National Park Service
U.S. Department of the Interior

ZION NATIONAL PARK
UTAH

Soundscape Management Plan and Environmental Assessment

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PURPOSE AND NEED

INTRODUCTION

Zion National Park (ZNP), located in southwest Utah, was established as Mukuntuweap National Monument on July 31, 1909 by Presidential Proclamation under the authority of the Antiquities Act (Figure 1). The proclamation stated that the area was set apart: as "…an extraordinary example of canyon erosion and is of greatest scientific interest, and it appears that the public interest would be promoted by reserving it as a National Monument, with such other land as may be necessary for its protection." In 1918 Presidential Proclamation 1435 (40 Stat.1760) recognized other geologic, archeologic, and geographic resources for protection within the monument and changed the name to Zion National Monument. Zion National Park was established by Congress in 1919. Since that time Congress has added lands to the park several times. The park now encompasses 148,733 acres.

The purpose of this Soundscape Management Plan (SMP) and Environmental Assessment (EA) is (1) to link soundscape management to existing park management direction, (2) to define the existing ambient soundscape, (3) to provide objectives and standards for its current and future management, and (4) to identify potential management actions designed to ensure that soundscape objectives and standards are met.

This document was formulated and prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, regulations of the Council on Environmental Quality (CEQ) (40 CFR §1508.9), and the National Park Service (NPS) Director's Order (DO)-12: *Conservation Planning, Environmental Impact Analysis, and Decision-making*. This plan is tiered from the Zion National Park General Management Plan (GMP) and Environmental Impact Statement (EIS) completed in 2001.

The NPS's *Management Policies, 2006* require analysis of potential effects to determine whether or not actions would impair park resources. The fundamental purpose of the national park system, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. National Park Service managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adversely impacting park resources and values.

However, the laws do give the NPS the management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the NPS the management discretion to allow certain impacts within park, that discretion is limited by the statutory requirement that the NPS must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of these resources or values. An impact to any park resource or value may, but does not necessarily, constitute an impairment, but an impact would be more likely to constitute an impairment when there is a major or severe adverse effect upon a resource or value whose conservation is:

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

An impact would be less likely to constitute an impairment if it is an unavoidable result of an action necessary to pursue or restore the integrity of park resources or values and it cannot be further mitigated. An impairment analysis for the preferred alternative can be found in Appendix 1.

BACKGROUND

Zion National Park displays important and diverse geologic, biological, cultural, and wilderness resources that are enjoyed by approximately 2.7 million visitors annually. The park is characterized by high plateaus, a maze of narrow, deep, sandstone canyons and striking rock towers and mesas. This varied topography includes five life zones that range from sub-alpine meadows and coniferous forests at the highest elevations, to juniper and pine forests at mid-elevation, and desert shrublands at the lowest elevations of the park.

The park soundscapes offer an array of rich and diverse natural sounds, as well as an environment relatively free of human-caused sound. These soundscapes are an integral component of what makes ZNP a unique place set aside for purposes expressed in both the NPS Organic Act and the Wilderness Act.

An important part of the NPS mission is to preserve or restore the natural soundscapes of parks and provide for enjoyable visitor experiences. Natural soundscapes exist in the absence of human-caused sound. The natural soundscape is the aggregate of all the natural sounds that occur in parks, together with the physical capacity for transmitting natural sounds. Natural sounds occur within and beyond the range of sounds that humans can perceive, and can be transmitted through air, water, or solid materials. Some natural sounds in the natural soundscape are also part of the biological or physical resource components of the park, such that protection of the soundscape also constitutes protection of other resource values directly identified as necessary to the park's purpose.

Natural sounds are inherent components of "the scenery and the natural and historic objects and the wild life" protected by the NPS Organic Act. They are vital to the visitor experience of many parks and provide valuable indicators of the health of various ecosystems. Intrusive sounds are of concern because they sometimes impede ecological function and diminish the NPS's ability to accomplish its resource protection mission.

Intrusive sounds are also a matter of concern to park visitors. As was reported to the U.S. Congress in the *Report on the Effects of Aircraft Overflights on the National Park System* (NPS, 1995), a system-wide survey of park visitors revealed that nearly as many visitors come to national parks to enjoy the natural soundscape (91 percent) as come to view the scenery (93 percent). Noise can also distract visitors from the resources and purposes of cultural areas--the tranquility of historic settings and the solemnity of memorials, battlefields, prehistoric ruins, and sacred sites. For many visitors the ability to hear clearly the delicate and quieter intermittent sounds of nature, the ability to experience interludes of extreme quiet for their own sake, and the opportunity to do so for extended periods of time are important reasons for visiting national parks and one of the driving forces behind the development of this plan.

Increasingly, even those parks that appear as they did in historical context do not sound like they once did. Natural sounds are being masked or obscured by a wide variety of human activities. In some parks, natural sounds are disappearing at such a rate that some may be gone before their existence can even be

documented. Thus, soundscape preservation and noise management is one more dimension of the complex problem of achieving the NPS mission of preserving park resources unimpaired for the enjoyment of present and future generations.

Superintendents must identify levels of human-caused sound which can be accepted within the management purposes of parks. Within and adjacent to parks, the NPS should monitor human-caused sound that adversely affects park soundscapes, including noise caused by mechanical or electronic devices. The NPS should take action to prevent or minimize all noise that adversely affects the natural soundscape or other park resources or values, or that exceeds levels that have been identified as being acceptable for visitor use and enjoyment.

PURPOSE

The purpose of the action is to protect and manage soundscapes in Zion National Park and to:

- Protect the acoustic experience of park visitors and ensure that natural sounds continue to play an important role in the enjoyment of park resources and values.
- Protect acoustic conditions for wildlife and the role of the soundscape in ensuring healthy and dynamic ecosystems.
- Provide an approach to managing the acoustic environment that is consistent with National Park Service policy.

Specifically the purpose is to:

- Identify appropriate and inappropriate sound sources for frontcountry and wilderness areas.
- Identify and implement indicators of soundscape quality.
- Develop soundscape standards for frontcountry and wilderness areas.
- Identify and implement methods for monitoring soundscape conditions to ensure that quality standards are being met.
- Identify management actions to be taken to ensure that soundscape quality standards are not exceeded and to restore degraded soundscapes to desired conditions.
- Identify a process to eliminate or mitigate sources of sound that are not appropriate to park purposes or management objectives.

Figure 1: General Location

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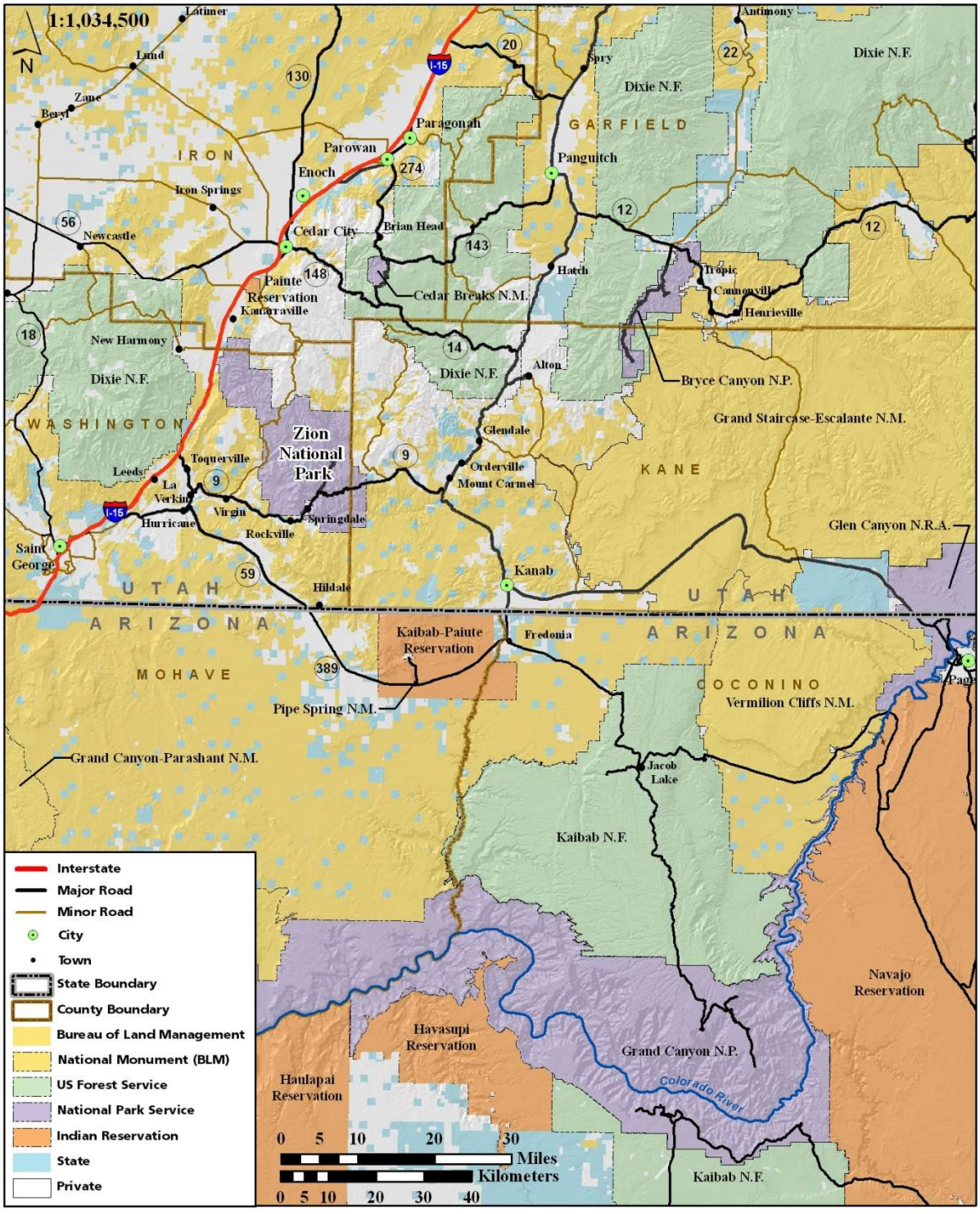
Zion National Park



NEED

In surveys of the American public, 91 percent of respondents indicated that providing opportunities to experience natural quiet and the sounds of nature was an important reason for having national parks. In fact, 72 percent felt that it was a "very important" reason. In response to the value the public places on natural sounds, NPS requires park managers to strive to preserve the natural soundscape associated with the physical and biological resources (for example, the sounds of wildlife or wind in the trees). Although nature is not always quiet (e.g., thunder, waterfalls), the absence of human-caused noise was discussed in the *Report on Effects of Aircraft Overflights on the National Park System* (NPS, 1995):

> *Parks and wildernesses offer a variety of unique, pristine sounds not found in most urban or suburban environments. They also offer a complete absence of sounds that are found in such environments. Together, these two conditions provide a very special dimension to a park experience — quiet itself. In the absence of any discernible source of sound (especially manmade), quiet is an important element of the feeling of solitude. Quiet also affords visitors an opportunity to hear faint or very distant sounds, such as animal activity and waterfalls. Such an experience provides an important perspective on the vastness of the environment in which the visitor is located, often beyond the visual boundaries determined by trees, terrain, and the like. In considering natural quiet as a resource, the ability to clearly hear the delicate and quieter intermittent sounds of nature, the ability to experience interludes of extreme quiet for their own sake, and the opportunity to do so for extended periods of time is what natural quiet is all about.*

The action is needed because:

- Sounds play an important role in maintaining healthy and diverse ecosystems in Zion National Park. Properly functioning soundscapes are important for animal communication, territory establishment, predator and prey relationships, mating behaviors, nurturing young and effective use of habitat. A soundscape management program is needed to promote ecosystem sustainability.
- Visitors to Zion appreciate and value natural sounds and a soundscape management program will help ensure that the soundscape resource is preserved in an unimpaired condition for future generations.
- Appropriate sounds and sound levels are essential to ensuring an authentic experience of cultural and traditional landscapes, resources, and values. Culturally significant sites and resources can be diminished by unwanted or inappropriate sounds.
- Soundscape management activities require collaboration with federal, state, county, tribal and local agencies, and a soundscape management plan provides a basis for communication, coordination, and project planning with partner agencies.

