra-

tion building and the associated access drive and parking lot, would have the same effects as described for alternative B, including the loss of approximately 3 acres of Rocky Mountain montane conifer forest. However, the same mitigation measures (e.g., pressure-washing construction equipment, revegetating disturbed areas using site-selected native species as soon as possible after construction; and monitoring/controlling nonnatives) would be used to minimize this potential, as well as the potential for nonnatives to outcompete natives and reduce species diversity in the vicinity of the South Entrance Station. Given the limited disturbance area that would be susceptible to invasion, there would be local, short-term, negligible, adverse impacts during construction from the potential introduction of nonnative plants during construction.

The majority of the approximately 585 to 714 piñon pine, Utah juniper, and ponderosa pine trees, as well as the associated understory vegetation, would be lost. To mitigate some loss of vegetation, construction and staging would be minimized in areas of structural diversity and mature tree stands. In addition, as many of the younger trees, shrubs, grasses, and forbs in construction areas as practical would be salvaged and used to revegetate disturbed areas.

Approximately 4,076 linear feet of edge areas would be created at the South Entrance Station. However, best management practices described for other disturbed areas would be used to mitigate adverse impacts associated with the potential for competition between native and nonnative species, and the potential for nonnatives to become established, in this new edge habitat.

Cryptobiotic soils, which are important for both soil nutrient enhancement and soil stabilization, would be trampled during construction, which affects the structure and function of these soils. These areas would be avoided to the extent possible, but some cryptobiotic soils would be lost.

The loss of 3 acres of vegetation in the vicinity of the South Entrance Station under alternative D, coupled with the potential for the introduction and spread of nonnative species in new edge habitat and the impacts to cryptobiotic soils, would have local, long-term, negligible to minor, adverse impacts to vegetation at this project site.

**Greenway Trail.** Constructing the new Greenway Trail under alternative D would have the same impacts as alternatives B and C, including the loss of 3 acres of Rocky Mountain montane conifer forest. Nonnative species could be inadvertently introduced and spread in construction and staging areas and could outcompete native species as well as reduce species diversity along the trail. However, the same mitigation measures would be used to minimize this potential (e.g., pressure-washing construction equipment, revegetating disturbed areas using site-selected native species as soon as possible after construction; and monitoring/controlling nonnatives). Given the limited disturbance area that would be susceptible to invasion, there would be local, short-term, negligible adverse impacts during construction from the potential introduction of nonnative plants during construction.

To mitigate some loss of vegetation, construction and staging would be minimized in areas of structural diversity and mature tree stands. In addition, as many of the younger trees, shrubs, grasses, and forbs in construction areas as practical would be salvaged and used to revegetate disturbed areas. Approximately 12,500 linear feet of new edge habitat would be created along the trail and would be susceptible to the introduction and spread of nonnative species. However, best management practices described for other disturbed areas would be used to mitigate adverse impacts associated with the potential for competition between native and nonnative species, as well as the potential for nonnatives to become established, in this new edge habitat.

Cryptobiotic soils, which are important for both soil nutrient enhancement and soil stabilization, would be trampled during construction, which affects the structure and function of these soils. These areas would be avoided to the extent possible, but some cryptobiotic soils would be lost.

The loss of 3 acres of vegetation in the vicinity of the Greenway Trail under alternative B, coupled with the potential for the introduction and spread of nonnative species in new edge habitat and the impacts to cryptobiotic soils, would have local, long-term, negligible to minor, adverse impacts to vegetation at this project site.

### Cumulative Impacts

Past, present, and reasonably foreseeable actions with the potential to have cumulative impacts to vegetation include those described for alternative A. Trails and road projects, as well as facility upgrades, maintenance, and demolition, would have local, long-term, negligible to moderate, adverse impacts. The implementation of plans and projects, including fire management actions, would have local, long-term, minor, beneficial effects on vegetation.

The impacts of the cumulative actions in combination with the local, long-term, negligible to moderate, adverse impacts under alternative D, as well as the local, long-term, negligible to minor, beneficial effects from restoration activities near Mather Point would result in local, long-term, minor to moderate, adverse cumulative impacts to vegetation. Incremental contributions from alternative D to overall cumulative impacts would be substantial.

### Conclusion

Alternative D would result in local, long-term, negligible to moderate, adverse impacts to vegetation resources at Canyon View Information Plaza/Mather Point, the South Entrance Station, along the Greenway Trail, and in Grand Canyon Village. Limiting

roadside parking and the associated social trailing, as well as restoration of natural conditions and protection of deer goldenbush near Mather Point, would result in local, long-term, negligible to minor, beneficial effects. Local, long-term, minor to moderate, adverse cumulative impacts to vegetation are expected. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of vegetation resources.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would not be unacceptable impacts on vegetation under alternative D.

## WILDLIFE

### Affected Environment

The discussion of wildlife has been grouped by habitat preference, based on the vegetation types described in the preceding section. These vegetation types include the Great Basin conifer woodland and the Rocky Mountain montane conifer forest. Wildlife that is common in the Great Basin desert scrub, found below the South Rim, is not discussed in this document because it would not be affected. Potential impacts would include effects to natural soundscapes and night sky (from new artificial lighting), as described in the analysis for other wildlife. However, the impacts would be negligible given the current



Mule deer occupy a variety of habitats, but tend to avoid large openings and mature forest with a closed canopy.

conditions related to noise and lighting in project areas above the South Rim.

### ***Great Basin Conifer Woodland***

As noted in the "Vegetation" section, the Great Basin conifer woodland is found at the Canyon View Information Plaza and Mather Point project areas, as well as in some parts of the South Entrance Station (Busco and Boyter 2007). It is also known to occur at Grand Canyon Village, Yavapai Observation Station, Yaki Point, and the East Entrance Station.

### ***Birds***

Piñon jays and gray flycatchers are among the few bird species closely tied to the Great Basin conifer woodland. Other birds that may center their range in this community include the gray vireo, black-throated gray warbler, Scott's oriole, and juniper titmouse. All of these birds have been identified as priority bird species (species that warrant consideration in conservation agreements) in the "Bird Conservation Plan" developed by the Arizona Working Group of Partners in Flight (Latta et al. 1999).

### ***Mammals***

Mule deer occupy a variety of habitats, but tend to avoid large openings and mature forest with a closed canopy. In general, the Great Basin conifer woodland provides important winter habitat for mule deer (D. E. Brown

1994), which depend on highly digestible, succulent forage and prefer forbs, new shoots, and fruits of shrubs, if available (Hoffmeister 1986). On the South Rim this woodland provides both winter and summer range for mule deer. They have been observed often in the project areas that support this plant community.

Elk occur throughout northern and eastern Arizona. Elk prefer grasses, sedges, and forbs, but will also browse on shrubs (such as mountain mahogany and silktassel) and needles of various conifers and oaks (Hoffmeister 1986). In general, the Great Basin conifer woodland provides important winter habitat for elk (D. E. Brown 1994). On the South Rim resident elk herds occupy ponderosa pine habitat, as well as residential areas of Grand Canyon Village. Elk are commonly seen year-round in project areas that support this plant community, which provides both winter and summer range.

Mountain lions occur throughout Arizona, with home ranges varying from 25 to 100 square miles, depending on gender, time of year, and prey availability (mostly on mule deer and elk). Mountain lions occur on both canyon rims, but population estimates are not available. Park mountain lion studies were initiated in 2000 and are ongoing.

The most common small mammal caught in piñon/juniper habitat during a 2005 small mammal survey for this transportation project (Lawes and Ward 2006) was the piñon mouse. Other small mammal species included the deer mouse, brush mouse, cliff chipmunk, white-throated woodrat, Mexican woodrat, and the eastern cottontail (Lawes and Ward 2006).

In addition, several species of bats could occur in the project areas that support Great Basin conifer woodland, including the Allen's lappet-browed bat, long-legged myotis, and pale Townsend's big-eared bat.

### Amphibians and Reptiles

Amphibians and reptiles occurring in the Great Basin conifer woodland may include tiger salamander, western rattlesnake, ring-neck snake, California kingsnake, Sonoran gopher snake, western terrestrial garter snake, several species of skink, striped whiptails (including the Plateau striped whiptail), sagebrush lizard, and the mountain short-horned lizard.

### **Rocky Mountain Montane Conifer Forest**

#### Birds

Breeding birds of the Rocky Mountain montane conifer forest include the northern goshawk, saw-whet owl, pine siskin, brown creeper, band-tailed pigeon, Steller's jay, yellow-rumped warbler, pygmy owl, dark-eyed junco, red crossbill, Townsend's solitaire, flammulated owl, Mexican chickadee, imperial woodpecker, western tanager, western bluebird, pygmy nuthatch, broad-tailed hummingbird, spotted owl, and warbling vireo.

#### Mammals

Common mammals include mule deer, elk, porcupine, gray fox, chipmunks, voles, cottontail rabbits, long-tailed weasel, and many others. The most common small mammal caught in this habitat during a 2005 small mammal survey was the deer mouse (Lawes and Ward 2006). Other small mammal species captured included the piñon mouse, brush mouse, cliff chipmunk, Mexican woodrat, Mexican vole, desert cottontail, and eastern cottontail (Lawes and Ward 2006).

In addition, several species of bats that use this habitat type could occur in the project areas that support Rocky Mountain montane conifer forest, including the Allen's lappet-browed bat, long-legged myotis, pale Townsend's big-eared bat, pocketed free-tailed bat, southwestern myotis, and spotted bat.

### Amphibians and Reptiles

Amphibians and reptiles are very likely to be similar to those encountered in the Great Basin conifer woodland — tiger salamander, western rattlesnake, ringneck snake, California kingsnake, Sonoran gopher snake, Western terrestrial garter snake, skink species, and the mountain short-horned lizard.

## **Environmental Consequences**

### ***Methodology and Assumptions***

The environmental consequences focus on the impacts of direct mortality, species displacement from habitat, habitat fragmentation, change in habitat quality, night sky changes, noise from construction and increased vehicle operations, and Greenway Trail use. Of particular interest are the species-specific breeding areas, foraging areas, and movement corridors. The impact assessment is based on numerous NPS surveys, a review of park natural resource information, wildlife assessments in the *Final General Management Plan and Environmental Impact Statement* (NPS 1995a) and the *Hermit Road Rehabilitation Environmental Assessment* (NPS 2006b), and other wildlife studies conducted at Grand Canyon National Park and Kaibab National Forest, as well as best professional judgment.

A review of avifauna studies of piñon/juniper woodland in northern Arizona, Utah, and Colorado indicate that there are between 60 and 190 bird territories per 100 acres in this habitat type (Dickson et al. 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 was positively correlated with the increasing density of the piñon/juniper stand. Because there are relatively dense, mature stands of piñon/juniper forest in the Canyon View Information Plaza/Mather Point area, higher estimates for avifauna territories are probably more applicable, and for the purposes of this document are estimated to be

between 150 and 190 per 100 acres, or between 1.5 and 2 territories per acre.

A review of the limited number of studies that provide estimates of small mammals in piñon/juniper habitat reveals 10 to 30 small mammals per acre in normal precipitation years. Preliminary analyses of data collected in Grand Canyon estimate the density of small mammals in this habitat type on the order of 15 to 20 individuals per acre (Lawes and Ward 2006). The same study found approximately 13 to 15 small mammal individuals per acre in ponderosa pine/piñon/Gambel oak forest.

### Impact Analysis Area

The impact analysis area for wildlife impacts includes the following sites: Canyon View Information Plaza and Mather Point, the South Entrance Station, the Greenway Trail, lot D in Grand Canyon Village, the Yavapai Observation Station, Yaki Point, the East Entrance Station, and Tusayan.

### Impact Thresholds

The following impact thresholds were defined for impacts on wildlife:

- *Negligible* — Wildlife, their habitats, or the natural processes sustaining them would not be affected, or changes would be so slight that they would not be measurable or perceptible. Impacts would be well within natural fluctuations.
- *Minor* — Impacts on wildlife, their habitats, or the natural processes sustaining them would be detectable, but the severity and timing of changes to parameter measurements would not be expected to be outside natural variability and would remain localized. Population numbers, structure, genetic variability, and other demographic factors might have slight changes, but characteristics would remain stable. Key ecosystem processes might have slight disruptions that would be 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 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). 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 natural variability. Changes within the natural variability may be permanent. Population numbers, population structure, genetic variability, and other demographic factors for species might have large declines, with 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 could be rendered not functional.

#### Nature of Impacts

**Adverse Impact.** An adverse impact would result in direct mortality, reduction in habitat acreage, temporal and spatial displacement of wildlife from habitat, habitat fragmentation, and reduction of habitat quality.

**Beneficial Impact.** A beneficial impact would result in improved acres of habitat or decreased mortality rates.

#### Duration

**Short-term Impact.** A short-term impact would be apparent for up to five years after implementation.

**Long-term Impact.** A long-term impact would be apparent longer than five years after implementation.

#### **Alternative A: No Action**

##### Direct / Indirect Impacts

Current conditions, including facilities, management strategies, and visitor services, would continue. This would include maintaining existing roads and no visitor parking at Canyon View Information Plaza. Parking and roads at Mather Point would remain in the current configuration. Current parking and management in Grand Canyon Village would continue. There would be no change at the South Entrance Station. Current parking at lodging and other commercial locations in Tusayan would remain. Tour and shuttle bus operations would remain unchanged.

Over time increasing levels of traffic on existing roads could increase the number of animal/vehicle collisions in the project area, which could lead to increased mortality. Noise increases associated with greater traffic volume could displace wildlife from available habitat, most notably in the vicinity of Canyon View Information Plaza and Tusayan. Habitat fragmentation caused by current roads, trails, and structures would continue. Vehicles parked along roadsides near Mather Point would continue to cause habitat impacts from trampling, soil compaction, and introduction of nonnative species, which could worsen over time under this alternative. The continued use of existing developments would not impact any sensitive wildlife habitat, such as nesting and/or roosting sites, key foraging areas, key calving or fawning areas, or primary wildlife travel corridors. Current night-sky

conditions would continue. Therefore, population level effects are not expected, and population fluctuations would be limited. As a result, the no-action alternative would have local, long-term, negligible, adverse impacts to wildlife.

### Cumulative Impacts

Past, present, and reasonably foreseeable actions with the potential to have cumulative impacts to wildlife include those described for alternative A for vegetation. Trails and road projects, as well as facility upgrades, maintenance, and demolition, would have long-term, negligible to moderate, adverse impacts to wildlife. Plans and projects, including fire management actions, would have local, long-term, minor, beneficial effects to wildlife.

The impacts of the cumulative actions in combination with the long-term, negligible, adverse impacts of alternative A would result in local, long-term, negligible to moderate, adverse cumulative impacts to wildlife. Incremental contributions from alternative A to overall cumulative impacts would be marginal.

### Conclusion

Alternative A would result in local, long-term, negligible, adverse impacts to wildlife in the project area. Cumulative impacts would be local, long-term, negligible to moderate, and adverse, as well as local, long-term, minor, and beneficial. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of wildlife resources.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and

cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would not be unacceptable impacts on wildlife under alternative A.

### **Alternative B: Preferred Alternative**

#### Direct / Indirect Impacts

Alternative B could result in direct mortality of individual animals, direct loss of available habitat, and displacement of wildlife during construction. Operations impacts could include the indirect impacts of temporal and spatial displacement of wildlife from habitat, noise impacts, habitat fragmentation, night-sky changes, and disturbance to wildlife species during foraging and/or breeding. Overall, alternative B would result in the loss of 41 acres of wildlife habitat (including some 3,653 to 4,464 trees) at all construction sites. Using the formula for bird and small mammal territories listed in the methodology for the wildlife section, this alternative could affect habitat for an unknown member of bird territories (data unavailable) and approximately 581 to 735 small mammals. Impacts are discussed in more detail below by area. Table 17 (page 145) provides a more detailed summary of the wildlife/wildlife habitat impacts by project site.

As described in the "Mitigation Measures" section of Chapter 2, material storage and equipment staging would occur in previously disturbed areas near the project sites, or in other disturbed areas that best meet project needs and minimize new ground disturbance. As a result, there would be no impacts on wildlife habitat (e.g., loss, fragmentation, degradation) from staging. Because the staging areas would occur in disturbed locations generally surrounded by other developments (e.g., facilities or roads), it is expected that wildlife are accustomed to some levels of disturbance, and that any potential temporary impacts on breeding or foraging wildlife (e.g.,

decreased breeding success or delayed feedings, temporary displacement) would be minimal. In addition, all staging areas would be returned to pre-construction conditions or better once construction had been completed.

Construction equipment would access all project sites on existing roads used by visitors under alternative B. This could cause some visitors to be displaced into other locations on the South Rim during construction activities, which could increase visitor-related impacts on wildlife in these other areas (e.g., wildlife/vehicle interactions that could result in mortality, displacement due to noise and the presence of people/vehicles, etc., potential disruption of breeding or foraging activities, and impacts to wildlife habitat associated with social trailing such as trampling of vegetation and compaction of soils).

These activities could have temporary effects on population fluctuations within the project areas that would contribute to similar impacts on wildlife as are described in detail for each project site.

**Canyon View Information Plaza / Mather Point.** *Construction* — Construction activities and the presence of equipment for the new parking area, the realigned roadway, and accessibility improvements at Mather Point could cause the direct mortality of individual animals from trampling, especially small and medium-sized mammals, the young of larger mammals, reptiles, amphibians, and insects. Wildlife species would likely avoid the project area as a result of construction-related noise. Similar habitat is available on the South Rim for animals displaced during construction; however, this habitat is expected to be occupied, and there could be increased competition for resources such as food and cover in adjacent areas. This could ultimately lead to some mortality should available resources not be adequate to accommodate the displaced species.

Construction during the spring and summer could overlap with the sensitive breeding season for many wildlife species. As a result,

the presence of people, equipment, and the associated construction noise could disturb breeding wildlife, potentially causing reduced breeding success for some species. Construction-related activities could also disturb foraging wildlife at Canyon View Information Plaza / Mather Point, causing wildlife to delay feedings or to forage in other occupied habitat. However, given the current levels of activity on the South Rim, breeding and foraging wildlife are likely accustomed to some levels of human disturbance. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding or important feeding areas), would also be implemented to minimize impacts during construction. Despite the adaptability of some animals and these mitigation measures, temporary population fluctuations in the vicinity of Canyon View Information Plaza and Mather Point could occur during construction as a result of mortality and displacement. Therefore, these construction-related activities would have short-term, minor, adverse impacts on wildlife.

The loss of approximately 24 acres of mature Great Basin conifer woodland (including 2,434–2,975 piñon pine and juniper trees and associated vegetation) would result in the loss of some mule deer and elk summer and winter habitat, and would cause wildlife species to be displaced into surrounding habitat. Although this community is relatively common on the South Rim, these are mature stands that provide important wildlife habitat. Using the formula for bird and small mammal territories listed in the methodology for the wildlife section, the net disturbance footprint of 24 acres would equal a loss of 36 to 48 bird territories and habitat for approximately 360–480 small mammals. Because surrounding available wildlife habitat is expected to already be occupied, competition for resources such as food and cover could increase as wildlife are displaced into adjacent areas.

The loss of bird and small mammal habitat would decrease the number of individuals in the project area that serve as prey available for

predators, such as mountain lions and raptors, forcing these species to forage in adjacent areas. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding and important foraging areas) and initiating revegetation as soon as possible after construction, would help offset some impacts by limiting habitat loss and the number of animals displaced. However, this loss of habitat would ultimately cause population fluctuations in the vicinity of Canyon View Information Plaza and Mather Point, and it could increase the stress on displaced wildlife and the species that occur in adjacent areas. This could ultimately lead to some mortality should available resources not be adequate to accommodate the displaced species. As a result, there would be local, long-term, moderate, adverse impacts on wildlife and wildlife habitat from habitat loss.

New roads and parking lots would cause some habitat fragmentation in the Canyon View Information Plaza / Mather Point area. This would result in the creation of approximately 15,064 linear feet of edge habitat and edge effects, including invasion by nonnative or edge wildlife species, such as brown-headed cowbirds, raccoons, and striped skunks. Impacts could include nest parasitism, or greater competition between species in the newly created edge. These new edge areas, as well as the restoration of approximately 6 acres of previously disturbed areas near Mather Point, would also be susceptible to spread of nonnative vegetation, which could degrade wildlife habitat by replacing native plant species with nonnatives and decreasing plant species diversity. However, mitigation measures would be implemented to monitor nonnative species, both plants and animals, and revegetation would be initiated as soon as possible. This would minimize competition between native and nonnative species, and minimize the potential for nonnatives to become established. Given the already fragmented habitat conditions, the new parking areas and roadway realignment would cause

local, long-term, minor adverse impacts to wildlife.

There would be local, long-term, minor, beneficial effects from the gradual restoration of 6 acres of wildlife habitat. However, revegetation of restored areas to standards of natural conditions would not be completed until after the life of the plan because of the arid climate and the soil conditions on the South Rim.

*Operations* — The increase in visitor activities and vehicle/bus traffic in new parking areas and along roadways could displace wildlife from the Canyon View Information Plaza / Mather Point area and create additional wildlife/human or wildlife/vehicle interactions. This could ultimately lead to some mortality should available resources not be adequate to accommodate the displaced species. Operations could disturb breeding and foraging wildlife, potentially affecting breeding success for some species and causing wildlife to delay feedings or forage in other occupied habitat. In addition, increased wildlife/human and wildlife/vehicle interactions could increase stress on some wildlife or cause direct mortality from trampling (primarily from the latter). As a result, operations could result in some population fluctuation at this project site. However, given current levels of noise, human presence, and vehicle traffic in this area, it is assumed that wildlife species in this area, including those that breed or forage, have already adapted to these types of disturbance and that fluctuations would be limited.

Although parking would be removed at Mather Point, night-sky changes could result from more vehicle parking at Canyon View Information Plaza. This could cause nocturnal species, such as common nighthawks, great horned owls, ringtails, or bats, to be displaced from or to avoid this habitat. However, most parking and travel would likely take place in daylight hours, and substantially fewer cars would probably use the lots at night. Park managers might also choose not to light the entire parking lot beyond that required for mobility or safety.

Artificial lighting from new facilities is not expected to appreciably alter night skies either, given existing development and lighting in the area and the mitigation measures described in Chapter 2 (see page 121) that would limit lighting impacts, such as zoning areas for appropriate lighting; limiting lighting to target areas and using trees and other light-absorbing elements in the landscape; using fully shielded fixtures to concentrate lighting on the horizontal surface only where needed and not beyond paved surfaces; and regulating exterior lighting with a timer or motion sensor that would turn lights off when they are not needed. As a result, population fluctuations from displacement or avoidance due to changes in night sky would be minimal.

As a result, impacts of operations on wildlife in the vicinity of Canyon View Information Plaza / Mather Point under alternative B would be local, long-term, negligible to minor, and adverse.

This alternative would also reduce impacts to wildlife habitat caused by vehicle parking along roadsides near Mather Point and the associated impacts of social trailing (soil compaction, vegetation trampling, and the introduction of nonnative species). This would have local, long-term, negligible, beneficial effects on wildlife.

**South Entrance Station. Construction** — Impacts to wildlife from construction of a new inbound traffic lane, as well as the new fee administration building and the associated access drive and parking lot, would be similar to those described for construction at Canyon View Information Plaza / Mather Point. These impacts include the potential for direct mortality to wildlife (primarily small mammals, reptiles, and amphibians) and avoidance of the area by wildlife due to noise and the presence of people and equipment. There is similar available habitat near the South Entrance Station for displaced animals. Due to the limited extent of construction, this displacement is not expected to result in increased competition, as surrounding areas are

assumed to support adequate resources to accommodate displaced species.

Construction during the spring and summer could overlap with the sensitive breeding season for many wildlife species. As a result, the presence of people, equipment, and the associated construction noise could disturb breeding wildlife, potentially causing reduced breeding success for some species. Construction-related activities could also disturb foraging wildlife in the vicinity of the South Entrance Station, causing wildlife to delay feedings or forage in other occupied habitat. However, given the current levels of activity in this area associated with existing facilities and roads, breeding and foraging wildlife are likely accustomed to some levels of human disturbance. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding or important feeding areas), would also be taken to minimize impacts during construction. Given the limited disturbance, the adaptability of some animals, and these mitigation measures, temporary population fluctuations in the vicinity of the South Entrance Station from mortality and displacement would be minimal. Therefore, these construction-related activities would have local, short-term, negligible, adverse impacts on wildlife in the vicinity of Canyon View Information Plaza / Mather Point.

The loss of approximately 3 acres of habitat (including approximately 585–714 piñon pine, Utah juniper, and ponderosa pine trees and associated vegetation) would result in the loss of some mule deer and elk summer and winter habitat and could displace wildlife into surrounding habitat. Based on information described in the methodology, a net disturbance footprint of 3 acres would equal a loss of habitat for approximately 39 to 45 small mammals, and an unknown number of bird territories (data unavailable). It is expected that surrounding available wildlife habitat could support these displaced species, given the limited loss of habitat. Any loss of prey for predators, such as mountain lions, would be

minimal. Mitigation measures described in Chapter 2, such as avoiding or minimizing impacts to ecologically important wildlife habitat and initiating revegetation as soon as possible after construction, would help offset impacts by limiting habitat loss. Ultimately, this loss of habitat would cause minimal population fluctuations in the vicinity of the South Entrance Station. Therefore, there would be local, long-term, negligible, adverse impacts to wildlife and wildlife habitat from habitat loss at this project site.

New roads and a parking lot would cause minimal habitat fragmentation in the South Entrance Station area given the limited disturbance footprint (3 acres) and the fragmented conditions created by current developments, including the existing entrance facilities and roads. Although this alternative would result in the creation of approximately 4,076 linear feet of new edge habitat, resulting impacts from the creation of new edge effects (e.g., invasion by nonnative or edge wildlife species, nest parasitism, or greater competition between species in the newly created edge) are expected to be limited given the limited disturbance. Mitigation measures, including monitoring for nonnatives (both plants and animals) and revegetation, would be implemented at this project site to minimize competition between native and nonnative species, as well as the potential for nonnatives to become established. Therefore, construction would have local, long-term, negligible, adverse impacts to wildlife as a result of the creation of new edge habitat near the South Entrance Station.

*Operations* — A new 1,000-square-foot fee collection facility, a new access drive, and a new parking area at the South Entrance Station would increase visitor activities and vehicle/bus traffic. This could cause wildlife displacement from the South Entrance Station area and create additional wildlife/human or wildlife/vehicle interactions. It is expected that displaced animals would be supported in the surrounding area with minimal competition for resources. Operations could disturb

breeding and foraging wildlife, potentially affecting breeding success for some species and causing wildlife to delay feedings or forage in other occupied habitat. In addition, increased wildlife/human and wildlife/vehicle interactions could increase stress on some individuals or cause direct mortality from trampling (primarily from the latter). As a result, operations could result in some population fluctuation at this project site. However, the new facility operations should not greatly increase adverse impacts as a result of disturbances or direct mortality to wildlife above current levels because of existing development and human activity in the immediate area.

The effects on night skies would also be minimal given existing developments in the area and the mitigation measures described for Canyon View Information Plaza (e.g., zoning, limiting lighting by using trees and other light-absorbing elements in the landscape, using fully shielded fixtures, and regulating exterior lighting with a timer or motion sensor). These measures would reduce lighting impacts due to wildlife displacement or avoidance of the area.

Therefore, operational impacts to wildlife would be local, long-term, negligible, and adverse in the vicinity of the South Entrance Station.

**Greenway Trail.** *Construction* — Impacts to wildlife from constructing the new Greenway Trail between Tusayan and the park boundary would be similar to construction impacts at the other areas. These could include the potential for direct mortality, displacement, and increased competition in nearby areas for food and cover. Due to the limited extent of construction, it is assumed that surrounding habitat has adequate resources (food and cover) to accommodate displaced species. Unlike the other two developed areas, however, the Greenway Trail project area is currently undeveloped, and there is not much human activity except for traffic-related noise. As a result, foraging and breeding individuals

might not be accustomed to much disturbance. Construction activities could cause some individuals to delay feeding or to forage in adjacent areas, as well as affect breeding success if construction occurs during spring or summer.

Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding or important feeding areas), would be taken to minimize impacts during construction. Given the limited disturbance, the adaptability of some animals, and these mitigation measures, temporary population fluctuations in the vicinity of the Greenway Trail from mortality and displacement would be minimal. Therefore, these construction-related activities would have local, short-term, negligible, adverse impacts on wildlife along the trail.

Approximately 3 acres of Rocky Mountain montane conifer forest habitat would be lost along the Greenway Trail. Many of the 337 to 412 ponderosa pine trees would be avoided; however, this would result in the loss of an unknown number of bird territories (data unavailable). Based on information in the methodology section, the net disturbance footprint of 3 acres would equal the loss of habitat for approximately 39 to 45 small mammals. These species would likely be displaced into surrounding habitat, which would probably be able to support these individuals given the limited loss of habitat. Any loss of prey for predators such as mountain lions would be minimal.

Mitigation measures described in Chapter 2, such as avoiding or minimizing impacts to ecologically important wildlife habitat and initiating revegetation as soon as possible after construction, would help offset some impacts by limiting habitat loss. It is expected that surrounding available wildlife habitat could support these displaced species, given the limited loss of habitat. Any loss of prey for predators, such as mountain lions, would be minimal. Ultimately, this loss of habitat would cause minimal population fluctuations in the

vicinity of the Greenway Trail. Therefore, there would be local, long-term, negligible adverse impacts to wildlife and wildlife habitat from habitat loss at this project site.

The new Greenway Trail would fragment habitat along its length and create additional edge habitat (approximately 12,500 feet) and edge effects, including invasion by nonnative species (plants and animals), nest parasitism, or greater competition between species in the edge. However, it is expected that wildlife species have adapted to the fragmented conditions created by the road corridor that the trail would generally parallel.

These new edge areas would also be susceptible to the spread of nonnative vegetation. Mitigation described for Canyon View Information Plaza, including monitoring for nonnatives (both plants and animals) and revegetation, would be implemented at this project site to minimize competition between native and nonnative species, as well as the potential for nonnatives to become established. Therefore, construction would have local, long-term, minor, adverse impacts to wildlife from creation of new edge effects along the trail.

*Operations* — Human activity along the new Greenway Trail could lead to increased wildlife/human interactions and wildlife avoidance of adjacent habitat, which could increase competition for food and cover in surrounding areas. This could ultimately lead to some mortality should available resources not be adequate to accommodate the displaced species. Operations could disturb breeding wildlife, potentially affecting breeding success for some species. These activities could also affect foraging wildlife in the vicinity of the South Entrance Station, causing wildlife to delay feedings or forage in other occupied habitat. In addition, increased wildlife/human interactions could increase stress on some individuals. As a result, operations could cause some populations to fluctuate at this project site. Therefore, impacts on wildlife would be local, long-term, negligible to minor, and

adverse once the Greenway Trail was open to use.

**Grand Canyon Village. Construction** — A previously disturbed construction staging area between the South Entrance Road and Center Road, approximately 0.25 mile west of the South Entrance Road near Grand Canyon Village, would be used for a diesel-powered asphalt batch plant. As a result, there would be no loss of wildlife habitat for this temporary facility. Construction and operation of the batch plant is expected to have impacts similar to those described for construction (e.g., noise effects such as displacement and disturbance during breeding/foraging; potential for direct mortality during operation of the plant and hauling of materials).

Impacts to wildlife from converting private vehicle parking spaces to tour bus loading and potentially restoring the railroad tracks beneath lot D, as well as constructing new shuttle bus stops in Grand Canyon Village, would be similar to those described for construction at Canyon View Information Plaza / Mather Point. Potential impacts include direct mortality to wildlife (especially small mammals, reptiles, and amphibians) and avoidance of the surrounding habitat due to the noise and presence of people and equipment. Displaced animals could occupy adjacent areas, increasing competition for resources such as food and cover, however it is assumed that surrounding habitat could accommodate the displaced species with minimal effects on competition for resources.

Construction during the spring and summer could overlap with the sensitive breeding season for many wildlife species potentially causing reduced breeding success for some species. Construction-related activities could also disturb foraging wildlife at Grand Canyon Village, causing wildlife to delay feedings or forage in other occupied habitat. However, given the current levels of activity on the South Rim, and more specifically Grand Canyon Village and lot D, breeding and

foraging wildlife are likely accustomed to some levels of human disturbance.

Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding or important feeding areas), would also be implemented to minimize impacts during construction. Taking into consideration the adaptability of some animals, the limited extent of construction in this developed environment, and the mitigation measures, these construction-related impacts on wildlife in Grand Canyon Village would be local, short-term, negligible to minor, and adverse. There would be no additional impacts on wildlife or their habitat from converting private vehicle parking spaces to tour bus loading and potentially restoring the railroad tracks beneath lot D because all construction would occur within the existing disturbed area.

New shuttle bus stop construction would affect approximately 1 acre of mature wildlife habitat; however, most mature trees could be avoided, and the number of trees to be removed would be minimal. This would result in limited loss of bird territories and habitat for small mammals. Surrounding habitat on the South Rim could absorb these individuals with little increase in competition for food or cover. Any loss of prey for predators, such as mountain lions, would be minimal. Additional mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat and revegetating, would also minimize habitat loss during construction.

Given the limited disturbance, the adaptability of some animals, and these mitigation measures, temporary population fluctuations in the vicinity of the Grand Canyon Village from displacement would be minimal. Therefore, these construction activities would have local, long-term, negligible, adverse impacts on wildlife from the loss of habitat at the new bus stops in Grand Canyon Village.

**Operations** — Providing new tour bus stops, loading and parking on the south side of the

railyard, along with accommodating up to 14 tour buses at lot E and up to 12 buses near the livery stable and the powerhouse, would increase visitor activities and vehicle/bus traffic. This would have minimal effects related to displacement or disturbance to wildlife, including foraging and breeding individuals, given the surrounding development and current visitor activities. There could be a slight increase in wildlife/ human or wildlife/vehicle interactions that could ultimately lead to increased stress on some individuals or cause direct mortality from trampling (primarily from the latter). However, the new facility operations should not greatly increase adverse impacts as a result of direct mortality to wildlife above current levels because of existing development and human activity in Grand Canyon Village.

The effects on night skies would also be minimal given existing developments in the area and the mitigation measures described for Canyon View Information Plaza (e.g., zoning, limiting lighting by using trees and other light-absorbing elements in the landscape, using fully shielded fixtures, and regulating exterior lighting with a timer or motion sensor). These measures would reduce lighting impacts due to wildlife displacement or avoidance of the area. Therefore, operational impacts to wildlife would be local, long-term, negligible, and adverse in the vicinity of Grand Canyon Village.

**Yavapai Observation Station.** There would be no construction-related impacts to wildlife or wildlife habitat at Yavapai Observation Station. However, opening the area to seasonal use (November to February) by no more than three tour buses could cause wildlife to avoid this area if visitation increased. This would have minimal effects related to increased competition in adjacent areas given the current developed nature of the overlook, and limited scope of the activities that would be allowed. There could be a slight increase in wildlife/ human or wildlife/vehicle interactions that could ultimately lead to increased stress on some individuals or cause direct

mortality from trampling (primarily from the latter). However, the new operations should not greatly increase adverse impacts (e.g., population fluctuations) as a result of disturbance or direct mortality to wildlife above current levels because of existing human activity in the immediate area. As a result, there would be long-term, negligible, adverse impacts to wildlife at Yavapai Observation Station.

**Yaki Point.** As with Yavapai Observation Station, impacts to wildlife could result from increased tour bus access and subsequent avoidance by wildlife. This would have minimal impacts related to increased competition in adjacent areas given the current developed nature of the overlook, and limited scope of the activities that would be allowed. There could be a slight increase in wildlife/ human or wildlife/vehicle interactions that could ultimately lead to increased stress on some individuals or cause direct mortality from trampling (primarily from the latter). However, the new operations should not greatly increase adverse impacts (e.g., population fluctuations) as a result of disturbance or direct mortality (e.g., population fluctuations) to wildlife above current levels because of existing human activity in the immediate area. As a result, there would be local, long-term, negligible, adverse impacts to wildlife at this site.

**Tusayan. Construction** —Impacts to wildlife from constructing new parking areas and a shuttle bus transfer station at Tusayan would be similar to those described for Canyon View Information Plaza and Mather Point. These impacts include the potential for direct mortality to wildlife (primarily small mammals, reptiles, and amphibians) and avoidance of the area due to the noise and the presence of people and equipment. Use of nearby habitat by displaced animals could increase competition for resources such as food and cover. This could ultimately lead to some mortality should available resources not be adequate to accommodate the displaced species.

Construction during the spring and summer could overlap with the sensitive breeding season for many wildlife species and could cause breeding success. Construction-related activities could also disturb foraging wildlife at Tusayan, causing wildlife to delay feedings or forage in other occupied habitat. However, given the current levels of activity in Tusayan, breeding and foraging wildlife are likely accustomed to some levels of human disturbance. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding or important feeding areas), would also be implemented to minimize impacts during construction. Despite the adaptability of some animals and these mitigation measures, temporary population fluctuations in the vicinity the Tusayan project area could occur during construction as a result of mortality and displacement. Therefore, these construction-related activities would have local, short-term, negligible to minor, adverse impacts on wildlife.

The loss of approximately 10 acres of Rocky Mountain montane conifer forest habitat (including approximately 297–363 ponderosa pine trees and associated vegetation) would result in the loss of mule deer and elk habitat. This would result in the loss of an unknown number of bird territories (data unavailable), as well as the loss of habitat for 130–150 small mammals. The displacement of animals into surrounding wildlife habitat could increase competition for resources such as food and cover, which could lead to some mortality if available resources are not adequate to accommodate displaced individuals. This could also result in the loss of prey available for predators such as mountain lions. Mitigation measures described in Chapter 2, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding or important feeding areas) and initiating revegetation as soon as possible after construction, would help offset some impacts. Ultimately, this loss of habitat would cause some population fluctuations in the vicinity of the Tusayan project site. Therefore, there would be local, long-term, minor adverse

impacts to wildlife and wildlife habitat from habitat loss.

New parking lots could cause some habitat fragmentation in the Tusayan project area and would create additional edge habitat (approximately 4,476 linear feet) and effects, including invasion by nonnative species (both plant and animals), nest parasitism, or greater competition between species in the edge. However, wildlife species in these project areas have probably adapted to the fragmented conditions. Mitigation described for Canyon View Information Plaza, including monitoring for nonnatives (both plants and animals) and revegetation, would be taken at this project site to minimize competition between native and nonnative species, as well as the potential for nonnatives to become established. Therefore, constructing new parking areas and the bus transfer station would have local, long-term, negligible, adverse impacts to wildlife from the creation of new edge effects at Tusayan.

*Operations* — The increase in visitor activities and vehicle/bus traffic at Tusayan could cause some species to leave the area, which could increase competition for food and cover in surrounding habitat. This could ultimately lead to some mortality should available resources not be adequate to accommodate the displaced species. Operations could disturb breeding and foraging wildlife, potentially affecting breeding success for some species, and causing wildlife to delay feedings or forage in other occupied habitat. In addition, increased wildlife/human wildlife/vehicle interactions could increase stress on some individuals and the potential for direct mortality (primarily from the latter). As a result, operations could result in some population fluctuation at this project site. However, given current levels of noise, human presence, and vehicle traffic in this area, it is assumed that most species currently found at Tusayan are adapted to this type of disturbance, and these fluctuations would be minimal.

Night-sky changes could result from increased parking. The primary effect of such changes would be displacement of nocturnal species that may ordinarily forage in or travel through this area (such as owls and bats). Although some overnight parking would be expected, the majority of use would likely take place in daylight hours, with fewer cars using the lots at night. It could also be decided not to light the entire parking lot if nighttime visitor numbers are low. Artificial lighting from the new bus transfer station is not expected to appreciably alter night skies given current development in the area and the mitigation measures described for Canyon View Information Plaza (e.g., zoning, limiting lighting by using trees and other light-absorbing elements in the landscape, using fully shielded fixtures, and regulating exterior lighting with a timer or motion sensor). These measures would reduce lighting impacts (e.g., displacement or avoidance). As a result, impacts on wildlife related to operations would be local, long-term, negligible to minor, and adverse.

**East Entrance Station.** No construction-related impacts would occur at the East Entrance Station; however, diverting traffic from the South Entrance Station to the East Entrance Station (projected to result in a 10% increase over the life of this plan) could result in more wildlife/vehicle collisions (primarily large and small mammals) that could increase direct mortality. Greater noise levels associated with more traffic could also temporarily displace some wildlife in the vicinity of the East Entrance Station. Because surrounding available wildlife habitat is expected to be occupied, competition for resources such as food and cover could increase in these adjacent areas. However, it is expected that the species temporarily displaced would be accommodated in the surrounding habitat with minimal stress and no mortality. As a result, temporary population fluctuations would be minimal and there would be local, long-term, negligible, adverse impacts to wildlife at the East Entrance Station.

### Cumulative Impacts

Past, present, and reasonably foreseeable actions with the potential to have cumulative impacts to wildlife include those described for alternative A under the analysis of vegetation impacts. Trail and road projects, as well as facility upgrades, maintenance, and demolition, would have local, long-term, negligible to moderate, adverse impacts to wildlife. Plans and projects, including fire management actions, would have local, long-term, minor, beneficial impacts on wildlife.

The impacts of these cumulative actions in combination with the impacts of alternative B would result in local, long-term, minor to moderate, adverse cumulative impacts to wildlife. Incremental contributions from alternative B to overall cumulative impacts would be marginal.

### Conclusion

Alternative B would result in local, long-term, negligible to moderate, adverse impacts to the wildlife depending on the project site. There would also be local, long-term, minor beneficial effects at Canyon View Information Plaza / Mather Point from limiting roadside parking and the associated social trailing, as well as the restoration of natural conditions. Cumulative impacts would be local, long-term, minor to moderate, and adverse. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of wildlife resources.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportu-

ities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would not be unacceptable impacts on wildlife under alternative B.

### **Alternative C: Tusayan Parking Emphasis**

#### ***Direct / Indirect Impacts***

Overall, alternative C would result in the loss of 38 acres of wildlife habitat (including approximately 2,753–3,364 trees). Using the formula for bird and small mammal territories listed in the methodology for the wildlife section, this alternative could affect habitat for an unknown number of bird territories (data unavailable) and 524–645 small mammals. As described for alternative B, impacts would include the potential for direct mortality (primarily small mammals, reptiles, and amphibians) and avoidance of the area by animals due to the noise and presence of people/equipment during construction. Impacts are further described below by area. Table 17 (page 145) provides a more detailed summary of the wildlife/wildlife habitat impacts by project site.

As described for alternative B, material storage and equipment staging would occur in previously disturbed areas near the project sites, or in other disturbed areas that best meet project needs and minimize new ground disturbance. As a result, there would be no impacts on wildlife habitat (e.g., loss, fragmentation, degradation) from staging. Because the staging areas would occur in disturbed locations generally surrounded by other developments (e.g., facilities or roads), it is expected that wildlife are accustomed to some levels of disturbance, and that any potential temporary impacts on breeding or foraging wildlife (e.g., decreased breeding success or delayed feedings, temporary displacement) would be minimal. In addition, all staging areas would be returned to pre-construction conditions or better once construction had been completed.

Construction equipment would access all project sites on existing roads used by visitors under alternative C. As described for alternative B, this could cause some visitors to be displaced into other locations on the South Rim during construction activities, which could increase visitor-related impacts on wildlife in these other areas (e.g., wildlife/vehicle interactions that could result in mortality, displacement due to noise and the presence of people/vehicles, potential disruption of breeding or foraging activities, and impacts to wildlife habitat associated with social trailing such as trampling of vegetation and compaction of soils).

These activities could have temporary effects on population fluctuations within the project areas that would contribute to similar impacts on wildlife as are described in detail for each project site.

**Canyon View Information Plaza / Mather Point. Construction** — Construction-related impacts to wildlife at Canyon View Information Plaza and Mather Point under alternative C would be similar to those described for alternative B, such as displacement or direct mortality from trampling. Should available resources not be adequate to accommodate the displaced species, it could ultimately lead to some mortality as well.

The presence of people, equipment, and the associated construction noise could disturb breeding wildlife if construction occurs during spring or summer. This would potentially cause reduced breeding success for some species. Construction-related activities could also disturb foraging wildlife at Canyon View Information Plaza and Mather Point, causing wildlife to delay feedings or forage in other occupied habitat. However, given the current levels of activity on the South Rim, breeding and foraging wildlife are likely accustomed to some levels of human disturbance. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding or important feeding areas), would also be implemented to mini-

mize impacts during construction. Despite the adaptability of some animals and these mitigation measures, temporary population fluctuations in the vicinity of Canyon View Information Plaza and Mather Point could occur during construction as a result of mortality and displacement. Therefore, these construction-related activities would have local, short-term, negligible to minor, adverse impacts on wildlife at this project site.

The loss of approximately 15 acres of Great Basin conifer woodland (including approximately 1,521–1,860 piñon pine and juniper trees and associated vegetation) would result in the loss of some mule deer and elk summer and winter habitat, and would cause wildlife species to be displaced into surrounding habitat. Although this community is relatively common on the South Rim, these are mature stands that provide important wildlife habitat. Based on the information in the methodology section, the net disturbance footprint of 15 acres would equal a loss of 23–30 bird territories and the habitat for approximately 225–300 small mammals. The displacement of wildlife could increase the competition for resources such as food and cover in adjacent areas. The loss of bird and small mammal habitat would decrease the number of individuals in the project area that serve as prey available for predators, such as mountain lions and raptors, forcing these species to forage in adjacent areas. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding and important foraging areas) and initiating revegetation as soon as possible after construction, would help offset some impacts by limiting habitat loss and the number of animals displaced.

However, this loss of habitat would ultimately cause population fluctuations in the vicinity of Canyon View Information Plaza and Mather Point, and could increase the stress on displaced wildlife and the species that occur in adjacent areas. This could ultimately lead to some mortality should available resources not be adequate to accommodate the displaced

species. As a result, there would be local, long-term, minor to moderate, adverse impacts on wildlife and wildlife habitat from habitat loss at Canyon View Information Plaza / Mather Point.

New roads and parking lots could cause some habitat fragmentation in the Canyon View Information Plaza / Mather Point project area. This would result in the creation of approximately 9,722 linear feet of additional edge habitat, with the resulting edge effects described under alternative B (e.g., invasion by nonnative species, nest parasitism, and greater competition). These new edge areas, as well as the restoration of approximately 1 acre of previously disturbed areas, would also be susceptible to the introduction and spread of nonnative vegetation, which could degrade wildlife habitat by replacing native plant species with nonnatives and decreasing plant species diversity. However, mitigation measures would be taken to monitor nonnative species, both plants and animals, and revegetation would be initiated as soon as possible. This would minimize competition between native and nonnative species, and minimize the potential for nonnatives to become established. Given the already fragmented habitat conditions, the new parking areas and roadway realignment would cause local, long-term, negligible to minor, adverse impacts to wildlife and wildlife habitat from the potential for nonnative species invasion at Canyon View Information Plaza / Mather Point.

There would be local, long-term, minor, beneficial effects from the gradual restoration of 1 acre of wildlife habitat. However, revegetation of restored areas to standards of natural conditions would not be completed until after the life of the plan because of the arid climate and the soil conditions on the South Rim.

*Operations* — Increased visitor activities and vehicle/bus traffic in new parking areas and along roadways under alternative C would have the same impacts as those described for alternative B (displacement, disturbances to foraging/breeding individuals, increased wild-

life/human and wildlife/vehicle interactions, and changes to the night sky). Displacement could ultimately lead to some mortality should available resources not be adequate to accommodate the displaced species. Disturbances during breeding and foraging could affect breeding success for some species, and could cause wildlife to delay feedings or forage in other occupied habitat. In addition, increased wildlife/human and wildlife/vehicle interactions could increase stress on some individuals or cause direct mortality from trampling (primarily from the latter). As a result, operations could result in some population fluctuation at this project site. However, given current levels of noise, human presence, and vehicle traffic in this area, it is assumed that wildlife species in this area, including those that breed or forage, have already adapted to these types of disturbance and that fluctuations would be limited.

Night-sky changes could cause nocturnal species, such as common nighthawks, great horned owls, ringtails, or bats, to be displaced from or to avoid this habitat in the project area. However, impacts from vehicles would be limited as most use would occur during the day; park managers might also choose not to light the entire parking lot beyond that required for mobility or safety.

Artificial lighting from the new facilities is not expected to appreciably alter night skies given current development in the area. The mitigation measures described for Canyon View Information Plaza (e.g., zoning, limiting lighting by using trees and other light-absorbing elements in the landscape, using fully shielded fixtures, and regulating exterior lighting with a timer or motion sensor) would reduce lighting impacts such as displacement or avoidance. As a result, impacts of operations on wildlife in the vicinity of Canyon View Information Plaza / Mather Point under alternative C would be local, long-term, negligible to minor, and adverse.

This alternative would also reduce impacts to wildlife habitat caused by vehicle parking

along roadsides near Mather Point and the associated impacts of social trailing (soil compaction, vegetation trampling, and introduction of nonnative species). This would have local, long-term, negligible, beneficial effects to wildlife.

**South Entrance Station. Construction** — Construction-related impacts to wildlife from a new fee administration building and the associated access drive and parking lot would be similar to those described for alternative B. Impacts could include the potential for direct mortality to wildlife (primarily small mammals, reptiles, and amphibians) and avoidance of the area due to the noise and presence of people and equipment. Animals displaced during construction could occupy similar nearby habitat, resulting in increased competition for resources such as food and cover. Due to the limited extent of construction, surrounding areas are assumed to support adequate resources to accommodate displaced species with little effect on competition for resources.

The presence of people, equipment, and the associated noise could disturb breeding wildlife if construction occurs during spring and summer. This could cause reduced breeding success for some species. Construction-related activities could also disturb foraging wildlife at the South Entrance Station causing wildlife to delay feedings or forage in other occupied habitat. However, given the current levels of activity at the existing entrance station, breeding and foraging wildlife are likely accustomed to some levels of human disturbance. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding or important feeding areas), would also be implemented to minimize impacts during construction. Given the limited disturbance, the adaptability of some animals, and these mitigation measures, temporary population fluctuations in the vicinity of the South Entrance Station from mortality and displacement would be minimal. Therefore, these construction-related activities would have

local, short-term, negligible, adverse impacts at this project site.

The loss of approximately 2 acres of habitat (including approximately 390–476 piñon pine, Utah juniper, and ponderosa pine trees and associated vegetation) would result in the loss of minimal mule deer and elk habitat, and would cause wildlife species to be displaced into surrounding habitat. This would result in the loss of an unknown number of bird territories, and based on information in the methodology section, the net disturbance of 2 acres would equal a loss of habitat for an estimated 26–30 small mammals. It is expected that surrounding wildlife habitat could support these displaced individuals, given the limited loss of habitat. Any loss of prey available for predators such as mountain lions would be minimal. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding or important feeding areas) and revegetation, would be implemented to minimize habitat loss. As a result, impacts on wildlife and wildlife habitat due to habitat loss in the vicinity of the South Entrance Station would be local, long-term, negligible, and adverse.

As with alternative B, a new road and parking lot would cause minimal habitat fragmentation at the South Entrance Station given the limited disturbance footprint (2 acres). This alternative would create edge habitat (approximately 2,349 linear feet), and resulting edge effects (e.g., invasion by nonnative species, nest parasitism, and greater competition) are expected to be limited, especially given current fragmented conditions and proposed mitigation measures (e.g., monitoring for nonnative plants and animals and revegetation to minimize competition between nonnatives and natives, and to minimize the potential for nonnatives to become established). Therefore, impacts to wildlife from construction of the new access road and parking lot in the vicinity of the South Entrance Station would be local, long-term, negligible, and adverse.

*Operations* — A new 1,000-square-foot fee administration facility, access drive, and parking lot at the South Entrance Station would increase visitor activities and vehicle/bus traffic. This could cause wildlife displacement from the South Entrance Station area and create additional wildlife/human or wildlife/vehicle interactions. It is expected that displaced animals would be supported by available resources in the surrounding area, and that competition for resources (e.g., food and cover) would be minimal. Disturbances during breeding and foraging could affect breeding success for some species, and could cause wildlife to delay feedings or forage in other occupied habitat. In addition, increased wildlife/human and wildlife/vehicle interactions could increase stress on some individuals or cause direct mortality from trampling (primarily from the latter). As a result, operations could result in some population fluctuation at this project site. However, the new facility operations should not greatly increase adverse impacts as a result of disturbances or direct mortality to wildlife above current levels because of existing development and human activity in the immediate area.

The effects on night skies would also be minimal given existing developments in the area. Mitigation measures described for Canyon View Information Plaza (e.g., zoning, limiting lighting by using trees and other light-absorbing elements in the landscape, using fully shielded fixtures, and regulating exterior lighting with a timer or motion sensor) would reduce lighting effects due to wildlife displacement or avoidance of the area.

Operational impacts to wildlife would be local, long-term, negligible, and adverse in the vicinity of the South Entrance Station.

**Greenway Trail. Construction** — Impacts to wildlife from the construction of the new Greenway Trail between Tusayan and the park boundary would be the same as those described for alternative B. Impacts could include direct mortality to wildlife (primarily small mammals, reptiles, and amphibians) and

avoidance of the area due to the noise and presence of people and equipment. As previously described, displaced animals could occupy nearby habitat, resulting in increased competition for resources such as food and cover. Due to the limited extent of construction, surrounding areas are assumed to support adequate resources to accommodate displaced species.

Currently, this undeveloped area does not see much human activity, except for traffic-related noise, and breeding and foraging individuals may not be accustomed to much disturbance. The presence of people, equipment, and the associated construction noise could disturb breeding wildlife if it occurs during spring or summer. This could result in reduced breeding success for some species. Construction-related activities could also cause wildlife to delay feedings or forage in other occupied habitat. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding or important feeding areas), would also be implemented to minimize impacts during construction. Given the limited disturbance from construction, the adaptability of some animals, and these mitigation measures, temporary population fluctuations in the vicinity of the Greenway Trail from mortality and displacement would be minimal. Therefore, these construction-related activities would have local, short-term, negligible, adverse impacts on wildlife in the vicinity of the Greenway Trail.

As described for alternative B, alternative C would result in the loss of approximately 3 acres of Rocky Mountain montane conifer forest habitat along the Greenway Trail. Many of the approximately 337–412 ponderosa pine trees could be avoided; however, an unknown number of bird territories (data unavailable), and habitat for approximately 39–45 small mammals, would be lost. There could be some wildlife displacement and loss of prey for predators such as mountain lions; however, the impacts would be minimal given the limited habitat loss. Mitigation measures, such as

avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding or important feeding areas) and revegetation, would be implemented to minimize habitat loss. As a result, impacts on wildlife due to habitat loss in the vicinity of the Greenway Trail would be local, long-term, negligible, and adverse.

The new Greenway Trail would fragment habitat along its length and would create additional edge habitat (approximately 12,500 linear feet) and edge effects, including invasion by nonnative species (plants and animals), nest parasitism, or greater competition between species in the edge. However, wildlife species in this project area may already be adapted to fragmented conditions created by the road corridor, which the Greenway Trail would generally parallel. In addition, mitigation measures (e.g., monitoring for nonnative plants and animals and revegetation to minimize competition between nonnatives and natives, as well as the potential for nonnatives to become established) would be taken. Therefore, impacts would be local, long-term, minor, and adverse from the creation of new edge areas in the vicinity of the trail.

*Operations* — Human activity along the new Greenway Trail could lead to increased wildlife/human interactions, as well as wildlife avoidance of surrounding habitat, potentially increasing competition for food and cover. Use of the trail could ultimately lead to some mortality should available resources not be adequate to accommodate the displaced species. Operations could disturb breeding and foraging wildlife, potentially affecting breeding success for some species and potentially causing wildlife to delay feedings or forage in other occupied habitat. In addition, increased wildlife/human interactions could increase stress on some individuals. As a result, operations could cause some populations to fluctuate at this project site. In addition, the new trail could lead to social trailing in this undeveloped area, which could result in the degradation of wildlife habitat through soil compaction, trampling of vegetation, and

the spread of nonnative species. Therefore, impacts on wildlife would be local, long-term, negligible to minor, and adverse once the Greenway Trail was open to use.

**Grand Canyon Village. Construction** — As described for alternative B, establishing a batch plant in previously disturbed areas would not result in any loss of wildlife habitat for this temporary facility. The construction and operation of the batch plant is expected to have impacts similar to those described for construction (e.g., noise effects such as displacement and disturbance to breeding/foraging wildlife; potential for direct mortality during operation of the plant and hauling of materials).

Impacts to wildlife would be the same as those described for alternative B, including the potential for direct mortality and avoidance of surrounding habitat due to the noise and presence of people and equipment. Displaced animals could occupy adjacent areas, increasing competition for resources such as food and cover; however it is assumed that surrounding habitat could accommodate the displaced species given the limited extent of the construction activities in this project area.

The presence of people, equipment, and associated construction noise could disturb breeding wildlife in the vicinity of Grand Canyon Village and lot D if construction occurred during spring or summer. This could result in reduced breeding success for some species. Construction-related activities could also cause wildlife to delay feedings or forage in other occupied habitat. However, given the current levels of activity on the South Rim, and more specifically in the project area, breeding and foraging wildlife are likely accustomed to some levels of human disturbance. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding or important feeding areas), would also be taken to minimize impacts during construction.

Taking into consideration the adaptability of some animals, the limited extent of construc-

tion, and the mitigation measures, these construction-related impacts on wildlife in Grand Canyon Village would be local, short-term, negligible to minor, and adverse. There would be no additional impacts on wildlife or their habitat from converting private vehicle parking spaces to tour bus loading and potentially restoring the railroad tracks beneath lot D because all construction would occur within the existing disturbed area.

New shuttle bus stop construction would affect approximately 1 acre of mature wildlife habitat; however, most mature trees could be avoided, and the number of trees to be removed would be minimal. This would result in the minimal loss of bird territories and habitat for small mammals. Surrounding habitat on the South Rim could absorb these individuals with little increase in competition for food or cover. Any loss of prey for predators, such as mountain lions, would be minimal. Additional mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat and revegetating, would also be implemented to minimize impacts during construction.

Given the limited disturbance, the adaptability of some animals, and these mitigation measures, temporary population fluctuations in the vicinity of the Grand Canyon Village from displacement would be minimal. Therefore, these construction activities would have local, long-term, negligible, adverse impacts on wildlife from the loss of habitat at the new bus stops.

**Operations** — As described for alternative B, providing new tour bus stops, loading and parking on the south side of the railyard, along with accommodating up to 14 tour buses at lot E and up to 12 buses near the livery stable and the powerhouse, would increase visitor activities and vehicle/bus traffic. This would have minimal effects related to displacement or disturbance to wildlife, including foraging and breeding individuals, given the surrounding development and current visitor activities in these areas. There could be a slight increase in

wildlife/ human or wildlife/vehicle interactions that could ultimately lead to increased stress on some individuals or cause direct mortality from trampling (primarily from the latter). However, the new facility operations should not greatly increase adverse impacts as a result of direct mortality to wildlife above current levels because of existing development and human activity in Grand Canyon Village.

The effects on night skies would also be minimal given existing developments in the area. Mitigation measures described for Canyon View Information Plaza (e.g., zoning, limiting lighting by using trees and other light-absorbing elements in the landscape, using fully shielded fixtures, and regulating exterior lighting with a timer or motion sensor) would reduce lighting effects due to wildlife displacement or avoidance of the area.

Operational impacts to wildlife would be local, long-term, negligible, and adverse in the vicinity of the Grand Canyon Village.

**Yavapai Observation Station.** As described for alternative B, there would be no construction-related impacts to wildlife or wildlife habitat at Yavapai Observation Station. Opening the area to seasonal use (November to February) by no more than three tour buses would have minimal effects related to increased competition between wildlife in adjacent areas given the current developed nature of the overlook, and limited scope of the activities that would be allowed. There could be a slight increase in wildlife/ human or wildlife/vehicle interactions that could ultimately lead to increased stress on some individuals or cause direct mortality from trampling (primarily from the latter). However, the new operations should not greatly increase adverse impacts (e.g., population fluctuations) as a result of disturbance or direct mortality to wildlife above current levels because of existing human activity in the immediate area. As a result, there would be 1 local, long-term, negligible, adverse impacts to wildlife at Yavapai Observation Station.

**Yaki Point.** As with Yavapai Observation Station, impacts to wildlife from increased tour bus access and subsequent avoidance by wildlife would have minimal effects related to increased competition in adjacent areas given the current developed nature of the overlook, and limited scope of the activities that would be allowed. There could be a slight increase in wildlife/human or wildlife/vehicle interactions that could ultimately lead to increased stress on some individuals or cause direct mortality from trampling (primarily from the latter). However, the new operations should not greatly increase adverse impacts (e.g., population fluctuations) as a result of disturbance or direct mortality to wildlife above current levels because of existing human activity in the immediate area. As a result, there would be local, long-term, negligible, adverse impacts to wildlife at this site.

**Tusayan. Construction** — Impacts to wildlife from constructing new parking areas and a shuttle bus transfer station at Tusayan would be similar to those described for Canyon View Information Plaza / Mather Point. These impacts could include the potential for direct mortality to wildlife (primarily small mammals, reptiles, and amphibians) and avoidance of the area due to the noise and presence of people and equipment. Animals displaced during construction could occupy adjacent habitat, resulting in increased competition for resources such as food and cover. This could ultimately lead to some mortality should available resources not be adequate to accommodate the displaced species.

Construction-related disturbances could affect breeding success for some species if construction occurred during spring or summer, and it could cause wildlife to delay feedings or forage in other occupied habitat. However, given the current levels of activity near Tusayan, breeding and foraging wildlife are likely accustomed to some levels of human disturbance. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding or important feeding areas), would also be

taken to minimize impacts during construction. Despite the adaptability of some animals and these mitigation measures, temporary population fluctuations in the vicinity the Tusayan project area could occur during construction as a result of mortality and displacement. Therefore, these construction-related activities would have local, short-term, negligible to minor, adverse impacts on wildlife.

The loss of approximately 17 acres of Rocky Mountain montane conifer forest habitat (including approximately 505–617 ponderosa pine trees and associated vegetation) would result in the loss of mule deer and elk habitat and possible displacement of animals into surrounding habitat. Based on information in the methodology section, this would cause an unknown loss of bird territories and a habitat loss for approximately 221–255 small mammals. If displaced animals moved into surrounding wildlife habitat, competition for resources such as food and cover could increase in these areas. This could ultimately lead to some mortality should available resources not be adequate to accommodate the displaced species. There could also be decreases in the amount of prey available for predators such as mountain lions. Mitigation measures described in Chapter 2, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding or important feeding areas) and initiating revegetation as soon as possible after construction, would help offset some impacts of habitat lost and minimize displaced species. Ultimately, this loss of habitat would cause some population fluctuations in the vicinity of Tusayan. Therefore, there would be local, long-term, minor to moderate adverse impacts to wildlife and wildlife habitat from habitat loss.

New parking lots could cause some habitat fragmentation in the Tusayan area. This would result in the creation of additional edge habitat (approximately 7,072 linear feet) and edge effects, including invasion by nonnative species (plants and animals), nest parasitism,

or greater competition between species in the edge. However, wildlife species in this project area may have adapted to fragmented conditions in the Tusayan project site. In addition, mitigation measures (e.g., monitoring for non-native plants and animals and revegetation to minimize competition between nonnatives and natives, and to minimize the potential for nonnatives to become established) would be implemented. Therefore, impacts would be local, long-term, minor, and adverse from the creation of new edge areas in the Tusayan project sites.

*Operations* — As described for alternative B, the increase in visitor activities and vehicle/bus traffic at Tusayan could cause some species to leave the area, which could ultimately lead to some mortality should available resources not be adequate to accommodate the displaced species in surrounding habitat. Operations could disturb breeding and foraging wildlife, potentially affecting breeding success for some species and causing wildlife to delay feedings or forage in other occupied habitat. In addition, increased wildlife/human wildlife/vehicle interactions could increase stress on some individuals and the potential for direct mortality (primarily from the latter). As a result, operations could result in some population fluctuation at this project site. However, given current levels of noise, human presence, and vehicle traffic in this area, it is assumed that most species currently found at Tusayan are adapted to this type of disturbance.

Night-sky changes could result from potentially more nighttime lighting, thus displacing nocturnal species (such as owls and bats) or causing them to avoid the area. Although some overnight parking would be expected, the majority of use would be during the day. Park managers might also choose not to light the entire parking lot if nighttime use was low. Artificial lighting from the new bus transfer station is not expected to appreciably alter night skies given current development in the area and the mitigation measures described for alternative B (e.g., zoning, limiting lighting

by using trees and other light-absorbing elements in the landscape, using fully shielded fixtures, and regulating exterior lighting with a timer or motion sensor), which would reduce lighting impacts due to wildlife displacement or avoidance. As a result, operations at Tusayan would have long-term, minor, adverse impacts on wildlife.

**East Entrance Station.** As described for alternative B, no construction-related impacts would occur at the East Entrance Station; however, diverting traffic from the South Entrance Station to the East Entrance Station (projected to result in a 10% increase over the life of this plan) could result in more wildlife/vehicle collisions (primarily large and small mammals) that could increase direct mortality. Greater noise levels associated with more traffic could also temporarily displace some wildlife in the vicinity of the East Entrance Station. Because surrounding available wildlife habitat is expected to be occupied, competition for resources such as food and cover could increase in these adjacent areas. However, it is expected that the species displaced would be accommodated in the surrounding habitat with minimal competition for resources (e.g., food and cover). As a result, temporary population fluctuations would be minimal and there would be local, long-term, negligible, adverse impacts to wildlife at the East Entrance Station.

### Cumulative Impacts

Past, present, and reasonably foreseeable actions with the potential to have cumulative impacts to wildlife include those described for alternative A under the analysis of vegetation impacts. Trails and road projects, as well as facility upgrades, maintenance, and demolition, would have local, long-term, negligible to moderate, adverse impacts to wildlife. Plans and projects, including fire management actions, would have local, long-term, minor, beneficial effects on wildlife.

The impacts of the cumulative actions in combination with the local, short- and long-term, negligible to moderate, adverse impacts

of alternative C, as well as the local, long-term, negligible, beneficial impacts from restoration at Canyon View Information Plaza / Mather Point, would result in local, long-term, minor to moderate, adverse cumulative impacts to wildlife. Incremental contributions from alternative C to overall cumulative impacts would be marginal.

### Conclusion

Alternative C would result in local, long-term, negligible to moderate, adverse impacts to the wildlife. There would also be local, long-term, negligible, beneficial effects at Canyon View Information Plaza / Mather Point from limiting roadside parking and the associated social trailing, as well as restoration of natural conditions. Cumulative impacts would be local, long-term, minor to moderate, and adverse. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of wildlife resources.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would not be unacceptable impacts on wildlife under alternative C.

### **Alternative D: Canyon View Information Plaza Parking Emphasis**

#### Direct / Indirect Impacts

Overall, this alternative would result in the loss of 33 acres of wildlife habitat (including approximately 3,558–4,349 trees). Using the

formula for bird and small mammal inventories listed in the methodology for the wildlife section, this alternative could affect habitat for an unknown number of bird territories (data unavailable) and approximately 481–625 small mammals. As described for alternatives B and C, impacts would include the potential for direct mortality (primarily small mammals, reptiles, and amphibians) and avoidance of the area by animals due to the noise and presence of people/equipment. Impacts are further described below by area. Table 17 (page 145) provides a more detailed summary of the wildlife/wildlife habitat impacts by project site.

As described for alternative B, material storage and equipment staging would occur in previously disturbed areas near the project sites, or in other disturbed areas that best meet project needs and minimize new ground disturbance. As a result, there would be no impacts on wildlife habitat (e.g., loss, fragmentation, degradation) from staging. Because the staging areas would occur in disturbed locations generally surrounded by other developments (e.g., facilities or roads), it is expected that wildlife are accustomed to some levels of disturbance, and that any potential temporary impacts on breeding or foraging wildlife (e.g., decreased breeding success or delayed feedings, temporary displacement) would be minimal. In addition, all staging areas would be returned to pre-construction conditions or better once construction had been completed.

Construction equipment would access all project sites on existing roads used by visitors under alternative D. As described for alternative B, this could cause some visitors to be displaced into other locations on the South Rim during construction activities, which could increase visitor-related impacts on wildlife in these other areas (e.g., wildlife/vehicle interactions that could result in mortality, displacement due to noise and the presence of people/vehicles, potential disruption of breeding or foraging activities, and impacts to wildlife habitat associated with

social trailing such as trampling of vegetation and compaction of soils).

These activities could have temporary effects on population fluctuations within the project areas that would contribute to similar impacts on wildlife as are described in detail for each project site.

**Canyon View Information Plaza / Mather Point. Construction** — Construction-related impacts to wildlife at Canyon View Information Plaza and Mather Point under alternative D would be similar to those described for alternative B, such as displacement or direct mortality from trampling. Should available resources not be adequate to accommodate the displaced species, it could ultimately lead to some mortality as well.

The presence of people, equipment, and associated construction noise could disturb breeding wildlife if it occurs in spring and summer, potentially causing reduced breeding success for some species. Construction-related activities could also disturb foraging wildlife at Canyon View Information Plaza / Mather Point, causing wildlife to delay feedings or forage in other occupied habitat. However, given the current levels of activity on the South Rim, breeding and foraging wildlife are likely accustomed to some levels of human disturbance. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding or important feeding areas), would also be implemented to minimize impacts to breeding and foraging wildlife during construction. Despite the adaptability of some animals and these mitigation measures, temporary population fluctuations in the vicinity of Canyon View Information Plaza / Mather Point could occur during construction as a result of mortality and displacement. Therefore, these construction-related activities would have local, short-term, negligible to minor, adverse impacts on wildlife at this project site.

The loss of approximately 26 acres of Great Basin conifer woodland (including 2,637–3,223 piñon pine and juniper trees and asso-

ciated vegetation) would result in the loss of some mule deer and elk summer and winter habitat, and would cause wildlife species to be displaced into surrounding habitat. Although this community is relatively common on the South Rim, these are relatively mature stands that provide important wildlife habitat. Based on information in the methodology section, the net disturbance footprint of 26 acres would equal a loss of 39–52 bird territories and habitat loss for approximately 390–520 small mammals. As previously described, the displacement of wildlife into adjacent habitat could increase competition for resources such as food and cover. There could also be decreases in the amount of prey available for predators such as mountain lions. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding and important foraging areas) and initiating revegetation as soon as possible after construction, would help offset some impacts by limiting habitat loss and the number of animals displaced.

However, this loss of habitat would ultimately cause population fluctuations in the vicinity of Canyon View Information Plaza and Mather Point, and could increase the stress on displaced wildlife and the species that occur in adjacent areas. This could ultimately lead to some mortality should available resources not be adequate to accommodate the displaced species. As a result, there would be local, long-term, moderate, adverse impacts on wildlife and wildlife habitat from habitat loss at Canyon View Information Plaza / Mather Point.

New roads and parking lots could cause some habitat fragmentation in the Canyon View Information Plaza / Mather Point project area and would create 15,367 linear feet of additional edge habitat, with the resulting edge effects described under alternative B (e.g., invasion by nonnative species, nest parasitism, and greater competition). These new edge areas, as well as the restoration of approximately 5 acres of previously disturbed areas, would also be susceptible to spread of nonnative vegetation, which could degrade wild-

life habitat by replacing native plant species with nonnatives and decreasing species diversity. However, mitigation measures would be taken to monitor nonnative species, both plants and animals, and revegetation would be initiated as soon as possible. This would minimize competition between native and nonnative species, as well as the potential for nonnatives to become established. Given the already fragmented habitat conditions, the new parking areas and roadway realignment would cause local, long-term, negligible to minor adverse impacts to wildlife and wildlife habitat from the potential for nonnative species invasion at Canyon View Information Plaza / Mather Point.

There would be local, long-term, minor, beneficial effects from the gradual restoration of 6 acres of wildlife habitat; however, revegetating restored areas to natural conditions would not be completed until after the life of this plan due to the arid climate and soil conditions on the South Rim.

*Operations* — Increased visitor activities and vehicle/bus traffic in new parking areas and along roadways under alternative D would have the same impacts as those described for alternative B (displacement, disturbances to foraging/breeding individuals, increased wildlife/human and wildlife/vehicle interactions, and changes to the night sky). Displacement could ultimately lead to some mortality should available resources not be adequate to accommodate the displaced species. Disturbances during breeding and foraging could affect breeding success for some species, and could cause wildlife to delay feedings or forage in other occupied habitat. In addition, increased wildlife/human and wildlife/vehicle interactions could increase stress on some individuals or cause direct mortality from trampling (primarily from the latter). As a result, operations could result in some population fluctuation at this project site. However, given current levels of noise, human presence, and vehicle traffic in this area, it is assumed that wildlife species in this area, including those that breed or forage,

have already adapted to these types of disturbance and that fluctuations would be limited.

Night-sky changes could cause nocturnal species, such as common nighthawks, great horned owls, ringtails, or bats, to be displaced from or to avoid this habitat in the project area. However, impacts from vehicles would be limited as most use would occur during the day; park managers might also choose not to light the entire parking lot beyond that required for mobility or safety. Artificial lighting from the new facilities is not expected to appreciably alter night skies given current development in the area. Proposed mitigation measures (e.g., zoning, limiting lighting by using trees and other light-absorbing elements in the landscape, using fully shielded fixtures, and regulating exterior lighting with a timer or motion sensor) would reduce lighting impacts due to wildlife displacement or avoidance.

As a result, impacts of operations on wildlife in the vicinity of Canyon View Information Plaza / Mather Point under alternative D would be local, long-term, negligible to minor, and adverse.

This alternative would also reduce impacts to wildlife habitat caused by vehicle parking along roadsides near Mather Point and the associated impacts of social trailing (soil compaction, vegetation trampling, and introduction of nonnative species). This would have local, long-term, negligible, beneficial effects to wildlife.

**South Entrance Station. Construction** — Construction-related impacts to wildlife from a new fee administration building and the associated access drive and parking lot would be the same as those described for alternative B. Impacts could include the potential for direct mortality to wildlife (primarily small mammals, reptiles, and amphibians) and avoidance of the area due to the noise and presence of people and equipment. Animals displaced during construction could occupy similar nearby habitat, resulting in increased competition for resources such as food and cover. Due to the limited extent of construc-

tion, it is assumed that surrounding areas support adequate resources to accommodate displaced species.

The presence of people, equipment, and the associated construction noise could disturb breeding wildlife if construction occurs during spring or summer. This could cause reduced breeding success for some species. Construction-related activities could also disturb foraging wildlife at the South Entrance Station causing wildlife to delay feedings or forage in other occupied habitat. However, given the current levels of activity at the existing entrance station, breeding and foraging wildlife are likely accustomed to some levels of human disturbance. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding or important feeding areas), would also be implemented to minimize impacts during construction. Given the limited disturbance, the adaptability of some animals, and these mitigation measures, temporary population fluctuations in the vicinity of the South Entrance Station from mortality and displacement would be minimal. Therefore, these construction-related activities would have local, short-term, negligible, adverse impacts on wildlife.

The loss of approximately 3 acres of habitat would result in the same impacts described for alternative B (including approximately 585–714 piñon pine, Utah juniper, and ponderosa pine trees and associated understory), resulting in the loss of mule deer and elk habitat, displacement of wildlife, loss of an unknown number of bird territories, and loss of habitat for approximately 39–45 small mammals. It is expected that adjacent available wildlife habitat could support displaced species, given the limited loss of habitat. Any loss of prey for predators, such as mountain lions, would be minimal. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding or important feeding areas) and revegetation, would be implemented to minimize habitat loss. As a result, impacts on

wildlife and wildlife habitat due to habitat loss would be local, long-term, negligible, and adverse at the South Entrance Station.

As with alternative B, a new fee administration building and the associated road and parking lot would cause minimal habitat fragmentation in the South Entrance Station project area given the limited disturbance footprint. This alternative would create some edge habitat (4,076 linear feet), and resulting edge effects (e.g., invasion by nonnative species, nest parasitism, and greater competition) are expected to be limited, especially given current fragmented conditions and proposed mitigation measures (e.g., monitoring for nonnative plants and animals and revegetation to minimize competition between nonnatives and natives, and to minimize the potential for nonnatives to become established). Therefore, new edge effects associated with the new access road and parking lot would have local, long-term, negligible, adverse impacts in the vicinity of the South Entrance Station.

*Operations* — A new 1,000-square-foot fee administration facility, access drive, and parking lot at the South Entrance Station would increase visitor activities and vehicle/bus traffic. This could cause wildlife displacement from the South Entrance Station area and create additional wildlife/human or wildlife/vehicle interactions. It is expected that displaced animals would be supported by available resources in the surrounding area, and competition for resources (e.g., food and cover) would be minimal. Disturbances during breeding and foraging could affect breeding success for some species, and could cause wildlife to delay feedings or forage in other occupied habitat. In addition, increased wildlife/human and wildlife/vehicle interactions could increase stress on some individuals or cause direct mortality from trampling (primarily from the latter).

As a result, operations could result in some population fluctuation at this project site. However, the new facility operations should not greatly increase adverse impacts as a result

of disturbances or direct mortality to wildlife above current levels because of existing development and human activity in the immediate area. The effects on night skies would also be minimal given existing developments in the area. Mitigation measures described for Canyon View Information Plaza (e.g., zoning, limiting lighting by using trees and other light-absorbing elements in the landscape, using fully shielded fixtures, and regulating exterior lighting with a timer or motion sensor) would reduce lighting effects due to wildlife displacement or avoidance of the area.

Operational impacts to wildlife would be local, long-term, negligible, and adverse in the vicinity of the South Entrance Station.

**Greenway Trail. Construction** — Impacts to wildlife from constructing the new Greenway Trail between Tusayan and the park boundary would be the same as those described for alternative B. These impacts could include the potential for direct mortality to wildlife (primarily small mammals, reptiles, and amphibians) and avoidance of the area due to the noise and presence of people and equipment. Animals displaced into similar nearby habitat could increase competition for resources such as food and cover. Due to the limited extent of construction, this temporary displacement is not expected to result in mortality, as adjacent areas are assumed to support adequate resources to accommodate displaced species.

Currently, this area does not see much human activity, with the exception of traffic-related noise, and breeding and foraging individuals may not be accustomed to much disturbance. The presence of people, equipment, and the associated construction noise could disturb breeding wildlife if construction occurred during spring or summer. This could cause reduced breeding success for some species. Construction-related activities could also cause wildlife to delay feedings or forage in other occupied habitat. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding or important feeding areas),

would also minimize impacts during construction. Given the limited disturbance footprint, the adaptability of some animals, and these mitigation measures, temporary population fluctuations in the vicinity of the greenway trail from mortality and displacement would be minimal. Therefore, these construction-related activities would have local, short-term, negligible, adverse impacts on wildlife.