Like many areas in the U.S., including other national parks, the sources and intensity of noise in ZNP has increased in recent decades. Today, 14 operators are authorized by the Federal Aviation Administration (FAA) to conduct commercial air tours over Zion, and commercial airlines, general aviation, and other aircraft routinely fly over the park. Tour buses, trucks, cars, and motorcycles as well as park operations and other activities also add to noise levels in many areas of the park. In response, Zion recently instituted a mandatory shuttle bus system during periods of high visitation to address noise and other issues created by vehicular traffic. The Zion shuttle system carried 2.8 million riders in 2009 resulting in a noticeable reduction in vehicular sound levels. This SMP would continue that effort by providing a systematic approach to addressing noise issues, now and in the future.

RELATIONSHIP WITH OTHER PLANS

Planning in the NPS takes two different forms: general management planning and implementation planning. General management plans are required for national parks by the National Park and Recreation Act of 1978. Implementation plans, which tier off of general management plans, focus on "how to implement an activity or project needed to achieve a long-term goal" (NPS, 2006 *Management Policies*). Zion National Park's *General Management Plan*, completed in 2001, is the foundational document for managing the park.

The ZNP GMP provides general guidance on the management of natural soundscapes. Descriptions, strategies for management, and actions reflected in the GMP are provided below in the description of the no action alternative. The programmatic guidelines, findings, objectives, standards and mitigation measures expressed in this SMP provide additional detail to the GMP direction for soundscape management, and are consistent with GMP decisions.

The GMP states that park managers will prepare a soundscape preservation and noise management plan to provide guidance for managing all noise sources in the park, including buses, generators, NPS equipment, other aircraft, and external sources. This planning document fulfills the direction in the GMP. It is the purpose of this plan, in tiering from the park's GMP, to meet these needs by providing specific management actions to be implemented and specific procedures to be followed.

There are other park specific planning documents that address, directly or indirectly, the value of enhancing all aspects of the visitor experience (including the ability to experience natural sounds) and the importance of protecting wildlife interactions. This SMP is consistent with and supports the goals and objectives identified in those plans, which include:

- **Zion National Park Backcountry Management Plan, November 2007 –** Provides guidance for the management of backcountry and wilderness resources.
- **Zion National Park Fire Management Plan, April 2005 –** Allows for a full range of fire management strategies including allowing fire to take a natural role in ecosystem maintenance.
- **Statement for Management, Zion National Park, August 2002 –** Management overview of park.
- **Zion National Park Master Plan, May, 1977** – Overview of management strategies for the park.

APPROPRIATE USE

Section 1.5 of *Management Policies* 2006, *Appropriate Use of Parks*, directs that the NPS must ensure that park uses that are allowed would not cause impairment of, or unacceptable impacts on park resources and values. A new form of park use may be allowed within the park only after a determination has been made in the professional judgment of the park manager that it will not result in unacceptable impacts.

Section 8.1.2 of *Management Policies* 2006, *Process for Determining Appropriate Uses*, provides evaluation factors for determining appropriate uses. All proposals for park uses are evaluated for:

- consistency with applicable laws, executive orders, regulations, and policies;
- consistency with existing plans for public use and resource management;
- actual and potential effects on park resources and values;
- total cost to the Service; and
- whether the public interest will be served.

Park managers must continually monitor park uses to prevent unanticipated and unacceptable impacts. If unanticipated and unacceptable impacts emerge, the park manager must engage in a thoughtful, deliberate process to further manage or constrain the use, or discontinue it.

From Section 8.2 of *Management Policies* 2006: "To provide for enjoyment of the parks, the National Park Service will encourage visitor use activities that:

- are appropriate to the purpose for which the park was established, and
- are inspirational, educational, or healthful, and otherwise appropriate to the park environment; and
- will foster an understanding of and appreciation for park resources and values, or will promote enjoyment through direct association with, interaction with, or relation to park resources; and
- can be sustained without causing unacceptable impacts to park resources and values."

The goals, objectives, and management actions outlined in this plan are consistent with NPS policy as described in NPS Management Policies 2006 §1.5, 8.1.2, and 8.2.

SCOPING

Scoping is an effort to involve agencies, organizations, governments, and the public:

- in determining which issues should be addressed in the EA;
- to determine important issues to be given detailed analysis and eliminate issues not requiring detailed analysis;
- identify related projects and associated documents;
- identify permits, surveys, consultations, etc., required by other agencies; and
- create a schedule that allows adequate time to prepare and distribute the EA for public review and comment before a final decision is made.

Early in the planning process, staff at ZNP conducted internal scoping. This interdisciplinary process defined the purpose and need, identified potential actions to address the need, determined the likely issues and impact topics, and identified the relationship of the proposed action to other planning efforts at ZNP.

External scoping involves any interested individual, organization, and agency, or agencies with jurisdiction by law or expertise to provide early input. External scoping was initiated in March 2010 with a newsletter, and press release describing the proposed action. Two public workshops were held in Kanab and Springdale, Utah. The workshops provided an overview of the planning process, information on natural sounds and why they are important to wildlife and visitors, and how the acoustic environment in parks is monitored. Comments were solicited during the scoping period that ended April 9, 2010. Nineteen comment letters were received.

Consultation was also initiated at that time with affiliated Native American Indian tribes, the Utah State Historic Preservation Officer (SHPO), and the United States Fish and Wildlife Service (USFWS). A summary of the all comments received can be found in the *Consultation and Coordination* section of the document.

Through internal and external scoping, issues associated with soundscape management were identified. Through issue identification, impact topics were also identified.

ISSUES AND IMPACT TOPICS RETAINED FOR FURTHER ANALYSIS

In this section and the following section *Impact Topics Dismissed from Further Analysis*, the NPS considers the direct, indirect, and cumulative effects of the proposed action on the environment, along

with connected and cumulative actions. Impacts are described in terms of context and duration. The context or extent of the impact is described as localized or widespread. The duration of impacts is described as short-term or long-term. The intensity and type of impact is described as negligible, minor, moderate, or major, and as beneficial or adverse. The NPS equates "major" effects as "significant" effects. The identification of "major" effects would trigger the need for an EIS. Where the intensity of an impact could be described quantitatively, the numerical data are presented; however, most impact analyses are qualitative and use best professional judgment in making the assessment.

The NPS defines "measurable" impacts as moderate or greater effects. It equates "no measurable effects" as minor or less effects. "No measurable effect" is used by the NPS in determining if a categorical exclusion applies or if impact topics may be dismissed from further evaluation in an EA or EIS. The use of "no measurable effects" in this EA pertains to whether the NPS dismisses an impact topic from further detailed evaluation in the EA. The reason the NPS uses "no measurable effects" to determine whether impact topics are dismissed from further evaluation is to concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail in accordance with CEQ regulations at 1500.1(b).

Impact topics for the proposed action have been identified on the basis of federal laws, regulations, and orders; 2006 *Management Policies*; and NPS knowledge of resources at ZNP. Impact topics that are carried forward for further analysis in this EA are listed below. Each impact topic is further described and analyzed in the *Affected Environment and Environmental Consequences* section of this document.

Soundscapes

In accordance with the 2006 *Management Policies* and DO-47: *Sound Preservation and Noise Management*, an important component of the NPS mission is the preservation of natural soundscape associated with national park units (NPS, 2006). Natural soundscapes exist in the absence of human-caused sound. The natural ambient soundscape is the aggregate of all the natural sounds that occur in park units, together with the physical capacity for transmitting natural sounds. Natural sounds occur within and beyond the range of sounds that humans can perceive and can be transmitted through air, water, or solid materials. The frequencies, magnitudes, and durations of human-caused sound considered acceptable varies among NPS units and can vary throughout each unit, being generally greater in developed areas and less in undeveloped areas. Because the proposed actions in this plan have the potential for measurable effects on natural soundscapes, this topic has been carried forward for further analysis in this document.

Visitor Use and Experience

According to the 2006 *Management Policies*, the enjoyment of park resources and values by people is part of the fundamental purpose of all park units. The NPS is committed to providing appropriate, high quality opportunities for visitors to enjoy the parks, and will maintain within parks an atmosphere that is open and inviting for all segments of society. Further, the NPS will provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the exceptional natural and cultural resources found in parks. One of the natural resources that visitors come to national parks to enjoy is the natural soundscape. A study by Haas and Wakefield (1998) found that 95 percent of Americans regard opportunities to experience natural peace and the sounds of nature as an important reason for preserving national parks; 72 percent thought it was very important (Haas and Wakefield, 1998).

Over 2.7 million people visited ZNP in 2009. The most common visitor activities include sightseeing, scenic drives, hiking, backpacking, canyoneering, and photography. As in other national parks, visitors to Zion enjoy the sounds of nature: bird songs, the rustling of leaves, the sound of the river, or wind through the trees. These sounds can have a calming or relaxing effect. Or they can trigger memories of a pleasant

past experience. Because the proposed actions in this plan have the potential for measurable effects on visitor use and experience, this topic has been carried forward for analysis in this document.

Park Operations

Park operations refer to the maintenance of infrastructure to protect and preserve vital natural and cultural resources and provide for a quality visitor experience. Infrastructure includes: roads; trails (both in the frontcountry and wilderness); housing for staff; visitor facilities (visitor centers, restrooms, picnic areas); administrative buildings; management-support facilities (garages, shops, storage buildings, areas used to house and store maintenance equipment, tools and materials); and utilities such as phones, sewer, water and electric. Other park operations include activities performed by law enforcement, search and rescue, resource management, interpretation of park resources, fire management, administrative activities, and concession activities.

Many of these actions use motorized equipment to accomplish the job. Because the proposed actions in this plan have the potential for measurable effects on park operations, this topic has been carried forward for analysis in this document.

Wildlife, Threatened and Endangered Animal Species and Animal Species of Concern

The NPS strives to maintain all components and processes of naturally evolving ecosystems; including the natural abundance, diversity, dynamics, distribution, habitats, and behaviors of native animal populations and the communities and ecosystems in which they occur. The NPS also strives to minimize human impact on native animal populations, communities, and the ecosystems that sustain them. The diverse vegetation communities within Zion support a variety of wildlife species, including threatened and endangered animal species and animal species of concern.

The Endangered Species Act (ESA) of 1973 requires examination of impacts on all federally-listed threatened, endangered, and candidate species. Section 7 of the ESA requires all federal agencies to consult with the USFWS to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of the listed species or critical habitat. In addition, the 2006 *Management Policies* and DO-77: *Natural Resource Management* requires the NPS to examine the impacts on all animal species including federal candidate species, state-listed threatened, endangered, candidate, rare, declining, and sensitive species.

Many animals, insects and birds decipher sounds to find desirable habitat and mates, avoid predators and protect young, establish territories and to meet other survival needs. Scientific studies have shown that wildlife can be adversely affected by human-caused sounds and sound characteristics that intrude on their habitats. Although the severity of the impacts varies depending on the species, research has found that wildlife can suffer adverse physiological and behavioral changes from intrusive sounds and other human disturbance. Because the proposed actions in this plan have the potential for measurable effects on wildlife and threatened, endangered, or animal species of concern, this topic has been carried forward for further analysis in this document.

Wilderness

Management Policies 2006 states that: *the NPS will manage wilderness areas for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness. Management will include the protection of these areas, the preservation of their wilderness character, and the gathering and dissemination of information regarding their use and enjoyment as wilderness.* The policy goes on to state that: *in evaluating environmental impacts, the NPS will take into*

account (1) wilderness characteristics and values, including the primeval character and influence of wilderness; (2) the preservation of natural conditions (including the lack of man-made noise); and (3) assurances that there will be outstanding opportunities for solitude, that the public will be provided with a primitive and unconfined type of recreational experience, and that wilderness will be preserved and used in an unimpaired condition.

The Wilderness Act of 1964 states that: *A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain.…with the imprint of man's work substantially unnoticeable…*

The Omnibus Public Land Management Act of 2009 (Public Law 111-11) designated 124,462 acres, 84 percent of the park, within Zion National Park as wilderness. Another 9,047 acres, 6 percent of the park, are recommended for wilderness designation. This means that 90 percent of the park is managed as wilderness, as per NPS policy.