As with alternative B, alternative D would result in the loss of approximately 3 acres of Rocky Mountain montane conifer forest habitat along the greenway trail. Many of the approximately 337–412 ponderosa pine trees could be avoided; however, an unknown number of bird territories, and habitat for approximately 39–45 small mammals would be lost. There could be some loss of prey for predators such as mountain lions, but impacts are expected to be minimal given the limited habitat loss. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding or important feeding areas) and revegetation, would be implemented to minimize habitat loss. As a result, impacts on wildlife due to habitat loss would be local, long-term, negligible and adverse along the trail.

The new Greenway Trail would fragment habitat along its length and create approximately 12,500 linear feet of additional edge habitat. Resulting impacts could include invasion by exotic species (plants and animals), nest parasitism, or greater competition between species in the edge. However, wildlife species in the area have adapted to the fragmented conditions created by the road corridor that the trail would generally parallel. In addition, mitigation measures (e.g., monitoring for nonnative plants and animals and revegetation to minimize competition between nonnatives and natives, and to minimize the potential for nonnatives to become established) would be implemented. Therefore, impacts would be local, long-term, minor, and adverse from the creation of new

edge areas in the vicinity of the Greenway Trail.

*Operations* — Human activity along the new Greenway Trail could lead to increased wildlife/human interactions, as well as wildlife avoidance of surrounding habitat, potentially increasing competition for food and cover in adjacent areas. This could ultimately lead to some mortality should available resources not be adequate to accommodate the displaced species. Operations could disturb breeding and foraging wildlife, potentially affecting breeding success for some species and potentially causing wildlife to delay feedings or forage in other occupied habitat. In addition, increased wildlife/human interactions could increase stress on some individuals. As a result, operations could result in some population fluctuation at this project site. In addition, the new trail could lead to social trailing in this undeveloped area, which could result in the degradation of wildlife habitat through soil compaction, trampling of vegetation, and the spread of nonnative species. Therefore, impacts on wildlife would be local, long-term, negligible to minor, and adverse once the Greenway Trail was operational.

**Grand Canyon Village.** *Construction* — As described for alternative B, establishing a batch plant in previously disturbed areas would not result in any loss of wildlife habitat for this temporary facility. The construction and operation of the batch plant is expected to have impacts similar to those described for construction (e.g., noise effects such as displacement and disturbance to breeding/foraging wildlife: potential for direct mortality during operation of the plant and hauling of materials).

Impacts to wildlife would be the same as those described for alternative B, including direct mortality and avoidance of surrounding habitat due to the noise and presence of people and equipment. Displaced animals could occupy adjacent areas, increasing competition for resources such as food and cover, however it is assumed that surrounding habitat could

accommodate the displaced species with minimal effects on competition for resources.

The presence of people, equipment, and associated construction noise could disturb breeding wildlife in the vicinity of Grand Canyon Village and lot D if it occurred during spring or summer. This could cause reduced breeding success for some species. Construction-related activities could also cause wildlife to delay feedings or forage in other occupied habitat. However, given the current levels of activity on the South Rim, and more specifically in the project area, breeding and foraging wildlife are likely accustomed to some levels of human disturbance. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding or important feeding areas), would also be implemented to minimize impacts during construction. Taking into consideration the adaptability of some animals, the limited extent of construction, and the mitigation measures, these construction-related impacts on wildlife in Grand Canyon Village would be local, short-term, negligible to minor, and adverse. There would be no additional impacts on wildlife or their habitat from converting private vehicle parking spaces to tour bus loading and potentially restoring the railroad tracks beneath lot D because all construction would occur within the existing disturbed area.

New shuttle bus stop construction would affect approximately 1 acre of mature wildlife habitat; however, most mature trees could be avoided, and the number of trees to be removed would be minimal. This would result in the minimal loss of bird territories and habitat for small mammals. Surrounding habitat on the South Rim could absorb these individuals with little increase in competition for food or cover. Any loss of prey for predators, such as mountain lions, would be minimal. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat and revegetating, would also be taken to minimize impacts during construction.

Given the limited disturbance, the adaptability of some animals, and these mitigation measures, temporary population fluctuations in the vicinity of the Grand Canyon Village from displacement would be minimal. Therefore, these construction activities would have local, long-term, negligible, adverse impacts on wildlife from the loss of habitat at the new bus stops.

*Operations* — As described for alternative B, providing new tour bus stops, loading and parking on the south side of the railyard, along with accommodating up to 14 tour buses at lot E and up to 12 buses near the livery stable and the powerhouse, would increase visitor activities and vehicle/bus traffic. This would have minimal effects related to displacement or disturbance to wildlife, including foraging and breeding individuals, given the surrounding development and current visitor activities in these areas. There could be a slight increase in wildlife/human or wildlife/vehicle interactions that could ultimately lead to increased stress on some individuals or cause direct mortality from trampling (primarily from the latter). However, the new facility operations should not greatly increase adverse impacts as a result of direct mortality to wildlife above current levels because of existing development and human activity in Grand Canyon Village.

The effects on night skies would also be minimal given existing developments in the area. Mitigation measures described for Canyon View Information Plaza (e.g., zoning, limiting lighting by using trees and other light-absorbing elements in the landscape, using fully shielded fixtures, and regulating exterior lighting with a timer or motion sensor) would reduce lighting effects due to wildlife displacement or avoidance of the area.

Operational impacts to wildlife would be local, long-term, negligible and adverse in the vicinity of the Grand Canyon Village.

**Yavapai Observation Station.** As described for alternative B, there would be no construction-related impacts to wildlife or wildlife habitat at Yavapai Observation Station.

Opening the area to seasonal use (November to February) by no more than three tour buses would have minimal effects related to increased competition between wildlife in adjacent areas given the current developed nature of the overlook, and limited scope of the activities that would be allowed. There could be a slight increase in wildlife/ human or wildlife/vehicle interactions that could ultimately lead to increased stress on some individuals or cause direct mortality from trampling (primarily from the latter). However, the new operations should not greatly increase adverse impacts (e.g., population fluctuations) as a result of disturbance or direct mortality to wildlife above current levels because of existing human activity in the immediate area. As a result, there would be local, long-term, negligible, adverse impacts to wildlife at Yavapai Observation Station.

**Yaki Point.** As with Yavapai Observation Station, impacts to wildlife from increased tour bus access and subsequent avoidance by wildlife would have minimal effects related to increased competition in adjacent areas given the current developed nature of the overlook, and limited scope of the activities that would be allowed. There could be a slight increase in wildlife/ human or wildlife/vehicle interactions that could ultimately lead to increased stress on some individuals or cause direct mortality from trampling (primarily from the latter). However, the new operations should not greatly increase adverse impacts (e.g., population fluctuations) as a result of disturbance or direct mortality to wildlife above current levels because of existing human activity in the immediate area. As a result, there would be local, long-term, negligible, adverse impacts to wildlife at this site.

**East Entrance Station.** As described for alternative B, no construction-related impacts would occur at the East Entrance Station; however, diverting traffic from the South Entrance Station to the East Entrance Station (projected to result in a 10% increase over the life of this plan) could result in more wildlife/

vehicle collisions (primarily large and small mammals) that could increase direct mortality. Greater noise levels associated with more traffic could also temporarily displace some wildlife in the vicinity of the East Entrance Station. Because surrounding available wildlife habitat is expected to be occupied, competition for resources such as food and cover could increase in these adjacent areas. However, it is expected that the species temporarily displaced would be accommodated in the surrounding habitat with minimal competition for resources (e.g., food and cover). As a result, temporary population fluctuations would be minimal and there would be local, long-term, negligible, adverse impacts to wildlife at the East Entrance Station.

### Cumulative Impact

Past, present, and reasonably foreseeable actions with the potential to have cumulative impacts to wildlife include those described for alternative A under the analysis of impacts to vegetation. Trail and road projects, as well as facility upgrades, maintenance, and demolition, would have local, long-term, negligible to moderate, adverse impacts on wildlife. Plans and projects, including fire management actions, would have local, long-term, minor beneficial effects on wildlife.

The impacts of the cumulative actions in combination with the local, short- and long-term, negligible to moderate, adverse impacts, as well as the local, long-term, minor, beneficial impacts from restoration activities at Canyon View Information Plaza / Mather Point, of alternative D would result in local, long-term, minor to moderate, adverse cumulative impacts to wildlife. Incremental contributions from alternative D to overall cumulative impacts would be marginal.

### Conclusion

Alternative D would result in local, long-term, negligible to moderate, adverse impacts to the wildlife. There would also be local, long-term, minor, beneficial effects from restoration at Canyon View Information Plaza / Mather

Point from limiting roadside parking and the associated social trailing, as well as the restoration of natural conditions.. Cumulative impacts would be local, long-term, minor to moderate, and adverse. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of wildlife resources.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would not be unacceptable impacts on wildlife under alternative D.

## **SPECIAL STATUS SPECIES**

### **Affected Environment**

Table 20 lists threatened species and species of concern within the project area, 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 being prepared to detail the potential impacts to federally-listed species and facilitate consultation under Section 7 of the Endangered Species Act with the U.S. Fish and Wildlife Service for this project. Of the 10 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 is noted in Table 20.

### **Bald Eagle**

Bald eagles inhabit coastal areas, estuaries, unfrozen inland waters, and some arid areas of the western interior and southwestern portion of the United States. They prefer areas with a high water-to-land edge, and areas with unimpeded views, including both horizontal and vertical aspects. Areas selected as wintering habitat would have an adequate food supply, and have open water such as river rapids, impoundments, dam spillways, lakes, and estuaries (Arizona Game and Fish Department [AGFD] 2002).

Bald eagles are known to occur in Grand Canyon National Park, including several documented winter roosts in the canyon and historically on the South Rim near Pipe Creek Overlook, which is more than 1 mile from the Canyon View Information Plaza/Mather Point area. No nests or active roosts have been documented in any project areas.

### **Mexican Spotted Owl**

The Mexican spotted owl is a nocturnal raptor that primarily breeds in dense old-growth mixed-conifer forests on steep slopes, especially deep, shady ravines. These sites have high canopy closure, high basal area, many snags, and many downed logs. For foraging, multistoried forest with many potential patches is desirable. In Arizona they occur primarily in mixed-conifer, pine/oak, and evergreen oak forests. They also occur in ponderosa pine forest and rocky canyonlands (Ganey and Balda 1989). In Arizona, they generally foraged more than or as frequently as expected (based on availability) in virgin mixed-conifer forests (Ganey and Balda 1994; NatureServe 2006). Range size for single owls in Arizona averages 1,600 acres, and combined home ranges occupied by pairs average 2,000 acres.

**TABLE 20. SPECIAL STATUS SPECIES KNOWN TO OCCUR, OR HAVING THE POTENTIAL TO OCCUR, IN THE VICINITY OF THE PROJECT AREA**

Species	Scientific Name	Federal Status	State Status	Occurrence in Project Areas
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Threatened (delisted 2007)	Wildlife species of special concern	Historic winter roost habitat near Yaki Point. Not used recently. Species is transient here during migration.
Mexican Spotted Owl	<i>Strix occidentalis lucida</i>	Threatened	Wildlife species of special concern	Nesting and roosting habitat below the South Rim, greater than 0.5 mile from Canyon View Information Plaza / Mather Point and from Grand Canyon Village.
California Condor	<i>Gymnogyps californicus</i>	Threatened*	Wildlife species of special concern	Foraging and roosting potential; all nests used since 2003 are greater than 0.5 mile from any project area.
Peregrine Falcon	<i>Falco peregrinus anatum</i>	Delisted		Nests occur at both Yaki Point and Grandeur Point on the perimeter of the project area.
Northern Goshawk	<i>Accipiter gentilis</i>	Species of concern	Wildlife species of special concern	Potential foraging habitat in ponderosa pine forests of Grand Canyon Village, South Entrance Station, and Tusayan. One nest near South Entrance Station.
Navajo Mexican Vole	<i>Microtus mexicanus navaho</i>	Species of concern	Wildlife species of special concern	Low shrub thickets with dense cover, as well as some bare ground in forests and grasslands of the South Rim. Detected near South Entrance Station in ponderosa pine forest.
Tusayan flameflower	<i>Phemeranthus validulus</i> E. L. Green		Plant species of special concern, salvage restricted	Habitat potential exists throughout the project area; populations exist at Canyon View Information Plaza and Tusayan. This species is no longer considered a sensitive species in Kaibab National Forest.

SOURCES: Park biologists, park records, AGFD Heritage Nongame Data Management System database (2003), and AGFD and USFWS biologists

Threatened\* — Federally listed as an experimental non-essential population in Arizona, but in national parks the species is considered federally listed as threatened under the Endangered Species Act.

Species of Concern — Some information showing vulnerability or threat, but not enough to support listing under the Endangered Species Act. These species are former USFWS category 1, 2, and 3 species. (The Southwest Region of the U.S. Fish and Wildlife Service no longer maintains a list of these category 1, 2 and 3 species).

Wildlife species of special concern based on Arizona Game and Fish Department 1996.

In the Grand Canyon the owl uses tributary canyons of the Colorado River, where it nests and hunts in the steep rocky habitat distinctive of the Colorado Plateau province (Ward and Goates 2007). There are two documented protected activity centers for Mexican spotted owls in the project vicinity near Grand Canyon Village and Mather Point. Protected activity centers include a minimum of 600 acres that includes the best nesting and roosting (i.e., resting) habitat in the area.

The 2007 compliance survey report for threatened, endangered, and special status species (Ward and Goates 2007) provides

detail on Mexican spotted owl protected activity centers and survey results near Grand Canyon Village and Mather Point. This report states that there is a 0.5-mile buffer around each roost site; this buffer would not intersect with the project area considered in this document.

### **California Condor**

The California condor, a diurnal raptor, is the largest flying land bird in North America, with a wingspan of 9.5 feet. Condors in Arizona typically roost and nest in steep terrain with rock outcroppings, cliffs, and caves. High

perches are necessary to access the strong updrafts the bird requires to lift into flight. Open grasslands or savannahs are essential to condors search for food. The California condor has nested successfully in cliff habitat below the South Rim near the project area, and it is anticipated that this will occur again during the life of the project (Ward and Goates 2007).

The 2007 compliance survey report for threatened, endangered, and special status species provides detail on California condor survey results near the project area (Ward and Goates 2007). A summary of this survey for the California condor includes the documentation of the failed nesting at the Dana Butte site on the South Rim in 2007. Additionally, condors nested at Deer Creek/Thunder River on the North Rim and in the Vermillion Cliffs area north of Grand Canyon National Park. None of these nest sites are near construction or operational areas considered in this document. All of the documented nest sites are more than 1.5 miles north and/or west of the Grand Canyon Village. Condors were sighted on numerous occasions over the project areas, and it is reasonable to assume that nesting could occur again below the South Rim in future years.

### ***Peregrine Falcon***

The peregrine falcon is a diurnal raptor that may occur in Arizona wherever sufficient prey is found near cliffs. Optimum peregrine habitat is generally considered to be steep cliffs overlooking woodlands, riparian areas, or other habitats supporting avian prey species in abundance. As Arizona's population grows, peregrines seem to be breeding in less optimal habitat — either small, broken cliffs in ponderosa pine forest, or large, sheer cliffs in very xeric areas. The presence of an open expanse is critical (Glinski 1998).

The peregrine falcon nests in cliff habitat in a variety of strata within Grand Canyon National Park. The importance of the Grand Canyon population was first documented in 1991 with the submission of a final report to

the National Park Service covering an extensive survey conducted during 1988 and 1989 (B. T. Brown 1991). This survey documented 58 pairs of peregrine falcons in the park and speculated that there may be upwards of 100 pairs within park boundaries. The abundance and distribution of the peregrine falcon was confirmed within the park in a 1998–99 study by Ward (2000). The 2007 compliance surveys for the Hermit Road transportation plan surveyed four peregrine falcon territories on the South Rim in the vicinity of the project area. The Yaki Point peregrine falcon territory was determined to be occupied by a male and female pair during the 2007 breeding season. Production of young was not determined for the nest. The Grandeur Point territory (near Grand Canyon Village) was occupied by a lone male during the 2007 breeding season (Ward and Goates 2007). The Pima and Hopi Point territories are well west of the project area and would not be affected.

### ***Northern Goshawk***

The northern goshawk is considered to be the largest accipiter (short-winged, long-tailed hawk) in Arizona. The goshawk nests in a wide variety of forest types, including deciduous, coniferous, and mixed forests. They typically nest in mature or old-growth forests, generally selecting larger tracts of forests over smaller tracts. In Arizona goshawks nest most commonly in ponderosa pine forests along the Mogollon Rim and on the Kaibab Plateau, as well as in pine and ponderosa pine forests in the southeastern mountains. Occasionally, they breed in relatively low elevation oak forests in the southeastern portion of the state (Snyder and Snyder, cited in Glinski 1998). In the western United States they characteristically nest in coniferous forests, including those dominated by ponderosa pine and lodgepole pine, or in mixed forests dominated by various coniferous species, including fir, Douglas-fir, cedar, hemlock, and spruce. They will also nest in deciduous forests with aspen, paper birch, and willow. Habitat requirements during winter are poorly understood.

The 2007 compliance survey report for threatened, endangered, and special status species provides detail on northern goshawk survey results near the project area (Ward and Goates 2007). The northern goshawk has been found primarily in drainages in conifer stands, especially old-growth ponderosa pine stands in Grand Canyon National Park. Only one goshawk and one nest were detected during the survey period within 0.25 and 0.5 mile of the South Entrance Road near the park boundary. No mitigation measures would be necessary to protect this species.

### ***Navajo Mexican Vole***

The Navajo Mexican vole is a small mouse-sized mammal that uses low thickets of various shrubs for cover in areas of high litter and bare ground. It may also be found in dry, grassy areas, usually adjacent to ponderosa pine forests, but sometimes as low as juniper woodland or stands of sagebrush, or as high as spruce-fir (Kime 1994). The species is listed by the U.S. Forest Service as a sensitive species and by Arizona as a species of concern.

The Navajo Mexican vole has been documented to occur in the forests and grasslands of the South Rim (Hoffmeister 1986), but systematic surveys for the species have not been undertaken since 1973. A small mammal survey by Lawes and Ward (2005, 2006) did result in the capture of 12 Mexican voles on the South Rim, but it is uncertain at this time what subspecies these individuals represented.

### ***Tusayan Flameflower***

The Tusayan flameflower is a low growing perennial herb that inhabits open mountain meadows with very shallow rocky clay soils derived from basalt in ponderosa pine forest, and shallow basins at rims of canyons and flat ridgetops with cherty gravels from Kaibab limestone in piñon/juniper woodland (Phillips 1993a). Because this plant is not a good competitor, it grows in openings in small, advantageous sites (Phillips 1993b) and in open meadows and hilltops in ponderosa pine and

piñon/juniper vegetation. Phillips (1993b) considers habitat more important than substrate. In the park the species is found in association with prickly pear cactus and blue grama.

Tusayan flameflower distribution is limited to Coconino and Yavapai counties in northern Arizona. It has been documented from two subpopulations (93 individuals) located between Mather Point and Canyon View Information Plaza, and at the proposed parking area near Tusayan. A total of 1,016 individuals from several subpopulations were documented within the Tusayan construction area (Busco and Boyter 2007).

## **Environmental Consequences**

### ***Methodology and Assumptions***

Impacts on special status species were determined by using GIS to produce mapping overlays of project construction and staging footprints for each alternative and comparing that with confirmed occurrence for each species. Occurrence was obtained from specific survey data collected by the National Park Service and other researchers. Habitat loss or alteration caused by the implementation of the alternatives was also assessed using the methods described for vegetation. Displacement and disturbance potential of alternative actions and the species' potential to be affected by these activities were also assessed.

### ***Impact Analysis Area***

The project study area considered for special status species impacts includes the following sites: Canyon View Information Plaza / Mather Point, South Entrance Station, the Greenway Trail, Grand Canyon Village (Bright Angel Lodge, lot D, Grand Canyon Depot), Yavapai Observation Station, Yaki Point, Tusayan, and the East Entrance Station.

### ***Impact Thresholds***

The following impact thresholds were defined for species of special concern:

- *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. 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.

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.

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 Impact.** An adverse impact would result from those actions that would increase the possibility for “take” as defined under the Endangered Species Act (harm, harassment, etc.) for listed species, or would result in habitat loss, mortality, displacement of individuals due to human-caused disturbance (like construction noise), or habitat fragmentation.

**Beneficial Impact.** A beneficial impact would result in a decrease in take or result in habitat improvement.

#### Duration

**Short-term Impact.** A short-term impact would generally occur within a year or less following implementation.

**Long-term Impact.** A long-term impact would continue beyond one year.

#### **Alternative A: No Action**

##### Direct / Indirect Impacts

Current conditions would continue, including facilities, management strategies, and visitor services. This would include maintaining existing roads and not providing visitor parking at Canyon View Information Plaza. Parking and roads at Mather Point would remain in their current configuration. No changes to parking would occur in Grand Canyon Village

or to the South Entrance Station. Current conditions in Tusayan would continue. Tour bus and shuttle bus operations would remain unchanged.

**Bald Eagle.** Nesting or roosting bald eagles do not occur within project areas at Canyon View Information Plaza, Mather Point, the South Entrance Station, the Greenway Trail, Grand Canyon Village, Yavapai Observation Station, East Entrance, or Tusayan. Nesting bald eagles have not occurred at Yaki Point, but there has been a historical winter roost at Pipe Creek Overlook, between Yaki Point and Mather Point on the East Rim Drive. Park biologists believe that this roost has not been active recently. Therefore, the only bald eagles that may occur in the project area would likely be transient migrants.

Over time increasing levels of traffic on existing roads and the presence of more people could increase disturbances, including noise, and cause bald eagles to avoid project areas. Social trailing in the vicinity of informal parking areas would continue and could worsen as visitation increases. However, continued use of existing developments would not result in any additional impact on sensitive habitat for bald eagles, such as nesting or roosting sites, or key foraging areas. Current night-sky conditions would also continue. Although increasing visitor use would cause bald eagles to avoid the area, there would be no measureable effect, and populations would not be affected. Therefore, the no-action alternative would have local, long-term, negligible, adverse impacts to bald eagles.

**Mexican Spotted Owl.** Mexican spotted owl foraging and roosting areas occur just beyond 0.5 mile from the northern end of Canyon View Information Plaza / Mather Point and the Grand Canyon Village. The spotted owl may occasionally use foraging habitat in the piñon/juniper forest above the South Rim in the vicinity of Mather Point, Yaki Point, Yavapai Observation Station, and Grand Canyon Village. Impacts in these locations would be limited to those associated with

increasing levels of visitation (traffic noise, presence of people, social trailing). While nest and roosting sites would not be affected, continued use of existing developments in these areas, including current effects on night skies that contribute to displacement, could affect the Mexican spotted owls that occasionally forage in the available habitat. Traffic noise and the presence of people could cause delayed feedings or cause Mexican spotted owls to forage in adjacent habitats. However, it is expected that surrounding habitat could support any displaced owls with little increase in competition for resources. These ongoing activities would not affect the population status of Mexican spotted owl in this project area, but could result in some perceptible population fluctuations. Therefore, there would be local, long-term, minor, adverse impacts to Mexican spotted owls.

**California Condor.** Nesting California condors have not been documented within 0.5 mile of the Canyon View Information Plaza, Mather Point, Grand Canyon Village, Yavapai Observation Station, Yaki Point, the East Entrance, the South Entrance, or Tusayan. Condors may occasionally use piñon/juniper foraging habitat on the South Rim (found at Canyon View Information Plaza, Mather Point, Grand Canyon Village, Yavapai Observation Station, and Yaki Point). The current infrastructure of the South Rim existed when these birds were introduced to the Grand Canyon as an experimental population, so the birds have adapted to human disturbance and may actually be attracted to some areas of disturbance. Human presence creates the possibility for condor/human interactions, which can increase stress. Condors are monitored daily by radio telemetry, and any condors that land in the project area now are hazed by permitted park employees to ensure that they do not become habituated to humans. As a result, impacts from traffic noise, the presence of people and vehicles, and social trailing (e.g. displacement, delayed feedings) associated with the continued and increasing use of existing developments could affect the foraging birds, but the population

status on the South Rim would not change. Therefore, there would be local, long-term, minor, adverse impacts on California condors.

**Peregrine Falcon.** The Yaki Point peregrine falcon territory was determined to be occupied by a male/female pair during the 2007 breeding season (production of young was not determined for this nest). Year-round noise and the presence of people and vehicles at Yaki Point could affect peregrines, including nesting birds during the breeding season. However, many peregrine falcon areas at Grand Canyon are near high-use visitor activity centers, and they are continually occupied and produce young. Impacts from traffic noise and the presence of people and vehicles (e.g., displacement, delayed feedings, reduced breeding success) could affect peregrine falcons, but the population status on the South Rim would not change. Therefore, there would be local, long-term, minor, adverse impacts.

**Northern Goshawk.** There are no documented nesting northern goshawks in the vicinity of Canyon View Information Plaza, Mather Point, Grand Canyon Village, Yavapai Observation Station, Yaki Point, the East Entrance, or Tusayan. A nesting goshawk has been confirmed southeast of the South Entrance Station. Northern goshawks may forage in any of the forested portions of the project area. It is expected that breeding and foraging northern goshawks that occur in the project areas are accustomed to some level of noise and disturbance associated with existing facilities and visitor use. Current and increasing traffic conditions and associated noise would contribute to these disturbances (e.g. displacement, delayed feedings, reduced breeding success). However, because the contribution is not likely detectable, there would be local, long-term, negligible, adverse impacts to northern goshawks.

**Navajo Mexican Vole.** Small mammal trapping studies conducted as recently as 2006 did not identify Navajo Mexican voles in the vicinity of the Canyon View Information Plaza,

Mather Point, Grand Canyon Village, Yavapai Observation Station, Yaki Point, or Tusayan. The 2006 studies identified probable Navajo Mexican voles in the vicinity of the South Entrance Station. It is expected that breeding and foraging Navajo Mexican voles that occur in project areas are accustomed to some level of noise and disturbance associated with existing facilities and visitor use. Current and increasing traffic conditions and the associated noise would contribute to these disturbances (e.g. displacement, delayed feedings, reduced breeding success). However, because the contribution is not likely detectable, there would be local, long-term, negligible, adverse impacts to Navajo Mexican voles.

**Tusayan Flameflower.** Vehicles parking informally near Mather Point and associated social trailing could affect habitat for the Tusayan flameflower as a result of trampling, soil compaction, and the potential introduction of nonnative species that would outcompete this native species. Because these impacts could be detectable, but would not affect the Tusayan flameflower population status, the effects would be local, long-term, negligible to minor, and adverse.

#### Cumulative Impact

Past, present, and reasonably foreseeable actions with the potential to have cumulative impacts to special status species include those described for alternative A under the analysis of impacts to vegetation. The original construction of Canyon View Information Plaza and Mather Point most likely resulted in the loss of individual Tusayan flameflowers and certainly reduced potential habitat for the species. This impact from past activities has been local, long-term, minor to moderate, and adverse. The construction of overlooks, trails and roads in the immediate vicinity of the South Rim has likely resulted in local, long-term, minor, adverse impacts to raptors, such as the peregrine falcon, Mexican spotted owl, and bald eagle. Trails and road projects, as well as facility upgrades, maintenance, and demolition, have likely resulted in local, long-

term, negligible to moderate, adverse impacts to special status species. Plans and projects, including fire management actions, would have local, long-term, minor, beneficial effects to special status species.

The impacts of the cumulative actions in combination with the local, long-term, negligible to minor, adverse impacts of alternative A would result in local, long-term, minor to moderate, adverse cumulative impacts to special status species. Incremental contributions from alternative A to overall cumulative impacts would be marginal.

### Conclusion

Alternative A would result in local, long-term, negligible to minor, adverse impacts to special status species within project areas considered in this plan. Cumulative impacts would include local, long-term, minor to moderate, adverse effects and local, long-term, minor, beneficial effects. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of special status species.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would not be unacceptable impacts on special status species under alternative A.

### **Alternative B: Preferred Alternative**

#### Direct / Indirect Impacts

Under alternative B construction disturbance would occur at Canyon View Information Plaza / Mather Point, South Entrance Station, Grand Canyon Village, and Tusayan, adversely affecting habitat for special status species. At Canyon View Information Plaza / Mather Point some previously disturbed lands would be restored to natural conditions. Even with mitigation, construction impacts could cause mortality to Tusayan flameflowers and Navajo Mexican voles. Impacts on special status species could also result from construction noise and increased human presence in construction zones.

As described in the "Mitigation Measures" section of Chapter 2, material storage and equipment staging would occur in previously disturbed areas near the project sites, or in other disturbed areas that would best meet project needs and minimize new ground disturbance. A previously disturbed construction staging area between the South Entrance Road and Center Road, approximately 0.25 mile west of the South Entrance Road near Grand Canyon Village, would be used for a diesel-powered asphalt batch plant. As a result, there would be no impacts on habitat for special status species (e.g., loss, fragmentation, degradation) or loss of special status plants from staging or the batch plant. Because the staging areas would occur in disturbed locations generally surrounded by other developments (e.g., facilities or roads), it is expected that special status wildlife are accustomed to some levels of disturbance in these areas, and that any potential temporary impacts on breeding or foraging species (e.g., decreased breeding success or delayed feedings, temporary displacement) would be minimal. Should the need to treat for non-native vegetation arise in these areas, it would be considered. In addition, all staging areas would be returned to pre-construction conditions or better once construction had been completed.

Construction equipment would access all project sites on existing roads used by visitors under alternative B. This could cause some visitors to be displaced into other locations on the South Rim during construction activities, which could increase visitor-related impacts on special status species in these other areas (e.g., wildlife/vehicle interactions that could result in mortality, displacement due to noise and the presence of people/vehicles, etc.; potential disruption of breeding or foraging activities; and impacts to special status species habitat and special status plants associated with social trailing, such as trampling vegetation and compacting soils).

These activities could temporarily cause population fluctuations within the project areas that would contribute to similar impacts on special status species as described in detail below for each species.

**Bald Eagle.** As stated under alternative A, there are no issues with nesting or roosting bald eagles at Canyon View Information Plaza, Mather Point, the South Entrance Station, the Greenway Trail, Grand Canyon Village, Yavapai Observation Station, the East Entrance, or Tusayan. There are no issues with nesting bald eagles at Yaki Point; however, there has been a historical winter roost at Pipe Creek overlook.

Any presence of bald eagles in project areas would be seasonal and migratory. Construction and operation impacts could include disturbance and temporal and spatial displacement from the South Rim. This would minimally affect bald eagle movements through the area, and there would be no population level effects, especially given current development and operations at the project site. Therefore, alternative B is expected to have local, short- and long-term, negligible, adverse impacts on bald eagles.

**Mexican Spotted Owl.** The nearest nesting occurrence of Mexican spotted owls is farther than 0.5 mile from any project area, except for the proposed road removal at Mather Point. No blasting is anticipated during this road removal, which would be undertaken outside

the breeding season to lessen potential effects to the greatest extent possible. As a result, the noise and presence of people and equipment during construction is not expected to affect breeding success, especially considering the current levels of activity at Mather Point.

Short-term, construction-related impacts described for wildlife (e.g., displacement that increases competition for resources, delayed feeding, degradation of habitat from non-native species invasion) could affect foraging Mexican spotted owls in the vicinity of Canyon View Information Plaza / Mather Point. However, given the current levels of activity on the South Rim, foraging Mexican spotted owls are likely accustomed to some levels of human disturbance. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., important feeding areas), would also be implemented to minimize impacts during construction. Despite the adaptability of the Mexican spotted owl and these mitigation measures, temporary population fluctuations in the vicinity of Canyon View Information Plaza and Mather Point could occur during construction as a result of displacement. Therefore, these construction-related activities would have local, short-term, minor, adverse impacts on Mexican spotted owls.

Occasional foraging habitat for this species may be present in the study area, but impacts from this alternative would likely be minimal. Alternative B would result in the loss of 24 acres of mature habitat at Canyon View Information Plaza / Mather Point area, with an estimated loss of 2,434–2,705 piñon pine and juniper trees, and the loss of habitat for approximately 360–480 small mammals that could be prey for Mexican spotted owls.

The loss of foraging habitat and loss of prey could cause Mexican spotted owls to forage in adjacent habitat, which is assumed to be occupied, causing an increase in competition for resources. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breed-

ing and important foraging areas) and initiating revegetation as soon as possible after construction, would help offset some impacts by limiting habitat loss and the number of prey displaced. However, this loss of habitat would ultimately cause small population fluctuations in the vicinity of Canyon View Information Plaza / Mather Point, and could increase the stress on displaced Mexican spotted owls and other species that occur in adjacent areas. However, available resources in the surrounding habitat are expected to be able to accommodate displaced individuals, given they are used only occasionally by foraging Mexican spotted owls. As a result, impacts on Mexican spotted owls would be local, long-term, negligible to minor, and adverse from decreased prey and the loss of foraging habitat.

As described for wildlife, new roads and parking lots could cause some habitat fragmentation and the creation of 15,064 linear feet of edge habitat. Edge effects (including invasion by nonnative or edge plant and animal species; greater competition between species in the newly created edge) would occur. These new edge areas would also be susceptible to spread of nonnative vegetation, which could degrade Mexican spotted owl foraging habitat. Restoring approximately 6 acres of habitat would also create an opportunity for the establishment of nonnative species. Taking into consideration current fragmented conditions and mitigation described for wildlife (e.g., monitoring and controlling nonnatives; revegetating as soon as possible) that would minimize the potential effects, impacts on foraging Mexican spotted owls and their habitat would be local, long-term, negligible, and adverse from the potential for the introduction and spread of nonnative species.

In the long term road removal at Mather Point would result in a minor, beneficial impact by the reduction in noise from motorized vehicles on this section of the South Rim and by the restoration of previously disturbed land. Revegetation of restored areas to natural conditions would not be completed until after the

life of this plan due to the arid climate and soil conditions on the South Rim.

Operational impacts would include disturbances from visitor use, traffic noise, and impacts to night skies that could affect foraging Mexican spotted owls. These disturbances would have little effect on population fluctuations given existing developments and visitor use in the area, as well as mitigation measures for night skies (e.g., zoning, limiting lighting by using trees and other light-absorbing elements in the landscape, using fully shielded fixtures, and regulating exterior lighting with a timer or motion sensor) that would limit impacts due to displacement or avoidance. As a result, alternative B would have local, long-term, minor, adverse impacts to foraging owls and their habitat from operations in the vicinity of Canyon View Information Plaza / Mather Point.

This alternative would also reduce impacts to Mexican spotted owl foraging habitat caused by vehicle parking along roadsides near Mather Point and the associated impacts of social trailing (soil compaction, vegetation trampling, and introduction of nonnative species). This would have local, long-term, negligible, beneficial effects to Mexican spotted owls.

**California Condor.** Alternative B would have similar effects on the California condor compared to those for the Mexican spotted owl. No effects on nesting habitat would be realized, but condors are known to forage in the Canyon View Information Plaza / Mather Point project area.

Construction-related activities could attract foraging California condors at Canyon View Information Plaza / Mather Point, as opposed to causing displacement. This could affect normal behavior, and population fluctuations could occur; however, the park biologists would monitor for the bird's presence during construction and would use techniques to haze the birds if they were observed. Contractors would also be educated about California condors and the appropriate personnel to

contact in the event they are observed at a project site. Construction sites 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. Mitigation measures for wildlife, such as avoiding or minimizing impacts to ecologically important habitat (e.g., important feeding areas) would also be implemented and would also minimize impacts to California condors. Despite these mitigation measures, there would be local, short-term, minor adverse impacts to California condors due to temporary effects on condor foraging behavior during construction in the vicinity of Canyon View Information Plaza / Mather Point.

The loss of 24 acres of mature foraging habitat (including approximately 2,434–2,705 piñon pine and juniper), and the loss of habitat for approximately 360–480 small mammals that could be prey, would displace foraging California condors into surrounding habitat, causing some population fluctuations in the area. However, available resources in adjacent habitat are expected to be adequate to accommodate displaced condors and competition for resources would be limited. As a result, there would be local, long-term, minor adverse impacts on foraging California condors in the vicinity of Canyon View Information Plaza / Mather Point from loss of foraging habitat and prey.

As described for the Mexican spotted owl, new roads and parking lots that cause some habitat fragmentation and create new edge habitat (approximately 15,064 linear feet) would be susceptible to invasion by nonnative plants and animals. This could increase competition for resources in this area and degrade California condor foraging habitat.

Restoring approximately 6 acres of habitat in this area could also allow the establishment of nonnative species; however, taking into consideration current fragmented conditions and mitigation described for wildlife (e.g., monitoring nonnatives and revegetating as soon as possible) that would minimize potential

effects from nonnatives, the potential for this to happen would be minimal. As a result, there would be local, long-term, negligible, adverse impacts on foraging California condors and their habitat at Canyon View Information Plaza / Mather Point from the potential for nonnative species invasion.

The removal of the parking lot footprint and a portion of the South Entrance Road near Mather Point would likely have local, long-term, negligible, beneficial impacts for this species by reducing noise and human disturbance in this area close to the canyon rim, and by restoring foraging habitat. Revegetating restored areas to natural conditions would not be completed until after the life of this plan due to the arid climate and soil conditions on the South Rim.

Operational impacts would include disturbances from visitor use and traffic noise that could displace foraging California condors or cause delays in feedings. These disturbances would have little effect on population fluctuations given existing developments and visitor use in the area. As a result, alternative B would have local, long-term, minor, adverse impacts to foraging condors and their habitat from operations in the vicinity of Canyon View Information Plaza / Mather Point.

This alternative would also reduce impacts to California condor foraging habitat caused by vehicle parking along roadsides near Mather Point and the associated impacts of social trailing (soil compaction, vegetation trampling, and introduction of nonnative species). This would have local, long-term, negligible, beneficial effects to California condors.

**Peregrine Falcon.** This species does not use the piñon/juniper forest on the South Rim for nesting or foraging, preferring instead to nest and hunt over the steep cliff sides below the South Rim. Local, short-term, minor adverse impacts from construction near the rim (e.g., displacement and delayed feedings from noise, reduced nesting success) could cause temporary effects on peregrine falcons, especially for those birds foraging in the

vicinity of Grandeur Point. There would be no construction at Yaki Point that would interfere with peregrine falcons (the only activity at Yaki Point would be the painting of lines for bus parking spaces). There would be no long-term, construction-related impacts (e.g., loss of prey or foraging/breeding habitat).

During normal use, overall noise and human disturbance in this area close to the canyon rim could increase because of expanded visitor activities, including new bus operations at Yaki Point. These impacts could cause avoidance of this portion of the South Rim habitat, resulting in minimal population fluctuations that would not affect the status of this species in the area. As a result, there would be local, long-term, minor, adverse impacts to peregrine falcons in the vicinity of the canyon rim at Canyon View Information Plaza / Mather Point and Yaki Point

Removing the parking lot and a portion of the South Entrance Road near Mather Point would reduce noise and human disturbance in this area, which would have local, long-term, minor, beneficial effects on peregrine falcons by reducing disturbances during feeding or breeding.

**Northern Goshawk.** Goshawks primarily occupy ponderosa pine forests with high canopy closure on the South Rim. Such forests provide suitable nesting and foraging habitat and are located at the South Entrance Station, along the Greenway Trail alignment, Grand Canyon Village, and Tusayan. No nesting habitat exists for the northern goshawk in the piñon/juniper forested portions of the study areas (Canyon View Information Plaza, Mather Point, Yavapai Observation Station, Yaki Point, and the East Entrance Station), but this species may use these forests for foraging, especially in winter (Drennan and Beier 2003). As a result, construction activities could displace or disrupt foraging individuals at Canyon View Information Plaza / Mather Point, increasing competition for resources in surrounding areas, delaying feedings, and potentially causing the introduction and spread of

nonnative species that could degrade habitat. However, available resources in surrounding areas are expected to be adequate to support displaced foraging goshawks in this project site.

Given the current levels of activity on the South Rim, foraging northern goshawks are likely accustomed to some levels of human disturbance. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., important feeding areas), would also be taken to minimize impacts during construction. Despite the adaptability of the northern goshawk and these mitigation measures, temporary population fluctuations in the vicinity of Canyon View Information Plaza / Mather Point could occur during construction as a result of displacement. This would result in local short-term, negligible, adverse impacts to northern goshawks. There would be no construction at Yavapai Observation Station, Yaki Point, and the East Entrance Station.

Construction activities at the South Entrance Station, along the Greenway Trail, at Grand Canyon Village, and at Tusayan could adversely affect nesting and foraging northern goshawks. There is one documented nest site approximately 0.25 mile from the South Entrance Road near the park boundary; however, it is approximately 0.75 mile from the South Entrance Station project area and would not be affected by construction at this site. The presence of people, equipment, and associated noise during construction of the Greenway Trail could affect the nest site, potentially disturbing nesting activities that could reduce breeding success. Foraging goshawks could be affected by construction-related activities at any of the project sites, resulting in delayed feedings or displacement into surrounding habitat that is assumed to be occupied. Displacement could increase competition for resources in the surrounding areas; however it is assumed that adjacent habitat could accommodate displaced individuals. As a result, there would be local, short-term, minor to moderate, adverse

impacts on northern goshawks from impacts to breeding and foraging during construction.

Long-term construction impacts would include loss of nesting and foraging habitat, as well as the loss of prey. Alternative B would result in the following site-specific impacts:

- the removal of approximately 24 acres of foraging habitat at Canyon View Information Plaza / Mather Point (including an estimated 2,434–2,705 piñon pine and juniper trees), and the loss of habitat for approximately 360–480 small mammals, which could be prey for northern goshawks
- the loss of approximately 3 acres of nesting and foraging habitat at the South Entrance Station (including an estimated 585–714 piñon pine, Utah juniper, and ponderosa pine trees) and the loss of habitat for approximately 39–45 small mammals (there would be no impact on the known nest site in the area)
- the loss of approximately 3 acres of nesting and foraging habitat along the Greenway Trail (including the removal of an estimated 585–714 ponderosa pine trees) and the loss of habitat for approximately 39–45 small mammals
- the loss of approximately 10 acres of nesting and foraging habitat at Tusayan (including an estimated 297–363 ponderosa pine trees) and habitat for 130–150 small mammal individuals
- no impacts on northern goshawk habitat at lot D because all construction activities would occur within the existing disturbed area
- the loss of approximately 1 acre of mature ponderosa pine habitat from the construction of the new shuttle bus stops; however, mature trees would be avoided, and the number of trees to be removed would be minimal, with a minimal loss of habitat for birds and small mammals.

This loss of habitat and prey could cause northern goshawks to seek foraging and nesting opportunities in adjacent areas of occupied habitat, which could increase competition for resources. However it is assumed the surrounding habitat could accommodate displaced individuals. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding and important foraging areas) and initiating revegetation as soon as possible after construction, would help offset some impacts by limiting habitat loss and the number of prey displaced. However, this loss of habitat could ultimately cause population fluctuations in the vicinity of Canyon View Information Plaza and Mather Point, the South Entrance Station, the Greenway Trail, and Tusayan, and could increase stress on displaced northern goshawks and the species that occur in adjacent areas. This would cause population fluctuations, resulting in local, long-term, moderate, adverse impacts to this species.

Construction would contribute minimally to habitat fragmentation given the existing developments. Habitat would be fragmented in undeveloped areas along the Greenway Trail; however, given its proximity to the existing South Entrance Road, it is assumed that northern goshawks are accustomed to these conditions.

Alternative B would create 36,116 linear feet of new edge habitat throughout the project areas that would be susceptible to the spread of nonnative plants and animals, which could increase competition and degrade habitat for goshawks. Restoring approximately 6 acres of habitat at Canyon View Information Plaza / Mather Point would also create an opportunity for the establishment of nonnative species. However, taking into consideration existing fragmented conditions and the mitigation measures described for wildlife (e.g., monitoring/controlling nonnatives and revegetating as soon as possible), impacts would be local, long-term, minor, and adverse from the potential for nonnative species invasion.

Removing the parking lot footprint and a portion of the South Entrance Road near Mather Point would likely have local, long-term, beneficial impacts for this species by reducing noise and human disturbance in this area close to the canyon rim, and by restoring foraging habitat. Revegetating restored areas to standards of natural conditions would not be completed until after the life of this plan due to the arid climate and soil conditions on the South Rim.

Operational impacts would include the effects of overall noise and human disturbance in the project areas, as described previously (e.g., displacement from noise, reduced breeding success, delayed feeding). However, given current levels of development and visitor use in the project areas, it is assumed that northern goshawks are accustomed to some levels of disturbance.

Diverting traffic from the South Entrance Station to the East Entrance Station (projected to result in a 10% increase over the life of this plan) could result in more traffic noise and displacement of northern goshawks that nest or forage in this area. This could result in a slight decrease in breeding success and cause some delayed feedings or displacement of foraging goshawks, but the effects would be minimal on population fluctuations given existing vehicle use in this area. As a result, impacts would be local, long-term, minor and adverse during operations.

This alternative would reduce impacts to northern goshawk foraging habitat caused by vehicle parking along roadsides near Mather Point and the associated impacts of social trailing (soil compaction, vegetation trampling, and introduction of nonnative species). This would have local, long-term, negligible, beneficial effects to northern goshawks near Mather Point.

Adding more lanes of traffic at the South Entrance Station could actually have a local, long-term, negligible, beneficial impact on breeding and foraging northern goshawks and their habitat by reducing traffic backups that

contribute to noise and air quality impacts in the area.

**Navajo Mexican Vole.** The Navajo Mexican vole usually prefers habitat in dense thickets with some openings or grassy areas near ponderosa pine forests, but they may occupy habitat in piñon/juniper forest. This particular species has not been detected in the vicinity of the Canyon View Information Plaza, Mather Point, Grand Canyon Village, Yavapai Observation Station, Yaki Point, or the East Entrance Station. If present, the vole could be affected by noise, mortality from construction vehicles, and displacement at Canyon View Information Plaza / Mather Point and in Grand Canyon Village. However, park staff would trap and relocate any individuals from suitable habitat before construction, which would minimize the potential for direct mortality. Relocating Navajo Mexican voles into surrounding habitat, which is assumed to be occupied, could increase competition for resources. Because this species was not observed during surveys, it is assumed that a limited number of voles would have to be relocated after trapping and that they could be accommodated in suitable habitat nearby.

Impacts from construction (displacement, direct mortality, reduced breeding success, and disruption of foraging, degradation of habitat from nonnatives) could cause some temporary population fluctuations. Given the current levels of activity on the South Rim, Navajo Mexican voles are likely accustomed to some levels of human disturbance. Mitigation measures described for wildlife, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., important feeding areas), would also be implemented and would also minimize impacts during construction. As a result, there would be local, short-term, minor, adverse impacts during construction. Voles have been detected in the ponderosa pine habitat in the vicinity of the South Entrance Station, making these impacts more likely in this project area. There would be no construction activities in the other project areas that support piñon/juniper habitat.

The following potential habitat areas for Navajo Mexican voles could be lost:

- 24 acres at Canyon View Information Plaza / Mather Point
- 3 acres at the South Entrance Station, where the Navajo Mexican vole has been detected in the ponderosa pine habitat
- 1 acre of ponderosa pine habitat at Grand Canyon Village for new bus stop construction
- 3 acres along the Greenway Trail
- 10 acres at Tusayan.

This loss of breeding and foraging habitat could cause Navajo Mexican voles to seek foraging and nesting opportunities in adjacent areas of occupied habitat, which could increase competition for resources. However, it is expected that surrounding areas could accommodate displaced Navajo Mexican voles. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding and important foraging areas) and initiating revegetation as soon as possible after construction, would help offset some impacts by limiting habitat loss. However, this loss of habitat could ultimately cause population fluctuations in the vicinity of these project areas, and could increase the stress on displaced Navajo Mexican voles and the species that occur in adjacent areas. Any population fluctuations would result in local, long-term, minor, adverse impacts to this species.

Construction would contribute minimally to habitat fragmentation at Canyon View Information Plaza / Mather Point, the South Entrance Station, Grand Canyon Village, and Tusayan, given the existing developments. Habitat would be fragmented in undeveloped areas along the Greenway Trail; however, given its proximity to the existing South Entrance Road, it is assumed that voles are accustomed to these conditions in this area.

Alternative B would create 36,116 linear feet of new edge habitat that would be susceptible to spread of nonnative plants and animals, which could increase competition and degrade habitat for Navajo Mexican voles. Restoring approximately 6 acres of habitat at Canyon View Information Plaza / Mather Point could also create an establishment opportunity for nonnative species. However, taking into consideration existing fragmented conditions and the mitigation measures described for wildlife (e.g., monitoring/controling nonnatives and revegetating as soon as possible), impacts from the potential for nonnative species to occur would be local, long-term, minor, and adverse.

Operational impacts would include the effects of overall noise and human disturbance in project areas, as described previously (e.g., displacement from noise, reduced breeding success, delayed feeding). However, given current levels of development and visitor use in the project areas, it is assumed that Navajo Mexican voles are accustomed to some levels of disturbance.

Diverting traffic from the South Entrance Station to the East Entrance Station (projected to result in a 10% increase over the life of this plan) could result in more traffic noise and displacement of Navajo Mexican voles that breed or forage in this area. More vehicles could also increase the potential for direct mortality from trampling. More noise could disrupt breeding and cause reduced breeding success, and could also cause some delayed feedings. This would all contribute to limited population fluctuations, especially considering existing use at the East Entrance Station. As a result, impacts would be local, long-term, minor, and adverse during operations.

This alternative would reduce impacts to Navajo Mexican vole habitat caused by vehicle parking along roadsides near Mather Point and the associated impacts of social trailing (soil compaction, vegetation trampling, and introduction of nonnative species). This

would have local, long-term, negligible, beneficial impacts to voles near Mather Point.

**Tusayan Flameflower.** The Tusayan flameflower has been detected in the vicinity of the Canyon View Information Plaza / Mather Point and the Tusayan project area. As described for vegetation, nonnative species could be inadvertently introduced and spread in construction and staging areas. However, mitigation measures (e.g., pressure-washing construction equipment, revegetating disturbed areas using site-selected native species as soon as possible after construction; and monitoring/controlling nonnatives) would be used to minimize this potential, as well as the potential for nonnatives to outcompete natives like the Tusayan flameflower. As a result, impacts would be local, short-term, negligible to minor, and adverse from the potential for nonnatives to be introduced and spread in these project areas.

Ongoing surveys by park biologists have determined exact locations of this species, and it is anticipated that the 89 documented Tusayan flameflowers at Canyon View Information Plaza / Mather Point would have to be salvaged as described in the mitigation measures in Chapter 2 (see page 117). There would be some mortality of individual plants during the salvage process, but most would be replanted in the project area.

There would be a loss of 24 acres of habitat in the Canyon View Information Plaza / Mather Point area, of which approximately 13 acres provides habitat for the Tusayan flameflower.

At Tusayan, 10 acres of suitable habitat and approximately 341 individual Tusayan flameflowers (about 30% of the population surveyed at this site) occur within the construction footprint. The National Park Service would attempt to avoid as many plants as possible and would coordinate with the U.S. Forest Service on salvaging and replanting those that could not be avoided. As a result, construction would have local, long-term, minor to moderate, adverse impacts on the

Tusayan flameflower from mortality and loss of habitat

Alternative B would create 19,540 linear feet of new edge habitat at Canyon View Information Plaza / Mather Point and Tusayan that would be susceptible to the spread of nonnative plants with the potential to outcompete Tusayan flameflowers. Restoring approximately 6 acres of habitat at Canyon View Information Plaza / Mather Point could also create an establishment opportunity for nonnative species. However, taking into consideration existing fragmented conditions and the mitigation measures described for vegetation (e.g., monitoring for nonnatives and revegetating as soon as possible), impacts would be local, long-term, minor, and adverse from the potential for nonnative species to occur.

This alternative would reduce impacts to Tusayan flameflowers and their habitat from vehicle parking along roadsides near Mather Point and the associated impacts of social trailing (soil compaction, vegetation trampling, and introduction of nonnative species). This would have local, long-term, negligible, beneficial effects to Tusayan flameflowers..

### ***Cumulative Impact***

Past, present, and reasonably foreseeable actions with the potential to have cumulative impacts to special status species include those described for alternative A under the analysis of impacts to vegetation. Original construction of Canyon View Information Plaza and Mather Point most likely resulted in the direct loss of Tusayan flameflowers and certainly reduced potential habitat for the species. This impact from past activities has been local, long-term, minor to moderate, and adverse. The construction of overlooks, trails, and roads in the immediate vicinity of the South Rim has likely resulted in local, long-term, minor, adverse impacts to raptors, such as the peregrine falcon, Mexican spotted owl, and bald eagle. Trail and road projects, as well as facility upgrades, maintenance, and demolition, would have long-term, negligible to

moderate, adverse impacts to special status species. Plans and projects, including fire management actions, would have long-term, minor, beneficial effects to special status species.

The impacts of the cumulative actions in combination with the local, short- and long-term, negligible to moderate, adverse impacts of alternative B would result in local, long-term, minor to moderate, adverse cumulative impacts to special status species. Incremental contributions from alternative B to overall cumulative impacts would be marginal.

### Conclusion

Alternative B would result in both local, short- and long-term, negligible to moderate, adverse impacts to special status species, as well as local, long-term, minor, and beneficial impacts from restoration activities at Mather Point and more efficient traffic flow, especially at the South Entrance Station. Minor to moderate adverse impacts could result from direct mortality of Tusayan flameflowers in the Tusayan parking lot footprint. Cumulative impacts would be local, long-term, minor to moderate, and adverse. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of special status species.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would not be unacceptable impacts on special status species under alternative B.

### **Alternative C: Tusayan Parking Emphasis**

#### Direct / Indirect Impacts

Under alternative C construction would result in disturbance at the Canyon View Information Plaza / Mather Point, South Entrance Station, Grand Canyon Village, and Tusayan project areas, with adverse effects on habitat for special status species. Construction impacts would include a potential for direct mortality of Tusayan flameflowers and Navajo Mexican voles. Impacts on special status species could also result from construction noise and increased human presence.

As described for alternative B, material storage, equipment staging, and the batch plant would occur in previously disturbed areas near the project sites. As a result, there would be no impacts on habitat for special status species (e.g., loss, habitat fragmentation or degradation) or loss of special status plants from staging or the batch plant. It is expected that special status wildlife are accustomed to some levels of disturbance in these areas, and that any potential temporary impacts on breeding or foraging species (e.g., decreased breeding success or delayed feedings, temporary displacement) would be minimal. If there was a need to treat for nonnative vegetation in these areas, it would be considered. In addition, all staging areas would be returned to pre-construction conditions or better once construction had been completed.

Construction equipment would access all project sites on existing roads used by visitors under alternative C. Visitors displaced during construction activities could increase impacts on special status species in other locations of the project area. This could include wildlife/vehicle interactions that could result in mortality; displacement due to noise and the presence of people/vehicles, etc.; potential disruption of breeding or foraging activities; and impacts to special status species habitat and special status plants associated with social trailing, such as trampling of vegetation and compaction of soils. These activities would contribute to temporary population fluctua-

tions within the project areas as described in detail below for each species.

**Bald Eagle.** As discussed under alternative B, there are no issues with nesting or roosting bald eagles at Canyon View Information Plaza, Mather Point, South Entrance Station, Greenway Trail, Grand Canyon Village, Yavapai Observation Station, East Entrance, or Tusayan. While there are no issues with nesting bald eagles at Yaki Point, there has been a historical winter roost at the Pipe Creek overlook.

Any presence of bald eagles in the study areas would be seasonal and migratory. Construction and operations impacts could include disturbance and the effects of temporal and spatial displacement from the South Rim. This would minimally affect bald eagle movement through the area, and there would have no population level effects, especially given current development and operations at the project site. Therefore, alternative C would have local, short- and long-term, negligible, adverse impacts on the bald eagle.

**Mexican Spotted Owl.** The nearest nesting occurrence of Mexican spotted owls is farther than 0.5 mile from the study area, with the exception of the proposed road removal area at Mather Point, which would be undertaken outside the breeding season to lessen possible effects to the greatest extent possible. As a result, the noise and presence of people and equipment during construction is not expected to affect breeding success, especially considering the current levels of activity at Mather Point.

Short-term, construction-related impacts described for alternative B (e.g., displacement that would increase competition for resources, delayed feeding, and degradation of habitat from nonnative species invasion) could affect foraging Mexican spotted owls in the vicinity of Canyon View Information Plaza / Mather Point. However, given the current levels of activity on the South Rim, foraging Mexican spotted owls are likely accustomed to some levels of human disturbance. Mitiga-

tion measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., important feeding areas), would also be taken to minimize impacts during construction. Despite the adaptability of the Mexican spotted owl and these mitigation measures, temporary population fluctuations in the vicinity of Canyon View Information Plaza and Mather Point could occur during construction as a result of displacement. Therefore, these construction-related activities would have local, short-term, minor, adverse impacts on Mexican spotted owls.

Occasional foraging habitat may be provided for the species at Canyon View Information Plaza / Mather Point, where 15 acres could be disturbed, with an estimated loss of 1,521–1,860 piñon pine and juniper trees, and the loss of habitat for approximately 225–300 small mammals, which could be prey for owls. As described for alternative B, the loss of foraging habitat and loss of prey could displace individuals and increase competition for resources in adjacent occupied habitat. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding and important foraging areas) and initiating revegetation as soon as possible after construction, would help offset some impacts by limiting habitat loss and the number of prey displaced. This loss of habitat would ultimately cause small population fluctuations in the vicinity of Canyon View Information Plaza / Mather Point and increase the stress on displaced Mexican spotted owls in adjacent areas. However, available resources in surrounding habitat are expected to be able to accommodate displaced individuals, given they are used only occasionally by foraging Mexican spotted owls. Impacts on Mexican spotted owls would be local, long-term, negligible to minor, and adverse as a result of decreased prey and the loss of foraging habitat at Canyon View Information Plaza / Mather Point.

As described for alternative B, new roads and parking lots could cause some habitat fragmentation and the creation of 9,722 linear feet

of edge habitat and the potential for edge effects at Canyon View Information Plaza / Mather Point. These new edge areas would also be susceptible to spread of nonnative vegetation, which could degrade spotted owl foraging habitat. Restoring approximately 1 acre of habitat under alternative C would also create an opportunity for the establishment of nonnative species. Taking into consideration current fragmented conditions and mitigation described for wildlife (e.g., monitoring and controlling nonnatives, and revegetating as soon as possible) impacts on foraging Mexican spotted owls and their habitat from the potential introduction and spread of nonnative species would be local, long-term, negligible, and adverse.

In the long term restoring 1 acre of foraging habitat at Mather Point would result in a negligible, beneficial impact. Revegetation of restored areas to standards of natural conditions would not be completed until after the life of this plan due to the arid climate and soil conditions on the South Rim.

Operational impacts would include disturbances from visitor use, traffic noise, and impacts to night skies that could affect foraging Mexican spotted owls. As described for alternative B, these disturbances would have little effect on population fluctuations given existing developments and visitor use in the area, as well as mitigation measures for night skies (e.g., zoning, limiting lighting by using trees and other light-absorbing elements in the landscape, using fully shielded fixtures, and regulating exterior lighting with a timer or motion sensor). As a result, alternative C would have local, long-term, minor, adverse impacts to foraging owls and their habitat from operations in the vicinity of Canyon View Information Plaza / Mather Point.

This alternative would also reduce impacts to Mexican spotted owl foraging habitat caused by vehicle parking along roadsides near Mather Point and the associated impacts of social trailing (soil compaction, vegetation trampling, and the introduction of nonnative

species). This would have local, long-term, negligible, beneficial effects to Mexican spotted owls.

**California Condor.** Alternative C would have similar impacts on the California condor as described for alternative B. No effects would be realized on nesting habitat, but this species is known to forage in the Canyon View Information Plaza / Mather Point area, and it is known to frequent construction sites, potentially altering natural feeding patterns as described for alternative B. As a result, mitigation measures would be taken (monitoring for the birds presence during construction, hazing birds if present, educating contractors, and cleaning up construction sites) in order to minimize the likelihood of condors visiting construction sites. Mitigation measures for wildlife, such as avoiding or minimizing impacts to ecologically important habitat (e.g., important feeding areas) would also be implemented and would minimize impacts to California condors. Despite these mitigation measures, there would be local, short-term, minor, adverse impacts due to temporary effects on condor foraging behavior during construction in the vicinity of Canyon View Information Plaza / Mather Point.

Occasional foraging habitat may be provided for the species at Canyon View Information Plaza / Mather Point, where 15 acres could be disturbed, with an estimated loss of 1,521–1,860 piñon pine and juniper trees, and the loss of habitat for approximately 225–300 small mammals, which could be prey for condors. As described for alternative B, the loss of foraging habitat and loss of prey could displace individuals and increase competition for resources in adjacent occupied habitat. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding and important foraging areas) and initiating revegetation as soon as possible after construction, would help offset some impacts by limiting habitat loss and the number of prey displaced. This loss of habitat would ultimately cause small population fluctuations in the vicinity of

Canyon View Information Plaza and Mather Point, increasing the stress on displaced California condors in adjacent areas. However, available resources in the surrounding habitat are expected to be able to accommodate displaced individuals. Impacts on California condors would be local, long-term, negligible to minor, and adverse as a result of decreased prey and the loss of foraging habitat at Canyon View Information Plaza and Mather Point.

As described for the Mexican spotted owl, new roads and parking lots that cause some habitat fragmentation and create edge habitat (approximately 9,722 linear feet) would be susceptible to invasion by nonnative plants and animals. This could increase competition for resources in this area and degrade California condor foraging habitat. The 1-acre restoration area would also be susceptible to these impacts; however, taking into consideration current fragmented conditions and mitigation described for wildlife (e.g., monitoring nonnatives and revegetating as soon as possible) the potential for this to happen would be minimal. As a result, impacts on foraging California condors and their habitat at Canyon View Information Plaza / Mather Point from the potential for nonnative species invasion would be local, long-term, negligible, and adverse.

There would be a long-term, negligible, beneficial effect from the restoration of 1 acre of foraging habitat at Canyon View Information Plaza / Mather Point. Revegetation of restored areas to natural conditions would not be completed until after the life of this plan due to the arid climate and soil conditions on the South Rim.

Operational impacts would include disturbances from visitor use and traffic noise that could displace foraging California condors or cause delays in feedings. These disturbances would have little effect on population fluctuations given existing developments and visitor use in the area. As a result, alternative C would have local, long-term, minor, adverse impacts to foraging condors and their habitat from

operations in the vicinity of Canyon View Information Plaza / Mather Point.

This alternative would also reduce impacts to California condor foraging habitat caused by vehicle parking along roadsides near Mather Point and the associated impacts of social trailing (soil compaction, vegetation trampling, and introduction of nonnative species). This would have local, long-term, negligible, beneficial effects to California condors.

**Peregrine Falcon.** As described under alternative B, the peregrine falcon does not use the piñon/juniper forest on the South Rim for nesting or foraging, preferring instead to nest and hunt over the steep cliff sides below the South Rim. Local, short-term, minor adverse impacts from construction near the rim (e.g., displacement and delayed feedings from noise, reduced nesting success) could cause temporary effects on peregrine falcons, especially for those birds foraging in the vicinity of Grandeur Point. There would be no construction at Yaki Point that would interfere with falcons (the only activity at Yaki Point would be the painting of lines for bus parking spaces). There would be no long-term, construction-related impacts (e.g., loss of prey or foraging/breeding habitat).

During normal use, overall noise and human disturbance in this area close to the canyon rim could increase because of expanded visitor activities, including new bus operations at Yaki Point. These impacts could cause avoidance of this portion of the South Rim habitat, resulting in minimal population fluctuations that would not affect the status of this species in the area. As a result, impacts to peregrine falcons in the vicinity of the canyon rim at Canyon View Information Plaza / Mather Point and Yaki Point would be local, long-term, minor, and adverse.

Restoring 1 acre would reduce noise and human disturbance in this area, which would have local, long-term, negligible, beneficial effects on peregrine falcons by reducing disturbances during feeding or breeding.

**Northern Goshawk.** As described for alternative B, suitable foraging and nesting habitat for northern goshawks occurs at the South Entrance Station, Greenway Trail, Grand Canyon Village, and Tusayan project areas. Piñon/juniper habitat, which is found at Canyon View Information Plaza, Mather Point, Yavapai Observation Station, Yaki Point, and the East Entrance Station, also provides foraging habitat, especially in winter (Drennan and Beier 2003). Construction activities could displace or disrupt foraging individuals at Canyon View Information Plaza / Mather Point, increasing competition for resources in surrounding areas, delaying feedings, and potentially causing the introduction and spread of nonnative species that could degrade habitat.

Available resources in surrounding areas are expected to be adequate to support displaced foraging goshawks in this project site. Also, foraging northern goshawks are likely accustomed to some levels of human disturbance. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., important feeding areas), would also be implemented to minimize impacts during construction. Temporary population fluctuations in the vicinity of Canyon View Information Plaza and Mather Point could still occur during construction as a result of displacement. This would result in local, short-term, negligible, adverse impacts. There would be no construction at Yavapai Observation Station, Yaki Point, or the East Entrance Station.

Construction noise and the presence of people at the South Entrance Station, along the Greenway Trail, in Grand Canyon Village, and at Tusayan could adversely affect nesting and foraging northern goshawks and their habitat, including one documented nest site. However, this site is approximately 0.75 mile from the South Entrance Station and would not be affected by construction. As described for alternative B, construction of the Greenway Trail could affect the nest site and foraging northern goshawks, which could reduce

breeding success or disrupt foraging. Displacement could increase competition for resources in the surrounding areas; however, it is assumed the surrounding habitat could accommodate displaced individuals. As a result, there would be local, short-term, minor to moderate, adverse impacts on northern goshawks in these areas.

Long-term construction impacts would include the loss of nesting and foraging habitat, as well as the loss of prey. Alternative C would result in the following site-specific impacts:

- the removal of approximately 15 acres of foraging habitat in the Canyon View Information Plaza/Mather Point study area (including 1,521–1,860 piñon pine and juniper trees), and the loss of habitat for approximately 225–300 small mammals, which could be prey for northern goshawks
- the loss of approximately 2 acres of nesting and foraging habitat at the South Entrance Station (including 390–476 piñon pine, Utah juniper, and ponderosa pine trees) and the loss of habitat for approximately 26–30 small mammals (there would be no impact on the known nest site in the area)
- the removal of approximately 3 acres of nesting and foraging habitat along the Greenway Trail (including an estimated 585–714 ponderosa pine trees) and the loss of habitat for approximately 39–45 small mammals
- the loss of approximately 17 acres of nesting and foraging habitat at Tusayan (including an estimated 505–617 ponderosa pine trees) and habitat for 130–150 individual small mammals
- no impacts on northern goshawk habitat at lot D because all construction activities would occur within the existing disturbed area
- the loss of approximately 1 acre of mature ponderosa pine habitat from the construction of the new shuttle bus

stops; however, mature trees would be avoided, and the number of trees to be removed would be minimal, with a minimal loss of habitat for birds and small mammals.

As described for alternative B, this loss of habitat and prey could cause northern goshawks to forage and nest in adjacent areas of occupied habitat, increasing competition for resources. However it is assumed the surrounding habitat could accommodate displaced individuals. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding and important foraging areas) and initiating revegetation as soon as possible after construction, would help offset some impacts by limiting habitat loss and the number of prey displaced.

However, this loss of habitat would ultimately cause population fluctuations in the vicinity of Canyon View Information Plaza and Mather Point, the South Entrance Station, the Greenway Trail, and Tusayan, and it could increase stress on displaced northern goshawks and the species that occur in adjacent areas. This could cause population fluctuations that would result in local, long-term, moderate, adverse impacts to this species.

Construction would contribute minimally to habitat fragmentation at Canyon View Information Plaza / Mather Point, South Entrance Station, Grand Canyon Village, and Tusayan given existing development. Habitat would be fragmented in undeveloped areas along the Greenway Trail; however, given its proximity to the South Entrance Road, it is assumed that goshawks are accustomed to these conditions in this area.

Alternative C would create 36,116 linear feet of new edge habitat that would be susceptible to the spread of nonnative plants and animals, which could increase competition and degrade habitat for goshawks. Restoring approximately 1 acre of habitat at Canyon View Information Plaza / Mather Point would also create opportunities for nonnative species.

However, taking into consideration existing fragmented conditions and the mitigation measures described for wildlife (e.g., monitoring/controlling nonnatives and revegetating as soon as possible), impacts from the potential for nonnative species invasion would be local, long-term, minor, and adverse.

There would be a local, long-term, negligible, beneficial effect from restoring 1 acre of foraging and nesting habitat at Canyon View Information Plaza / Mather Point. Revegetation of restored areas to natural conditions would not be completed until after the life of this plan due to the arid climate and soil conditions on the South Rim.

The removal of the parking lot footprint and a portion of the South Entrance Road near Mather Point would also contribute to beneficial impacts for this species by reducing noise and human disturbance in this area close to the canyon rim.

Operational impacts would include the effects of overall noise and human disturbance in the project areas, as described previously (e.g., displacement from noise, reduced breeding success, delayed feeding). However, given current levels of development and visitor use in the project areas, it is assumed that northern goshawks are accustomed to some levels of disturbance.

Diverting traffic from the South Entrance Station to the East Entrance Station (projected to result in a 10% increase over the life of this plan) could result in more traffic noise and displacement of northern goshawks that nest or forage in this area. This could result in a slight decrease in breeding success and cause some delayed feedings or displacement of foraging goshawks, but the effects would be minimal on population fluctuations given existing vehicle use in this area. As a result, there would be local, long-term, minor adverse impacts on northern goshawks during operations.

This alternative would reduce impacts to northern goshawk foraging habitat caused by vehicle parking along roadsides near Mather Point and the associated impacts of social trailing (soil compaction, vegetation trampling, and introduction of nonnative species). This would have local, long-term, negligible, beneficial impacts to California condors near Mather Point.

The addition of more lanes of traffic at the South Entrance Station could actually have a local, long-term, negligible, beneficial impact on breeding and foraging northern goshawks and their habitat by reducing traffic backups that contribute to noise and air quality impacts in the area.

**Navajo Mexican Vole.** As previously described, the Navajo Mexican vole usually prefers habitat in dense thickets with some openings or grassy areas near ponderosa pine forests, but they may occupy habitat in piñon/juniper forest. The Navajo Mexican vole has not been specifically detected in the vicinity of Canyon View Information Plaza, Mather Point, Grand Canyon Village, Yavapai Observation Station, Yaki Point, or the East Entrance Station. If present, noise, mortality from construction vehicles, and displacement at Canyon View Information Plaza / Mather Point and Grand Canyon Village could affect this species.

NPS staff would trap and relocate any individual voles from suitable habitat before construction, which would minimize the potential for direct mortality. Relocating Navajo Mexican voles into surrounding habitat, which is assumed to be occupied, could increase competition for resources. Because the number of Navajo Mexican voles that would have to be relocated after trapping is expected to be minimal, they would be accommodated in suitable habitat nearby.

Impacts from construction (displacement, direct mortality, reduced breeding success, and disruption of foraging, degradation of habitat from nonnatives) could cause some temporary population fluctuations. Given the

current levels of activity on the South Rim, Navajo Mexican voles are likely accustomed to some levels of human disturbance. Mitigation measures described for wildlife, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., important feeding areas), would also be taken and would minimize impacts during construction. As a result, there would be local, short-term, minor, adverse impacts during construction. Voles have been detected in the ponderosa pine habitat in the vicinity of the South Entrance Station, making impacts more likely in this project area. There would be no construction activities in the other project areas that support piñon/juniper habitat.

The following potential habitat areas for Navajo Mexican voles could be lost:

- 15 acres at Canyon View Information Plaza / Mather Point
- 3 acres at the South Entrance Station
- 1 acre at Grand Canyon Village
- 3 acres along the Greenway Trail route
- 10 acres at Tusayan

As described for alternative B, this loss of breeding and foraging habitat could cause Navajo Mexican voles to seek foraging and nesting opportunities in adjacent occupied habitat, which could increase competition for resources. However, it is expected that surrounding areas could accommodate displaced Navajo Mexican voles. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding and important foraging areas) and initiating revegetation as soon as possible after construction, would help offset some impacts by limiting habitat loss. This loss of habitat could ultimately cause population fluctuations in the vicinity of these project areas, and it could increase the stress on displaced Navajo Mexican voles and the species that occur in adjacent areas. This would cause population fluctuations that would result in local, long-term, minor adverse impacts to this species.

Construction would contribute minimally to habitat fragmentation at Canyon View Information Plaza / Mather Point, the South Entrance Station, Grand Canyon Village, and Tusayan given existing development. Habitat would be fragmented in undeveloped areas along the Greenway Trail; however, given its proximity to the existing South Entrance Road, it is assumed that voles are accustomed to these conditions.

Alternative C would create 36,116 linear feet of new edge habitat that would be susceptible to spread of nonnative vegetation, which could degrade habitat for voles. Restoring approximately 1 acre of habitat at Canyon View Information Plaza / Mather Point would also create an establishment opportunity for nonnative species. However, taking into consideration existing fragmented conditions and implementing the mitigation measures described for wildlife (e.g., monitoring/controlling nonnatives and revegetating as soon as possible) would minimize effects, resulting in local, long-term, minor, adverse effects from the potential for nonnative species.

There would be a local, long-term, negligible, beneficial effect from restoring 1 acre of foraging and nesting habitat at Canyon View Information Plaza / Mather Point. Revegetation of restored areas to natural conditions would not be completed until after the life of this plan due to the arid climate and soil conditions on the South Rim.

The removal of the parking lot footprint and a portion of the South Entrance Road near Mather Point would also contribute to beneficial impacts for voles by reducing noise and human disturbance in this area close to the canyon rim.

Operational impacts would include the effects of overall noise and human disturbance in the project areas, as described previously (e.g., displacement from noise, reduced breeding success, delayed feeding). However, given current levels of development and visitor use in the project areas it is assumed that Navajo

Mexican voles are accustomed to some levels of disturbance.

Diverting traffic from the South Entrance Station to the East Entrance Station (projected to result in a 10% increase over the life of this plan) could result in more traffic noise and displacement of Navajo Mexican voles that breed or forage in this area. More vehicles could also increase the potential for direct mortality from trampling. More noise could disrupt breeding and cause reduced breeding success, and could also cause some delayed feedings. This would all contribute to limited population fluctuations, especially considering existing use at the East Entrance Station. As a result, there would be local, long-term, minor, adverse impacts on Navajo Mexican voles during operations.

This alternative would reduce impacts to Navajo Mexican vole habitat caused by vehicle parking along roadsides near Mather Point and the associated impacts of social trailing (soil compaction, vegetation trampling, and introduction of nonnative species). This would have local, long-term, negligible, beneficial effects to Navajo Mexican voles near Mather Point.

**Tusayan Flameflower.** As previously described, Tusayan flameflowers have been identified in the vicinity of Canyon View Information Plaza / Mather Point and the Tusayan project area. Nonnative species with the potential to outcompete the Tusayan flameflower could be inadvertently introduced and spread in construction and staging areas. However, mitigation measures (e.g., pressure-washing construction equipment, revegetating disturbed areas using site-selected native species as soon as possible after construction, and monitoring/controlling nonnatives) would be used to minimize this potential. As a result, there would be local, short-term, negligible to minor, adverse impacts to this species from the potential for nonnatives to be introduced and spread in these project areas.

Ongoing surveys by park biologists have determined exact locations of this species, and it is anticipated that the 89 documented flameflowers would be avoided. About 15 acres of habitat would be lost in the Canyon View Information Plaza / Mather Point area, of which approximately 4 acres provide habitat for the Tusayan flameflower.

At Tusayan alternative C would result in the loss of 17 acres of Tusayan flameflower habitat and approximately 1,060 individual plants that occur within the construction footprint.

Overall impacts on the Tusayan flameflower would be local, long-term, moderate, and adverse from mortality and loss of habitat.

Alternative C would create 12,071 linear feet of new edge habitat at Canyon View Information Plaza / Mather Point and Tusayan that would be susceptible to the spread of non-native plants with the potential to outcompete Tusayan flameflowers. Restoring approximately 1 acre of habitat at Canyon View Information Plaza / Mather Point could also create an establishment opportunity for nonnative species. However, taking into consideration existing fragmented conditions and the mitigation measures described for vegetation (e.g., monitoring for nonnatives and revegetating as soon as possible), impacts from the potential for nonnative species would be local, long-term, negligible to minor, and adverse.

This alternative would reduce impacts to Tusayan flameflowers and their habitat from vehicle parking along roadsides near Mather Point and associated impacts of social trailing (soil compaction, vegetation trampling, and introduction of nonnative species). This would have local, long-term, negligible, beneficial effects to Tusayan flameflowers.

### Cumulative Impact

Past, present, and reasonably foreseeable actions with the potential to have cumulative impacts to special status species include those

described for alternative A under the analysis of impacts to vegetation. The original construction of Canyon View Information Plaza and Mather Point most likely resulted in the direct loss of Tusayan flameflowers and certainly reduced potential habitat for this species. This impact from past activities has been local, long-term, minor to moderate, and adverse. The construction of overlooks, trails, and roads in the immediate vicinity of the South Rim has likely resulted in local, long-term, minor, adverse impacts to raptors, such as the bald eagle, Mexican spotted owl, and peregrine falcon. Trail and road projects, as well as facility upgrades, maintenance, and demolition, would have local, long-term, negligible to moderate, adverse impacts to special status species. Plans and projects, including fire management actions, would have local, long-term, minor, beneficial effects to special status species.

The impacts of the cumulative actions in combination with the local, short- and long-term, negligible to moderate, adverse impacts of alternative C would result in local, long-term, minor to moderate, adverse cumulative impacts to special status species. Incremental contributions from alternative C to overall cumulative impacts would be marginal.

### Conclusion

Alternative C would result in local, short- and long-term, negligible to moderate, adverse impacts; local, long-term, minor, beneficial impacts are expected from road removal and habitat restoration at Mather Point and from more efficient flow of traffic, especially at the South Entrance Station. Local, long-term, minor to moderate, adverse impacts to the Tusayan flameflower population at Tusayan would result from parking lot construction. Cumulative impacts would be local, long-term, minor to moderate, and adverse. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of special status species.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would not be unacceptable impacts on special status species under alternative C.

#### ***Alternative D: Canyon View Information Plaza Parking Emphasis***

##### ***Direct / Indirect Impacts***

Under alternative D construction disturbance would occur at Canyon View Information Plaza / Mather Point, South Entrance Station, and Grand Canyon Village, resulting in adverse effects on habitat for special status species. At Canyon View Information Plaza / Mather Point some previously disturbed lands would be restored to natural conditions. Construction impacts would include a potential for direct mortality to Tusayan flameflowers and Navajo Mexican voles. Impacts on special status species could also result from construction noise and increased human presence.