Clearly, the opportunities for park visitors to experience the sounds of nature are an important component of the wilderness experience. Because the proposed actions in this plan have the potential for measurable effects on wilderness character and values, the topic of wilderness has been carried forward for further analysis in this document.

IMPACT TOPICS DISMISSED FROM FURTHER ANALYSIS

In this section of the EA, NPS provides a limited evaluation as to why some impact topics are not evaluated in more detail. Impact topics are dismissed from further evaluation in this EA if:

- they do not exist in the analysis area, or
- they would not be affected by the proposal or alternatives, or the likelihood of impacts are not reasonably expected, or
- through the application of mitigation measures, there would be minor or less effects (i.e., no measureable effects) from the proposal or other alternatives, and there is little or no controversy on the subject or reasons to otherwise include the topic.

Due to there being no effect or no measurable effects, there would either be no contribution towards cumulative effects or the contribution would be low. For each issue or topic presented below, if the resource is found in the analysis area or the issue is applicable to the proposal, then a limited analysis of direct and indirect, and cumulative effects is presented. There is no impairment analysis included in the limited evaluations for the dismissed topics because the NPS's threshold for considering whether there could be impairment is based on "major" effects.

Vegetation

NPS policy is to maintain native plants by preserving and restoring the natural abundance, diversities, dynamics, distributions, and habitats of native plants populations and the communities and ecosystems in which they occur. Further, the NPS will minimize human impacts on native plant populations, communities, and the ecosystems and processes which sustain them (*Management Policies* 2006).

The actions proposed in this plan would not affect vegetation in any way. Because there would be no measurable effects, this topic is dismissed from further analysis in this document.

Threatened and Endangered Plant Species and Plant Species of Special Concern

The ESA of 1973 requires examination of impacts on all federally-listed threatened, endangered, and candidate species. Section 7 of the ESA requires all federal agencies to consult with USFWS to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of listed species or critical habitats. In addition, the 2006 *Management Policies* and DO-77: *Natural Resource Management* requires the NPS to examine the impacts on federal candidate species, as well as state-listed threatened, endangered, candidate, rare, declining, and sensitive species.

The proposed action would not affect threatened, endangered or sensitive plant species or habitats in any way. Because there would be no measurable effects, this topic is dismissed from further analysis in this document.

Lightscape Management

In accordance with 2006 *Management Policies*, the NPS strives to preserve natural ambient lightscapes, which are natural resources and values that exist in the absence of human-caused light (NPS, 2006). The proposed action would not change or add to existing lighting in the park. The effects of the proposed action on the lightscape would be less than negligible. Because there would be no measurable effects, this topic is dismissed from further analysis in this document.

Air Quality

The Clean Air Act of 1963 (42 U.S.C. 7401 et seq.) was established to promote the public health and welfare by protecting and enhancing the nation's air quality. The act establishes specific programs that provide special protection for air resources and air quality related values associated with NPS units. Section 118 of the Clean Air Act requires a park unit to meet all federal, state, and local air pollution standards.

Zion National Park is designated as a Class I air quality area under the Clean Air Act. A Class I designation sets a maximum allowable increase in concentrations of pollutants over baseline concentrations of sulfur dioxide and particulate matter as specified in §163 of the Clean Air Act. Further, the Clean Air Act provides that the federal land manger has an affirmative responsibility to protect air quality related values (including visibility, plants, animals, soils, water quality, cultural resources, and visitor health) from adverse pollution impacts.

The Class I air quality would not be affected by the proposed action. Because there would be no measurable effects, this topic is dismissed from further analysis in this document.

Water Resources

National Park Service policies require protection of water quality consistent with the Clean Water Act. The purpose of the Clean Water Act is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." To enact this goal, the U.S. Army Corps of Engineers has been charged with the evaluation of federal actions that could result in potential degradation of waters of the United States and issuing permits for actions consistent with the Clean Water Act. The U.S. Environmental Protection Agency (EPA) also has responsibility for oversight and review of permits and actions, which affect waters of the United States.

The proposed actions in this plan would result in less than negligible effects to water resources. Because there would be no measurable effects, this topic is dismissed from further analysis in this document.

Wetlands

NPS DO-77-1: *Wetland Protection* and Executive Order 11990 (*Protection of Wetlands*) provide guidelines for the protection of wetlands within NPS units. It states a policy of no net loss of wetlands and provides a process for evaluating actions that have a potential to have adverse effects on wetlands.

Wetlands occur in the park along river margins and floodplains, and as isolated wetlands associated with springs, seeps, and small impoundments. The area of the park that consists of wetlands is very small; 191 acres have been mapped or about 0.1 percent. Of this about half are palustrine (marshy or with standing water) and half are associated with rivers. About 6 percent are classified as saturated or semi-permanently flooded, 4 percent are seasonally flooded, and 89 percent are intermittently or temporarily flooded.

The actions identified in this document would not affect wetland characteristics or functions. Wetlands would not be degraded or lost due to the implementation of the proposed actions in this plan. Because there would be no measurable effects, this topic is dismissed from further analysis in this document.

Floodplains

Executive Order 11988 (*Floodplain Management*) requires an examination of impacts to floodplains and potential risk involved in placing facilities within floodplains. NPS *Management Policies* 2006; DO-2: *Planning Guidelines*; and DO-12: *Conservation Planning, Environmental Impact Analysis, and Decision-making* provide guidelines for proposed actions in floodplains.

There are no proposed actions within floodplains in this plan. Because there would be no measurable effects, this topic is dismissed from further analysis in this document.

Geologic and Soil Resources

According to the NPS *Management Policies* 2006, the NPS will preserve and protect geologic resources and features from adverse effects of human activity, while allowing natural processes to continue. These policies state that the NPS will strive to understand and preserve the soil resources of park units and to prevent, to the extent possible, the unnatural erosion, physical removal, or contamination of the soil, or its contamination of other resources.

The proposed action would not disturb any geologic feature or any soils in the park. This would result in negligible or less impact to geology and soils. Because these effects are negligible or less in degree, this topic is dismissed from further analysis in this document.

Prime and Unique Farmlands

The Farmland Protection Policy Act of 1981, as amended, requires federal agencies to consider adverse effects to prime and unique farmlands that would result in the conversion of these lands to non-agricultural uses. Prime or unique farmland is classified by the U.S. Department of Agriculture Natural Resources Conservation Service, and is defined as soil that particularly produces general crops such as common foods, forage, fiber, and oil seed; unique farmland produces specialty crops such as fruits, vegetables, and nuts.

No prime or unique farmlands occur in the park or the near vicinity. Two soil types that have been mapped in the park are classified as Statewide Important Farmland by the State of Utah. Cavel fine sandy loam is cultivated on private inholdings in Cave and Lee Valley, and Mespun fine sand is found in sandy valleys and gentle slopes in the southeastern corner of the park.

Any actions associated with the implementation of the SMP would not affect prime or unique farmlands. Because there would be no measurable effects, this topic is dismissed from further analysis in this document.

Archeological Resources

The National Historic Preservation Act (NHPA), as amended in 1992 (16 USC 470 et seq.), NEPA, NPS Organic Act, NPS *Management Policies* 2006, DO-12: *Conservation Planning, Environmental Impact Analysis, and Decision-making*, and DO-28: *Cultural Resources Management Guidelines* require consideration of impacts on cultural resources, including archeological resources. The process and documentation required for preparation of this EA will be used to comply with section 106 of the NHPA.

Approximately 13 percent of the park has been surveyed for archeological resources. Over 400 sites, both prehistoric and historic, have been documented. Many of these sites are artifact scatters, containing prehistoric flaked stone tools and ceramics or historic period tin cans and bottles. Other site types include caves and rock shelters with cultural deposits, rock art sites, historic sawmills, erosion control features, historic roads and trails.

The actions described in this EA would protect archeological resources by decreasing human-caused noise throughout the park. This would result in no adverse effect on archeological resources. Because there would be no measurable effects, this topic is dismissed from further analysis in this document.

Historic Structures

The NHPA, as amended in 1992 (16 USC 470 et seq.), NEPA, NPS Organic Act, NPS *Management Policies* 2006, DO-12: *Conservation Planning, Environmental Impact Analysis, and Decision-making*, and DO-28: *Cultural Resource Management* requires consideration of impacts on cultural resources, including historic structures, either listed in or eligible to be listed in the National Register of Historic Places. The process and documentation required for preparation of this EA will be used to comply with section 106 of the NHPA, in accordance with section 800.8(3)(c) of the Advisory Council on Historic Preservation regulations (36 CFR Part 800).

Historic structures are constructed works that are architecturally designed or engineered to serve a human activity. These may include buildings, roads, trails, bridges, irrigation ditches, or earthen berms. The majority of the historic structures at Zion are associated with the development of the national park. For the most part, this development was intended to improve services and provide opportunities for visitors to enjoy the park. There are no representative historic soundscape elements associated with the development of these structures or with the structures themselves in Zion.

The actions described in this EA would improve the ability for visitors to enjoy and learn about these historic structures by limiting the amount and level of human-caused noise in these areas. There would be no effect on the structures themselves; which would result in a no adverse effect on historic structures. Because there would be no measurable effects, this topic is dismissed from further analysis in this document.

Ethnographic Resources

The NPS DO-28: *Cultural Resource Management* defines ethnographic resources as any site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it. According to DO-28 and Executive Order 13007 on sacred sites, the NPS should try to preserve and protect ethnographic resources.

As part of scoping, letters were sent to 11 affiliated American Indian tribes asking for comments and concerns about the proposed action. The park did not receive any comments or concerns from any tribes relating to ethnographic resources. The actions described in this EA would have a positive effect on ethnographic resources by reducing human-caused noise throughout the park. The actions outlined in this EA would have no adverse effect on ethnographic resources. The positive effects would be negligible or less in degree, therefore, this topic is dismissed from further analysis in this document.

Cultural Landscapes

According to the NPS DO-28: *Cultural Resource Management*, a cultural landscape is a reflection of human adaptation and use of natural resources, and is often expressed in the way land is organized and divided, patterns of settlement, land use, systems of circulation, and the types of structures that are built. NPS *Management Policies 2006* section 5.3.5.2 states: …*cultural landscapes will preserve significant physical attributes, biotic systems, and uses when those uses contribute to historical significance.*

The actions described in this EA would have no adverse effect on cultural landscapes. There would be some positive effect on cultural landscapes because of the decrease in human-caused noise park wide as described in the plan. Because there would be no measureable effects, this topic is dismissed from further analysis in this document.

Museum Collections

According to DO-24: *Museum Collections*, the NPS requires the consideration of impacts on museum collections (historic artifacts, natural specimens, and archival and manuscript material), and provides further policy guidance, standards, and requirements for preserving, protecting, documenting, and providing access to, and use of, NPS museum collections.

The primary goal is preservation of artifacts in as stable condition as possible to prevent damage and minimize deterioration. The proposed actions would not affect the museum objects of ZNP and there is no potential to add objects to the collection because of the actions. Because there would be no measurable effects, this topic is dismissed from further analysis in this document.

Indian Trust Resources

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

There are no Indian trust resources in Zion National Park. The lands comprising the park are not held in trust by the Secretary of the Interior for the benefit of Indians due to their status as Indians. Because the proposed action would not affect Indian trust resources, this topic is dismissed from further analysis in this document.

Environmental Justice

Executive Order 12898 (*Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* – February 11, 1994), requires all agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations or communities.

The proposed actions in this plan would not disproportionately affect any group because of race or income, and would not have disproportionate health or environmental effect on minorities or low-income populations or communities as defined in the Environmental Protections Agency's *Final Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analysis* – April 1998. Because the actions proposed in this plan would not have any disproportionate effects, this topic is dismissed from further analysis in this document.