As described for alternative B, material storage, equipment staging, and the batch plant would occur in previously disturbed areas near project sites. As a result, there would be no impacts on habitat for special status species (e.g., loss, fragmentation, degradation) or loss of special status plants from staging or the batch plant. It is expected that special status wildlife are accustomed to some levels of disturbance in these areas, and that any potential temporary impacts on breeding or foraging species (e.g., decreased breeding success or delayed feedings, temporary dis-

placement) would be minimal. If there was a need to treat for nonnative vegetation in these areas, it would be considered. In addition, all staging areas would be returned to pre-construction conditions or better once construction had been completed.

Construction equipment would access all project sites on existing roads used by visitors under alternative D. Visitors displaced during construction activities could increase impacts on special status species in other locations of the project area. This could include wildlife/vehicle interactions that could result in mortality; displacement due to noise and the presence of people/vehicles, etc.; potential disruption of breeding or foraging activities; and impacts to special status species habitat and special status plants associated with social trailing, such as trampling of vegetation and compaction of soils.

These activities would contribute to temporary population fluctuations within the project areas as described in detail below for each species.

**Bald Eagle.** As previously discussed under alternative B, there are no issues with nesting or roosting bald eagles at the Canyon View Information Plaza, Mather Point, the South Entrance Station, the Greenway Trail, Grand Canyon Village, Yavapai Observation Station, or the East Entrance. While there are no issues with nesting bald eagles at Yaki Point, there has been an historical winter roost at the Pipe Creek overlook.

Any presence of bald eagles in project areas would be seasonal and migratory. Construction and operations impacts could include disturbance and the effects of temporal and spatial displacement from the South Rim. This would minimally affect bald eagle movement through the area, and would have no population level effects, especially given current development and operations at the project site. Therefore, alternative D would have local, short- and long-term, negligible, adverse impacts on the species.

**Mexican Spotted Owl.** The nearest nesting occurrence of Mexican spotted owls is farther than 0.5 mile from the plan project area, except for the road removal proposed at Mather Point, which would be undertaken outside the breeding season to lessen potential effects to the greatest extent possible. As a result, the noise and presence of people and equipment during construction is not expected to affect breeding success, especially considering the current levels of activity at Mather Point.

Short-term, construction-related impacts described for alternative B (e.g., displacement that increases competition for resources, delayed feeding, degradation of habitat from nonnative species invasion) could affect foraging Mexican spotted owls in the vicinity of Canyon View Information Plaza / Mather Point. However, given the current levels of activity on the South Rim, foraging owls are likely accustomed to some levels of human disturbance. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., important feeding areas) would also be taken to minimize impacts during construction. Despite the adaptability of the Mexican spotted owl and these mitigation measures, temporary population fluctuations in the vicinity of Canyon View Information Plaza and Mather Point could occur during construction as a result of displacement. Therefore, potential effects on Mexican spotted owls from construction-related activities would be local, short-term, minor, and adverse.

Occasional foraging habitat may be provided at Canyon View Information Plaza / Mather Point. The net area of disturbance at this site would be 26 acres (including a loss of an estimated 2,637–3,223 piñon pine and juniper trees) and the loss of habitat for 390–520 small mammals, which could be prey for Mexican spotted owls.

As described for alternative B, the loss of foraging habitat and prey could displace individual owls and increase competition for resources in adjacent occupied habitat. Miti-

gation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding and important foraging areas) and initiating revegetation as soon as possible after construction, would help offset some impacts by limiting habitat loss and the number of prey displaced. This loss of habitat could ultimately cause small population fluctuations in the vicinity of Canyon View Information Plaza / Mather Point and increase stress on displaced spotted owls in adjacent areas. However, available resources in surrounding habitat are expected to be able to accommodate displaced individuals, given that they are used only occasionally by foraging owls. Impacts on Mexican spotted owls would be local, long-term, minor, and adverse as a result of decreased prey and the loss of foraging habitat at Canyon View Information Plaza / Mather Point.

As described for alternative B, new roads and parking lots could cause some habitat fragmentation and create 15,367 linear feet of edge habitat and the potential for edge effects at Canyon View Information Plaza / Mather Point. These new edge areas would also be susceptible to the spread of nonnative vegetation, which could degrade spotted owl foraging habitat. Restoring approximately 5 acres of habitat would also create an opportunity for the establishment of nonnative species. Taking into consideration current fragmented conditions and mitigation measures described for wildlife (e.g., monitoring and controlling nonnatives; revegetating as soon as possible) would result in local, long-term, minor, adverse impacts on foraging Mexican spotted owls and their habitat from the potential for the introduction and spread of nonnative species.

In the long term restoring 5 acres of foraging habitat at Mather Point would result in a local, minor, beneficial impact. This restoration would also reduce the effects of noise and human activity in this area of the South Rim. Revegetation of restored areas to standards of natural conditions would not be completed

until after the life of this plan due to the arid climate and soil conditions on the South Rim.

Operational impacts would include disturbances from visitor use, traffic noise, and impacts to night skies that could affect foraging Mexican spotted owls. As described for alternative B, these disturbances would have little effect on population fluctuations given existing developments and visitor use in the area, as well as mitigation measures for night skies (e.g., zoning, limiting lighting by using trees and other light-absorbing elements in the landscape, using fully shielded fixtures, and regulating exterior lighting with a timer or motion sensor). As a result, impacts to foraging owls would be long-term, minor, and adverse.

This alternative would also reduce impacts to Mexican spotted owl foraging habitat caused by vehicle parking along roadsides near Mather Point and the associated impacts of social trailing (soil compaction, vegetation trampling, and introduction of nonnative species). This would have local, long-term, negligible, beneficial effects to Mexican spotted owls.

**California Condor.** Impacts under alternative D for the California condor would be similar to those under alternative B. There would be no impacts on nesting habitat, but this species is known to forage in the Canyon View Information Plaza / Mather Point project area, and it is known to frequent construction sites, which could alter natural feeding patterns as described for alternative B. As a result, mitigation measures (monitoring for the birds' presence during construction, hazing birds if present, educating contractors, and cleaning up construction sites) would be taken to minimize the likelihood of condors visiting construction sites. Mitigation measures for wildlife, such as avoiding or minimizing impacts to ecologically important habitat (e.g., important feeding areas) would also be implemented and would also minimize impacts to California condors. Despite these mitigation measures, there would be local,

short-term, minor adverse impacts to California condors due to temporary effects on condor foraging behavior during construction in the vicinity of Canyon View Information Plaza / Mather Point.

Occasional foraging habitat may be provided at Canyon View Information Plaza / Mather Point. The net area of disturbance at this site would be 26 acres (including a loss of an estimated 2,637–3,223 piñon pine and juniper trees) and the loss of habitat for 390–520 small mammals, which could be prey for California condors.

As described for alternative B, the loss of foraging habitat and loss of prey could displace individuals and increase competition for resources in adjacent occupied habitat. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding and important foraging areas) and initiating revegetation as soon as possible after construction, would help offset some impacts by limiting habitat loss and the number of prey displaced. This loss of habitat would ultimately cause small population fluctuations in the vicinity of Canyon View Information Plaza / Mather Point and increase the stress on displaced California condors in adjacent areas. However, available resources in the surrounding habitat are expected to be able to accommodate displaced individuals, given they are used only occasionally by this species. As a result, there would be local, long-term, minor, adverse impacts on California condors as a result of decreased prey and the loss of foraging habitat in the Canyon View Information Plaza / Mather Point area.

As described for the Mexican spotted owl, new roads and parking lots could cause some habitat fragmentation and create new edge habitat (approximately 15,367 linear feet) that would be susceptible to invasion by nonnative plants and animals. This could increase competition for resources in this area and degrade California condor foraging habitat.

Restoring approximately 5 acres of habitat in this area could also allow the establishment of nonnative species; however, taking into consideration current fragmented conditions and taking mitigation measures described for wildlife (e.g., monitoring nonnatives and revegetating as soon as possible) would minimize potential effects from nonnatives. As a result, impacts on foraging California condors and their habitat at Canyon View Information Plaza / Mather Point would be local, long-term, negligible to minor, and adverse.

Ultimately, there would be local, long-term, minor, beneficial effects from reducing noise and human disturbance near Mather Point close to the canyon rim, and by restoring 5 acres of foraging habitat for condors. Revegetation of restored areas to natural conditions would not be completed until after the life of this plan due to the arid climate and soil conditions on the South Rim.

Operational impacts would include disturbances from visitor use and traffic noise that could displace foraging California condors or cause delays in feedings. These disturbances would have little effect on population fluctuations given existing developments and visitor use in the area. As a result, alternative D would have local, long-term, minor, adverse impacts to foraging condors and their habitat from operations in the vicinity of Canyon View Information Plaza / Mather Point.

This alternative would also reduce impacts to California condor foraging habitat caused by vehicle parking along roadsides near Mather Point and the associated impacts of social trailing (soil compaction, vegetation trampling, and introduction of nonnative species). This would have local, long-term, negligible, beneficial effects to California condors.

**Peregrine Falcon.** As described under alternative B, this species does not use the piñon/juniper forest on the South Rim for nesting or foraging, preferring instead to nest and hunt over the steep cliff sides below the canyon rim. Local, short-term, minor, adverse impacts from construction near the rim (e.g., displace-

ment and delayed feedings from noise, reduced nesting success) could cause temporary effects on peregrine falcons, especially for those birds foraging in the vicinity of Grandeur Point. There would be no construction at Yaki Point that would interfere with peregrine falcons (the only activity at Yaki Point would be the painting of lines for bus parking spaces). There would be no long-term construction-related impacts (e.g., loss of prey or foraging/breeding habitat).

After construction overall noise and human disturbance in this area could increase because of expanded visitor activities, including new bus operations at Yaki Point. These impacts could cause peregrine falcons to avoid this portion of the South Rim habitat, resulting in minimal population fluctuations that would not affect this species' status in the area. As a result, there would be local, long-term, minor, adverse impacts to peregrine falcons in the vicinity of the canyon rim at Canyon View Information Plaza / Mather Point and Yaki Point.

Removing the parking lot footprint and a portion of the South Entrance Road near Mather Point would reduce noise and human disturbance in this particular area, which would have local, long-term, minor, beneficial impacts on peregrine falcons by reducing disturbances during feeding or breeding.

**Northern Goshawk.** As described for alternative B, suitable foraging and nesting habitat for northern goshawks occurs at the South Entrance Station, the Greenway Trail, Grand Canyon Village, and Tusayan project areas. Under this alternative no actions are proposed at Tusayan, so impacts at this area are not discussed. Piñon/juniper habitat at Canyon View Information Plaza, Mather Point, Yavapai Observation Station, Yaki Point, and the East Entrance Station also provides foraging habitat, especially in winter (Drennan and Beier 2003). Construction activities could displace or disrupt foraging individuals at Canyon View Information Plaza / Mather Point, increasing competition for resources in sur-

rounding areas, delaying feedings, and potentially causing the introduction and spread of nonnative species that could degrade habitat. However, available resources in surrounding areas are expected to be adequate to support displaced foraging goshawks in this project site.

Given the current levels of activity on the South Rim, foraging northern goshawks are likely accustomed to some levels of human disturbance. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., important feeding areas) would also be implemented to minimize impacts during construction. Despite the adaptability of the northern goshawk and these mitigation measures, temporary population fluctuations in the vicinity of Canyon View Information Plaza / Mather Point could occur during construction as a result of displacement. This would result in local, short-term, negligible, adverse impacts to northern goshawks. There would be no construction at Yavapai Observation Station, Yaki Point, or the East Entrance Station.

Construction noise and the presence of people at the South Entrance Station, along the Greenway Trail, and in Grand Canyon Village could adversely affect nesting and foraging northern goshawks and their habitat, including one documented nest site. However this nest site is approximately 0.75 mile from the South Entrance Station and would not be affected by construction at this site. Even though the nest site would be outside the construction footprint for the Greenway Trail, construction-related activities could disturb nesting, as well as foraging northern goshawks, which could reduce breeding success or disrupt foraging. Displacement could increase competition for resources in the surrounding areas; however, it is assumed that surrounding habitat could accommodate displaced individuals. As a result, there would be local, short-term, minor to moderate, adverse impacts on northern goshawks in these areas.

Long-term construction impacts would include loss of nesting and foraging habitat, as well as the loss of prey. Alternative D would result in the following site-specific impacts:

- the loss of approximately 26 acres of foraging habitat at Canyon View Information Plaza / Mather Point (including an estimated 2,637–3,223 piñon pine and juniper trees), and the loss of habitat for approximately 390–520 small mammals (potential prey for northern goshawks)
- the loss of approximately 3 acres of nesting and foraging habitat at the South Entrance Station (including an estimated 585–714 piñon pine, Utah juniper, and ponderosa pine trees), and the loss of habitat for approximately 39–45 small mammals
- the removal of approximately 3 acres of nesting and foraging habitat along the Greenway Trail (including an estimated 585–714 ponderosa pine trees), and the loss of habitat for approximately 39–45 small mammals
- no impacts on northern goshawk habitat at lot D because all construction activities would occur within the existing disturbed area
- the loss of approximately 1 acre of mature ponderosa pine habitat due to construction of shuttle bus stops; however, mature trees would be avoided, and the number of trees to be removed would be minimal, with a minimal loss of habitat for birds and small mammals.

Construction would contribute minimally to habitat fragmentation at Canyon View Information Plaza / Mather Point, the South Entrance Station, and Grand Canyon Village given present development. Habitat would be fragmented in undeveloped areas along the Greenway Trail; however, given its proximity to the existing South Entrance Road, it is assumed that goshawks are accustomed to these conditions.

Alternative D would create 31,943 linear feet of edge habitat that would be susceptible to the spread of nonnative plants and animals, which could increase competition and degrade habitat for goshawks. Restoring approximately 5 acres of habitat at Canyon View Information Plaza / Mather Point would also create establishment opportunities for nonnative species. However, taking into consideration existing fragmented conditions and the mitigation measures described for wildlife (e.g., monitoring/controlling nonnatives and revegetating as soon as possible), would minimize the effects, resulting in local, long-term, minor, adverse impacts from the potential for nonnative species invasion.

Ultimately, there would be local, long-term, minor, beneficial effects from reducing noise and human disturbance near Mather Point close to the canyon rim, and by restoring 5 acres of foraging habitat for northern goshawks. Revegetating restored areas to natural conditions would not be completed until after the life of this plan due to the arid climate and soil conditions on the South Rim.

Operational impacts would include the effects of overall noise and human disturbance in project areas, as described previously (e.g., displacement from noise, reduced breeding success, delayed feeding). However, given current levels of development and visitor use in the project areas, it is assumed that northern goshawks are accustomed to some levels of disturbance.

Diverting traffic from the South Entrance Station to the East Entrance Station (projected to result in a 10% increase over the life of this plan) could result in more traffic noise and displacement of northern goshawks that nest or forage in this area. This could result in a slight decrease in breeding success and cause some delayed feedings or displacement of foraging goshawks, but the effects would be minimal on population fluctuations given existing vehicle use in this area. As a result, impacts on northern goshawks during opera-

tions would be local, long-term, minor, and adverse.

This alternative would reduce impacts to northern goshawk foraging habitat caused by vehicle parking along roadsides near Mather Point and the associated impacts of social trailing (soil compaction, vegetation trampling, and introduction of nonnative species). This would have local, long-term, negligible, beneficial effects to northern goshawks near Mather Point.

The addition of more lanes of traffic at the South Entrance Station could actually have a local, long-term, negligible, beneficial impact on breeding and foraging northern goshawks and their habitat by reducing traffic backups that contribute to noise and air quality impacts in the area.

**Navajo Mexican Vole.** As previously described, the Navajo Mexican vole usually prefers habitat in dense thickets with some openings or grassy areas near ponderosa pine forests, but it may occupy habitat in piñon/juniper forest. It has not been detected in the vicinity of project areas at Canyon View Information Plaza, Mather Point, Grand Canyon Village, Yavapai Observation Station, Yaki Point, or the East Entrance Station. If present, voles could be affected by noise, mortality from construction vehicles, and displacement from potential habitat at Canyon View Information Plaza / Mather Point and Grand Canyon Village. However, park staff would trap and relocate any individuals from suitable habitat before construction, which would minimize the potential for direct mortality. Relocating Navajo Mexican voles into surrounding habitat, which is assumed to be occupied, could increase competition for resources. Because the number of Navajo Mexican voles that would have to be relocated after trapping is expected to be minimal, they would likely be accommodated in suitable habitat nearby.

Impacts from construction (displacement, direct mortality, reduced breeding success, and disruption of foraging, degradation of

habitat from nonnatives) could cause some temporary population fluctuations. Given the current levels of activity on the South Rim, Navajo Mexican voles are likely accustomed to some levels of human disturbance. Mitigation measures described for wildlife, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., important feeding areas), would also be taken to minimize impacts during construction. As a result, there would be local, short-term, minor, adverse impacts. Voles have also been detected in the ponderosa pine habitat in the vicinity of the South Entrance Station, making impacts more likely in this project area. There would be no construction activities in the other project areas that support piñon/juniper habitat.

The following potential habitat areas for Navajo Mexican voles could be lost:

- 26 acres at Canyon View Information Plaza / Mather Point
- 3 acres at the South Entrance Station
- 1 acre at Grand Canyon Village
- 3 acres along the Greenway Trail route

As described for alternative B, this loss of breeding and foraging habitat could cause Navajo Mexican voles to seek foraging and nesting opportunities in adjacent areas of occupied habitat, which could increase competition for resources. However, it is expected that surrounding areas could accommodate displaced voles. Mitigation measures, such as avoiding or minimizing impacts to ecologically important wildlife habitat (e.g., known breeding and important foraging areas) and initiating revegetation as soon as possible after construction, would help offset some impacts by limiting habitat loss. This loss of habitat could ultimately cause population fluctuations in the vicinity of these project areas and could increase stress on displaced Navajo Mexican voles and the species that occur in adjacent areas. This would result in local, long-term, minor to moderate, adverse impacts to this species.

Construction would contribute minimally to habitat fragmentation at Canyon View Information Plaza / Mather Point, the South Entrance Station, and Grand Canyon Village, given existing development. Habitat would be fragmented in undeveloped areas along the Greenway Trail; however, given its proximity to the existing South Entrance Road, it is assumed that voles are accustomed to these conditions in this area.

Alternative D would create 31,943 linear feet of edge habitat that would be susceptible to the spread of nonnative vegetation, which could degrade habitat for voles. Restoring approximately 5 acres of habitat at Canyon View Information Plaza / Mather Point would also create establishment opportunities for nonnative species. However, taking into consideration existing fragmented conditions and implementing the mitigation measures described for wildlife (e.g., monitoring/controlling nonnatives and revegetating as soon as possible), impacts from the potential for nonnative species to occur would be local, long-term, minor, and adverse.

Ultimately, there would be long-term, minor, beneficial effects from reducing noise and human disturbance near Mather Point close to the canyon rim, and by restoring 5 acres of habitat for Navajo Mexican voles. Revegetating restored areas to natural conditions would not be completed until after the life of this plan due to the arid climate and soil conditions on the South Rim.

Operational impacts would include the effects of overall noise and human disturbance in project areas, as described previously (e.g., displacement from noise, reduced breeding success, delayed feeding). However, given current levels of development and visitor use in the project areas, it is assumed that Navajo Mexican voles are accustomed to some levels of disturbance.

Diverting traffic from the South Entrance Station to the East Entrance Station (projected to result in a 10% increase over the life of this plan) could result in more traffic noise and

displacement of Navajo Mexican voles that breed or forage in this area. More vehicles could also increase the potential for direct mortality from trampling. More noise could disrupt breeding and cause reduced breeding success and could also cause some delayed feedings. This would all contribute to limited population fluctuations, especially considering existing use at the East Entrance Station. As a result, impacts on Navajo Mexican voles during operations would be local, long-term, minor, and adverse.

This alternative would reduce impacts to Navajo Mexican vole habitat caused by vehicle parking along roadsides near Mather Point and the associated impacts of social trailing (soil compaction, vegetation trampling, and introduction of nonnative species). This would have local, long-term, negligible, beneficial impacts to Navajo Mexican voles near Mather Point.

**Tusayan Flameflower.** Tusayan flameflowers have been detected in the vicinity of the Canyon View Information Plaza / Mather Point. Nonnative species with the potential to outcompete Tusayan flameflower could be inadvertently introduced and spread in construction and staging areas. However, mitigation measures (e.g., pressure-washing construction equipment, revegetating disturbed areas using site-selected native species as soon as possible after construction; and monitoring/controlling nonnatives) would be used to minimize this potential. As a result, impacts to this species from the potential for nonnatives to be introduced and spread in project areas would be local, short-term, negligible to minor, and adverse.

Ongoing surveys by park biologists have determined exact locations of this species, and it is anticipated that the 89 documented Tusayan flameflowers would be avoided. There would be a loss of 26 acres of habitat in the Canyon View Information Plaza / Mather Point project area, of which approximately 10 acres is suitable for Tusayan flameflower habitat. This loss of habitat would be measur-

able, but would not affect the status of the Tusayan flameflower population. Therefore, impacts to the Tusayan flameflower would be local, long-term, minor, and adverse.

Alternative C would create 15,367 linear feet of new edge habitat at Canyon View Information Plaza / Mather Point that would be susceptible to the spread of nonnative plants with the potential to outcompete Tusayan flameflowers. Restoring approximately 5 acres of habitat at Canyon View Information Plaza / Mather Point could also create an establishment opportunity for nonnative species. However, taking into consideration existing fragmented conditions and implementing mitigation measures described for vegetation (e.g., monitoring for nonnatives and revegetating as soon as possible) would minimize effects, resulting in local, long-term, minor, adverse effects from the potential for nonnative species to occur.

This alternative would reduce impacts to Tusayan flameflowers and their habitat from vehicle parking along roadsides near Mather Point and the associated impacts of social trailing (soil compaction, vegetation trampling, and introduction of nonnative species). This would have local, long-term, negligible, beneficial impacts to Tusayan flameflowers.

#### Cumulative Impacts

Past, present, and reasonably foreseeable actions with the potential to have cumulative impacts to special status species include those described for alternative A under the analysis of impacts to vegetation. The original construction of Canyon View Information Plaza and Mather Point most likely resulted in the direct loss of Tusayan flameflowers and certainly reduced potential habitat for this species. The impact from past activities has been local, long-term, minor to moderate, and adverse. The construction of overlooks, trails, and roads in the immediate vicinity of the South Rim has likely resulted in local, long-term, minor, adverse impacts to raptors, such as the bald eagle, Mexican spotted owl, and peregrine falcon. Trails and road projects, as

well as facility upgrades, maintenance, and demolition, would have local, long-term, negligible to moderate, adverse impacts to special status species. Plans and projects, including fire management actions, would have local, long-term, minor, beneficial effects to special status species.

The impacts of the cumulative actions in combination with the local, short- and long-term, negligible to moderate, adverse impacts of alternative D would result in local, long-term, minor to moderate, adverse cumulative impacts to special status species. Incremental contributions from alternative D to overall cumulative impacts would be marginal.

### Conclusion

Alternative D would result in local, short- and long-term, negligible to moderate, adverse impacts; local, long-term, minor, beneficial impacts are also expected as a result of restoring a road section at Mather Point and more efficient traffic flow at the South Entrance Station. Cumulative impacts would be local, long-term, minor to moderate, and adverse. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of special status species.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would not be unacceptable impacts on special status species under alternative D.

## **SOUNDSCAPES**

### **Affected Environment**

#### ***Background Information***

Natural soundscapes are composed completely of natural sounds without the presence of human-made sounds (NPS 2006d). Physical and biological components such as wind, water, weather, birds, and insects help create the natural soundscape. The natural soundscape is an important park resource and is specifically identified as a resource requiring protection in the 1975 Grand Canyon National Park Enlargement Act; the 1987 National Parks Overflights Act; the 1995 *General Management Plan*; and the National Parks Air Tour Management Act of 2000. One of the management objectives in the *General Management Plan* 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.

Noise is sound that can degrade the natural soundscape. Sound can be perceived as noise because of loudness, frequency, duration, and occurrence at unwanted times or from an unwanted source, or because it interrupts or interferes with a desired activity. In a national park setting, noise is a subset of human-made sounds that may adversely affect park resources, including visitor experiences or biological resources, by modifying or intruding on the natural soundscape or by impeding or covering the natural sounds that are an intrinsic part of the park environment (NPS 2006d). Noise may vary in character from day to night, and from season to season.

Sound is measured in a logarithmic scale using units called decibels (dB). Sound is composed of various frequencies, but the human ear does not respond to all frequencies. The A-weighted decibel scale (dBA) takes this into account and emphasizes the frequencies between 1 kilo Hertz (kHz) and 6.3 kHz in an effort to simulate the relative response of

human hearing. Table 21 shows a range of decibel levels for recognizable sounds.

The threshold of perception of the human ear is approximately 3 dBA, which is considered barely perceptible, and a 5 dBA change is considered to be clearly noticeable. A 10 dBA increase in the measured sound level is typically perceived as being twice as loud, and a 10 dBA decrease as half as loud (Minnesota Pollution Control Agency 1999). For example, a 70 dBA sound level will be perceived by an average person as twice as loud as a 60 dBA sound (USFS 2007).

Individual dBA ratings for different noise sources cannot be directly added to provide the combined sound level. For example, two noise sources producing equal dBA ratings at a given location will produce a combined noise level 3 dBA greater than either sound alone. When two noise sources differ by 10 dBA, the combined noise level will be 0.4 dBA greater than the louder source alone (USFS 2007).

Many factors affect how an individual responds to noise. Primary acoustical factors include the sound level, its frequency, and duration. Non-acoustical factors also play a role in how an individual responds to sounds. These factors vary from past experience and adaptability of an individual to the predictability of when a noise may occur. The listener's activity also affects how he/she responds to noise (Mestre Greve Associates 2005).

Some human-caused sound can be considered acceptable in that it results from uses for which the park was created. *Director's Order #47, Soundscape Preservation and Noise Management*, requires park units to determine the level of human-caused sound that is necessary for park purposes, and to achieve that level by reducing noise and restoring natural soundscape to the greatest extent possible (NPS 2000).

Nearly all agencies and organizations with authority over noise-producing sources (including the World Health Organization and the National Research Council) use 55 dBA as

**TABLE 21. SOUND LEVEL COMPARISON CHART**

Decibels (dBA)	Equivalent Sounds
180	Rocket launching pad
140	Gunshot blast, jet engine
130	Air raid siren at 3 feet
120	Automobile horn, rock concert
110	Sandblasting, power saw at 3 feet
100	Woodworking shop, power mower at 3 feet, snowmobile
95	Subway, screaming child
90	Average factory, outboard motor, heavy truck traffic
80	Noisy restaurant
75	Busy traffic
70	Typical office, piano practice
60	Normal conversation
50	Average home
45	Refrigerator hum
40	Quiet room
30	Whisper, secluded woods
20	Rustling leaves

SOURCE: Musani n.d.; Dumond 2000; Henderson n.d.; Minnesota Pollution Control Agency 1999; Galen Carol Audio n.d.

the threshold for defining day-night noise levels in urban areas. Many of these organizations recommend a lower threshold for sparsely populated suburban and rural residential areas, and a 10 dBA reduction for rural areas (Schomer and Associates 2001).

#### Noise Attenuation

Factors affecting noise impacts include the distance from the noise source, the frequency of the sound, the absorbency of the intervening terrain, the presence or absence of obstructions, and the duration of the noise event. The degree of impact also depends on who is listening, the existing sound levels, and when the noise event takes place. Topographic features and structural barriers that absorb, reflect, or scatter sound waves can increase or decrease noise levels (USFS 2007), as described below:

- *Distance* — Noise levels depend on the distance from the noise source and the attenuation of the surrounding environment. At distances greater than 50 feet from a sound source, every doubling of distance produces a 6 dBA reduction in the sound. Therefore, a sound level of 70 dBA at 50 feet would have a sound

level of approximately 64 dBA at 100 feet, and at 200 feet, approximately 58 dBA (New York State Department of Environmental Conservation [NYSDEC] 2000).

- *Air Absorption* — Sound energy is absorbed in the air as a function of temperature, humidity, and the frequency of the sound. This attenuation can be up to 2 dBA over 1,000 feet. Such attenuation is short-term and occurs over a great distance. Sound waves bend towards cooler temperatures, and temperature inversions may allow for more distant transmission of sound (NYSDEC 2000).
- *Land Forms and Structures* — Sound levels can be accentuated or focused by certain features, causing noise at specified locations, such as structures. The location of structures can influence noise impact potential (NYSDEC 2000). Large structures at the South Rim include those at Canyon View Information Plaza and the historic Grand Canyon Village. Even though the area is not hilly, it generally slopes upward closer to the rim.
- *Trees* — Vegetation can provide a noticeable noise reduction, but to do so it must be at least 15 feet high, 100 feet wide, and dense enough to completely obstruct the line-of-sight between the source and the receiver. This size of vegetation area may provide up to 5 dBA of noise reduction. Taller, wider, and denser areas of vegetation may provide even greater noise reduction. The maximum reduction that can be achieved is approximately 10 dBA (FHWA 2000). Evergreens provide a better vegetative screen than deciduous trees (NYSDEC 2000). Much of the South Rim is moderately vegetated with piñon, juniper, and ponderosa pines.



Motorcycles, heavy vehicles (trucks and buses), and vehicles with faulty exhaust systems tend to produce high noise levels within the park.

### Automobile and Bus Noise

Motor vehicles cause various types of noise, including engine acceleration, tire/road contact, braking, horns and vehicle theft alarms (Victoria Transport Policy Institute 2007). The noise made by a motor vehicle depends on basic vehicle design, whether the vehicle's exhaust system has become defective with use, whether the vehicle's exhaust system has been modified, and how the vehicle is operated. Vehicle noise characteristics are closely related to engine size (Miller 1982).

Heavy vehicles can cause vibration and infrasound (low frequency noise). Motorcycles, trucks, and buses, and vehicles with faulty exhaust systems tend to produce high noise levels. Diesel bus noise is estimated in one study to be five times louder than an automobile. Motorcycles are estimated to be 10 times noisier than automobiles. At low speeds most noise comes from the vehicle engine and drivetrain, at higher speeds aerodynamic and tire/road noise dominate (Victoria Transport Policy Institute 2007).

Generally, loudness is increased by heavier traffic volumes, higher speeds, and a greater number of trucks, as well as defective mufflers or other faulty equipment on vehicles. Any condition (such as a steep incline) that causes heavy laboring of motor vehicle engines also increases noise levels. Other, more complicated factors affect the loudness of traffic noise. For example, as a person moves away from a roadway, noise levels are reduced by distance, terrain, vegetation, and natural and

**TABLE 22. MAXIMUM PERMISSIBLE SOUND LEVEL READINGS**

Distance between Listener and Vehicle	Decibels (dBA)			
	Soft Site*		Hard Site**	
	35 mph or less	Above 35 mph	35 mph or less	Above 35 mph
31–34 feet	87	91	89	93
35–38 feet	86	90	88	82
39–42 feet	85	89	87	81
43–47 feet	84	88	86	80
48–57 feet	83	87	85	89
58–69 feet	82	86	84	88
70–82 feet	81	85	83	87

SOURCE: Federal Motor Carrier Safety Administration 1989.  
 \*Soft site means that the ground surface is covered with grass, other ground cover, or similar absorptive material for one-half or more of the distance between the listener and the vehicle.  
 \*\*Hard site means that the ground surface is covered with concrete, asphalt, packed dirt, gravel, or similar reflective material for more than on-half the distance between the listener and the vehicle.

manmade obstacles, as discussed above (FHWA 1995) (see Table 22).

Most U.S. manufactured passenger automobiles having 8- or 6-cylinder engines, as measured along roads with speed limits of 35 mph or less, produce maximum passby sound levels between 60 and 75 dBA. The mean level, based on a study of 3,936 vehicles, was 67.9 dBA (Miller 1982). Federal regulations define maximum allowable noise levels for motor

**TABLE 23. SOUND LEVELS FOR VEHICLE TYPES**

Type of Vehicle	Sound Level (dBA)
Gasoline passenger car	62–67
Medium-sized truck	73–78
Urban diesel bus	80–85
Heavy Truck	80–85

SOURCE: Edmonton Trolley Coalition n.d.

**TABLE 24. NOISE ABATEMENT CRITERIA HOURLY A-WEIGHTED SOUND LEVEL (dBA)**

Decibels (dBA)	Type of Area
60 (Exterior)	Category A: Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
70 (Exterior)	Category B: Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
75 (Exterior)	Category C: Developed lands, properties, or activities not included in Categories A or B above.

SOURCE: FHWA 1995.

vehicles, as shown in Table 22.

Traffic control techniques can sometimes reduce noise problems. For example, trucks can be prohibited from certain streets and roads, or they can be permitted on certain streets and roads only during daylight hours. Traffic lights can be changed to smooth out traffic flow and to eliminate frequent stops and starts. Speed limits can be reduced, but about a 20 mph reduction is necessary for a noticeable decrease in noise (FHWA 1980).

The noise level on a typical city street with automobile traffic averages 60–65 dBA; larger vehicles like heavy trucks and diesel buses cause noise peaks ranging up to about 90 dBA. Table 23 gives sound levels associated with various types of vehicles; the measurements were made with the vehicles traveling in urban conditions at 27–37 mph (Edmonton Trolley Coalition n.d.).

Because a 10 dBA increase in noise is perceived as twice as loud, the medium-sized truck in Table 23 would be perceived as twice as loud as the passenger car, and the diesel bus would be perceived as approximately twice as loud as the truck (assuming a noise level for each of 65, 75, and 85 dBA respectively).

Table 24 shows the decibel levels where noise abatement must be considered for different types of activities, as determined by the Federal Highway Administration. The criteria are only used as absolute values, and when approached or exceeded, traffic noise abatement measures must be considered (FHWA 1995).

Construction Noise

Noise from construction equipment can vary from intermittent to fairly continuous. Assuming that a truck (90 dBA), scraper-grader (87 dBA), moveable crane (82 dBA), tractor (85 dBA), and two saws (78 dBA) are operating in the same area, peak construction-period noise would generally be about 93 dBA at 50 feet from the construction site (EPA 1971, cited in USFS 2007). As distance from the noise source doubles, the decibel level would decrease by 6 dBA. Therefore, using

this scenario, peak construction noise would be 87 dBA at 100 feet, 81 dBA at 200 feet, 75 dBA at 400 feet, etc. (USFS 2007).

**Noise Levels at Grand Canyon National Park**

Extensive ambient, or background, noise measurements have been gathered in Grand Canyon National Park, and an ongoing effort continues to measure sounds in many park areas, including locations in the study area. Table 25 provides sounds levels as measured at selected locations in the study area.

As described below under the “Visitor Experience” section, the South Rim of Grand Canyon National Park receives nearly 4.5 million visitors annually, with most visitors arriving through the South Entrance Station. Canyon View Information Plaza, the South Entrance Road corridor, and Grand Canyon Village are managed as developed areas. Human noise sources are commonly present and include private vehicles, shuttle buses, tour buses, and NPS and concessioner vehicles; the train; hikers and bicyclists; activities at parking areas, lodging, and restaurants; and overflights (tour and non-tour). Typical sound levels for some these types of noise sources are shown in Table 26.

As visitor numbers increase, so does the level of human-related noises from conversations, private vehicles, tour buses, shuttle buses, and parking area activities. Peak visitor use occurs in June, July and August, and sound levels from human noise are highest during the daytime. Although the majority of the study area is developed with a high occurrence of human noise sources, specific noise sources, frequencies, and durations vary at different locations. Existing noise sources and sound-scape conditions at specific locations in the study area are described below.

**Canyon View Information Plaza**

Canyon View Information Plaza includes a visitor center, outdoor displays, and a bookstore. Although not directly accessible by private vehicle, this is the primary South Rim

**TABLE 25. SOUND MEASUREMENTS AT SELECT LOCATIONS IN THE STUDY AREA**

Location	Typical Measured Ambient Level (dBA)*	Range of Measured Ambient Levels (dBA)
Canyon View Information Plaza (between tour bus parking and Kaibab Trail route shuttle bus stop)	42.3	18.3 to 78.8
Village Loop Drive (west end)	55.2	26.3 to 99.8
South Entrance Road	51.2	14.5 to 84.4
Mather Point Parking Lot	51.4	18.20 to 95.4
Desert View Drive	38.7	16.30 to 78.0

SOURCE: NPS 2007g.  
 \* These dBA values represent the level of sound that was exceeded 50% of the time during summer shuttle bus operations (4 a.m.–9 p.m. daily).

location for commercial tour bus parking and drop-off, and it is the shuttle bus transfer point for the Village, Kaibab Trail, and Canyon View Information Plaza / Mather Point routes. Additionally, the Greenway Trail runs through the plaza to Mather Point.

The primary sources of human noise at Canyon View Information Plaza are shuttle bus and tour bus operations, including idling and operating vehicle noise, shuttle and tour bus passenger loading/unloading, and passenger queuing at the shuttle stops. Secondary

**TABLE 26. SOUND LEVELS FOR TYPICAL NOISE SOURCES IN THE STUDY AREA**

Sound Source	Distance (feet)	Sound (dBA)
Conversation between two people	0	60
Tour Bus	10	82–86
Tour Bus	50	60–70
Tour Bus Passing	20	82
Shuttle Bus Passing	20	78
Automobiles Passing	20	65
Airplane Taking Off	1,000	75–82
Airplane Landing	1,000	62
Helicopter Taking Off	200	88
Helicopter Landing	200	80
Steam Train Whistle	100	90–100
Steam Train Whistle	1,000	72–74
Diesel Train Whistle	1,000	80
Train Bell	200	60
Steam Train	50	90
Diesel Train	50	80
Train	500	70

SOURCE: NPS 1995a.

noise sources include visitor activities related to the visitor center, outdoor displays, and the bookstore. The frequency of tour bus and shuttle bus service varies, depending on the time of day, and the time span of daily service varies depending on the time of year. Parking is currently provided for 24 tour buses and approximately 30 buses per day access this area in the peak season (DEA 2006). The Village, Kaibab Trail and Canyon View Information Plaza / Mather Point shuttle buses run year-round, with peak ridership and service frequencies during June, July and August between 11 a.m. and 12 p.m. each day. Between the three shuttle routes and the tour buses, passenger loading/unloading occurs at least every 10 minutes during peak times.

Given the level of activity at Canyon View Information Plaza, multiple sources of human noise are relatively constant during daylight hours in the peak season. Noise sources are less frequent and of lower magnitude in the early morning and late evening hours and during the off-peak seasons.

#### Mather Point

The Mather Point overlook, one of the park's most popular viewing points, is on the canyon rim north of the information plaza, approximately 250 feet from the South Entrance Road. Visitors arrive on foot, bicycle, in private vehicles and by shuttle bus. Human noise sources include visitors at the overlook, hikers on the Rim Trail, activities in the adjacent parking area, vehicles on the South Entrance Road, and overflights (non-airtour).

Although natural quiet is a desirable condition at overlooks, the location of this overlook in the developed area near Canyon View Information Plaza contributes to a high level of human-related noise. During summer park rangers host a 30–45 minute program at Mather Point that begins 30 minutes before sunrise. Based on data collected in July 2006, the adjacent parking area is at maximum capacity (111 vehicles) between 11 a.m. and 7 p.m., and the average parking stay is approximately one hour. Shuttle buses drop-off

and pick-up passengers at this location every 15 minutes during peak times, and traffic volumes along the adjacent section of the South Entrance Road are second only to the traffic volume between the South Entrance Station and Center Road.

Multiple sources of human noise are relatively constant during daylight hours in the peak season. Human-related noise is less frequent and of lower magnitude in the early morning and late evening hours and during the off-peak seasons. However, ranger-led nighttime activities during full moon and new moon cycles contribute more noise in the late evenings at this location than in other locations in the project area.

#### South Entrance Station and SR 64

Human noise sources are very common at the South Entrance Station and include fee collection activities, staff parking area, tour bus and private vehicle traffic, and overflights (tour and non-airtour). Traffic and visitation data indicate that these noise sources are consistent and of lengthy duration during the peak season. Based on a July 2006 traffic count, the average daily traffic (ADT) volume through the South Entrance Station was 7,440 vehicles. The highest volumes of traffic in and out of the park at this location occur between 12 p.m. and 6 p.m. SR 64 extends from Tusayan to the park boundary and is surrounded by Kaibab National Forest.

Human noise sources in the SR 64 and the South Entrance Road corridors are common and are generally related to vehicle traffic and overflights. Other human noise sources could result from bicyclists, hikers, and equestrian riders on USFS trails; however, the predominant noise sources are related to vehicles and overflights.

#### Grand Canyon Village

Transportation-related activities associated with private vehicle parking, shuttle buses, tour buses, delivery vehicles, and passenger rail are the primary sources of human-related noise in Grand Canyon Village. The charac-

teristics of these facilities and services shape the existing soundscape in this area. The frequency of tour bus and shuttle bus service varies depending on the time of day, and the time span of daily service varies depending on the time of year. Approximately 80% of the visitor parking capacity on the South Rim is provided within the historic district, with an average parking duration of two hours. Tour bus access in the village is provided in the Bright Angel tour bus loading/unloading zone, and tour buses park in scattered locations throughout the area. Three tour bus parking spaces and six short-term passenger loading spaces are located at Bright Angel Lodge. Tour buses also park in lot B (Market Center), lot E (near the Backcountry Office), and in scattered informal locations throughout the village developed area.

The Village shuttle bus route serves 15 stops in the village, with service year-round. Peak ridership and service frequency are during June, July and August between 11 a.m. and 12 p.m. each day. The Hermits Rest route has one stop in the village and operates March through November. The Grand Canyon Depot is served by two trains per day during the peak season, with arrivals between 11:15 and 11:45 a.m. and departures between 3 and 4:30 p.m. Between the two shuttle routes, tour buses, and the Grand Canyon Railway, passenger loading and unloading occurs at least every 10 minutes in various areas of the village during peak times.

With the frequency of tour bus and shuttle bus activities, the volume of private vehicle parking, and visitor activity related to lodging, restaurants, and ranger-led programs, as well as occasional overflights (non-airtour), multiple sources of human noise are relatively constant during peak-season days. These noise sources are less frequent and of lower magnitude in the early morning and late evening hours and during the off-peak seasons. However, the presence of lodging and restaurant facilities contributes more human-related noise in the early morning and late

evening hours than at other locations in the project area.

#### Yavapai Observation Station

The observation station, which is open from 8 a.m. to 8 p.m. daily, is accessible to visitors on foot, bicycle, and in private vehicles or shuttle buses. Tour buses do not currently have access to this location. Human noise sources include visitors at the observation station, hikers on the Rim Trail, visitor and vehicle activity in the adjacent parking area, and overflights.

Although natural quiet is a desirable condition for overlooks, the location of this overlook in the developed area contributes to a high frequency, magnitude, and duration of visitor activity and thus human-related noise. During summer park rangers host two programs along the Rim Trail that depart from the bicycle rack at Yavapai Observation Station at 11:30 a.m. and 1:30 p.m. each day. The parking area, which has a capacity of 89 vehicles, is busiest around 2 p.m., with parking durations averaging about one hour (based on data collected in July 2006). Average daily traffic volume on the access road to the parking lot is about 2,560 vehicles during the peak season, including shuttle buses, which serve this location every 10 minutes during peak times.

With the frequency of shuttle bus service, vehicle activity in the parking area, and visitor activity at the overlook, as well as occasional overflights (non-airtour), multiple sources of human noise are relatively constant during peak-season days. Human-related noise is less frequent and of lower magnitude in the early morning and late evening and during the off-peak seasons.

#### Yaki Point

The Yaki Point overlook is approximately 1 mile east of Canyon View Information Plaza off of Desert View Drive. It is only accessible by the Kaibab Trail shuttle bus service and tour bus (three tour buses per day). Human noise sources include visitors at the overlook, shuttle buses, and overflights. The frequency,

magnitude, and duration of visitor activity at Yaki Point are lower than at other overlooks in the study area.

Because Yaki Point is only accessible by the Kaibab Trail shuttle bus route, human-caused noise at this location is directly related to the ridership and service frequency. Passenger pick-ups and drop-offs occur every 15 minutes during peak times, and the ridership peak each day occurs around 11 a.m. Human-related noise is less frequent and of lower magnitude in the early morning and late evening hours and during the off-peak seasons. Outside the shuttle bus operating hours, natural quiet can be expected at this location.

### Tusayan

Various commercial tour companies operate from Tusayan, including helicopter and airplane tours that depart from the Grand Canyon National Park Airport directly south of Tusayan. Human noise sources are very common and include commercial tour bus and private vehicle traffic, bicyclists, hikers, overflights, and activities associated with parking areas, lodging, and restaurants.

## **Environmental Consequences**

### ***Methodology and Assumptions***

The fundamental purpose of the national park system is to conserve park resources and values (16 USC 1 et seq.). Further, the NPS *Management Policies 2006* state that the National Park Service will strive to preserve the natural quiet and natural sounds associated with the physical and biological resources of the park (NPS 2006d). Degraded soundscapes are to be restored to natural conditions whenever possible, and natural soundscapes are to be protected from degradation due to noise (undesirable human-caused sound). The National Park Service is specifically directed to “take action to prevent or minimize all noise that, through frequency, magnitude, or duration, adversely affects the natural soundscape or other park resources or values, or that exceeds levels that have been identified as being acceptable to, or appropriate for, visitor

uses at the sites being monitored” (NPS 2006d). The methodology used to assess noise impacts in this document is consistent with NPS *Management Policies 2006* and *DO #47, Soundscape Preservation and Noise Management* (NPS 2000).

The Natural Sounds Program of the National Park Service is currently working to establish standards and protocols for acoustic studies in national parks. This work includes establishing acoustic zones in each park unit based on vegetation, land cover, topography, elevation, and climate. Acoustic zones are areas in which these attributes are similar; therefore, they may have similar natural sound sources, sound levels, and propagation and attenuation properties. The study area is located in two of the five acoustic zones that have been defined for Grand Canyon National Park — the ponderosa pine and the piñon/juniper vegetation zones. In Grand Canyon National Park, the daytime natural ambient sound level is 22.8 dBA for the ponderosa pine zone and 20.0 dBA for the piñon/juniper zone (NPS 2007g).

As documented in the *General Management Plan*, Grand Canyon National Park has established management zones to designate where various strategies for management and use will best fulfill management objectives and achieve the purpose of the park (NPS 1995b). Two management zones exist within the study area — the development zone and the natural zone. The natural zone consists of proposed wilderness, Havasupai use lands, and non-wilderness areas and corridors (commonly referred to as transition areas). The development zone, which includes the Grand Canyon Village (including Canyon View Information Plaza) and the connecting transportation corridors, is surrounded by transition areas. These areas, although adjacent to developed areas where human-caused sounds are commonly present, are managed as less-urbanized and quieter areas of the developed South Rim. No Havasupai lands or wilderness areas exist within the study area.

Proposed activities were qualitatively analyzed to determine potential impacts to soundscapes from changes in levels of human-caused noise, including factors that may affect the visitor's experience of the soundscape or biological resources. Impacts were assessed within a 1,000-foot area around each proposed parking lot or other transportation-related facility. Based on the existing sound levels and the proposed actions by alternative, the potential effects to soundscapes would likely not extend beyond 1,000 feet.

Impacts were assessed for the park's noise-sensitive locations, which are defined as those locations or areas that include dwelling units or other fixed, developed sites where frequent human use occurs. The level of impact at each noise-sensitive location was assessed using best professional judgment based on the type of noise introduced (including the frequency, magnitude, and duration), the degree of change from existing conditions, and the management objectives for that location (i.e. desired visitor use and experience). The level of impact depends on which management zone surrounds the noise-sensitive location. In development zones human-generated noise is expected and tolerated at higher levels than in natural zones. Thus, the acceptable level of human-generated noise is higher in developed areas than in the surrounding transition areas.

To assess potential short-term construction noise impacts, potential noise generated from the simultaneous operation of onsite equipment during project construction were analyzed at noise-sensitive locations, while also considering topographic barriers and distance. National literature was used to estimate the average decibel levels of construction- and transportation-related activities.

Changes in traffic levels and vehicle types, operations, facilities, and activities would result in long-term noise impacts and would occur primarily during daylight hours. Proposed transportation changes were qualitatively assessed at noise-sensitive locations based on changes in vehicle miles traveled

(VMT) of private vehicles, tour buses, and shuttle buses. Additional long-term noise impacts from sources other than traffic noise were also assessed based on existing documentation and site reconnaissance data. This analysis includes a qualitative evaluation of noise-generating uses (e.g., parking areas and drop-off locations, overlooks, and trails) that could affect sensitive locations.

#### Study Area

The study area for soundscapes consists of the following locations: Canyon View Information Plaza, Mather Point, the South Entrance Station, Grand Canyon Village the and Maswik Lodge area (Bright Angel Lodge, lot D, and Grand Canyon Depot), Yavapai Observation Station, Yaki Point, SR 64 corridor, Tusayan, and the areas below the South Rim where noise may carry. As noted above, noise impacts were considered within 1,000 feet of the noise sources at these locations.

#### Impact Thresholds

As previously discussed, the frequency, duration, and magnitude of human-caused noise is more acceptable in developed areas than in transition areas. Therefore, for each impact threshold, a higher degree of change in the soundscape of a developed area results in a lesser degree of change in a transition area.

- *Negligible* — For transition areas, the effects on the existing sound environment would be barely detectable, and the changes would be so slight that they would not be of any consequence to visitor experience or to biological resources. For development zones, the existing sound environment would not be affected, or the effects would be at or below the level of detection due to the existing human-related activity in the area.
- *Minor* — For transition areas, the effects on the existing sound environment would be readily detectable, although the effects would be small and of little consequence to the visitor experience

or to biological resources. For development zones, the effects to the existing sound environment would be detectable, but due to the existing human-related activity in the area, the changes would be of little consequence to visitor experience or to biological resources. Mitigation measures, if needed to offset adverse effects, could be easily and successfully implemented.

- *Moderate* — For transition areas, the effects on the natural sound environment would be obvious, and the changes would be readily apparent to visitors or to a limited amount of biological resources. For development zones, effects would be readily detectable, and despite existing human-related activity in the area, the changes would be apparent to visitors or to biological resources. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.
- *Major* — For transition areas, the effects to the existing sound environment would be extensive and would have substantial consequences to visitor experience or to biological resources. For development zones, effects would be obvious, and despite existing human-related activity in the area, the changes would result in substantial consequences to visitor experience or to a broader range of biological resources. Extensive mitigation measures would be needed to offset any adverse effects, and their success could not be guaranteed.

#### Nature of Impact

**Adverse Impact.** An adverse impact could result from construction noise and greater human-generated noise as a result of increased private vehicle traffic, transit vehicle operations, tour bus operations, or activities associated with expanded parking areas, overlooks, and trails.

**Beneficial Impact.** A beneficial impact would result from reduced private vehicle traffic, improvements related to tour bus operations, and reductions in private vehicle parking.

#### Duration

**Short-term Impact.** The impact would occur only during the construction period and would end when the project was completed.

**Long-term Impact.** The impact would occur or continue after the project was completed.

#### **Alternative A: No Action**

##### Direct / Indirect Impacts

**Construction Noise.** No construction would occur under this alternative, and there would be no short-term impacts.

**Transportation and Visitor-Related Noise.** Visitation is expected to remain flat until 2010, when the number of annual visitors in 2010 is projected to be 4.56 million people. The number of annual visitors in 2020 is expected to be 5.48 million people, which equates to a 23% growth rate from 2005 to 2020. The number of visitors during the peak visitation month of July is expected to increase at a slightly lower rate (20%) than annual park-wide visitation (NPS 2007f). This increase in visitation would result in greater noise levels throughout the park, particularly at the most popular locations, such as Grand Canyon Village. Increased noise would result primarily from additional private vehicles and tour buses driving through the park, and more people talking at scenic overlooks and other popular locations.

*Shuttle and Tour Buses* — Under this alternative the current mix of transportation modes would continue through 2020, and there would be no change in modes of travel used by visitors. Shuttle buses could become more crowded, and tour bus use would likely increase, resulting in more people unloading at popular destinations, as well as more people waiting at loading locations. Larger crowds would increase noise levels in localized areas.

Vegetation along shuttle routes would help attenuate noise impacts of visitors, as well as buses traveling through the park. Impacts would be long-term, local, minor, and adverse, as the effects from increased use of shuttles and tour buses would be readily detectable, but of little consequence.

*Canyon View Information Plaza / Mather Point* — Although Canyon View Information Plaza and Mather Point together comprise one of the park's most visited areas, many visitors never access the information plaza because private vehicle access is not allowed, so private vehicle noise levels there would not increase proportionately with increased visitation. Other noise sources at Canyon View Information Plaza would include tour bus parking and idling (up to 24 buses) and operation of the South Rim shuttle bus. Because tour bus parking would remain unchanged, peak noise levels associated with tour bus use would not change.

Peak noise levels could be experienced over a longer time period since tour bus use would likely spread to other time periods. Current noise levels at Canyon View Information Plaza are typically 42 dBA, which is well below the 70 dBA threshold the Federal Highway Administration established for picnic and recreation areas, or the 75 dBA threshold for other developed lands and properties (see Table 22). However, noise at Canyon View has ranged as high as 79 dBA, which is equivalent to a noisy restaurant (see Table 21). If increased visitation at this location resulted in a 5 dBA increase (considered “clearly noticeable”), noise levels would increase to 47 dBA on a typical day, which would still be below the FHWA threshold and close to the 45 dBA recommendations by the World Health Organization for rural areas. The existence of thick vegetation around the area, as well as the buildings at Canyon View Information Plaza, would also contribute some noise attenuating factors. Impacts to noise at Canyon View Information Plaza would be long-term, local, minor, and adverse as the change would be readily detectable but of little consequence,

primarily due to the type of activity that occurs here, which functions as a visitor center, not an area for solitude or reflection.

Mather Point is one of the park's most popular overlooks, and the adjacent parking lot is often at maximum capacity (111 vehicles) during peak visitation. Multiple sources of human noise are constant throughout the day. This area would also experience noise from car doors frequently opening and closing, music, and car alarms as visitors would be continually arriving and departing. Increased visitation would result in an increase in human noise levels at this overlook by a spreading of peak noise periods to more times of the day. Like all overlooks, Mather Point is situated on the rim, which is upslope of the rest of the study area. Therefore, noise attenuation from land forms would not apply. However, vegetation surrounding the area would help attenuate some noise.

The Mather Point parking lot currently experiences noise levels of 51 dBA, which is equivalent to an average home. However, noise at this area has ranged as high as 95 dBA, which is the point at which conversation stops. An increase in the daily volume of private vehicles, which typically produce 67 dBA, would result in more noise at this location by spreading out peak sound levels to more times of the day. Because the number of parking spaces would not change, peak noise levels from parking likely would not change. However, peak noise levels from the adjacent South Entrance Road would likely increase due to an increase (about 20%) in the volume of traffic passing by Mather Point.

Two noise sources producing equal dBA ratings would increase noise levels by 3 dBA (the addition of another car would not double the decibels). Therefore, it is difficult to determine exactly how much noise levels would increase, but less than a 3 dBA increase could be expected, which would result in a barely perceptible increase in noise. For these reasons, impacts at Mather Point would be long-term, local, minor, and adverse during a

“typical” 56 dBA day; impacts would be readily detectable but more apparent because natural quiet is a desirable condition for overlooks, and the listener’s activity affects how he or she responds to noise.

*South Entrance Station / SR 64 Corridor* — A considerable amount of transportation-related noise due to tour buses and private vehicles occurs at the entrance station and along SR 64 between Tusayan and the park. Congestion occurs at the South Entrance Station, where lines of cars wait to enter the park, and engines idle, accelerate, and decelerate. This area typically experiences sound levels of 51 dBA and as high as 84 dBA. Increased visitation would result in more vehicular traffic at this entrance station, resulting in more noise. Visitors would remain in their cars, likely with the windows closed and air conditioning on (especially during peak summer hours in Arizona) and possibly playing music as they wait to enter the park. Visitors also would not expect solitude and natural quiet along the corridor or at the entrance station, which would affect how they respond to noise at these locations. For these reasons, impacts would be barely detectable due to the existing human-related activity in the area, resulting in long-term, local, negligible, adverse impacts.

*Grand Canyon Village* — Grand Canyon Village is the center of activity and an important transportation hub for the South Rim, providing lodging, parking, and other visitor services. The Grand Canyon Railway also travels through the village. Market Plaza, the business center of the village, includes a general store and delicatessen, bank, post office, and a cafeteria at Yavapai Lodge.

Transportation-related noise in this area is fairly constant due to traffic from shuttle buses, tour buses, and private vehicles. Table 26 shows decibel ranges for typical noise sources in this area, such as 80–90 dBA for a train (experienced up to six times per day as the two to sometimes three daily trains arrive and depart) and 60–86 dBA for tour buses,

depending on the distance from the listener. The Village Loop Drive (west end) experiences high noise levels in the park — 55 dBA on a typical day, ranging as high as 100 dBA (considered very loud).

As visitation increases, noise impacts in this center of activity would also increase. The location of structures could help attenuate some noise. As described for Mather Point above, it is difficult to determine exactly how much noise levels would increase, but a 3 dBA increase or less could be expected, which is considered barely perceptible. An increase of 3 dBA during typical days would result in 58 dBA, which is still considered relatively quiet. Unlike Mather Point, the nature of Grand Canyon Village is not one of solitude and quiet reflection; its purpose is to provide visitor services. Impacts would be detectable since peak sound levels could be experienced more often, depending on the wide range of measured ambient levels in this location. The result would be long-term, local, minor, adverse impacts.

*Yavapai Observation Station* — The Yavapai Observation Station currently experiences transportation-related noise due to private vehicle and shuttle bus traffic, and high levels of visitor activity. More noise could be expected at this area as visitation increases over the next several years. Although no sound data have been gathered, sound levels are likely similar to other park locations. An increase of less than 3 dBA, which could be expected with increased vehicles and human-created noise, or an increase in the number of occurrences of peak noise levels, could result in detectable changes that would be noticeable to visitors given the expectation of solitude at this location. Impacts would therefore be long-term, local, minor, and adverse.

*Yaki Point* — Unlike Mather Point and Yavapai Observation Station, Yaki Point is not accessible by private vehicle, only by shuttle bus and tour bus. The frequency, magnitude, and duration of visitor activity here is lower than at other park overlooks, likely resulting

in lower ambient sound levels. Impacts from increased visitation would be less than at other overlooks because visitation is directly related to shuttle bus ridership and schedule. Because no changes are expected to the shuttle bus service, visitation to Yaki Point is not expected to increase measurably. Impacts would be at or below the level of detection, resulting in long-term, negligible, adverse effects.

*Tusayan* — Tusayan currently experiences a considerable amount of transportation-related noise due to private vehicle and tour bus traffic, as well as helicopter and airplane tours from the nearby airport (see Table 26 for decibel ranges for helicopters and airplanes). Increased visitation would concentrate more people in this community, resulting in higher overall ambient noise levels. Because Tusayan is a community, a certain level of human-related noise is expected, and visitors would not expect quiet and natural solitude. The location of several buildings and structures in town would help attenuate some noise. Impacts from increased visitation to Tusayan would be long-term, local, minor, and adverse, as the effects would be detectable but of little consequence to visitors.

*Summary* — Overall, transportation and visitor-related noise impacts would be long-term, local, negligible to minor (at Mather Point), and adverse, depending on the range of ambient recorded sound levels a visitor might experience, as well as the conditions expected at different locations (e.g., solitude at overlooks but more human activity at developed areas).

#### Cumulative Impacts

Because there would be no construction-related activities under alternative A, there would be no short-term cumulative impacts to soundscapes due to construction.

Several past, present, and reasonably foreseeable long-term actions within the project area could affect, or be affected by, actions under the alternative A. Past or in-progress

actions have eliminated some noise sources, such as the removal and revegetation of the Moqui Lodge and the closure of roads and motorized routes in Kaibab National Forest. These actions have resulted in long-term, beneficial impacts.

Past or in-progress projects that have had or would have short- or long-term adverse noise impacts include implementation of ongoing park fire management actions (scheduled burns) and fuel reduction activities under the fire protection plans; improvements and repairs to the Grand Canyon Depot; construction of a new entrance station at Desert View; and expansion of the airport, which would encourage more people to visit the area.

Foreseeable future actions with potential for adverse impacts include improvements to the Bright Angel trailhead, Bright Angel Lodge, Hermit Road, and the South Entrance Road. These projects would include noise-related activities, such as developing a plaza area, relocating a power substation, removing hazardous material, and rehabilitating or improving roads. Land conveyance to the Grand Canyon Unified School District would require the installation of infrastructure and facilities. The possible operation of the nearby uranium mine is another potential noise source, as well as future airport improvements, resulting in both short-term construction impacts and long-term impacts. If Tusayan became incorporated, it would provide police protection, street maintenance, and other administrative activities that could increase noise in the town. Construction of improvements to SR 64 would also result in short-term impacts.

Taken together, the additional impacts to soundscapes would be long-term and primarily adverse because the actions described could cause substantial noise impacts (e.g., operation of the uranium mine and expansion of the airport). The long-term, negligible to minor, adverse impacts expected under alternative A would contribute a minor overall effect as a result of increased visitation and

congestion. When combined with the impacts expected under alternative A, cumulative impacts would be local and regional, long-term, minor, and adverse, as the beneficial actions described above would not be sufficient to offset expected increases in visitation and congestion. Impacts would be readily detectable and apparent, and they could have substantial consequences on visitor experiences.

### Conclusion

No short-term impacts related to construction would result under alternative A. Impacts under alternative A would be local, long-term, negligible to minor, and adverse. Cumulative effects would be local and regional, long-term, minor, and adverse. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of the park's soundscape.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would not be unacceptable impacts on soundscapes under alternative A.

### **Alternative B: Preferred Alternative**

#### Direct / Indirect Impacts

Alternative B would result in substantial changes to the way in which various areas on the South Rim are used and managed. New parking facilities would be provided outside the park on national forest system land adjacent to Tusayan and at Canyon View

Information Plaza so that visitors could ride shuttle buses to other park destinations.

Changes would take place in several phases, resulting in a series of long-term impacts to soundscapes that might or might not occur because implementation would be adaptively managed and based on the results of previous phases. The first phase would include the following actions on the South Rim:

- adding private vehicle and tour bus parking and loading/unloading areas at Canyon View Information Plaza (600 spaces)
- improving South Rim shuttle bus service
- adding shuttle bus service between Tusayan and Canyon View Information Plaza
- constructing a new shuttle bus maintenance facility

Future phases that could impact soundscapes include the following:

- developing parking at Tusayan (400 spaces)
- expanding parking at Canyon View Information Plaza (up to 300 spaces)
- constructing an additional entrance kiosk at the South Entrance Station
- expanding the Greenway Trail
- implementing improvements to Grand Canyon Railway

**Construction Noise.** Alternative B would include activities associated with construction of new roadways, parking areas, visitor facilities, fee collection facilities, and an overlook viewing platform in areas such as Canyon View Information Plaza, Mather Point, South Entrance Station, Grand Canyon Village, Yaki Point, SR 64 corridor, and Tusayan. Short-term impacts to soundscapes in these areas could occur from construction equipment, which would emit 70–90 dBA depending on distance from the listener and vehicle type; however, all of the affected areas occur within

a developed zone, where human-caused noise is common. Visitors could experience sporadic and intermittent increases in noise levels during the day due to pieces of construction equipment being operated simultaneously. These increases would be readily detectable, but of little consequence. Several mitigation measures, including using best available noise control techniques and scheduling construction to minimize impacts to noise sensitive areas, would be implemented to reduce construction-related impacts. With mitigation, short-term and minor adverse impacts would result due to increased noise during the construction period.

#### **Transportation and Visitor-Related Noise.**

Alternative B would result in changes to the frequency, duration, and magnitude of transportation-related noise and visitor use patterns within the study area due to additional visitor facilities and changes in shuttle bus service, tour bus service, and private vehicle parking. Impacts due to transportation-related changes would be most evident during peak-season days. These impacts are discussed below for specific activities and areas.

*Shuttle and Tour Buses* — A new shuttle bus route between Tusayan and Canyon View Information Plaza would increase bus traffic along the South Entrance Road. Increased frequency of buses along the Hermits Rest, Village, and Kaibab Trail routes would also increase the frequency of shuttle bus noise (82–86 dBA for a tour bus at 10 feet) and human-caused noise related to visitor loading/unloading at shuttle stops along those routes. New shuttle transfer stations at Canyon View Information Plaza and in Tusayan would further increase exposure to human-caused noise due to visitor loading/loading activities, as would new and expanded tour bus access at Canyon View Information Plaza, Grand Canyon Village, Yavapai Observation Station (November through February only), and Yaki Point. Because tour bus access is not currently available at Yaki Point, and because this area experiences a lower magnitude of visitor use relative to some other South Rim areas, in-

creases in human-caused noise at this location might be more noticeable than at Canyon View Information Plaza or the village. Although there would be more frequent occurrences of shuttle bus related noise, there would be no increase in peak noise from shuttle buses. Mitigation measures, including using best available noise control equipment for shuttle buses, would help to limit noise impacts. Overall impacts related to shuttle and tour bus activity would be long-term, local, negligible, and adverse, as impacts would be barely detectable and of no consequence to visitor experiences or biological resources.

*Canyon View Information Plaza / Mather Point* — Although fewer vehicles would be approaching Canyon View Information Plaza under this alternative, private vehicle traffic and the magnitude of traffic noise would increase at Canyon View Information Plaza, where up to 900 new parking spaces could eventually be constructed. The realignment of the South Entrance Road (which would be closer to Canyon View Information Plaza than the existing alignment) would further increase the magnitude of noise related to private vehicles.

Increased tour bus and shuttle bus traffic at Canyon View Information Plaza would also result in increased frequency and magnitude of vehicle noise from buses. Although Canyon View Information Plaza is a developed area where visitors would not expect solitude or natural quiet, the addition of private vehicle noise (including car doors opening and closing, visitors talking, and occasional music and car alarms), along with increased bus noise from the additional tour buses (40 instead of 24) under all phases would be apparent to visitors during daylight hours. Peak sound levels from tour buses could occur more often. As shown in Table 26, tour buses produce 82–86 dBA at 10 feet, compared to 65 dBA for passenger cars. Because it is not possible to directly add (or subtract) multiple noise sources to obtain a total noise level, it is difficult to estimate the resultant increase in noise that would be expected from up to 900 new vehicles in this area.

Sound levels at Canyon View Information Plaza currently range from 18 to 78 dBA (depending on location), with 42 dBA being the median decibel level between tour bus parking and the Kaibab Trail route shuttle bus stop. For purposes of evaluation, a 3 to 6 dBA increase would be a barely perceptible to clearly noticeable change. Increases would be readily detectable despite the existing human-related activity in the area, particularly in the Canyon View Information Plaza parking lot near the road, where sound levels could range from 52 to 56 dBA. Attenuation factors, such as trees and the building itself would help offset some impacts. Areas farther from the road and parking, such as the center of the information plaza, would experience fewer noise impacts. Mitigation measures, including berms and other noise attenuating features, might be needed to further offset adverse effects, and could be extensive but would likely be successful. Therefore, local, long-term, moderate, adverse impacts are expected due to increased private vehicle noise at Canyon View Information Plaza. The degree of impact in the long term would partly depend on the outcome of adaptive management and the total amount of parking actually constructed over time.

As described under alternative A, private vehicle and shuttle bus traffic at Mather Point is a relatively constant source of transportation noise during daylight hours. Under alternative B noise from shuttle buses would continue at the new stop at the west end of the present parking lot, but private vehicle noise would be substantially reduced because the 111-car parking area would be removed and the South Entrance Road would be realigned. Such a dramatic change in vehicular use at this location would be readily detectable and apparent to visitors, particularly given the desire for natural quiet at overlooks.

A proposed overlook viewing area at Mather Point connected to the new tour bus drop-off could result in increased and concentrated visitor use, resulting in additional human-caused noise just east of Mather Point. Shuttle

bus arrivals would be the primary noise event at Mather Point. This area typically experiences noise levels of 51 dBA. If a 5 dBA reduction were achieved by eliminating parking for 111 vehicles, a clearly noticeable change would be perceived. Again, determining an actual numeric amount is difficult as sound sources cannot be directly added or subtracted to achieve a total. Overall, removing parking areas at Mather Point and associated noise would result in a local, long-term, moderate, beneficial impact.

*South Entrance Station and SR 64 Corridor*— Vehicle noise at the entrance station includes both engine and tire noise from idling, acceleration, and deceleration. Under alternative B a 15% reduction in total traffic (visitor and non-visitor) would be expected through the South Entrance Station (see the “Transportation” section). The new shuttle bus route between Tusayan and Canyon View Information Plaza would introduce shuttle bus noise to this area; however, some private vehicle use would be eliminated. Adding another service lane in future phases could shorten wait times, which would likely improve traffic flow and reduce the time that vehicles were queued at the station, resulting in long-term, negligible beneficial impacts at this location. Sound levels would not be expected to drop appreciably from the 51 dBA currently experienced, and would not be easily detected by most peak season visitors since they would likely remain enclosed in their vehicles while passing through the entrance station.

*Grand Canyon Village* — More frequent service on the Village shuttle bus route and more space for tour bus parking and drop-offs would likely increase the frequency and magnitude of noise from buses, which generate 82–86 dBA at 10 feet. However, the 31% reduction in private vehicles (see the “Transportation” section), which generate 62–67 dBA as shown in Table 26, throughout Grand Canyon Village would result in a perceptible reduction of noise from private vehicles. Grand Canyon Village is a developed area that already experiences vehicle noise from buses and private vehicles,

resulting in high noise levels from 26 to 100 dBA. Moving some noise impacts associated with train unloading and train tour bus activity from Village Loop Drive near El Tovar to lot D would result in a beneficial impact. A 5 dBA decrease in this area would be clearly noticeable. Increasing the frequency and magnitude of bus noise would likely be more than offset by the reduction in private vehicle traffic, resulting in local, long-term, negligible, beneficial impacts to the local soundscape.

*Yavapai Observation Station* — More frequent service on the Village shuttle bus route and new access for tour buses November through February would likely result in an increase in the frequency and magnitude of transportation-related noise from buses. However, the reduction in noise from private vehicle traffic throughout the study area would likely more than offset increased bus noise. Yavapai Observation Station is in a developed area, but lower levels of human-caused noise are desirable along the rim. Therefore, local, long-term, minor, beneficial impacts are expected due to decreased private vehicle noise, offsetting any increased bus noise.

*Yaki Point* — Increased bus frequency for the Kaibab Trail shuttle bus route and new access for the addition of tour buses would likely result in increased frequency and magnitude of transportation-related noise. Up to seven tour buses could be at this location at one time. Yaki Point is in a developed area, but private vehicles would not be allowed, making the frequency, magnitude, and duration of visitor activity lower here than at other overlooks. However, like all South Rim overlooks, lower levels of human-caused noise are desirable along the rim. Potential local, long-term, minor, adverse impacts are expected due to increased frequency of shuttle bus noise and the introduction of tour buses, which would be readily detectable and apparent.

*Tusayan* — The new shuttle bus route between Tusayan and Canyon View Information Plaza would introduce shuttle bus noise in future phases at the Tusayan shuttle transfer

station, which would be at the north end of Tusayan on national forest system land. New parking would be provided for up to 400 vehicles for use by day visitors as well as some overnight visitors. This alternative would seek to attract 19% of the day visitors entering through the South Entrance Station to use this parking near Tusayan (see the “Transportation” section). Developing a 400-car parking lot and implementing shuttle bus service to the park would result in increased noise from vehicles that would be readily detectable and apparent. Mitigation measures, including noise control equipment on shuttle buses and noise attenuating landscape features, might be needed to offset noise impacts, depending on the presence of existing attenuation factors, and would likely be successful. Therefore, local, long-term, minor, adverse impacts are expected due to introducing new noise sources into this area.

*Summary* — Overall, long-term impacts to transportation and visitor-related noise would be local and both beneficial and adverse, depending on the location and actions proposed. Intensity of impacts would range from negligible to moderate. Beneficial impacts are expected at Mather Point, the South Entrance Station, Grand Canyon Village, and Yavapai Observation Station due to reductions in overall vehicle traffic that would occur in those areas. Adverse impacts would occur due to increased shuttle and tour bus use, as new sources of visitor noise from parking and/or tour bus loading/unloading activities would be introduced at some locations, and the frequency of visitor noise would increase at locations served by the Village, Kaibab Trail, and Hermits Rest shuttle bus routes. Adverse impacts would also occur at Yaki Point as a result of increased bus service and at Canyon View Information Plaza and Tusayan due to greatly expanded parking. Retaining as much vegetation as possible within islands in parking areas would help mitigate noise impacts in these locations. The frequency and magnitude of transportation noise would vary by implementation phase.

### Cumulative Impacts

The same cumulative scenario described for alternative A would apply to alternative B. Differences would be primarily related to activities proposed at Tusayan and Canyon View Information Plaza, where new parking areas would be created. A new 400-space parking area at Tusayan would combine with the other activities in the area, such as improvements to and expansion of the airport, wildfire fuel reduction activities, installation of infrastructure and facilities by the school district, and possible operation of a uranium mine. The new 900-space parking area at Canyon View Information Plaza would primarily combine with the other construction activities in the area. These actions, particularly those at Tusayan, would be detectable and would result in long-term, moderate, adverse impacts. Combined with the long-term, negligible to moderate, beneficial and adverse impacts expected under alternative B, which would add a modest impact, cumulative impacts would be local and regional, long-term, moderate, and adverse, particularly in Tusayan.

### Conclusion

Alternative B would result in local, short-term, minor, adverse impacts during construction. Local, long-term, negligible to moderate, beneficial and adverse impacts would occur related to transportation and visitor-related noise. Cumulative impacts would be local and regional, long-term, moderate, and adverse. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of the park's soundscape.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and

cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would not be unacceptable impacts on soundscapes under alternative B.

### **Alternative C: Tusayan Parking Emphasis**

#### Direct / Indirect Impacts

Like alternative B, new parking would be provided at Tusayan and Canyon View Information Plaza, but the emphasis would be reversed — 920 spaces would be provided at Tusayan, and 400 at Canyon View Information Plaza. The focus would be on attracting day visitors to park in Tusayan and take shuttle buses into the park, minimizing the need for as much in-park parking as under alternative B. Short- and long-term changes in human-caused noise would occur in several locations depending on the proposed activity. Anticipated soundscape impacts from construction-related activities, transportation activities, and other noise sources are evaluated below.

The first phase of Alternative C would include the following:

- constructing private vehicle parking (400 spaces), tour bus parking, and a bus loading/ unloading area at Canyon View Information Plaza
- improving the South Entrance Road
- improving South Rim shuttle bus service
- implementing a shuttle bus system between Tusayan and Canyon View Information Plaza
- constructing parking (265 spaces) and shuttle bus facilities in Tusayan
- constructing a new shuttle bus maintenance facility

Future phases that could impact soundscapes include the following actions:

- developing additional parking at Tusayan (up to 655 spaces)
- expanding the South Rim shuttle bus service
- constructing additional kiosks at South Entrance Station
- expanding the Greenway Trail
- implementing improvements to Grand Canyon Railway.

**Construction Noise.** Alternative C would have similar effects to soundscapes from construction-related activities as alternative B, although noise impacts would be concentrated differently. Parking lot construction would occur in the first phase at both Canyon View Information Plaza and Tusayan, but these areas are widely separated, so noise at both locations would occur in isolation from each other. Visitors in the affected areas could experience sporadic and intermittent increases in noise levels during the day due to various pieces of construction equipment operating simultaneously during different phases of project implementation. These impacts would be mitigated through the use of noise control measures on construction equipment and scheduling of construction work. Short-term, minor, adverse impacts are expected due to increased noise during construction.

**Transportation and Visitor-Related Noise.** Alternative C would result in changes to shuttle bus service, tour bus service, and private vehicle traffic. Alternative C would have similar effects to soundscapes from transportation-related activities described for alternative B, with the following exceptions.

*Canyon View Information Plaza / Mather Point* — Like alternative B, vehicle noise at Canyon View Information Plaza would intensify due to increased tour and shuttle bus and private vehicle parking, but visitors would be discouraged from parking in Canyon View Information Plaza for more than short-term purposes. However, a quick parking turnover could result in more noise, as vehicles would be traveling through the area more frequently

than if they parked for a longer time. Although substantially fewer privately operated vehicles (29%) would be expected to travel through Grand Canyon Village overall (see the “Transportation” section), providing 400 new parking spaces at Canyon View Information Plaza would result in a readily detectable change in that area compared to existing conditions (no private vehicle parking at all). Like alternative B, this would represent a long-term, local, minor, adverse impact, even though the number of parking spaces proposed for alternative C would be roughly half of alternative B. More frequent shuttle bus service would occur at Canyon View Information Plaza, and visitor loading/unloading activities would contribute more heavily to soundscape changes at this location than activities in the parking area. Noise impacts from shuttle buses would be mitigated through the use of noise control equipment on shuttle buses. Alternative C would result in fewer impacts than alternative B due to the smaller amount of parking and higher percentage of decreased traffic expected. Impacts would therefore be long-term, local, minor, and adverse.

Overall traffic volumes throughout the park are anticipated to be lower, which would reduce noise levels at Mather Point, resulting in a beneficial impact compared to alternative A. However, unlike alternative B, the adjacent parking area would be retained under alternative C. Noise generated at this parking area would continue, but at much lower levels given the overall lower traffic volumes. Even though fewer visitors would be driving through the park, those who do would likely still concentrate in the popular overlook areas. Compared to baseline conditions (alternative A), impacts would be long-term, local, negligible to minor, and beneficial because reduced noise levels would be barely detectable due to the existing human activity in the area, or would be readily detectable but of little consequence.

*South Entrance Station and SR 64 Corridor* — Wait times at the South Entrance Station would likely be reduced compared to alterna-

tive A due to lower traffic volumes (44% fewer day visitors entering through the South Entrance Station, see the “Transportation” section). Compared to alternative B, more visitors would be expected to park in Tusayan and take shuttles into the park, which would help alleviate congestion at the entrance. The amount of time that vehicles would be queued up along the road would likely be reduced because of smaller traffic volumes. Impacts would be similar to alternative B for the same reasons, resulting in long-term, local, negligible, beneficial impacts at this location.