Wild and Scenic Rivers

The Omnibus Public Land Management Act of 2009 (Public Law 111-11) designated over 140 miles of river and tributaries within Zion National Park as wild and scenic rivers. These rivers are managed under the Wild and Scenic Rivers Act of 1968 as follows:

> *…certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations. The Congress declares that the established national policy of dam and other construction at appropriate sections of the rivers of the United States needs to be complemented by a policy that would preserve other selected rivers or sections thereof in their free-flowing condition to protect the water quality of such rivers and to fulfill other vital national conservation purposes.*

The majority of the designated rivers are within the Wilderness Zone. There are no proposed actions that would adversely impact the free-flowing condition, water quality, or the outstandingly remarkable values for which the river was designated. Because there would be no measurable effects, this topic is dismissed from further analysis in this document.

Socioeconomics

The proposed action would not change local or regional land use or appreciably impact local business, other agencies, or properties adjacent to the park. Implementation of the actions proposed in this plan would not increase or decrease the local or regional workforce or revenues for local businesses or governments. Because there would be no measurable effects, this topic is dismissed from further analysis in this document.

Climate Change and Sustainability

Although climatologists are unsure about the long-term results of global climate change, it is clear that the planet is experiencing a warming trend that affects ocean currents, sea levels, polar sea ice, and global weather patterns. Although these changes will likely affect winter precipitation patterns and amounts in the parks, it would be speculative to predict localized changes in temperature, precipitation, or other weather changes, in part because there are many variables that are not fully understood and there may be variables not currently defined. Therefore, the analysis in this document is based on past and current weather patterns and the effects of future climate changes are not discussed further.

ALTERNATIVES

ALTERNATIVE A - NO ACTION ALTERNATIVE - CURRENT MANAGEMENT

In accordance with CEQ NEPA guidance the no action alternative for this Soundscape Management Plan (SMP) represents no change from current management direction or level of management intensity and involves continuing with the present course of action expressed in existing park management documents.

The GMP, completed in 2001, provides details on strategies and actions to address resource problems and research needs. Resources are to be managed from an ecosystem perspective, applying ecological principles for the maintenance of resources and prevention of impairment. Some individual natural resources are demonstrably or potentially interrelated with the natural sound environment. Other resources may also be affected.

The ZNP GMP provides direction relating to Natural Sounds on pages 12-13. Introductory material in those pages is similar to that contained in this planning document, derived from the same sources and authorities. The GMP states: *aircraft flights over the park for sightseeing, photography, or filming purposes can adversely affect the natural soundscape. The potential exists for increases in air tours and associated noise impacts in the park. Land-based sources, such as motor vehicles, can also affect natural sounds*. Other direction found in the plan is as follows.

Strategies
Park managers will continue to follow several policies and practices to minimize noise from both land and air sources. These policies and strategies include:

- Park staff will work with FAA to develop an air tour management plan in accordance with Public Law 106-181.
- NPS will work with the Department of Defense to address issues associated with military overflights.
- Park managers will continue operating the shuttle system and eventually prohibit tour buses in Zion Canyon, which will reduce noise levels and eliminate the greatest source of noise in the canyon.
- Park managers will continue to require bus tour companies to comply with regulations that reduce noise levels (e.g., turning off engines when buses are parked).
- Encourage visitors to avoid the use of generators, thus reducing related noise (electric hookups in the Watchman Campground should eliminate most of the need for generators).
- Maintain the existing quiet hours in campgrounds.
- Continue to enforce existing noise policies in the backcountry.
- Park managers will minimize noise generated by park management activities by strictly regulating NPS and concession administrative use of noise producing machinery, including aircraft and motor vehicles.
- Noise will be a consideration when procuring and using park equipment.
- In designated and recommended wilderness, the use of motorized equipment will conform to the requirements of the Wilderness Act, “minimum requirements procedures,” and related NPS policies (*Management Policies* 2006).
- Park managers will prepare a soundscape preservation and noise management plan.

ALTERNATIVE B - PROPOSED ACTION

This alternative includes the development of a SMP for Zion National Park. The alternative describes appropriate and inappropriate sound sources, soundscape objectives, soundscape indicators and standards, monitoring approaches and protocols, and methods for modifying the SMP using an adaptive management approach.

Sound Sources and Sound Levels Consistent With Park Legislation and Purposes

The GMP identifies, by management zone, the kinds of activities and developments that are appropriate to the purposes of the park (GMP pages 69-76). It is inferred in this plan that the human-caused sounds generated by activities deemed appropriate in the GMP are also appropriate sound sources.

Although the sources of sound may be deemed appropriate, the GMP also recognizes that some noise associated with them is excessive, and should be mitigated to the greatest extent possible. Generally, mitigation can consist of educating park visitors, staff, and concessionaires, reducing the sound level, duration, frequency of occurrence, or changing the frequency spectrum of the sound to one less obtrusive in the soundscape.

The GMP identified seven management zones. For the purposes of this SMP, these management zones have been combined into two zones: Frontcountry and Wilderness (Figure 2).

The SMP Frontcountry Zone (14,814 acres) includes the following GMP management zones:

- **Frontcountry High Development**: Most human-made sound sources within the park are generated in this zone, and frequency of their occurrence is relatively high.
- **Frontcountry Low Development**: Most sources of sound within this area immediate, and frequency of occurrence is less than in the frontcountry high development zone.
- **Transition**: Sources are more distant, less immediate, and frequency of occurrence is less than frontcountry low development zone.
- **Administrative**: Most sources of sound are located within this zone, are immediate, and frequency of occurrence is less than in the frontcountry low development zone. There would generally be no sound sources associated with visitors or visitor activities.

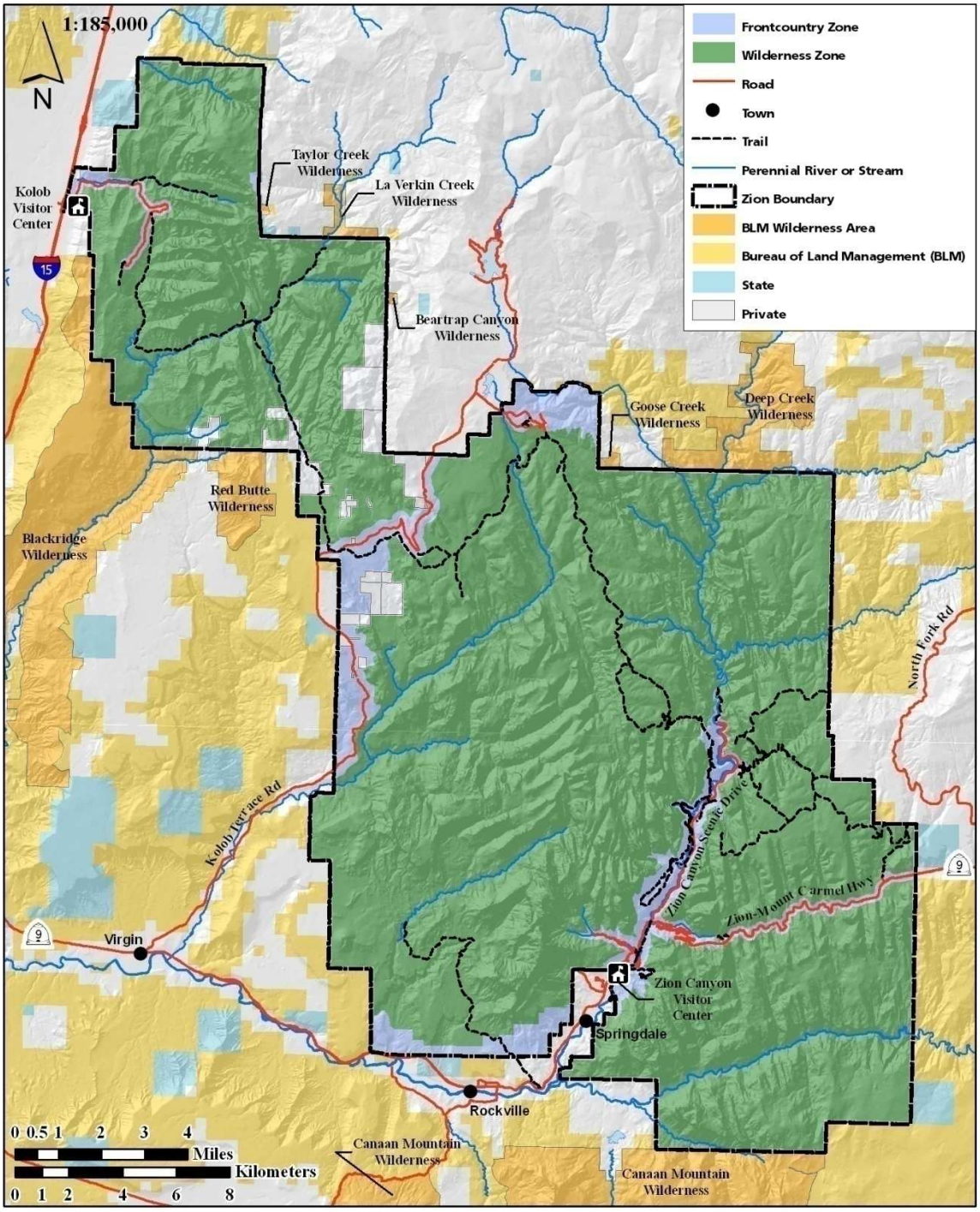
The SMP Wilderness Zone (133,919 acres) includes the following GMP management zones:

- **Primitive:** Sources are immediate or distant, and frequency of occurrence is greater than in the pristine zone, but usually less than in transition zone.
- **Pristine:** Sources are immediate or distant, and frequency of occurrence is low to rare at any given location. Sound sources and their placement in the scale of impact level and appropriateness are the same as in the primitive zone.
- **Research Natural:** Sources are immediate or distant, and frequency of occurrence is low to rare at any given location.

Figure 2: Soundscape Management Zones

National Park Service
U.S. Department of the Interior

Zion National Park



Tables 1 and 2 identify the appropriate sound sources for each zone and management actions that should be considered to minimize the impact of that sound. Management actions carried forward from the GMP are noted below.

Table 1: Appropriate Sound Sources for Frontcountry Zone	
Appropriate Sound Sources	**Management Actions**
People	
General: e.g. voices	▪ Encourage visitors to be respectful of others by not shouting, yelling, loud conversations, or producing other excessive noise. ▪ Enforce quiet hours in campground. Consider expanding the quiet hours. ▪ Develop and implement educational and interpretive programs on soundscapes. ▪ Encourage and remind visitors to limit noise, turn off cell phones, deactivate beepers on cameras, reduce volume on mp3 players. ▪ Discourage the use of stationary or handheld messaging devices on trails and in undeveloped areas. ▪ Add article in park paper on the importance of natural soundscape. ▪ Consider identifying and designating "Quiet Zones/Areas" in the Frontcountry. These areas would be identified on maps, through signs and interpretation. Visitors would be encouraged to be quiet enough to hear natural sounds in these areas.
Interpretive talks for visitors	▪ Limit use of amplification, use only when necessary and to the minimum level necessary (evening programs at amphitheaters and interpretive tours on shuttle bus, etc.).
Vehicles	
General e.g. – idling vehicles, generator use, security alarms	▪ Manage parking areas to established capacity limits. ▪ Encourage visitors to avoid the use of generators in parking lots and campgrounds (GMP). ▪ Provide electric hookups in campgrounds where feasible to eliminate the need for generators. ▪ Encourage visitors to deactivate the beepers for locking doors and deactivate car alarms. ▪ Encourage maintenance and delivery trucks to deactivate back-up beepers where appropriate. ▪ Work with delivery companies to determine appropriate times for deliveries. ▪ Enforce quiet hours in campgrounds. ▪ Enforce existing noise ordinances (36 CFR §2.12).
Tour busses, shuttle busses, public address systems on buses/shuttles	▪ No idling of vehicles (tour busses, shuttles, etc.) in parking areas for layovers of more than 3 minutes (especially at Temple of Sinawava). ▪ Continue to require bus tour companies to comply with regulations that reduce noise levels (e.g., turning off engines when buses are parked) (GMP). ▪ Consider quiet technology for replacement shuttle buses. ▪ Consider smaller speakers placed closer to the seats to keep public address system volume lower on shuttle buses. ▪ Encourage shuttle drivers to talk only on up canyon trips – allowing visitors the opportunity to experience a quieter trip down canyon. ▪ Continue operating the shuttle system. ▪ Consider shuttle bus timing/schedules to ensure opportunities for visitors to experience natural sounds in Zion Canyon. ▪ Eventually phase out private tour buses in Zion Canyon above Canyon Junction to reduce noise levels and eliminate the greatest source of noise in the canyon (GMP).