*Tusayan* — Along with the parking at Canyon View Information Plaza, a new private vehicle parking area would be provided in Tusayan. Up to 920 parking spaces would accommodate day visitors, who would then use the new shuttle bus service to Canyon View Information Plaza. This alternative would seek to attract 44% of day visitors entering through the South Entrance Station to park in Tusayan and use the shuttle bus service. This level of development would be readily detectable and apparent. Mitigation measures might be needed to offset noise impacts, depending on the presence of existing attenuation factors, and would likely be successful. Impacts would be mitigated through the use of noise control equipment on shuttle and noise attenuating landscape features. Like alternative B, long-term, local, moderate, adverse impacts are expected due to introducing new noise sources at this area; however, alternative C would result in more impacts than alternative B due to a larger operation.

*Other Noise Sources* — Effects to soundscapes in other areas of the South Rim would be similar to those described under alternative B.

Beneficial impacts would occur at Mather Point, the South Entrance Station, Grand Canyon Village, and Yavapai Observation Station. Adverse impacts would occur due to increased shuttle and tour bus use. Increased bus service at Yaki Point, and greatly expanded parking at Canyon View Information Plaza and Tusayan would have adverse, local

impacts, with the intensity varying from negligible to moderate. Vegetation would be retained as much as possible within islands in parking areas to help mitigate noise impacts in those locations. The frequency and magnitude would vary by implementation phase. Impacts would be mitigated through the use of noise control equipment on shuttle buses and noise attenuating landscape features.

#### Cumulative Impacts

The same cumulative scenario described for alternative A would apply to alternative C, with an emphasis on activities proposed at Tusayan and Canyon View Information Plaza, where new parking areas would be created. Therefore, impacts would be similar to alternative B, but the emphasis would be switched because more parking would be provided at Tusayan than at Canyon View Information Plaza. The new 920-space parking area at Tusayan under full build-out would combine with the other activities in the area, such as improvements to and expansion of the airport, wildfire fuel reduction activities, installation of infrastructure and facilities by the school district, and possible operation of a uranium mine. The new 400-space parking area at Canyon View Information Plaza would primarily combine with the other construction activities in the area. These actions, particularly at Tusayan, would be detectable and would result in long-term, moderate, adverse impacts. Combined with the long-term, negligible to moderate, beneficial and adverse impacts expected under alternative C, cumulative impacts would be local and regional, long-term, moderate, and adverse, particularly in Tusayan. The contribution of alternative C to cumulative impacts would be marginal.

#### Conclusion

Alternative C would result in local, short-term, minor, adverse impacts during the construction period. Long-term impacts would be local, negligible to moderate, and beneficial and adverse. Cumulative impacts would be local and regional, long-term, moderate, and adverse. Because there would

be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of the park's soundscape.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would not be unacceptable impacts on soundscapes under alternative C.

#### **Alternative D: Canyon View Information Plaza Parking Emphasis**

##### Direct / Indirect Impacts

Unlike the other action alternatives, new parking would be provided only at Canyon View Information Plaza; no new parking facilities would be provided at Tusayan. The focus of this alternative would be on attracting day visitors to park at Canyon View Information Plaza and take shuttle buses throughout the South Rim. Short- and long-term changes in human-caused noise would occur primarily at Canyon View Information Plaza, and changes at other areas would be similar to those described under alternative B. Anticipated soundscape impacts from construction-related activities, transportation activities, and other noise sources are evaluated below.

The first phase would include the following changes:

- developing private vehicle parking (790 spaces), and tour bus parking and loading/unloading area at Canyon View Information Plaza

- improving South Rim shuttle bus service
- improving roadways at Canyon View Information Plaza

Future phases that could include impact soundscapes include the following actions:

- expanding parking at Canyon View Information Plaza (400 additional spaces)
- expanding the South Rim shuttle bus service
- enhancing the Greenway Trail
- implementing improvements to Grand Canyon Railway

**Construction Noise.** Alternative D would have similar effects to soundscapes from construction-related activities as alternative B. Visitors in the affected areas could experience sporadic and intermittent increases in noise levels during the day from the simultaneous operation of various pieces of onsite construction equipment. The majority of the impacts would occur at Canyon View Information Plaza. These impacts would be mitigated through the use of noise control measures on construction equipment and scheduling of construction activities. Local, short-term, minor, adverse impacts are expected from increased noise levels during construction.

**Transportation and Visitor-Related Noise.** Alternative D would result in changes to shuttle bus service, tour bus service, and private vehicle traffic. Alternative D would not offer a shuttle route between Tusayan and Canyon View Information Plaza, so the percentage of visitors driving private vehicles into the park would be similar to alternative A. Impacts of proposed actions would be similar to alternative B, with the exceptions noted below.

*Canyon View Information Plaza / Mather Point* — All new private vehicle parking for day visitors under alternative D would be provided at Canyon View Information Plaza, with up to 1,190 parking spaces at full build-out. Parking here would accommodate short-term visitors

to the Canyon View Visitors Center as well as long-term visitors who would park and ride shuttles to other areas of the South Rim. Impacts would be similar to alternative B, although there would be 290 fewer parking spaces under alternative B. The operational noise of the parking area would contribute more to the changes in soundscapes at this location than the increased frequency of loading/unloading activities from shuttle and tour buses. Due to the expanded amount of parking at this location, the South Entrance Road would be relocated farther south than under either alternative B or C. However, this realignment would still move the road closer to Canyon View Information Plaza, increasing the magnitude of noise in this area. In addition, projected traffic volumes along the South Entrance Road would be the highest of any of the action alternatives. Impacts would be mitigated through the use of noise attenuating landscape features. Impacts would be readily detectable as a result of increased parking and would be local, long-term, moderate, and adverse.

Impacts at Mather Point would be similar to alternative B, as that parking area would be removed. However, because the canyon rim is upslope of the rest of the study area, substantially more noise at Canyon View Information Plaza could travel to Mather Point, increasing noise there. Trees around Canyon View Information Plaza, as well as the building itself, and the implementation of mitigation measures (see page 117) would help offset this possibility. However, realigning the South Entrance Road farther south under this alternative would beneficially affect Mather Point. Impacts would be local, long-term, moderate, and beneficial as a result of removing parking at Mather Point.

*South Entrance Station and SR 64 Corridor* — Alternative D would have the highest private vehicle traffic at the South Entrance Station because no parking would be provided outside park boundaries. Additional entrance lanes would expedite the waiting process and help alleviate congestion. Therefore, impacts

would remain similar to alternative B, without the addition of new shuttle bus service from Tusayan to Canyon View Information Plaza. Impacts would be local, long-term, negligible, and beneficial for the reasons described under alternative B.

*Grand Canyon Village* — Similar to alternative B, more frequent service on the Village shuttle bus route and more space for tour bus parking and drop-offs would likely increase the frequency and magnitude of noise from buses. However, a 31% reduction in private vehicles (see the “Transportation” section) throughout the village would result in less noise from private vehicles. Moving some noise impacts associated with train unloading and train tour bus activity from Village Loop Drive near El Tovar to lot D would result in a beneficial impact. Increasing the frequency and magnitude of bus noise would likely be more than offset by the reduction in private vehicle traffic, resulting in local, long-term, negligible, beneficial impacts to the local soundscape.

*Tusayan* — No additional parking or shuttle bus transfer station is proposed in Tusayan, so no associated noise would be introduced there. Impacts would result from overall increased visitation and would be local, long-term, minor, and adverse, similar to alternative A.

*Other Noise Sources* — Alternative D would have similar effects to soundscapes in other areas of the South Rim as alternative B.

Like alternative B, beneficial impacts would occur at Mather Point, the South Entrance Station, Grand Canyon Village, and Yavapai Observation Station. Although local, adverse impacts would occur as a result of increased shuttle and tour bus use, the brunt of adverse impacts would occur at Canyon View Information Plaza. Vegetation would be retained as much as possible within islands in parking areas at Canyon View Information Plaza to help mitigate noise impacts in those locations. Intensity would vary from negligible to moderate.

### Cumulative Impacts

The same cumulative scenario described for alternative A would apply to alternative D, with an emphasis on activities proposed at Canyon View Information Plaza. A new 1,190-space parking area at this location would combine with the other construction activities in the area, as described under alternative A. The additional actions would be detectable and would result in local and regional, long-term, minor, adverse impacts because alternative D would include no actions at Tusayan. The long-term, negligible to moderate, beneficial and adverse impacts expected under alternative B would contribute a modest amount of change. Combining alternative D with other past, present, and reasonably foreseeable actions would result in local and regional, long-term, moderate, and adverse cumulative impacts.

### Conclusion

Alternative D would result in local, short-term, minor, adverse impacts during construction. Long-term impacts would be local, negligible to moderate, and beneficial and adverse. Cumulative impacts would be local and regional, long-term, moderate, and adverse. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of the park's soundscape.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there



Mather Point serves as an introduction to the panorama of the Grand Canyon and is one of the most popular vista areas.

would not be unacceptable impacts on soundscapes under alternative D.

## **VISUAL / SCENIC RESOURCES**

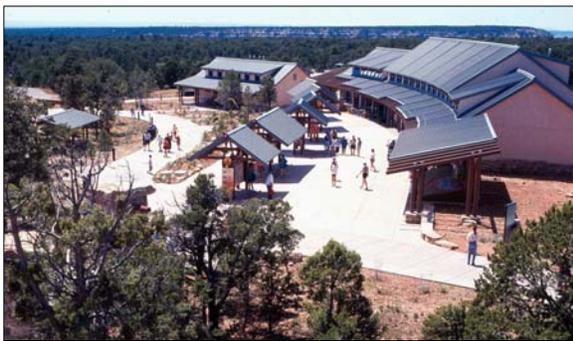
### **Affected Environment**

In accordance with the NPS *Management Policies 2006*, a park's scenery and scenic features are considered a park resource and value that is to be conserved and protected. Conserving national park scenery and providing for visitor enjoyment are fundamental purposes of the National Park Service 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 Centre 2005). The Grand Canyon has internationally recognized scenic vistas, qualities, and values. It is widely considered one of the world's most beautiful natural areas.

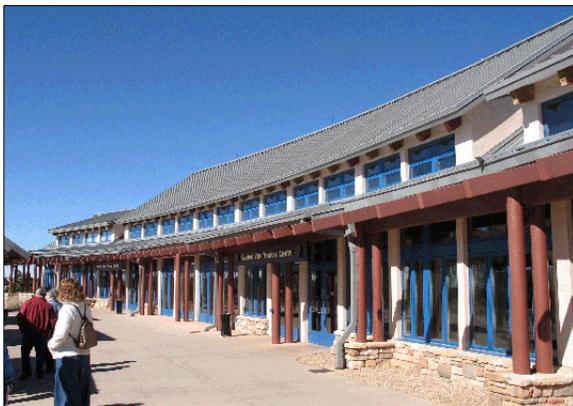
Any new construction or development in Grand Canyon National Park has the potential to affect the park's scenic values. In 1994 the National Park Service prepared park *Architectural Character Guidelines* to ensure that future developments would be done in a manner compatible with the park's setting (NPS 1994a). The purpose of the guidelines is

to direct and shape the efforts of architects, planners, landscape architects, concessioners, administrators, maintenance personnel and design review staff as they work to create aesthetically and environmentally appropriate structures. If these guidelines are used successfully, the built environment will contribute to, rather than detract from, the unique sense of places within Grand Canyon National Park.

These guidelines are still in use today and have even been referenced by both USFS and Tusayan planners as they design projects. The guidelines provide three overarching principles for new construction and development:



Canyon View Information Plaza is the park's primary information and orientation facility. Multiple buildings and facilities are provided in a village setting, including an orientation center, a bookstore, two shuttle bus shelters, restrooms, service buildings, and shade shelters.



The overall design of Canyon View Information Plaza adheres to the principles of the park's 1994 *Architectural Character Guidelines* but also incorporates many elements of sustainable design.

- to encourage new buildings to contribute to the existing sense of place — structures should be designed to fit in with their sites rather than to dominate them
- to encourage sustainable building systems, materials, and construction techniques in all buildings
- to continue the rustic style for important public buildings, which contributes to visitors' understanding of where they are and why this place is important

The following discussion describes the existing visual and scenic resources in the project area that could be affected by actions under the alternatives. Descriptions of key visual characteristics, including important observation points and viewing areas, are provided for each location where changes are proposed under one or more alternatives. The description of the visual information (such as landforms, vegetation, man-made developments) within a project area, as well as its visual character and quality, serves as a baseline of existing conditions against which to measure potential impacts of the alternatives.

Both natural and built features can make up the character of an area or a view. Visual quality is based on the relative degree of vividness, intactness, and unity of an area. Viewer sensitivity is based on the visibility of resources in the landscape, the proximity of viewers to the visual resource, the frequency and duration of viewing, the number of viewers, and the type and expectations of individuals and viewer groups.

### ***Canyon View Information Plaza***

Canyon View Information Plaza, opened in 2000, is the place where most visitors go to get their first view of the Grand Canyon at nearby Mather Point, which is less than 1,000 feet away. For visitors arriving by bus and shuttle bus, Canyon View Information Plaza is the first stop before proceeding to the Mather Point overlook; for visitors arriving by private car, they must park at Mather Point and then

proceed to the information plaza. The multiple buildings at Canyon View Information Plaza create a village setting that fits into the sloping topography; the pathways and building arrangement help distribute sometimes large number of visitors. The visual character of the area is a contained development that synthesizes site, buildings, and exhibits in a harmonious manner, with strong connections between indoor and outdoor spaces and an emphasis on the natural environment. The buildings are organized around a pedestrian circulation loop, and modern materials and detailing are used to evoke an inviting, rustic architectural form.

The overall design of this facility adheres to the principles of the park's 1994 *Architectural Character Guidelines* but also incorporate many elements of sustainable design. The principal structures around the plaza area include an orientation center, a bookstore, two shuttle bus shelters serving routes to other South Rim destinations, two restrooms, a system of freestanding outdoor shelters and outdoor orientation exhibit kiosks, an extensive network of pedestrian paths connecting the information plaza to Mather Point, shaded rest structures, a bus parking area, and a transit pavilion. The facilities blend with the existing environment through building design, compatible materials and colors, native vegetation, and the buildings' spatial orientation. The two largest structures, the orientation center and bookstore, are the most visually dominant and inviting buildings, with clerestory windows and shaded portico entryways. Unifying visual elements include building scale, the use of gable standing seam metal roofs, stucco finish, and stone throughout the buildings and site (foundation wall wainscot, retaining walls, signage piers, etc.). Service buildings are less visually prominent, one-story structures with simple gable roofs, set away from the main circulation route. Parking, service access drives, and connector routes are on the perimeter of the built area.

The pathways are approximately 16 feet wide, and directional signage clearly articulates path

options for visitors. Path edges are sometimes delineated with metal pole and cable fencing to protect vegetated areas. Small scale landscape features also blend with the overall design, so that the complex reads as a whole. The kiosks, wayside exhibits, and shade shelters found around the site repeat the architectural character of the area and help visually unify the site while also providing a visitor function. Informational and directional signs play an important role, directing visitors to and from the Mather Point overlook, as well as to shuttle bus stops and visitor amenities.

### **Mather Point**

Mather Point is one of the most visited viewpoints at the Grand Canyon. As one of the first vistas that visitors encounter as they enter the park from the south, Mather Point serves as an introduction to the panorama of the Grand Canyon, with its expansive views across the 18-mile width of this portion of the canyon. Mather Point includes two overlooks known as the east and west overlooks, as well as a parking area pullout and pathways to the overlooks. The primary view of the canyon is a panorama from east to northwest. Vegetation has grown in along the rim since Mather Point's original construction in the 1950s, and it now obscures canyon views from the Rim Trail. No structures are visible from Mather Point when one looks toward the village area or back towards Canyon View Information Plaza. This is because of the screening effects of the surrounding woodland vegetation and topography.

At the Mather Point pullout, a landscaped island varying from 30 to 50 feet wide separates the parking area from the South Entrance Road, with entrances/exits on the west and east ends. These entrances are hazardous because the long scenic pullout is popular as the first canyon-view pullout for visitors entering the park from the south. Vehicles traveling along the broad sweeping curve of the entrance road have to decelerate quickly to enter the pullout (NPS 1994b). The pullout offers perpendicular parking on the canyon



The popularity of the scenic vistas at Mather Point, combined with the lack of parking at Canyon View Information Plaza, often causes vehicle congestion in this area.

side and parallel parking for larger vehicles on the roadway side. Both sides of the parking area have masonry curbing the entire length of the pullout. The island between the road and the parking area dates from the original construction and provides a vegetative screen that runs the entire length of the parking area.

The canyon-side parking area is fronted by an asphalt walkway with stone edging. The main circulation corridor along the parking area is in fair condition, with some areas worn and weathered more than others. The pathway between the parking area and the rim is densely vegetated. A vegetated island between the parking lot and the overlook is a theme found at other overlooks along the East Rim Drive, as well as a curvilinear safety guardrail to protect visitors from the canyon below. The paths that lead out to the rim and overlooks narrow from the main path and are lined by a historic metal guardrails and some stone edging. The defining qualities of this landscape include the stone walls that blend in with the natural landscape, the widespread use of native vegetation, the low, fieldstone

curbing and steps, and the use of benches on the perimeter of the overlook to provide for a semiprivate place from which to view the canyon (NPS 1997a).

Today, while the scenic views from Mather Point are still exceptional and a main visitor attraction, the immediate views on the approach to and from Mather Point are of the often overcrowded parking lot. Because of the popularity of the scenic vistas at Mather Point combined with the lack of parking at Canyon View Information Plaza, this area is often congested with vehicles as drivers search for parking and a large number of pedestrians arriving from and returning to Canyon View Information Plaza. The flashing lights and painted crosswalks in the roadway near the parking lot are a visual distraction and intrude on the otherwise natural setting of the overlook area. At peak visitation during summer parked automobiles and motor homes fully line the approaching roadway since there is insufficient parking in the designated lot. This renders a visually cluttered and confusing arrival to the area, which was not the original design intent for this parking area (University of Idaho 2003).

### ***Grand Canyon Village***

Grand Canyon Village is the largest developed area in the park, occupying about 3.3 square miles on the South Rim. The majority of park and concessioner services and residential facilities are in the village. This area is a popular destination and provides one of the park's major overlook areas for visitors. The visual character of the landscape surrounding Grand Canyon Village has been significantly altered over time by man-made structures, roads, utilities, buildings, parking areas, and vehicles. The historic village illustrates the origins, growth, and development of this area as the hub of tourist and transportation-related activities at the South Rim since the establishment of the park.

Bright Angel Wash is a natural divide between the more public area along the rim and the utility and residential zones to the south, and

it has historically served as the transportation corridor for the railway. The railroad tracks and 1909 depot are located in the wash. The 20- to 30-foot terraced rock slopes directly north of the wash are the dominant topographic features, in contrast to the drainage's relatively flat, accessible grades. The slope on the north side of the wash is retained by a historic masonry wall that dates to 1928. Immediately along the south side of the wash is an access road flanked by three historic utility buildings — the laundry, the power-house, and the mule barn. Informal gravel parking occurs along the road, as well as in two unmarked lots. Very little tree cover remains within the area adjacent to these buildings. The *Grand Canyon Village NHL Cultural Landscape Report* (Milner Associates Inc. 2004) calls for retaining and maintaining, as much as possible, the existing tree cover that is non-invasive and in good condition. Further to the east a significant grove of trees in grassland remains and serves as a visual buffer and screen between the railroad tracks and land uses to the south, and the report also recommends retaining this feature. The long east-west views through the interior of the wash and down the railroad tracks are similar to the historical views, and they reinforce the open space and industrial character of the area. The natural drainage swale still exists on the south side of the wash, between the railroad tracks and the access drive.

### **South Entrance Station**

For many visitors the first park experience is the South Entrance Station, preceded by the park entrance sign and pull-off area approximately 0.2 mile south of the entrance station, on the east side of SR 64. The visual character of the corridor leading up to the entry is a two-lane forested road, and the entrance sign and pull-off provide a visual and physical break from the roadway before one enters the park. After this point the roadway begins to widen from a single lane to four lanes approximately 470 feet from the entrance station. The four lanes pass by ticket booths/kiosks and then merge back into one northbound lane

(Upchurch 2005). The current South Entrance Station, constructed in 1987, consists of three masonry and wood toll booths covered by two peaked roofs of shake shingles and three pre-fabricated fee collection kiosks. These modern structures are a “rustic revival” style of park architecture, set in a forested landscape, which is consistent with NPS *Management Policies 2006*, which state that entrance and fee collection stations will be harmonious with the park environment and should reflect the architectural character of the park.

The park is currently studying the widening of SR 64 from the park boundary to the entrance area, with the addition of two northbound lanes and a separate bypass lane to the east. The bypass lane would diverge from SR 64 between the park boundary and park entrance sign and would merge back onto the highway approximately 750 feet north of the entrance station. This proposal, which would alleviate long waits at the entrance station and improve public safety, is a separate project (NPS 2007c).

### **Greenway Trail**

The visual character of SR 64 on the northward approach to the park transitions from urbanized development in Tusayan to woodland vegetation. The adjacent land on both sides of the road is part of the Kaibab National Forest, and the terrain is generally flat to rolling, climbing gradually from south to north. Management of these lands is guided by the *Kaibab National Forest Land and Resource Management Plan* (as amended in 2004; USFS 2004). The landscape is dominated by moderately dense to sparse ponderosa pine forest, and the large trees and density of vegetation preclude views across the landscape. The Tusayan Ranger Station (previously known as the Moqui Ranger Station) is on the east side of SR 64 and includes a complex of historic buildings and modern buildings, including a USFS residential area as well as the historic ranger station. The vegetated landscape in this area is pre-

dominantly ponderosa pine with some scattered oak and juniper.

**Tusayan**

SR 64 runs north-south through the center of Tusayan, the most common route for visitors traveling from Flagstaff or Williams to Grand Canyon National Park. The view along SR 64 in Tusayan is open, and the visual character is a developed commercial landscape with businesses that include hotels, restaurants, and services. The Arizona Department of Transportation maintains a 100-foot right-of-way flanking SR 64, and there is often a paved area or a minimally landscaped building set back from the highway. Sidewalks parallel the road to separate vehicular traffic from businesses. Structures in Tusayan south of the USFS site lack a unified architectural style. Motels, fast-food restaurants, a grocery store, and the National Geographic Visitor Center are the main structures seen by travelers driving north through Tusayan.

The overall visual quality of the developed area along SR 64 is characteristic of roadside commercial strip development. However, the *Tusayan Area Plan* envisions an improvement to the aesthetic quality of Tusayan through appropriate architectural designs, landscaping, and restricted use of signs to provide a positive visitor experience (Coconino County 1997).

The visual appearance of Highway 64 in the Tusayan business district shall be improved through requirements for appropriate landscaping and signage for new developments and redevelopment or expansion of existing businesses.

The plan’s “Design Review Overlay Zone” provides specific guidance for future development, such as an emphasis on preserving existing trees, using native plant material, incorporating adequate open space, providing landscaping within parking lots to break up impermeable surface coverage, and setting utilities underground. In addition, the Arizona Department of Transportation is planning a



SR 64 runs north-south through the center of Tusayan. The visual character is a developed commercial landscape.



On the north side of Tusayan development decreases and views become enclosed by forest on the way to the park entrance.

roadway and landscape improvement project on SR 64 to enhance the pedestrian environment and general area’s aesthetics. As part of this state project, the roadway will be widened to accommodate raised medians and a wider paved shoulder for bicyclists, also pedestrian crossings and two roundabouts (one at each end of Tusayan) will be added. Construction of these improvements is anticipated to begin in 2010 (USDOT and ADOT 2007).

On the north side of Tusayan the views become more enclosed by forest on the way to the park entrance. The foreground views from SR 64 towards the National Geographic Visitor Center and the adjacent national forest system parcel at the northwest end of town are primarily open with some vegetative screening. There is an access drive on the north side of the building, with some parking in front and the majority in the rear (west side), out of direct view from SR 64. The national forest system land adjacent to the National Geographic Visitor Center is visually dominated by moderately sparse ponderosa

pine forest. The terrain slopes gently upward from SR 64 and becomes more densely forested farther back from the road. The landscape in the area closest to SR 64 has been heavily disturbed over time, with random rock piles, irregularly graded soil, and debris piles.

The 1995 *Tusayan Area Plan Design Review Overlay*, as amended, provides direction for new development and redevelopment of multiple family, commercial, industrial, and public or semi-public uses within Tusayan (Coconino County 1997). The intent of the guidelines is to encourage a very high aesthetic quality identified in the plan's vision statement. The guidelines are "designed to achieve the effect of a model gateway community, which integrates the built environment with the existing natural environment." The guidelines are intended to be complementary to and compatible with architectural and design standards which the National Park Service has developed for the South Rim, to promote an "aesthetically harmonious transition from the Tusayan community into the Park." The plan also states that for development permitted on national forest system land, "Proposals for special use permits for development on Forest Service land should meet the standards set forth with these policies."

The *Kaibab National Forest Land and Resource Management Plan* (as amended 2004; USFS 2004) identifies SR 64 as a "sensitive travelway" with important scenic features. The management direction for the South Zone, which encompasses the Tusayan and Williams ranger districts, calls for the Forest Service to provide extensive management of recreation, visual, and heritage resources and to maintain and enhance the scenic and aesthetic values of Kaibab National Forest.

## Environmental Consequences

### *Methodology and Assumptions*

This environmental assessment considers each alternative's consistency with applicable NPS and USFS design goals and management policies for visual and scenic resources. The

NPS *Management Policies 2006* describe the park resources and values that are subject to the agency's no-impairment standard, which includes a park's scenery, scenic features, natural visibility, both in daytime and at night; and natural landscapes. Important national park values also include appropriate opportunities to experience enjoyment of these resources to the extent that this can be done without impairing them.

The NPS *Management Policies 2006* also require the National Park Service to design facilities that are integrated into the park landscape and environs with sustainable design and systems to minimize environmental impact. The integration of facilities into the park environment will involve sensitivity to cultural, regional, aesthetic, and environmental factors. "Development will not compete with or dominate park features or interfere with natural process" (NPS 2006d, sec. 9.1.1.2).

The USFS *Landscape Aesthetics: A Handbook for Scenery Management* (USFS 1995) includes widely used criteria for visual resource analysis. The goal of the scenery management system is to create and maintain landscapes having high scenic diversity, harmony, and unity for the benefit of society in general. Generally, the closer a resource is to the viewer, the more dominant it is and the greater its importance to the viewer. This handbook provides guidance for determining the sensitivity of scenes based on their distance from an observer:

- *foreground* — up to 0.5 mile from the viewer
- *middleground* — up to 4 miles from the foreground
- *background* — 4 miles from the viewer to the horizon

Landscapes that do not fall into one of these categories and that are not visible from selected travelways or use areas are considered seldom-seen areas (USFS 1995).

The *Kaibab National Forest Land and Resource Management Plan* (as amended 2004) provides management direction for the land area encompassed by the Tusayan and Williams ranger districts. This plan calls for the U.S. Forest Service to provide extensive management of recreation, visual, and heritage resources, and to maintain and enhance the scenic and aesthetic values of Kaibab National Forest.

The degree of impact considers both the magnitude of change in the visual resource (visual character and quality) and viewers' responses to and concern for those changes. The visual features of the landscape were identified by reviewing literature and park studies, NPS and USFS staff knowledge of the resources and sites, site observations, input provided by specialists, and best professional judgment.

The analysis of visual and scenic resources for this project focuses on those sites described in the "Affected Environment" section. Each of these areas is evaluated for the effect that an alternative would have on key features, including scenic vistas, observation points, and scenic resources. The assessment of impacts considers whether the resulting visual change would substantially degrade or improve scenic resources and the existing visual character. An assessment of impacts on the cultural landscape, where this is applicable, is addressed in the "Cultural Resources" section (beginning on page 150). Impacts for each alternative are described based on an overall assessment of the alternative's ability to preserve the scenic qualities of the study area, including scenic vistas. The overall visual impact analysis of the study area is based on an analysis of the component pieces of the landscape setting.

The level of impact was determined by assessing the following:

- potential of proposed elements to alter immediately surrounding views, both foreground and intermediate ground views

- potential of proposed elements to affect distance views, including alteration in background views of Grand Canyon vistas
- importance to people, or sensitivity, of views of visual resources in the landscape
- number of people affected, duration of view, and the magnitude of the effects
- method for viewing (by vehicle, on foot, etc.)
- for adverse impacts, the effectiveness of mitigation measures to avoid or reduce impacts associated with the proposed actions

#### Study Area

The study area includes the entire project area and surrounding land uses and key view corridors from within the project area, as identified in the "Affected Environment."

#### Impact Thresholds

The following impact thresholds were defined:

- *Negligible* — Effects would result in little or no detectable change in visual character or views. Effects would be noticed by few people within the vicinity of the impacts; however, the impacts would not dominate either the foreground or background.
- *Minor* — Most of the landscape character would be retained, with the alteration of small elements. Changes to the visual character and views would be detectable, but they would not appreciably alter important landscape characteristics or views, and scenic quality would not be negatively affected. Foreground effects would be readily noticeable to people within the impact area; however, background vistas would not be affected, and the landscape would have the capability to visually absorb and incorporate most of the changes.

- *Moderate* — Changes to the visual character and views of the site would be readily noticeable. One or more secondary features of views of the site would be altered, but key features or views would remain intact. Effects would dominate the foreground vistas and would be noticeable by most people. Background vistas would be impacted, but the effects would not dominate the viewshed. Some modification of the landscape character would be evident.
- *Major* — Changes to the visual character and views of the site would be highly noticeable and severe, and the pre-project landscape would be altered beyond recognition. Key features of views would change. A majority of both foreground and background viewsheds would be dominated by changes and/or impacts would be noticed over large distances, such as from the North Rim. The landscape character would be modified to a degree where no retention would be achieved and most of the adjacent views would not be maintained.

#### Duration

**Short-term Impact.** The impact would occur only during project implementation, including moderate revegetation efforts.

**Long-term Impact.** The impact would continue after implementation and would be permanent and continual.

#### Nature of Impact

**Adverse Impact.** An adverse impact would reduce the existing landscape character, impede on access to the natural scene and important viewpoints, and dominate or compete with the natural park features.

**Beneficial Impact.** A beneficial impact would enhance the existing landscape character, minimize the visual effects of man-made development, remove existing impediments to the natural scene and access to viewpoints, and would not dominate or compete with

natural park features, such as the canyon views.

#### **Alternative A: No Action**

##### Direct / Indirect Impacts

**Canyon View Information Plaza / Mather Point.** Under alternative A vehicular and pedestrian congestion at Mather Point would continue because of limited parking and not enough spaces to meet current or future demand. Visitors would park illegally on the side of the road. National Park Service staff would implement traffic management measures, such as flashing signs for crosswalks and the use of road cones, as feasible to control congestion. Parking congestion and these temporary measures often add visual clutter to the already congested site. Parking demand at Mather Point would exceed capacity by nearly 240%. This would result in longer lines of private vehicles along the South Entrance Road as drivers circle through the parking area looking for space, and in more informal off-road parking as a result of the lack of spaces. All of this would add to the visual clutter and congestion of the area. Tour buses would continue to park at existing designated spaces at Canyon View Information Plaza. Therefore, local, long-term, minor, adverse visual impacts would continue as a result of insufficient parking.

**South Entrance Station.** The South Entrance Station would continue to operate with five entry lanes and one exit lane. To relieve congestion, the park recently added a fifth lane and added three prefabricated entry kiosks to increase operational capacity. One kiosk was placed at lane 5 and two were placed north of the pre-existing kiosks on lanes 2 and 3. This configuration would continue in the future and monitored for its operational efficiency. As proposed in the *Environmental Assessment / Assessment of Effect, South Entrance Road Improvements* (NPS 2007c), the park would construct up to two additional northbound lanes between the park boundary and the entrance station to relieve current congestion, and a new inbound bypass lane would be

added for shuttle buses and other authorized traffic. These actions would improve the queuing capacity at the station. The resulting visual impact would be local, long-term, negligible, and beneficial.

**Grand Canyon Village.** Under alternative A there would be no changes to the parking supply and parking lot configurations in the Grand Canyon Village. Tour buses would continue to park in lots B and E as well as undesignated locations, depending on availability and choices made by individual bus operators. Loading and unloading for up to six tour buses would be retained at Bright Angel Lodge. Private vehicles would continue to park in existing lots. The Grand Canyon Railway would continue to operate under current conditions, with no modifications of the loading / unloading area by the depot. As a result, tour buses would continue to temporarily contribute to roadway congestion along Village Loop Drive when the train arrives or departs, causing visual clutter and congestion in this area. This would result in a local, long-term, minor, adverse effect on visual resources in Grand Canyon Village.

**Tusayan.** No physical improvements and actions are proposed in the Tusayan area in this alternative; therefore there would be no impacts.

#### Cumulative Impacts

Other past, present, and reasonably foreseeable planned actions in and around Grand Canyon National Park have the potential to impact visual and scenic resources in the study area. Several projects that are either scheduled or proposed for construction work could result in local, short-term, negligible to minor, adverse cumulative impacts on visual resources. This is due to the nature of construction staging and associated activities; but all of these impacts would be short-term in duration and local.

Long-term projects that could cause cumulative impacts include fire management activities, rehabilitation of the Grand Canyon

Depot, improvements at park entrance stations, roadway and landscape modifications along SR 64 in Tusayan, and rehabilitation of South Rim viewpoints. These projects are further discussed below:

- Treatment recommendations in the park's *Fire Management Plan*, including fuel reduction projects such as prescribed burns, could have both short-term, minor, adverse impacts and long-term, minor, beneficial impacts on visual and scenic resources.
- Rehabilitating the historic Grand Canyon Depot would have a long-term, minor, beneficial impact on the historic Grand Canyon Village setting.
- Undertaking the park's scheduled improvements at both the East and South Entrance Stations would reduce vehicle congestion and enhance the visitor entry experience and the visual character at both areas, with long-term, minor beneficial impacts.
- Improvements to the SR 64 road corridor through Tusayan would include landscaping, circulation modifications, and restricted use of signs to improve the visual character of area, with local, long-term, moderate, beneficial impact to visual resources.
- Rehabilitating and enhancing approximately 14 South Rim viewpoints would have long-term, minor, beneficial impacts on visual and scenic resources.

These impacts from past, in-progress, and reasonably foreseeable projects in combination with the long-term, minor adverse and negligible, beneficial impacts of alternative A would result in long-term, minor, beneficial cumulative impacts to visual resources in the project area. Alternative A would contribute marginally to these total cumulative impacts.

#### Conclusion

Alternative A would result in local, long-term, minor, adverse impacts to visual resources

from vehicular and pedestrian congestion at Mather Point and tour bus congestion in Grand Canyon Village. There would also be a local, long-term, negligible, beneficial impact from anticipated improvements at the South Entrance Station. Cumulative impacts would be local, long-term, minor, and beneficial. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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 NPS planning documents, there would be no impairment of the park's visual resources.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would not be unacceptable impacts on visual resources under alternative A.

### **Alternative B: Preferred Alternative**

#### Direct / Indirect Impacts

The primary actions under alternative B that could impact visual resources include modifications at Mather Point and Canyon View Information Plaza, relocation of a segment of the South Entrance Road, construction of up to 900 parking spaces at Canyon View Information Plaza, and development of a shuttle staging and parking area at the north end of Tusayan on national forest system land. Other aspects of this alternative would have less potential to affect the overall visual character and scenic resources in the project area, as described below.

**Construction Impacts.** Construction activities would occur in phases. The primary areas

of disturbance would be at Canyon View Information Plaza, Mather Point, the Grand Canyon Railway and lot D area, the South Entrance Station, and the Tusayan shuttle bus staging area. The first phase of work would focus on improvements at Canyon View Information Plaza and Mather Point, plus the expansion of the shuttle maintenance facility. Subsequent phases would affect Canyon View Information Plaza, Grand Canyon Railway (lot D), the South Entrance Station, and Tusayan. Less intrusive impacts would occur from constructing the Greenway Trail, restriping parking areas, and adding signs and wayfinding elements throughout the project area. Construction activities, wherever they occurred, would create temporary local changes to the visual character of specific areas. The resulting impacts would be local and short-term.

At major construction sites, such as Canyon View Information Plaza and Mather Point, activities would include the use of heavy equipment, including dozers, graders, scrapers, and trucks in key view corridors. Safety and directional signs would also be visible. Construction staging areas would be sited in previously disturbed areas and/or parking areas that would be returned to the previous use and function when construction was complete. A batch plant would be set up at the park's dump site, located between South Entrance Road and Center Road, approximately 0.25 mile west of the South Entrance Road near Grand Canyon Village. This batch plant use would not affect visual resources as the area is already disturbed, is about 0.25 mile from the South Entrance Road, and is screened from public view by vegetation. At Canyon View Information Plaza, Mather Point, and Tusayan, these activities would result in short-term, moderate, adverse impacts to the existing visual character and views of the area. At the South Entrance Station, construction activities would be visible, but since they would primarily be to the side of the entrance area, they would not be prominent enough to detract from the overall visual character of the area and would result in local,

short-term, minor, adverse impacts. Entrance operations could continue without much disruption.

Overall, alternative B would result in local, short-term, minor to moderate, adverse impacts on visual resources in specific project locations during construction. Implementation would occur in different phases and at different locations. Multiple phases of work would occur at Canyon View Information Plaza and Tusayan, which would result in a recurrence of local, short-term, moderate, adverse impacts to visual resources in the area. Construction activities, including staging areas, heavy equipment storage and use, materials storage, and increased truck traffic on roads, would be visible to most visitors. Mitigation measures would somewhat reduce the adverse visual effect of construction activities, but they would not reduce the intensity of the adverse impact.

**Operations Impacts.** *Canyon View Information Plaza* — The primary modifications at Canyon View Information Plaza at full build-out under alternative B would include rerouting the South Entrance Road to loop around the area, developing new parking for visitors and tour buses, and constructing new buildings and amenities for visitor services. These modifications would have a noticeable change to the visual character of Canyon View Information Plaza; however, efforts would be made to minimize the visual impact of new features and to design them in such a manner as to enhance the overall visitor arrival and orientation experience to the South Rim.

In the first phase of construction the South Entrance Road segment would be rerouted to loop south and west around Canyon View Information Plaza, changing the current arrival sequence for visitors. Most visitors would no longer arrive directly at Mather Point, typically a very congested area, but would first arrive at Canyon View Information Plaza and then proceed by foot or shuttle bus to the Mather Point overlook. New parking adjacent to the existing Canyon View devel-

oped area would be accessible from the realigned South Entrance Road. Initially, parking would be provided for 600 vehicles, with an additional 300 vehicles at full build-out. If the park determined that other transportation means were effective in meeting parking needs, the second phase might not be necessary, and the visual impacts of the local area would be reduced.

Parking would be broken into clusters, each accommodating no more than 200 parking spaces and separated by large islands of retained vegetation of at least 40–50 feet wide to lessen the visual impact of a large number of parking spaces. Changes to the existing topography would be kept to a minimum. To the extent possible, the design of parking clusters and roads would incorporate the use of native vegetation to aid in blending the new development into the existing landscape. Clearly delineated pathways that connect from the parking area to the plaza would be included in the design layout.

A new tour bus parking lot for 40 buses would be provided to the north or northeast of Canyon View Information Plaza. A passenger drop-off would be constructed within 200–400 feet of the rim. A new trail would provide access from the tour bus loading area to the canyon rim and connect with Canyon View Information Plaza. A new double vault restroom, which would be consistent in design and materials to other restrooms currently being installed at other park overlooks, would also be provided near the tour bus drop-off.