Table 1: Appropriate Sound Sources for Frontcountry Zone	
Appropriate Sound Sources	**Management Actions**
	▪ Enforce existing noise ordinances (36 CFR §2.12).
Motorcycles, street legal ATVs	▪ Encourage quiet and courteous riding through education. ▪ Discourage use of modified exhausts that increase noise levels. ▪ Require groups of organized riders to acquire a special use permit. ▪ Any applications for organized rides must go through the appropriate NEPA analysis. ▪ Enforce existing noise ordinances (36 CFR §2.12).
Aircraft Use (Administrative and Authorized Overflights)	▪ Consider other ways of accomplishing the task. ▪ Combine flights whenever possible. ▪ Require flight following using GPS or similar technology and reporting for all administrative flights. ▪ Minimize noise generated by park management activities by strictly regulating NPS and concession administrative use of noise producing machinery, including aircraft and motor vehicles (GMP). ▪ Noise will be a consideration when procuring, contracting, and using park equipment. Prior to purchase, research will be conducted in regard to the best available technology and the quietest equipment will be identified and purchased unless there is an overwhelming reason not to. ▪ Any applications for commercial filming permits must comply with existing safety and aviation restrictions and must go through the appropriate NEPA analysis. ▪ Enforce existing noise ordinances (36 CFR §2.12).
Routine Park Operations/NPS Facilities/Maintenance	
Building security/fire alarms	▪ Ensure systems are maintained to reduce false alarms.
Leaf blowers, lawn mowers, other gas-powered hand tools	▪ Limit the hours of operation of motorized tools, etc. from 9:00 am to 5:00 pm. Protecting dawn, dusk and nighttime quiet. ▪ Minimize the use of leaf blowers, chainsaws, and other mechanical equipment. Consider other products that accomplish the same task (handheld non-power tools, brooms, rakes, electric powered mowers or trimmers, etc.). ▪ Minimize noise generated by park management activities by strictly regulating NPS and concession administrative use of noise producing machinery (GMP). ▪ Consider quiet technology when replacing equipment. Prior to purchase, research will be conducted in regard to the best available technology and the quietest equipment will be identified and purchased unless there is an overwhelming reason not to. ▪ Enforce existing noise ordinances (36 CFR §2.12).
Use of explosives	▪ Limit use to emergency trail or road work. ▪ Analyze noise impacts through the appropriate NEPA analysis.
Heavy equipment for construction and other activities (fire, maintenance, etc.)	▪ Consider the effects of human-caused sound when deciding on the equipment needed to perform a task. ▪ Limit the hours of operation of motorized equipment from 9:00 am to 5:00 pm. Protecting dawn, dusk and nighttime quiet. ▪ Noise should be addressed through appropriate NEPA analysis. ▪ Consider quiet technology when replacing equipment. Prior to purchase or contracting, research will be conducted in regard to the best available technology and the quietest equipment will be identified and purchased unless there is an overwhelming reason not to. ▪Minimize noise generated by park management activities by strictly regulating NPS and concession administrative use of noise producing

Table 1: Appropriate Sound Sources for Frontcountry Zone	
Appropriate Sound Sources	**Management Actions**
	machinery, including motor vehicles (GMP). ▪Enforce existing noise ordinances (36 CFR §2.12).
Protection/Administration/Law Enforcement	
Administrative vehicles	▪ Increase the use of quiet technology where appropriate. ▪ Minimize the use of back-up beepers when appropriate. ▪ Encourage alternate forms of transportation when traveling in the park (shuttle, walk, bike, carpool, etc.). ▪ Minimize noise generated by park management activities by strictly regulating NPS and concession administrative use of noise producing machinery, including motor vehicles (GMP). ▪ When replacing vehicles, consider hybrid or full electric vehicles. ▪ Noise will be a consideration when procuring, contracting, and using park equipment. Prior to purchase, research will be conducted in regard to the best available technology and the quietest equipment will be identified and purchased unless there is an overwhelming reason not to. ▪ Enforce existing noise ordinances (36 CFR §2.12).
Sirens, emergency response vehicles	▪ Emergency use only.

Table 2: Appropriate Sound Sources for Wilderness Zone	
Appropriate Sound Sources	**Management Actions**
People	
Sounds of recreation mostly self-generated (e.g., hikers, camp activities, climbers, limited interpretative programs)	▪ Subject to park policy and management direction such as campsite densities or group size limits. ▪ Encourage and remind visitors to limit noise, shouting, and loud conversations. ▪ Encourage visitors to turn off cell phones, deactivate beepers on cameras, reduce volume on mp3 players. ▪ Develop and implement educational and interpretive programs on soundscapes. ▪ Add article in park paper on the importance of the natural soundscape in Wilderness. Distribute information with backcountry permits.
Vehicles	
Aircraft Use (Administrative and Authorized Overflights)	▪In designated and recommended wilderness, the use of motorized equipment will conform to the requirements of the Wilderness Act, minimum requirements procedures, and related NPS policies (DO-41: *Wilderness Preservation and Management*) (GMP). ▪ Combine flights whenever possible. ▪ Require flight following and reporting for all administrative flights. ▪ Consider quiet technology when replacing or contracting for aircraft. Noise will be a consideration when procuring and using park equipment. Prior to purchase, research will be conducted in regard to the best available technology and the quietest equipment will be identified and purchased unless there is an overwhelming reason not to.

Table 2: Appropriate Sound Sources for Wilderness Zone	
Appropriate Sound Sources	**Management Actions**
	▪ Minimize noise generated by park management activities by strictly regulating NPS and concession administrative use of noise producing machinery, including aircraft (GMP). ▪ Limit the hours of operation of motorized equipment from 9:00 am to 5:00 pm. Protecting dawn, dusk and nighttime quiet. ▪ Any applications for commercial filming permits must comply with existing safety and aviation restrictions and must go through the appropriate NEPA analysis. ▪ Enforce existing noise ordinances (36 CFR §2.12).
Routine Park Operations/NPS Facilities/Maintenance	
Habitat rehabilitation, fuels treatment, weed control, large crews, research groups, explosive use, use of chainsaw and other motorized tools	▪ In designated and recommended wilderness, the use of motorized equipment will conform to the requirements of the Wilderness Act, minimum requirements procedures, and related NPS policies (DO-41: *Wilderness Preservation and Management*) (GMP). ▪ Mitigate by administrative review with statement addressing soundscape management or address through appropriate NEPA analysis. ▪ Limit the hours of operation of motorized equipment from 9:00 am to 5:00 pm. Protecting dawn, dusk and nighttime quiet. ▪ Prior to purchase of equipment, research will be conducted in regard to the best available technology and the quietest equipment will be identified and purchased unless there is an overwhelming reason not to. ▪ Educate staff on quieter tool choices. ▪ Use quiet technology when appropriate. ▪ Minimize noise generated by park management activities by strictly regulating NPS and concession administrative use of noise producing machinery, including aircraft and motor vehicles (GMP). ▪ Enforce existing noise ordinances (36 CFR §2.12).
Protection/Administration/Law Enforcement	
Search and rescue, fire suppression – helicopters, other aircraft, large crews	▪ All actions planned and evaluated through the park's "go/no go" checklist. ▪ Conduct minimum requirement procedures and NEPA analysis required except for emergency actions. ▪ Use quiet technology when appropriate. ▪ Require flight following and reporting for all administrative flights. ▪ Enforce existing noise ordinances (36 CFR §2.12).

Sound Sources and Sound Levels Not Consistent With Park Legislation and Purposes

Other sources of human-caused sound that exist in, or affect the park are not consistent with park purposes. These are also outlined in the GMP. Zion National Park management and staff are obligated under law, policy, and in accordance with the GMP, to take steps in addressing inappropriate sound sources.

Table 3 lists inappropriate sound sources that generally originate from beyond the park boundary or in the airspace above the park. The park does not have the authority to control the sound sources, but the park is committed to working with adjacent property owners, appropriate federal, state, and local agencies, and organizations to mitigate potential soundscape impacts.

Table 3: Inappropriate Sound Sources - Not Consistent With Park Legislation and Purposes

Inappropriate Sound Sources	Potential Management Actions
•Commercial aviation •General aviation •Air tours •Gravel pit operations •Fireworks •Off-Highway Vehicles (OHV's) •Snowmobiles •Excessive noise from businesses and other facilities •Large public events (festivals, concerts, etc.) •Amplified handheld or stationary communication devices	Collaborate with adjacent property owners, appropriate federal, state, and local agencies, and organizations with the following: ▪ Engage in the planning efforts of other agencies in which there is a potential to impact park soundscapes. Seek cooperating agency status when appropriate. ▪ Work with FAA and the NPS Natural Sounds Program to develop an air tour management plan in accordance with Public Law 106-181 (GMP). ▪ Work with the Department of Defense to address soundscape issues with military overflights (GMP). ▪ Work with FAA, state and local government, and other parties in developing plans for new or expanded airport facilities, or altered flight routes, that can potentially affect the park. ▪ Work with adjacent land owners, inholders, or other land management jurisdictions to mitigate impacts of sources of noise from those lands. ▪ Encourage the use of new, quieter snowmobile and OHV technology. ▪ Seek active partners to develop and implement quieter technology in and out of ZNP.

Soundscape Objectives

Below are the soundscape management objectives for the frontcountry and wilderness zones. The objectives are based on and are compatible with the descriptions of park management zones provided in the ZNP GMP. The objectives support the overall desired conditions for soundscape management, as expressed in the GMP: *Natural sounds predominate in ZNP. Visitors have opportunities throughout most of the park to experience natural sounds in an unimpaired condition. The sounds of civilization are generally confined to developed areas*.

Soundscape Objectives for the Frontcountry Zone

- Natural sounds are audible and discernable, with common noise intrusions by visitors and park operations that are concentrated at locations near roads and heavily developed areas.
- Active intensive management is used to maximize noise free intervals and limit the intensity and duration of noise intrusions.
- Noise levels that interfere with general conversation rarely occur and are of limited duration except when caused by emergency services, search and rescue operations (sirens, search and rescue aircraft), and park operations (road repairs, grounds and building maintenance).
- Sound levels that interfere with interpretive programs do not occur except when caused by emergency services and search and rescue operations (sirens, search and rescue aircraft).

- Sound levels that exceed thresholds for sleep interruption rarely occur.
- Noise levels at common rock climbing areas should not interfere with effective communication among climbers.
- Noise levels that mask important auditory signals for wildlife should be uncommon and should be limited to locations near roads and heavily developed areas.
- Noise levels that affect wildlife behavior, distribution and numbers should be uncommon and should be limited to locations near roads and heavily developed areas.

Soundscape Objectives for the Wilderness Zone

- Only natural sounds are audible and discernable, except for short duration, infrequent human-caused sounds.
- Noise levels that interfere with general conversation are very rare and are of limited duration except when caused by emergency services, search and rescue operations (aircraft), and approved park operations (aircraft, motorized/mechanical tool use).
- Sound levels that exceed thresholds for sleep interruption are extremely rare.
- Noise levels at rock climbing areas and technical canyons should not interfere with effective communication among climbers and canyoneers.
- Noise levels that mask important auditory signals for wildlife should be rare.
- Noise levels that affect wildlife behavior, distribution, and numbers should be rare.

Soundscape Indicators and Standards

The following soundscape indicators are used to determine the extent to which soundscape objectives are being met. For each indicator, a standard is prescribed (Refer to Tables 5 and 6). In the performance of monitoring, a violation of a standard shows that objectives are not being met or that the use/activity is not in compliance. The discussion describes the data collection and analysis required to monitor the indicator and the extent and duration of the monitoring program required to track compliance with soundscape objectives and standards.