At Canyon View Information Plaza proposed building and landscape modifications would be in keeping with the original design intent for the area. When seen from within the site, views would be similar from most any direction. New structures (the theater and bike rental facility) would be compatible with the existing buildings in material, color, scale, height, and massing. The new theater would be an addition to the existing visitor center and would be sized to seat approximately 250 visitors. The bike rental service would be

located in a new building on the west side of the plaza building cluster, in an area previously disturbed and cleared. This new structure would help unify and complete the “circle of development” around the central plaza, as originally intended. The new buildings would adhere to the principles established in the park’s *Architectural Character Guidelines*, which were used in the design development for Canyon View Information Plaza. The new buildings and site features would maintain the village character and setting.

New paths would be compatible with the existing ones in material, scale, and color so as to blend in with the existing development. Service vehicle and delivery areas would be screened from view as much as possible. Improvements to pedestrian circulation and orientation would be achieved by means of additional directional signs and readily accessible paths to key visitor destination points, including South Rim shuttle stops and Mather Point. Site restoration for areas disturbed during construction, as well as for areas where existing pavement would be removed, would use existing vegetation to provide a sense of naturalness to the setting. For areas of new construction, vegetative screens and buffers would be used to minimize visual impacts of the development, including the filtering of direct light from vehicular headlights.

The construction of parking, a new roadway, and new buildings under alternative B would be a substantial visual change to the existing setting. Although parking construction would have a moderate impact on the area’s scenic values, the use of vegetative screening integrated into the design would help soften the appearance of the lots. Through incorporation of mitigation measures to ensure that new elements are visually compatible with the existing development, the proposed modifications would help unify and strengthen the visual presence and character of Canyon View Information Plaza as a park visitor orientation facility. At full build-out, the area of new ground disturbance would be approximately

24 acres and would include the removal of approximately 2,700 trees to accommodate the proposed road realignment, new parking, pathways and building construction. These changes would result in a local, long-term, moderate, adverse impact to visual resources. These impacts could be reduced to minor if only the first phase of construction was implemented, resulting in a reduced footprint of parking with less ground disturbance and tree removals.

*Mather Point* — Numerous improvements would be made at Mather Point to enhance the overall visual quality and scenic resources of this area. Changes would include removing and rerouting the South Entrance Road, removing the Mather Point parking area, rehabilitating the Mather Point overlook, enhancing the Rim Trail with selective vegetative clearing, constructing a new shuttle stop at the west end of the lot, constructing a new canyon viewing area on an existing outcrop, and installing additional walls and/or guardrails along the rim and other visitor amenities such as seating, picnic tables, and shelters.

Removing the South Entrance Road segment and associated parking area at Mather Point would result in an overall reduction in congestion and visual clutter because of the absence of vehicles. For areas where pavement would be removed, as well as areas along the South Entrance Road that would remain and are currently used for overflow parking, the landscape would be restored to more natural conditions through soil decompaction and native plant revegetation. Informal pull-offs from the road would be blocked to prevent illegal roadside parking. Revegetation of areas previously impacted by social trailing and off-road parking would benefit the landscape character in these areas. Without the cars, visitors would be able to experience middle-ground and background views of the canyon without vehicular clutter in the foreground. This would also allow for a more natural and serene landscape character to be reestablished adjacent to popular rim views, and it would allow more room for pedestrian flow. This

would result in a local, long-term, moderate, beneficial impact on visual resources at Mather Point. In addition, with the removal of vehicles and associated headlights at Mather Point, there would be a regional, long-term, negligible, beneficial effect for views from the North Rim to Mather Point.

Several improvements are proposed to rehabilitate the Mather Point overlook area to be fully accessible to all visitors, including those with disabilities. Modifications include constructing an accessible trail, approximately 200 feet long, from the canyon rim to the primary easternmost overlook. This would require removing some rock on the point; filling areas; constructing retaining walls or other structural supports; adding walls, guardrails, and/or handrails in some locations; and modifying the base of the existing stairway. Some vegetation would be removed along the rim edge to accommodate the new trail. Where necessary, existing paved surfaces throughout the Mather Point area would be repaired, widened, and resurfaced to eliminate uneven surfaces. All of these proposed improvements would be designed to be compatible with the setting and would be in keeping with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*.

Vegetation along the Rim Trail that has grown since the original construction of Mather Point and now obstructs views to the canyon would be cleared and/or pruned. This would enhance canyon viewing opportunities for visitors.

A new canyon viewing area, approximately 30 by 40 feet, would be created on an existing flat rock outcrop to the east of the primary overlook and adjacent to the Rim Trail, providing another viewing opportunity for visitors. The overlook would be visible from the other Mather Point overlooks but would be designed so as to blend in with the natural setting through materials and color.

New site furnishings such as seating, picnic tables, and trash receptacles would be in-

stalled in previously disturbed areas and would be similar in style with other park furnishings and small scale features such as those found at other nearby overlooks and at Canyon View Information Plaza.

A new shuttle bus stop and turnaround at the west end of the existing parking lot would be constructed, and the shuttle bus shelter, seating, and signs and would be similar in design to those elements at other park shuttle stops. It would be fully accessible and readily visible for ease of visitor access. A new double vault restroom would be constructed near the tour bus drop-off area and would be similar to those being installed at other South Rim overlooks. The shelter would be of natural, muted colors that replicate existing hues to visually blend in with the setting as much as possible. The structure would also be sited in a manner so as not to compete with views and vistas and would allow for adequate queuing away from traffic.

The proposed modifications at Mather Point, with the removal of a segment of the South Entrance Road, parking area, and informal off-road parking; the rehabilitation of Mather Point; and the improvement of other sites and pedestrian routes would result in local, long-term, moderate, and beneficial impacts to visual and scenic resources. Proposed mitigation measures (see page 122) would ensure the visual compatibility of new features with the historic setting and existing Canyon View Information Plaza development.

*Grand Canyon Village* — Parking management efforts for lots A–E would reduce vehicular congestion and visual clutter, helping clarify for visitors where to park. Specific actions would include restriping areas to maximize the number of cars that can be parked and designating spaces by vehicle type (e.g., automobiles, RVs, and tour buses).

Modifications at the Grand Canyon Railway staging area and lot D would improve tour bus loading / unloading for Grand Canyon Railway passengers. If needed, tracks 5 and 6, which are currently buried beneath lot D,

could be re-opened to accommodate additional trains. To improve railway passenger tour bus loading operations, a one-way west-bound access road and nine passenger loading / unloading spaces would be provided south of the railyard and within the eastern portion of lot D. The access road and bus spaces would be constructed on the south side of track 6, north of the Bright Angel Wash. To construct the access road, a portion of the historic stone wall on the east side of the railyard would need to be removed. The 14- to 16-foot-wide access road would be designed to be compatible with the historic setting and character of the area; it would be paved and vehicular parking at lot D would be removed, enhancing the overall visual character. In addition, pedestrians and bicyclists could share the new access road to get to Hermit Road by way of the Old Village Bypass Road. As needed, a new passenger platform between the tracks and between the bus loading area and the tracks would be built. The platform extension would be compatible in design, color, and style with the existing platform and would not detract from the historic setting.

With the implementation of these changes, there would be a local, long-term, minor, beneficial impact to the visual character of the railway staging area and lot D.

*South Entrance Station* — One additional service lane for inbound traffic would be constructed at the South Entrance Station if needed. This would result in a total of six entry lanes, in addition to the bypass lane that would be constructed to the east under a separate project. If the stacked temporary kiosks continued to provide adequate ticketing capacity, they could be replaced with permanent kiosks that would be compatible in design with the existing entry station in terms of building style, materials, and color.

In addition, a new fee administration building, access drive, and parking area would be constructed east of the entrance station. The building would be approximately 1000 square feet and one-story high. This new building

would be visible from the entrance lanes, but it would be partially screened by existing trees and other vegetation. The access road to the administration building would connect to the South Entrance Road approximately 750 feet north of the entrance station. Parking at the building would be for employees only. The building's design and landscaping would adhere to the principles established in the park's *Architectural Character Guidelines*, and it would be compatible with the existing entrance station structures. Approximately 3 acres of new ground disturbance would occur, and approximately 650 trees would be removed to accommodate these changes. These modifications at the South Entrance Station would result in a local, long-term, minor, adverse impact to visual resources.

*Greenway Trail* — The 1.2-mile extension of the Greenway Trail from the park boundary south to Tusayan would be set back from SR 64 on the east side in forested lands. The trail would provide a new opportunity for hikers, bicyclists, and equestrians to enter the park. The southern terminus of the trail would connect to the proposed roundabout to be constructed in Tusayan by the Arizona Department of Transportation, just north of SR 64 milepost 236.

The proposed trail would be 10 feet wide with a hardened surface and a stabilized shoulder made from a mix of aggregate and topsoil. An area 12–14 feet wide would be temporarily disturbed during construction; this area would be restored and revegetated after construction. Some trail segments might be visible from the highway, but in general a vegetative buffer would screen the trail from the roadway. Trail users would primarily see foreground views, as the landscape is dominated by trees and dense vegetation that block long-distance views. Some areas with dense vegetation could be cleared below shoulder height to allow for safe maneuverability for bicyclists and to allow for views outward toward the road.

Approximately 375 trees would be removed to construct the trail, with approximately 3 acres of new ground disturbance. Safety and traffic control signs, consistent with other park Greenway Trail signs, would be located along the trail as needed. The trail would be designed to meander through the landscape, while generally following the roadway's alignment to minimize tree removals and grading, as well as to avoid sensitive plant locations and cultural resources. Overall, the construction of the Greenway Trail would result in a local, long-term, negligible, adverse impact to visual and scenic resources.

*Tusayan* — The proposed improvements at Tusayan, on national forest system land adjacent to the National Geographic Visitor Center, would include construction of a shuttle bus staging area and related amenities, and new private vehicle parking, including RV and spaces accessible to people with disabilities. Visitor parking would first be constructed inside the park at Canyon View Information Plaza. Then, in subsequent phases, if the results of the park's adaptive management strategies required it, the shuttle staging, associated amenities, and parking would be constructed at Tusayan.

The parking areas would be broken into at least two clusters of no more than 200 spaces each, for a total build-out of 400 spaces. A separate but related project proposed by the Arizona Department of Transportation would be the construction of a roundabout at the proposed parking area's entrance on SR 64. If constructed, the shuttle staging area would include a fee collection and visitor information station, a covered shelter for shuttle bus passengers, restrooms, and a wayside exhibit area. New paths would be provided to connect the parking areas to the shuttle bus transfer station and to existing pedestrian sidewalks along SR 64 and the proposed extension of the Greenway Trail on the east side of SR 64. The area of new disturbance would be approximately 10 acres, and approximately 330 trees would be removed to accommodate the new facilities.

It is anticipated that the Tusayan facility would only be used during the peak visitation season, when shuttle bus service was provided between Canyon View Information Plaza and Tusayan. The various sizes, configurations, and locations of the parking areas would affect how they would be perceived visually and which viewer groups would be affected. Motorists along SR 64 would be slightly affected with the introduction of the new shuttle staging area and parking lots as they traversed the highway. Consistent with the *Tusayan Area Plan* guidelines for site design, the new parking areas would include adequate landscaping within the periphery and interior to break up the impermeable surfaces. Landscaped islands with existing vegetation plus native vegetation would be used. To the largest extent possible, the amount of grading and changes to the existing topography would be minimized. Parking areas would be built into the landscape and terraced into the slope, and vegetation would be retained and supplemented to provide screening from the highway. In the short term, during construction and for the first couple of years after completion, the vegetation would not fully screen the parking areas. Once mature, the vegetation would improve the quality of views in the immediate vicinity and break up the visual appearance of the new parking area.

Sidewalks and pedestrian paths would also be integrated into the landscape design to facilitate movement from the parking areas to the shuttle stop, as well as connecting to the Greenway Trail. Parking lot and pedestrian path lighting would also be provided and would be consistent with guidelines in the *Tusayan Area Plan*. The shuttle staging area would be visible from SR 64 and access to the parking and shuttle area would be well-signed along the highway to facilitate visitor access. The structures' design and landscaping would be consistent with the architectural design palette used at the South Entrance Station and would comply with the park's *Architectural Character Guidelines*. The National Park Service would work closely with the U.S. Forest Service during the design development phase

to ensure that the facilities would blend into the natural landscape by retaining natural vegetation and integrating natural features.

At full build-out at Tusayan, the overall impact of this proposed development would be long-term, minor, and adverse to local visual and scenic resources. This would be achieved by incorporating mitigation measures such as adherence to applicable design guidelines and sensitive layout and design. These impacts at Tusayan would not occur until deemed necessary by the National Park Service to ensure a successful visitor transportation program at the park.

*Orientation and Wayfinding* — Implementing recommendations from the park’s updated “Sign Plan for the South Rim” would enhance the visual continuity of messaging in the park and could reduce sign clutter. Consistent signage would facilitate in-park vehicular circulation and provide visual cues to orient visitors. Signs, icons, or graphic systems would be employed to help visitors make routing decisions to parking areas, shuttle stops, and other visitor attractions. These improvements would provide a more legible landscape for visitors to navigate and result in a local, long-term, negligible, beneficial impact to the visual setting within the park.

#### Cumulative Impacts

Other past, in-progress, and reasonably foreseeable actions within and around Grand Canyon National Park would impact visual and scenic resources. As noted under alternative A, several projects that are either scheduled or proposed for construction work in or adjacent to the project area could have short-term, localized, adverse cumulative impacts to visual resources due to the nature of construction staging and associated activities. The implementation of mitigation measures, namely the park’s coordination of construction activities to minimize the visual intrusion of construction equipment and activity in visitor areas, would reduce the adverse cumulative effects of simultaneous construc-

tion activities to short-term and minor to moderate.

The individual impacts associated with long-term projects would be the same as alternative A. However, when combined with impacts from alternative B, the following cumulative impacts would result.

- Treatment recommendations identified in the park’s *Fire Management Plan* could have short-term, minor, adverse impacts as well as long-term, minor, beneficial impacts with fuel reduction projects, such as prescribed burns. Combined with the proposed actions in alternative B, the cumulative impacts would be short-term, minor to moderate, and adverse and long-term, minor, and beneficial.
- Rehabilitating the Grand Canyon Depot would have a long-term, beneficial effect on the historic Grand Canyon Village setting. When combined with the modifications to the railway staging area and lot D as proposed under alternative B, the cumulative impact would be local, long-term, minor, and beneficial.
- Scheduled improvements at the East and South Entrance Stations, and proposed modifications to increase the number of northbound lanes between Tusayan and the entrance station, would enhance the visual character of the visitor park arrival experience. These modifications, when combined with the proposed modifications at the South Entrance Station under alternative B, would result in long-term, minor, beneficial cumulative impacts.
- Proposed improvements along SR 64 in Tusayan would enhance the overall roadway character. When combined with the proposed development on national forest system land north of Tusayan under alternative B, the long-term cumulative impact on visual resources would be minor and beneficial.

- Rehabilitating and enhancing some 14 South Rim viewpoints would have long-term, minor, beneficial impacts on visual and scenic resources. When combined with proposed modifications at Mather Point and the addition of a new overlook, the resulting cumulative impacts on visual resources would be long-term, moderate, and beneficial.

In summary, the overall cumulative impact of these past, in-progress, and reasonably foreseeable future projects in combination with alternative B would be local, short-term, minor to moderate, and adverse due to construction work. The long-term cumulative impacts would be local and regional, minor to moderate, and beneficial. Alternative B would noticeably contribute to the total overall cumulative impact.

### Conclusion

Alternative B would result in local, short-term, minor to moderate, adverse impacts during construction. Local, long-term impacts to visual resources would be moderate and adverse at Canyon View Information Plaza; moderate and beneficial at Mather Point; minor and beneficial at the Grand Canyon Railway yard; minor and adverse at Tusayan and the South Entrance Station; and negligible to minor and adverse impacts at other locations. Adverse impacts would be lessened in the long term by revegetation efforts along disturbed edges and the implementation of mitigation measures. Short-term cumulative impacts would be local, minor to moderate, and adverse; long-term cumulative impacts would be local and regional, minor to moderate, and beneficial. There would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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; therefore, there would be no impairment of park visual and scenic resources.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would not be unacceptable impacts on visual resources under alternative B.

### **Alternative C: Tusayan Parking Emphasis**

#### Direct / Indirect Impacts

The primary actions under alternative C that could impact visual resources are modifications at Canyon View Information Plaza and Mather Point, relocation of a segment of the South Entrance Road, a shuttle bus system between Canyon View Information Plaza and Tusayan, and construction of a shuttle staging and long-term parking area at the north end of Tusayan. Other aspects of this alternative would have less potential to affect overall visual character and scenic resources in the project area, as discussed below.

**Construction Impacts.** Construction activities under alternative C would occur in phases. Wherever construction occurred, the visual character of specific areas would be temporarily changed. The type, extent, and duration of construction would vary by location and would be phased; however, the resulting local, short-term impacts would be similar.

The primary areas of disturbance under alternative C would be at Canyon View Information Plaza, Mather Point, and the Tusayan shuttle staging area, all of which would be affected during the initial phase of implementation. Activities would include the use of heavy equipment, including dozers, graders, scrapers, and trucks, in key view corridors; safety and directional signs would also be visible. Construction staging areas would be sited in previously disturbed areas

and/or parking areas that would be returned to the previous use and function when construction had been completed. At Canyon View Information Plaza, Mather Point, and Tusayan, these activities would result in local, short-term, moderate, adverse impacts to the existing visual character and views.

As noted in alternative B, a batch plant would be set up at the park's dump site but would not affect visual resources as the area is already disturbed, is about 0.25 mile from the South Entrance Road, and is screened by vegetation. At the South Entrance Station improvements to the kiosk stations would be minimal and would not be prominent enough to detract from the overall visual character of the area. Entrance operations could continue without much disruption.

Future phases of construction work would occur at Tusayan and Canyon View Information Plaza, adjacent to the first phase of work. This would result in a reoccurrence of local, short-term, moderate, adverse impacts to visual resources in these project areas.

In summary, alternative C would have local, short-term, moderate, adverse impacts on visual resources in specific project locations during construction. Since implementation would occur in different phases and at different locations, impacts would be local and short-term. Construction activities, including staging areas, heavy equipment storage and use, materials storage, and increased truck traffic on roads, would be visible to most visitors. Mitigation measures would somewhat reduce the adverse visual effect of construction activities, but it would not reduce the intensity of the adverse impact.

**Operations Impacts.** *Canyon View Information Plaza* — The primary modifications at Canyon View Information Plaza under full build-out would include the realignment of a portion of the South Entrance Road to loop around the plaza, constructing a new parking area for visitors and tour buses, and adding buildings and amenities for visitor services. Similar to alternative B, these modifications

would be noticeable to visitors but would improve the overall visitor arrival and orientation experience to the park's South Rim.

Removing and realigning the eastern segment of the South Entrance Road to loop south and west of Canyon View Information Plaza would change the current visitor arrival sequence. For visitors coming from the east, their first point of arrival would be the parking and staging areas at Canyon View Information Plaza, and they would then proceed by foot or shuttle bus to the Mather Point overlook. While the parking lot at Mather Point would be retained under alternative C, it would be used only for parking by persons with disabilities and for a shuttle bus stop and turnaround. Visitor vehicle and tour bus parking would be located to the south and east of Canyon View Information Plaza. A total of 400 parking spaces for cars, including RVs, would be provided, and only short-term use would be allowed. The existing tour bus parking lot would be expanded to accommodate 40 buses. A drop-off area would be provided at the west end of the tour bus parking lot. These improvements would all be made during the initial phase of implementation. A rerouted South Entrance Road and new parking area would be noticeable changes to the visual character of Canyon View Information Plaza; however, mitigation measures would help minimize the visual impact of these new built features.

Parking would be broken into clusters separated by large islands at least 40–50 feet wide with vegetation to lessen the visual impact of a large number of parking spaces. Changes to existing topography would be kept to a minimum. To the extent possible, the design of parking clusters and roads would use native vegetation to help the new development blend into the existing landscape. Clearly delineated pathways to Canyon View Information Plaza would be included in the design layout.

As described under alternative B, other proposed modifications at Canyon View Information Plaza would include a theater and a

bike rental facility, which would be in the same locations. The design of these facilities would be in keeping with the original intent for the area, with compatible materials, colors, scale, height, and massing. In addition, improvements would be made to the existing shuttle bus stop on the northeast side of the plaza to the north of the tour bus parking area. It would not be readily visible from the plaza area. As noted under alternative B, all of these new buildings would adhere to the design principles established in the park's *Architectural Character Guidelines*.

New paths, service vehicle and delivery areas, and improvements to pedestrian circulation and orientation would also be similar to alternative B. Site restoration for areas disturbed during construction, as well as for areas where existing pavement would be removed, would use existing vegetation to provide a sense of naturalness to the setting. For areas of new construction, vegetative screens and buffers would be used to minimize visual impacts, including the filtering of direct light from vehicular headlights.

Under alternative C the total area of new disturbance at Canyon View Information Plaza would be approximately 15 acres, with the removal of approximately 1,690 trees in the area. This would result in a noticeable visual change to the existing setting. The long-term impact to visual resources would be minor and adverse. Although construction of new parking lots would have a moderate impact on the area's scenic values, the number of spaces and area of disturbance at Canyon View Information Plaza under alternative C would be less than the other action alternatives. Integrating vegetative screening into the design and breaking the parking areas into smaller clusters would help soften their appearance. Using mitigation measures to ensure that new elements are visually compatible with existing development would help unify and strengthen the visual presence and character of Canyon View Information Plaza as the primary visitor orientation facility on the South Rim.

*Mather Point* — Some modifications would be made at Mather Point to enhance the overall visual quality and scenic resources of this area, including removing pavement, rerouting a segment of the South Entrance Road to loop around Canyon View Information Plaza, converting the parking area to spaces for people with disabilities plus a shuttle bus stop and turnaround, and rehabilitating the overlook to be accessible to all visitors.

The eastern segment of the South Entrance Road pavement would be removed and revegetated. The parking lot would only be accessed from the west end and would be for people with disabilities and shuttle bus access. These changes to the road and parking would result in an overall reduction in congestion and visual clutter along the rim. These actions would allow a more natural and serene landscape character to be reestablished in the eastern portion of Mather Point, resulting in a local, long-term, minor, beneficial impact on visual resources. In addition, reducing the number of vehicles and associated headlights at Mather Point would have a regional, long-term, negligible, beneficial impact for nighttime views from the North Rim to Mather Point.

As described under alternative B, several improvements are proposed to rehabilitate the Mather Point overlook area. Modifications would be the same as alternative B and include constructing an accessible trail from the canyon rim to the primary easternmost overlook, removing some vegetation to accommodate the trail and to reestablish scenic views, and repairing and resurfacing pavement. A new viewing area would be created on an existing rock outcrop, and new site furnishings would be installed in previously disturbed areas. A new shuttle bus stop, seating, and signs would be provided at the west end of the parking lot, as described for alternative B.

For areas where pavement was removed, as well as areas along the South Entrance Road that currently are used for overflow parking, the landscape would be restored to more

natural conditions through soil decompaction and native plant revegetation. Informal pull-offs along the road would be blocked to prevent illegal parking. Revegetation of areas previously impacted by social trailing and off-road parking would benefit the landscape character in these areas.

Proposed modifications at Mather Point under alternative C would result in local, long-term, minor, beneficial impacts to the area's visual and scenic resources. Unlike alternative B, some parking would still be provided near the rim, which would continue to detract from the more natural setting of the canyon rim. Proposed mitigation measures would ensure visual compatibility of new features with the historic setting and existing Canyon View Information Plaza development.

*Grand Canyon Village* — Similar to the other action alternatives, parking management efforts for lots A–E would reduce vehicular congestion and visual clutter, helping clarify for visitors where to park. Specific actions would include restriping areas to maximize the number of cars that can be parked and designating spaces by vehicle type (e.g. automobiles, RVs, and tour buses) and use (such as lodging).

Modifications to the Grand Canyon Railway yard would be the same as alternative B and would provide for new tour bus loading / unloading for railway passengers. Modifications would include providing a new access road along the south side of the railroad tracks, a loading/unloading area for nine buses along the access drive, potential uncovering tracks 5 and 6, and removing parking from lot D. These actions would result in a local, long-term, minor, beneficial impact to the visual character of this area.

*South Entrance Station* — The treatment of the South Entrance Station under alternative C would be similar to alternative A. The five existing entrance lanes would remain, and no new lanes would be constructed. The existing temporary kiosk on lane 5 could be removed and a permanent kiosk constructed in its

place. If the stacked kiosks continued to provide adequate entry ticketing capacity, they could be replaced with permanent kiosks or removed. In addition, as described for alternative B, a new fee administration building, access drive, and parking area would be constructed east of the entrance station. The building's design and landscaping would adhere to the principles established in the park's *Architectural Character Guidelines* and would be compatible with the existing structures. The area of new disturbance would be 2 acres and approximately 430 trees would be removed. These changes would result in a local, long-term, minor, adverse impact to visual resources.

*Greenway Trail* — As described under alternative B, the 1.2-mile-long Greenway Trail extension from the park boundary southward to Tusayan would be constructed on the east side of SR 64 in forested lands. The impacts to visual and scenic resources would be the same as alternative B and would result in a local, long-term, negligible, adverse impact.

*Tusayan* — Proposed improvements at Tusayan would occur on national forest system land adjacent to the National Geographic Visitor Center. They would include a shuttle bus staging area and related amenities, and new private vehicle parking for up to 920 vehicles, including RVs and parking for persons with disabilities. The parking areas would be constructed in multiple phases; after initial construction, future phases would be undertaken in conjunction with visitation increases, parking demand, and the successful implementation of shuttle bus service between Canyon View Information Plaza and Tusayan. The shuttle staging area would include a fee collection and visitor information station, a covered shelter for passengers, restrooms, and a wayside exhibit area. New paths would connect the parking areas to the shuttle bus transfer station and to existing pedestrian sidewalks along SR 64 and the proposed Greenway Trail extension on the east side of SR 64.

The area of new disturbance would be approximately 17 acres, and approximately 560 trees would be removed to accommodate the new facilities. Although more parking spaces would be developed than under alternative B, the impacts would be similar. The National Park Service would work closely with the U.S. Forest Service, as well as the community of Tusayan, to ensure that the proposed new development would blend into the natural landscape as much as possible. The various sizes, configurations, and locations of parking areas would affect how they were perceived visually and which viewer groups would be affected. Parking lots would be broken into clusters of no more than 200 spaces each, and they would be designed to be terraced into the slope and include adequate landscaping within the periphery and interior to break up the impermeable surfaces. Landscaped islands with existing vegetation and additional native plantings would be used, and changes to the existing topography would be minimized.

As described under alternative B, sidewalks and pedestrian paths would also be integrated into the landscape design to facilitate movement from the parking areas to the shuttle bus stop and Greenway Trail. Parking lot and pedestrian path lighting would be consistent with guidelines in the *Tusayan Area Plan*. The shuttle staging area would be visible from SR 64, and access to the parking and shuttle bus area would be well-signed along the highway to facilitate access by visitors. The structures' design and landscaping would be consistent with the park architectural design palette for the South Entrance Station and would comply with the park's *Architectural Character Guidelines*.

At full build-out, actions at Tusayan would result in a local, long-term, moderate, adverse impact to visual and scenic resources. It is anticipated that this area would only be used from March through October, when shuttle bus service would be provided to Canyon View Information Plaza. Mitigation measures such as adherence to applicable design guidelines and sensitive layout and design of

the parking areas would minimize the effects of this development. These impacts could also be reduced if only the first phase of construction was implemented.

*Orientation and Wayfinding* — Similar to alternative B, implementation of recommendations from the park's updated "Sign Plan for the South Rim" would enhance the visual continuity of messaging in the park and could reduce sign clutter. Consistent signage would facilitate in-park vehicular circulation and provide visual cues to orient visitors. Signs, icons, or graphic systems would help visitors make routing decisions to parking areas, shuttle stops, and other visitor attractions. These improvements would result in a local, long-term, negligible, beneficial impact to the visual setting within the park.

#### Cumulative Impacts

Other past, in-progress, and reasonably foreseeable future projects within and around Grand Canyon National Park that would result in local, short- and long-term cumulative impacts to visual and scenic resources would be the same as alternative B. As previously discussed, several projects that are either scheduled or proposed for construction work in or adjacent to project areas could result in local, short-term, minor to moderate, adverse cumulative impacts because of the visual intrusion of construction equipment and activity in visitor areas.

Long-term, minor to moderate, beneficial impacts would be related to the same viewpoint, road corridor, and entrance station improvements as described in alternative B. When these long-term project impacts are combined with impacts from alternative C, the cumulative impacts would generally be the same as identified in alternative B, except related to Mather Point improvements. When other viewpoint project impacts are combined with proposed modifications at Mather Point in alternative C, the cumulative impact would be local and regional, long-term, minor, and beneficial. Overall, the long-term cumulative impact of past, present, and reasonably

foreseeable projects in combination with the impacts of alternative C would be local, short-term, minor to moderate, and adverse due to construction and local, long-term, minor to moderate, and beneficial because of multiple transportation improvements.

### Conclusion

Alternative C would result in local, short-term, moderate, adverse impacts during construction. Local, long-term impacts to visual resources would be minor and adverse at Canyon View Information Plaza and the South Entrance Station; minor and beneficial at Mather Point and the Grand Canyon Railway yard; moderate and adverse at Tusayan; and negligible to minor and adverse at other locations. These impacts would be reduced if only the first phase of construction at Tusayan occurred, resulting in a smaller area of impact. Impacts on the North Rim from reducing headlights at Mather Point would be regional, long-term, negligible, and beneficial. The impacts would also be lessened over the long term by natural encroachment and revegetation efforts in disturbed areas and with the implementation of mitigation measures. Short-term cumulative impacts would be local, moderate, and adverse; long-term cumulative impacts would be local and regional, minor to moderate, and beneficial. There would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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; therefore, there would be no impairment of park visual and scenic resources.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5)

do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would not be unacceptable impacts on visual resources under alternative C.

### **Alternative D: Canyon View Information Plaza Parking Emphasis**

#### Direct / Indirect Impacts

Alternative D proposes that all new private vehicle parking for day visitors would be provided at Canyon View Information Plaza, with no development in Tusayan. Actions that could impact visual resources include modifications at Mather Point and Canyon View Information Plaza, realignment of a segment of the South Entrance Road, removal of Mather Point parking, and construction of nearly 1,200 parking spaces at Canyon View Information Plaza. Other aspects of this alternative would impact the overall visual character and scenic resources in the project area to a lesser degree, as discussed below.

**Construction Impacts.** Construction activities under alternative D would occur in phases and would create temporary changes to the visual character of specific construction areas during implementation. The type, extent, and duration of construction would vary by location and would be sequenced; however, the resulting short-term impacts would be similar.

The primary areas of disturbance would be at Canyon View Information Plaza, Mather Point, Grand Canyon Railway staging area and lot D, and the South Entrance Station. Construction activities would include the use of heavy equipment, including dozers, graders, scrapers, and trucks, in key view corridors; safety and directional signs would also be visible. Construction staging areas would be sited in previously disturbed areas, and a batch plant would be set up at the park's dump site, as described for alternatives B and C, but it would not affect visual resources. Construction impacts under alternative D would be the same as alternative B at Canyon

View Information Plaza and Mather Point, with local, short-term, moderate, adverse impacts to the existing visual character and views. Construction activities at the South Entrance Station would also be similar to alternative B.

At least two phases of construction would take place at Canyon View Information Plaza resulting in a reoccurrence of local, short-term, moderate, adverse impacts to visual resources in this area. Construction activities, including staging areas, heavy equipment storage and use, materials storage, and increased truck traffic, would be visible to most visitors. Mitigation measures would somewhat reduce the adverse visual effect of construction activity, but they would not reduce the intensity of the adverse impact.

**Operations Impacts.** *Canyon View Information Plaza* — The primary modifications at Canyon View Information Plaza under alternative D at full build-out would include the realignment of the South Entrance Road to loop around the information plaza, the construction of parking for visitors and tour buses, and the development of new buildings and amenities for visitor services. These modifications would be similar to those described under alternative B except that more parking would be provided at Canyon View Information Plaza under alternative D. These changes would be noticeable to visitors but would improve the overall visitor arrival and orientation experience to the South Rim. Efforts would be made to minimize the visual impact of the new parking areas.

Similar to the other action alternatives, removing and realigning the South Entrance Road segment to loop south and west around Canyon View Information Plaza would change the current arrival sequence for visitors. Visitors would first arrive at Canyon View Information Plaza and then proceed by foot or shuttle bus to the Mather Point overlook. Parking would be located to the south and east of Canyon View Information Plaza. Parking would be built in phases, and at

full build-out a maximum of 1,190 parking spaces would be provided. The existing stop for the Kaibab Trail shuttle bus route would be converted to use for tour bus passenger loading / unloading, and a new 40 space tour bus parking area would be located northeast of the existing bus parking area at Canyon View to provide closer access to Mather Point.

As described under alternative B, parking would be broken into clusters, each accommodating no more than 200 spaces and separated by 40- to 50-foot-wide islands with vegetation to lessen the visual impact of a large number of parking spaces. Changes to the existing topography would be kept to a minimum. To the extent possible, the design of parking clusters and roads would use native vegetation to aid in blending the new development into the existing landscape. Clearly delineated pathways to the Canyon View Information Plaza area would also be included.

Other proposals for Canyon View Information Plaza would be the same as alternatives B and C, and would be in keeping with the original design intent for the area. The new facilities to house these services would adhere to the principles established in the park's *Architectural Character Guidelines*. The new buildings and site features would blend in with the existing development cluster to maintain the village character and setting.

New paths, service vehicle and delivery areas, and improvements to pedestrian circulation and orientation would also be similar to alternative B. Site restoration for areas disturbed during construction, as well as for areas where existing pavement would be removed, would use existing vegetation to provide a sense of naturalness to the setting. For areas of new construction, vegetative screens and buffers would minimize visual impacts, including filtering direct light from vehicular headlights.

Under alternative D the construction of parking, a realigned roadway, and new

buildings would be a substantial visual change to the existing setting. The area of new ground disturbance would be approximately 26 acres, and approximately 2,930 trees would be lost. Although parking lot construction would have a local, long-term, moderate, adverse impact on the area's scenic values, integrating vegetative screening into the design, similar to alternative B, would help soften their appearance.

*Mather Point* — Numerous improvements would be made at Mather Point that would enhance its overall visual quality and scenic resources. Changes would include removing and realigning the South Entrance Road, removing the Mather Point parking lot, rehabilitating the overlook, enhancing the Rim Trail, providing a new shuttle stop and turnaround, and other visitor amenities.

The proposed treatment for Mather Point and the South Entrance Road would be the same as for alternative B. The South Entrance Road pavement and parking lot would be removed and the area restored to natural vegetation. A new shuttle bus stop and turnaround would be constructed at the west end of Mather Point. These changes would result in a long-term, moderate, beneficial impact because of reduced congestion and visual clutter by removing vehicles and associated headlights at Mather Point. A regional, long-term, negligible, beneficial effect for views from the North Rim to Mather Point would also occur.

For other areas where pavement was removed, as well as areas along the South Entrance Road that are currently used for overflow parking, the landscape would be restored to more natural conditions through soil decompaction and native plant revegetation. Informal pull-offs along the road would be blocked to prevent illegal parking. Revegetation of areas previously impacted by social trailing and off-road parking would benefit the landscape character in these areas.

Consistent with the other action alternatives, Mather Point overlook would be rehabilitated to accommodate all visitors, including persons

with disabilities. The Rim Trail would be enhanced to offer more scenic viewing opportunities for visitors. A new viewing area would be constructed on an existing flat rock outcrop, the same as alternative B. New built elements at the Mather Point overlook would be designed to be compatible and consistent with the setting and similar in style to other park furnishings and small-scale features found at other nearby overlooks and Canyon View Information Plaza. A shuttle bus shelter at the west end of Mather Point would be consistent in design with other park shuttle stops and would be fully accessible and readily visible for ease of visitor access.

Overall, the impacts to visual and scenic resources at Mather Point would be the same as alternative B — local and regional, long-term, moderate, and beneficial. Proposed mitigation measures would ensure visual compatibility of new features with the historic setting and the existing Canyon View Information Plaza development.

*Grand Canyon Village* — Proposed changes at Grand Canyon Village would be the same as those described for alternatives B and C, and they would result in the same impacts. Parking management efforts for lots A–E would reduce vehicular congestion and visual clutter, helping clarify for visitors where to park. Modifications to the Grand Canyon Railway yard, with a new access drive and new loading/unloading area, would improve the existing tour bus loading conditions, resulting in a local, long-term, minor, beneficial impact to the visual character of this area.

*South Entrance Station* — Modifications at the South Entrance Station would be similar to those proposed under alternative B. A total of six service lanes and a bypass lane would be available at the entrance. As in alternative B, a permanent kiosk could replace the prefabricated kiosk in lane 5, and the stacked kiosks in lanes 2 and 3 could be replaced with permanent kiosks or removed at the discretion of park management. In addition, a new fee administration building, access drive, and

parking would be constructed east of the entrance station. The total area of new ground disturbance would be 3 acres, and approximately 350 trees would be lost, the same as alternative B. These changes would result in local, long-term, minor, adverse impacts to visual resources.

*Greenway Trail* — The implementation of the Greenway Trail would be the same as described under alternatives B and C, with a local, long-term, negligible, adverse impact to visual and scenic resources.

*Tusayan* — No physical improvements and actions are proposed in the Tusayan area in this alternative; therefore, there would no impacts.

*Orientation and Wayfinding* — Implementing recommendations from the park's updated "Sign Plan for the South Rim," as described under alternative B, would result in a local, long-term, negligible, beneficial impact to the park's visual setting by providing a more legible landscape for visitors to navigate.

#### Cumulative Impacts

Cumulative impacts to visual and scenic resources would be the same as alternative B with the exception that no NPS development would occur at Tusayan under alternative D. Local, short-term, minor to moderate, adverse impacts would occur from construction activities and local and regional, long-term, minor to moderate, beneficial impacts would occur from improvements to viewpoints, entrance stations, and road corridors. These impacts when combined with the impacts of alternative D would result in local, short-term, minor to moderate, adverse cumulative impacts and local and regional, long-term, minor to moderate, beneficial cumulative impacts. Alternative D would noticeably contribute to the total overall cumulative impact.

#### Conclusion

Alternative D would result in local, short-term moderate, adverse impacts during construction. Local, long-term impacts to visual resources would be moderate and adverse at Canyon View Information Plaza; moderate and beneficial at Mather Point; minor and beneficial at the Grand Canyon Railway yard; minor and adverse at the South Entrance Station; and negligible to minor and adverse at other locations. No new impacts would occur in Tusayan. Adverse impacts would be lessened in the long term by revegetation efforts along disturbed edges and the implementation of mitigation measures. Regional, long-term, negligible impacts at the North Rim would result from reducing headlights at Mather Point. Short-term cumulative impacts would be local, minor to moderate, and adverse; long-term cumulative impacts would be local and regional, minor to moderate, and beneficial. There would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in park establishing legislation or proclamations, (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* of other relevant NPS planning documents; therefore, there would be no impairment of park visual resources.

Because the impacts previously described (1) are not inconsistent with the park's purpose and values, (2) do not prevent the attainment of desired future conditions for natural and cultural resources, (3) do not create an unsafe environment, (4) do not diminish opportunities for future enjoyment of the park, and (5) do not unreasonably interfere with park programs or activities, an appropriate use, or concessioner or contractor operations, there would not be unacceptable impacts on visual resources under alternative D.