Time audible

The percentage of time during a 12-hour day that human-caused sounds can be heard by the human ear. For example, 25 percent time audible (TA) means human-caused sounds could potentially be heard in specified areas for 25 percent of the day, or three hours during a 12-hour day – not necessarily consecutive hours, but spaced throughout the day. Time audible or "audibility" is one of the ways NPS measures or characterizes the acoustic environment in national park units.

Sound Level

Sound levels are expressed using two metrics: **Deviation from Natural Ambient** and **Maximum Sound Levels** as described below.

Deviation from Natural Ambient is the difference between the average sound level and the natural ambient condition. This metric reports the difference between the average hourly sound level, including all natural and human-caused sounds, and the hourly natural ambient. It represents the extent to which human-caused sounds raise the natural ambient background levels. This metric does not provide information on event duration or timing, nor does it mean that human-caused sound levels cannot be heard at or below the ambient. It means that the sound levels produced by human sources are above the natural ambient sound level.

Deviation from natural ambient is depicted in Figure 3 as the gray shaded area and can have important implications for the protection of visitor experience, wildlife, and other natural resources. For example,

deviation from natural ambient can be used to identify reductions in listening area and alerting distance. Reduction in listening area quantifies the loss of hearing ability to humans and animals as a result of an increase in ambient noise level. Under natural ambient conditions a sound is audible within a certain area around a visitor or animal. If the ambient level is increased due to a noise event, the area in which the sound is audible decreases. Table 4 and Figure 4 illustrate the relationship between increased ambient and listening area reduction.

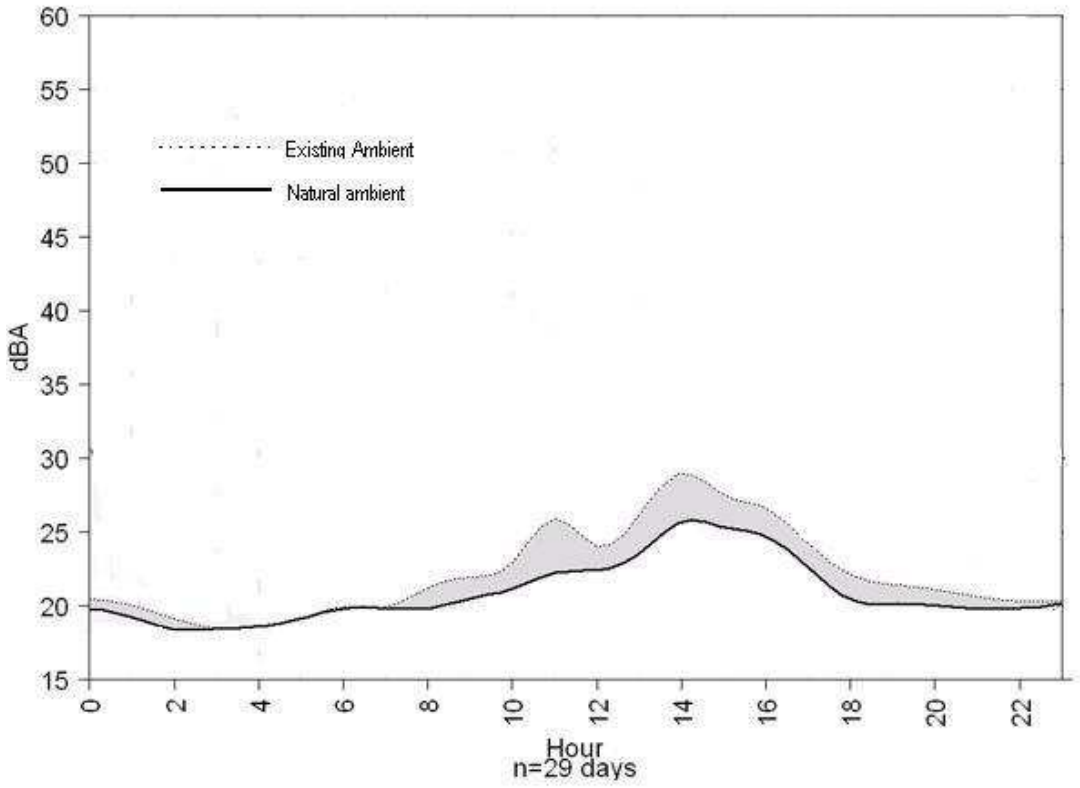


Figure 3: Deviation from Natural Ambient

Table 4: Reduction in Listening Area Due to Increases in Ambient Levels				
dBA Ambient Increase	3	6	10	20
Percent Reduction in Listening Area	50%	75%	90%	99%
Percent Reduction in Alerting Distance	30%	50%	70%	90%

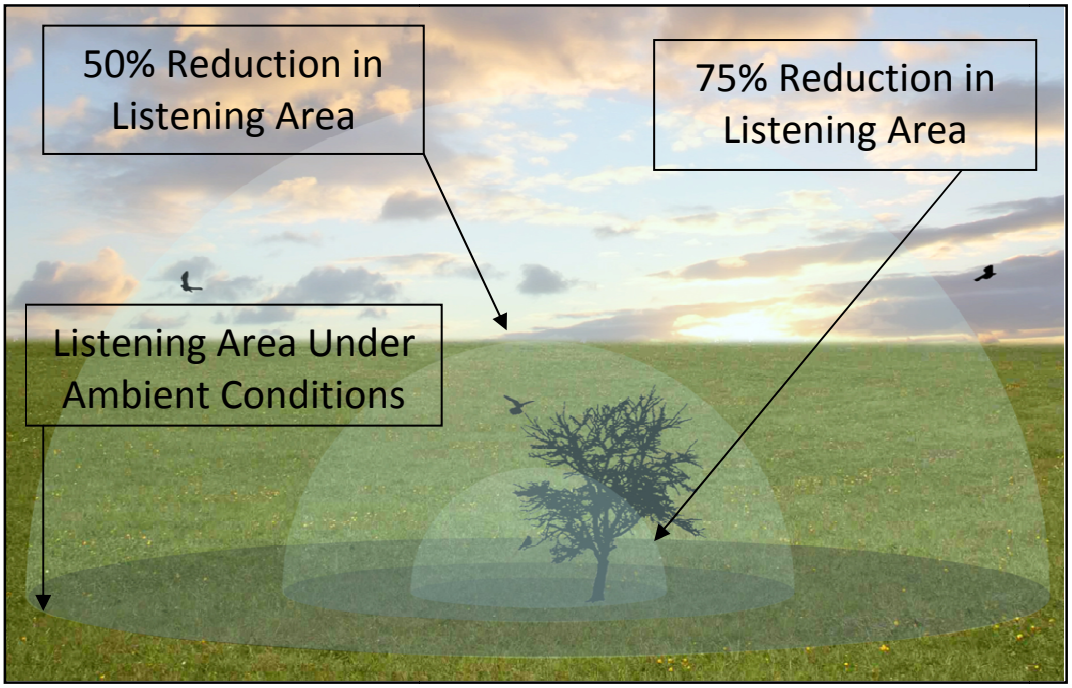


Figure 4: Reduction in Listening Area

For example, under natural ambient conditions, an owl perched in a tree may be able to hear a mouse scurrying through the brush anywhere within an area of 100-square-meters of the perch. If a noise event increases the ambient level by 3 decibels (dBA), the area in which the owl can hear a mouse would decrease by 50 percent to approximately 50-square-meters.

Reduction in alerting distance is closely related to reduction in listening area. The residual alerting distance is equal to the square root of the residual listening area. Instead of addressing losses in terms of an area, reduction in alerting distance expresses the reduction as a linear distance from a source. For example, under natural ambient conditions, a canyoneer may be alerted to the sound of a flash flood at a distance of 1-mile. If a noise such as an aircraft overflight increases the ambient level by 6 dBA, the distance at which the flood could be detected would decrease by 50 percent to approximately ½-mile or 2,640-feet.

Visitors and wildlife are impacted by their failure to hear natural sounds that would have been audible in the absence of noise: a bird misses the sound of a worm, a mouse misses the footfall of a coyote, a visitor misses the sound of a distant waterfall. Reductions in listening area and alerting distance capture these types of impacts.

Deviation from ambient is calculated from sound pressure data collected at the park.

Maximum Sound Level (Lmax) is the loudest sound level in an A-weighted decibel (dBA) generated during a noise event.

Noise Free Intervals

Noise free intervals (NFI) are time periods during which only natural sounds are audible. NFI data is expressed as maximum NFI, minimum NFI, and median NFI. NFI is calculated from on-site listening data and sound pressure data collected at the park. NFIs are calculated for daytime and nighttime hours.

Speech Interference

Speech interference represents the amount of time during which noise may interfere with human speech. The potential for speech interference from a noise depends on the distance between the speaker and listener and the acceptable level of intelligibility. Figure 5 illustrates thresholds for speech interference for various distances and intelligibility levels. The percentage of time or number of minutes per day that speech may be adversely affected by noise is calculated from the sound pressure data collected at the park. Using the chart in Figure 5, speech interference thresholds were determined for each of the different "types" or contexts of speech that is likely to occur at the park: general conversation, interpretive programs, and rock climbers/canyoneers.

General Conversation

This type of conversation occurs between two or more people standing relatively close together (approximately 2-meters) speaking at normal conversational volume. Hikers and visitors viewing scenic vistas in the park would likely fall in this category. Based on 95 percent speech intelligibility and normal voice communications at 2-meter, the EPA's speech interference threshold for this type of conversation is 60 dBA.

Interpretive Programs

This type of conversation occurs during interpretive programs conducted by park staff or other groups (schools, tours, etc.). Interpreters typically speak in a "raised voice" with approximately 10-meters between the speaker and the furthest participants. Based on 95 percent speech intelligibility and raised voice communications at 10-meters, the EPA's speech interference threshold for this type of conversation is 52 dBA.

Rock Climbers/Canyoneers

This type of conversation occurs between technical rock climbers or between climbers and belayers in the climbing areas or technical slot canyons in the park. Climbers and canyoneers appreciate and value a natural setting when climbing and effective communication is critical among climbers and canyoneers for safety reasons. Typically, the distance between rock climbers and canyoneers ranges from less than 1-meter to more than 50-meters. Because 25-meters would likely be the average distance between climbers and canyoneers, a threshold of 44 dBA was used, based on 95 percent speech intelligibility and raised voice communications, to estimate the potential for speech interference for climbers and canyoneers.

Noises that exceed these thresholds are likely to interfere with speech communication. The potential for speech interference is determined by calculating the time that human-caused sounds exceed speech interference thresholds.

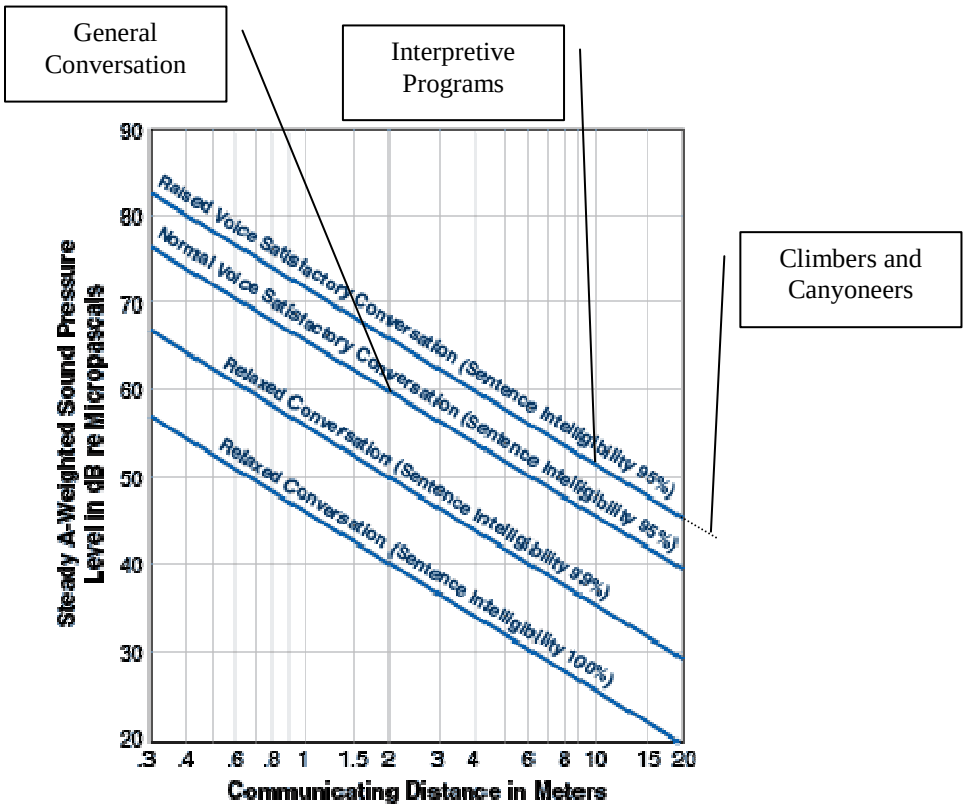


Figure 5: Speech Interference for General Conversation, Interpretative Programs, and Climbers/Canyoneers (Source EPA, 1974)

Sleep Interruption

In 1997 the Federal Interagency Committee on Aircraft Noise (FICAN) issued a report on sleep interruption. The report contains a model for estimating the probability of awakening due to a noise event based on the intensity of the sound (see Figure 6). The model developed in 1997 indicates that the likelihood of awaking from a 30 dBA noise event is close to zero percent. At 65 dBA, about the level of a normal conversation, there is a 5 percent chance of awakening, and at 80 dBA, the likelihood increases to 10 percent. The FICAN study uses the sound level exposure (SEL) metric to determine the probability of awakening. The sleep interruption standards in this plan use the maximum sound level (Lmax). This provides a more conservative estimate of sleep interruption because the Lmax of an event is always lower than the SEL. Thus using the values in Figure 6, the Lmax of an event will provide a slightly lower probability of awakening than the SEL for the same event.

The World Health Organization (WHO) (Berglund and Lindvall, 1999) recommends noise levels below 45 dBA inside bedrooms. They state, *it is important to limit the number of noise events with a LAmax exceeding 45 dB… To protect sensitive persons, a still lower guideline value would be preferred when the background level is low*. The likelihood for sleep interruption at campsites, lodges, employee housing, and other areas can be calculated from sound pressure data collected at the park. FICAN explicitly cautions against applying this criterion in campgrounds or other temporary residences, where people are typically more prone to disturbance. Therefore, the actual likelihood of sleep interruption may be greater than those calculated for areas within national parks. More recent studies (Haralabidis, 2008) suggest that sound events as low as 35 dBA can have adverse effects on blood pressure while sleeping.

Research on the effects of noise on sleep patterns of other animal species is sparse. However, protecting humans from sleep interruption likely provides other vertebrates a level of protection from sleep

disruption. The adequacy of standards for sleep interruption should be reexamined as more data on non-human sleep interruption becomes available.

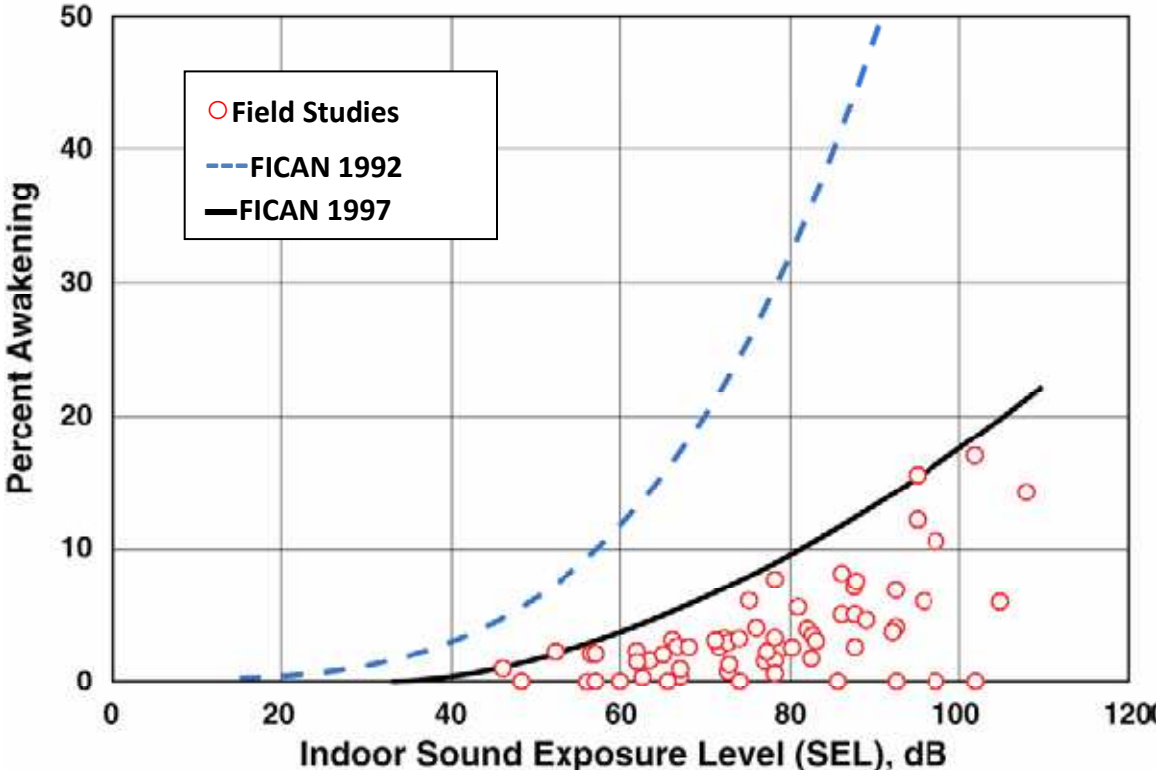


Figure 6: Likelihood of Awakening from Noise (Source: FICAN 1997)

Tables 5 and 6 provide standards for each indicator for Frontcountry and Wilderness Zones. The rationale supporting each standard is also included. The indicator would be monitored to determine if the standard is being met. This data would assist the park in determining whether existing management actions are sufficient to protect the park soundscape or if additional management actions need to be implemented.

According to the NPS Visitor Experience and Resource Protection (VERP) Handbook, standards represent the point at which management must take action to protect the resource. Standards do not represent ideal resource conditions, rather standards are defined as the minimally acceptable condition.

According to the VERP Handbook (p. 59 emphasis added):

> "…it may be determined that the amount of bare ground at campsites is a key measure of the naturalness of resource condition. Thus, the amount of bare ground at campsites may be a good resource indicator. Moreover, it may be determined that when the amount of bare ground exceeds 50% of the total campsite area, most visitors and agency personnel believe that impacts are

> **unacceptable**. Thus, the resource standard for bare ground at campsites in zone 'x' may be set at 50% of the total campsite area.
>
> Similarly, it may be determined that the number of encounters with other groups along trails is a key measure of the opportunities for solitude. Thus, the number of trail encounters with other groups per day may be a good social indicator. Moreover, most visitors may report that once they encounter more than three groups along a trail per day, they no longer have an **acceptable** level of solitude. Thus, the social standard for the number of trail encounters per day in zone 'y' may be set at three— **a minimally acceptable social condition**…
>
> The reason for standards is to 'draw a line in the sand,' which clearly shows when conditions are unacceptable and action must be taken. "

Additionally, an important characteristic of effective standards is that they must be realistic and attainable. According to the VERP Handbook,

> "Standards must reflect conditions that are attainable. In some cases, managers or the public may prefer conditions that are better than can realistically be achieved. For example, an unrealistically low standard for encounter rates that prohibits most of the visitors from using the resource may not be politically feasible. Moreover, such extreme measures that would place serious restrictions on visitors may not be ethically defensible unless an extraordinary situation, such as imminent loss of a significant resource, would justify the action.
>
> In some cases where existing conditions are significantly below standards (in a highly impacted natural area, for example), strict standards could be set even though achieving the standard could be many years in the future. A standard in this situation would be used to measure long-term improvement in conditions."

Data collected at Zion National Park (ZNP) and presented in the Affected Environment section of the EA indicate that acoustic conditions are highly impacted by noise from aircraft overflights and other sources. The standards presented in Tables 5 and 6 represent a considerable improvement to those conditions. The standards represent realistic and attainable conditions, however achieving the referenced conditions will likely take several years of focused and effective management actions including working closely and cooperatively with Federal Aviation Administration (FAA) to address noise effects from overflights.

As discussed in the Monitoring and Adaptive Management section, the Soundscape Management Plan (SMP) also incorporates an adaptive management approach to reassessing standards. If acoustic monitoring indicates that standards established in this plan are being achieved, adaptive management dictates that a reassessment of the standards be conducted to determine if revisions to the standards are warranted. Other factors such as changes in the availability of new research, an increased understanding of the effects of noise on visitors, wildlife and other resources, a major change in technology, or a significant, unanticipated event occurring inside or outside the park boundary could lead to a reassessment and possible revision of standards. The overall goal of soundscape management at ZNP is protection, restoration, and improvement of acoustic conditions for the enjoyment of future generations. Establishing, monitoring, and reassessing standards when appropriate is an important tool in achieving that goal.

When determining if desired conditions, as outlined in the GMP and soundscape objectives are being met, it is important to understand acoustic conditions throughout the park. Spatial analyses of acoustic conditions would provide information on the proportion of each management zone that is experiencing desired conditions and the proportion that may be exceeding standards. Initially, acoustic monitoring and

analyses would only provide information about acoustic conditions in areas near the monitoring sites. As data are collected at additional sites throughout the Frontcountry and Wilderness Zones, conditions can be estimated in terms of the portion of each zone that is in compliance with acoustic standards. In order to ensure that desired acoustic conditions and management objectives are being met, acoustic conditions must be below standards in 95 percent of the Frontcountry Zone and 97 percent of the Wilderness Zone.

Table 5: Indicators and Standards for the Frontcountry Zone[1]		
Indicator	**Standard[2]**	**Rationale**
Time audible (TA)	<u>*Daytime Hours*</u>: The hourly percent time audible is less than 50% for 60% of the day. The hourly percent time audible never exceeds 65%. <u>*Nighttime Hours*</u>: The hourly percent time audible is less than 30% for 80% of the night. The hourly percent time audible never exceeds 40%.	These standards ensure even though visitors experience highly social conditions in the Frontcountry Zone, that they would still have the opportunity to experience solitude at certain times. It also ensures management identification and review of areas where human-caused sounds are audible more than 65% (day) and 40% (night) of the time. [exceeds standards by 100%] Acceptable to have 40% of daytime hours that exceed 50% TA. Probably meeting 50% TA for at least 50% of the day currently. 60% of the day would create incentive to reduce extrinsic noise levels further. All of the hourly %TA that exceed the standard are currently below 80% and most are around 70% the 65% maximum. TA provides incentive to reduce levels below current conditions. Night – interval between shuttles increases, less vehicle traffic, park operations are less frequent, quiet hours start in campgrounds – generators prohibited, restrictions on equipment usage by road crews. The 30% TA standard may be exceeded during the early evening hours and in the morning around dawn. This is due to increased human activity (the shuttle begins to run during this time).
Sound level	<u>*Daytime Hours*</u>: The hourly change in exposure is less than or equal to 3 dBA for 40% of the day and does not exceed 6 dBA for 90%. Human-caused sound events never exceed 60 dBA (CFR Audio Disturbance). <u>*Nighttime Hours*</u>: The hourly change in exposure is less than or equal to 3 dBA for 70% of the night and does not exceed 6 dBA for 95%. Human-caused sound levels never exceed 45 dBA (related to sleep threshold).	The daytime standard ensures that human-caused sound levels are not likely to mask natural sounds in most of the zone. An increase of 3 dBA corresponds to a 50% reduction of listening area and a 30% reduction of alerting distance. You can only exceed this condition for 60% of the day. An increase of 6 dBA corresponds to a 75% reduction of listening area and a 50% reduction of alerting distance. You can only exceed this condition for 10% of the day. The nighttime standard also ensures that a reduction in listening area of 50% and a reduction in alerting distance of 30% occurs no more than 30% of the night. Activity for many species increases during these hours (dawn/dusk). An increase of 6 dBA corresponds to a 75% reduction of listening area and a 50% reduction of alerting distance. You can only exceed this condition for 5% of the night. The standard also ensures management identification and review of areas where human-cause sound exceeds 60 dBA (CFR Audio Disturbance) and 45 dBA (WHO Sleep Interruption standard).

Table 5: Indicators and Standards for the Frontcountry Zone[1]		
Indicator	**Standard[2]**	**Rationale**
Noise free interval	<u>*Daytime Hours*</u>: The daily maximum noise free interval is at least 19 minutes (over 12-hour-period). The daily median noise free interval is at least 4 minutes (over 12-hour-period). <u>*Nighttime Hours*</u>: The nightly maximum noise free interval is at least 35 minutes (over 12-hour-period). The nightly median noise free interval is at least 6 minutes (over 12-hour-period).	This standard ensures that enough time occurs between noise events to ensure that visitors to frontcountry areas will have the opportunity to experience natural sounds free from human-caused noise intrusions. The standard also provides wildlife needed time to recover between noise events.
Time above speech interference thresholds	<u>*General Conversation*</u> Human-caused sound levels are less than or equal to 60dBA for more than 5% of the 12-hour-day. <u>*Interpretive Programs*</u> Human-caused sound levels are less than or equal to 52dBA for more than 5% of the 12-hour-day in areas where interpretive programs are conducted. The number of events above 52 dBA does not exceed 2-per-hour.	The General Conversation standard ensures that human-caused sound will not interfere with speech among visitors involving normal voice levels over a distance of 2-meters for more than 36-minutes-per-day (3-min/hr). The Interpretive Program standard ensures that human-caused sound will not interfere with interpretive programs involving raised voice levels over a distance of 10-meters for more than 36-minutes-per-day.
Time above sleep interruption thresholds	Noise events during nighttime at designated campsites, hotels, and housing areas do not exceed 45 dBA.	Based on the FICAN study (1997), the likelihood of waking due to a noise events of 45 dBA is approximately 3%. The World Health Organization (Berglund and Lindvall, 1999) recommends noise levels below 45 dBA inside bedrooms.

[1]In order to ensure that desired acoustic conditions and management objectives are being met, acoustic conditions must be at or below standards in 95% of the Frontcountry Zone.

[2] <u>*Daytime Hours*</u> (1 hour after sunrise to 1 hour prior to sunset) <u>*Nighttime Hours*</u> (1hour prior to sunset to 1 hour after sunrise)

Table 6: Indicators and Standards for the Wilderness Zone[1]		
Indicator	**Standard[2]**	**Rationale**
Time audible	<u>*Daytime Hours*</u>: The hourly percent time audible is less than 25% for 90% of the day. The hourly percent time audible never exceeds 50%. <u>*Nighttime Hours*</u>: The hourly percent time audible is less than 20% for 90% of the night. The hourly percent time audible never exceeds 40%.	These standards ensure that natural sounds are predominant in the Wilderness Zone, and that visitors have the opportunity to experience solitude (GMP and soundscape objective). It also ensures management identification and review of areas where human-caused sounds are audible more than 50% (day) and 40% (night) of the time. [exceeds standards by 100%]
Sound level	<u>*Daytime Hours*</u>: The hourly change in exposure is less than or equal to 3 dBA for 75% of the day and does not exceed 6 dBA for 90%. Human-caused sound events never exceed 60 dBA (CFR Audio Disturbance). <u>*Nighttime Hours*</u>: The hourly change in exposure is less than or equal to 3 dBA for 90% of the night and does not exceed 6 dBA for 95%. Human-caused sound levels never exceed 45 dBA (related to sleep threshold).	The daytime standard ensures that human-caused sound levels are not likely to mask natural sounds. An increase of 3 dBA corresponds to a 50% reduction of listening area and a 30% reduction of alerting distance. You can only exceed this condition for 25% of the day. An increase of 6 dBA corresponds to a 75% reduction of listening area and a 50% reduction of alerting distance. You can only exceed this condition for 10% of the day. The nighttime standard also ensures that a reduction in listening area of 50% and a reduction in alerting distance of 30% occurs no more than 90 % of the night. Activity for many species increases during these hours (dawn/dusk). An increase of 6 dBA corresponds to a 75% reduction of listening area and a 50% reduction of alerting distance. You can only exceed this condition for 5% of the night. The standard also ensures management identification and review of areas where human-caused sound exceeds 60 dBA (CFR Audio Disturbance) and 45 dBA (WHO Sleep Interruption standard).
Noise free interval	<u>*Daytime Hours*</u>: The daily maximum noise free interval is at least 60 minutes (over 12-hour-period). The daily median noise free interval is at least 7 minutes (over 12-hour- period). <u>*Nighttime Hours*</u>: The nightly maximum noise free interval is at least 73 minutes (over 12-hour-period). The nightly median noise free interval is at least 11 minutes (over 12-hour- period).	This standard ensures that enough time occurs between noise events to ensure that visitors to park wilderness have the opportunity to experience solitude free from human-caused noise intrusion. The standard also provides wildlife needed time between noise events.

Table 6: Indicators and Standards for the Wilderness Zone[1]		
Indicator	**Standard[2]**	**Rationale**
Time above speech interference thresholds	*General Conversation* Human-caused sound levels are less than or equal to 60 dBA for more than 1% of the day. *Rock Climbing/Canyoneering* Human-caused sound levels are less than or equal to 44 dBA for more than 5% of the day in commonly used rock climbing and canyoneering areas.	The General Conversation standard ensures that human-caused sound are not capable of interfering with speech among visitors involving normal voice levels over a distance of 2-meter for more than 7-minutes-per-day. This standard would include interpretive programs in the backcountry which involve small groups (maximum 12 people). The Rock Climbing/Canyoneering standard ensures that human-caused sound levels are not capable of interfering with communication among rock climbers and canyoneers involving raised voice levels over a distance of 25-meters for more than 36-minutes-per-day.
Time above sleep interruption thresholds	Noise events during nighttime do not exceed 35 dBA.	Based on the FICAN study (1997), the likelihood of waking due to a noise event of 35 dBA is very close to zero. At levels of 35 dBA and below there is little chance that backcountry visitors would be awakened by noise. In addition, a study by Haralabidis et.al (2008) indicated that noise events above 35dBA (Lmax) contributed to an increase in blood pressure in subjects even when they did not awaken. In the absence of data concerning probability of disturbing wildlife due to sleep interruption, the use of human thresholds provides a reasonable proxy for wildlife impacts.
[1]In order to ensure that desired acoustic conditions and management objectives are being met, acoustic conditions must be at or below standards in 97% of the Wilderness Zone. [2] *Daytime Hours* (1 hour after sunrise to 1 hour prior to sunset) *Nighttime Hours* (1hour prior to sunset to 1 hour after sunrise)		

Monitoring and Adaptive Management

The implementation of this plan requires an assertive and focused monitoring effort. Short-term monitoring is necessary to characterize the natural soundscape and to describe the sources of noise that affect it. Long-term monitoring is designed to meet a number of needs including identifying trends in soundscape conditions. For proper soundscape management, monitoring is necessary for the following reasons:

- Describe the total ambient soundscape, separating the natural from the human-caused elements (baseline monitoring).
- Determine whether a particular use is in compliance with soundscape protection standards or limits provided in the plan (implementation monitoring).
- Determine the effectiveness of specific management actions that could affect the soundscape (effectiveness monitoring).
- Determine whether soundscape management objectives are being met and that the park is in compliance with its plan (implementation monitoring).
- Verify that the soundscape monitoring objectives are appropriate to meet park purposes (effectiveness monitoring).
- Validate the specific soundscape standards/limits that have been set (validation monitoring).
- Validate the monitoring methods and protocols; ensure that they measure what they are intended to measure (validation monitoring).

- Validate links between impact sources and effects on soundscape resources or values (validation monitoring).
- Provide periodic feedback to management about the need for change.

Monitoring is also necessary to implement an adaptive management approach to modify the SMP, as necessary. Decisions to modify soundscape indicators, standards, and other elements of the plan should be based on the results of data collection and analysis conducted as part of the long-term monitoring plan.

The fundamental purpose for monitoring is the identification of resource trends. The overall objectives for monitoring and adaptive management are to provide information to managers about the status and condition of park resources and values relative to law and policy, to assess the long-term effects of management actions on park resources and values, and to adjust the plan as needed as additional data are collected and understanding increases. Monitoring would be conducted throughout the park during various times of the year with the goal of capturing the variability of acoustic conditions throughout the park to the greatest extent possible based on effective use of funds and personnel. The guiding principle for monitoring is to collect purposeful data – even if the amount is limited – rather than collecting a great deal of data that cannot be used to arrive at valid conclusions. In order to meet the goal of collecting useful data, the park would develop a five year monitoring plan that addresses the following items:

- The management zones to be sampled.
- Specific locations for monitoring, and the planned intensity – frequency of monitoring.
- A schedule (times) for data collection and submittal.
- The staff responsible for monitoring and reporting.
- The plan would be updated every five years.

Sampling schedules may vary from year to year, focusing on different areas within the park. It is expected that initial monitoring would be intensive, both in geographic and temporal extent, so that correlations can be made and results can be extrapolated. It is also expected that monitoring over time would become less intensive ultimately resulting in a low intensity, long-term monitoring approach. Initially, routine monitoring should occur for 25 days at each site during each season of the year. In addition, monitoring should occur during special events or activities that may generate soundscape impacts. During monitoring, the following data would be collected:

- *Sound Pressure Levels (SPL)* – SPL data are collected in the form of A-weighted decibel readings (dBA) every second.
- *⅓-Octave Bands* – ⅓-octave band data are collected every second. (The ⅓-octave band data ranges from 12.5 Hz – 20,000 Hz when the Larson Davis system is used).
- *Meteorological Data* – Wind speed and direction are collected every second.
- *Audio Recordings* – Continuous audio is also recorded (mp3).
- *On-site Listening* – Generally last for one hour. Staff record the beginning and ending times of all audible sound sources using custom-designed Personal Digital Assistant (PDA) software. These data provided the basis for the calculated average noise free interval, percent time each sound source was audible, and maximum, minimum, and mean length (in seconds) of sound source events.

Feedback for management is implicit in monitoring and adaptive management programs. In order for feedback to occur, data must be collected effectively in accordance with a plan. Then, evaluations must be put in meaningful terms for management. The requirement of a formal report is essential to meet this need. A biennial monitoring report would be prepared every other year to provide useful information to park managers. The report would provide information on the following areas:

- Summarize data collected during the previous two year period.
- Calculate the extent to which standards are being met.
- Identify areas where standards are being violated, primary sources of violations, and possible management actions to resolve the violations.
- Assess the effectiveness of any management actions previously implemented to address soundscape issues, adjust actions as necessary.
- Extrapolate the measured conditions to other areas, when possible and appropriate.
- Make recommendations for changes in monitoring locations, protocols, techniques or thresholds that should be considered.
- As data accumulate, report trends in soundscape conditions over time.

ALTERNATIVES CONSIDERED AND DISMISSED

In developing the alternatives a range of acoustic indicators and standards were considered resulting in three action alternatives. Two of the alternatives were dismissed from further analysis because they did not fully meet the purpose and need as described earlier in this document. The alternatives and the reasons they were dismissed are summarized below.

- High Level of Protection Alternative – This alternative considered a set of standards and management actions that provided a very high level of protection for both the Frontcountry and Wilderness Zones. The indicators, such as time audible, noise free interval, sound level, speech interference, and sleep interruption were designed to ensure the most protective conditions possible and would virtually eliminate human-caused sound from much of the park. In order to meet the standards, management actions would include limiting visitor access below current levels in most areas of the park. This alternative does not provide an approach to managing the acoustic environment that is consistent with NPS policy as required. Although limiting visitor access and numbers in some areas is consistent with NPS policy, the scope of the limitations that would need to be implemented to achieve the standards in this alternative would be excessive. This alternative is also inconsistent with comments received during scoping to "keep policies reasonable" (Refer to *Public Involvement Summary*). As a result this alternative was dismissed from further analysis.

- Low Level of Protection Alternative – This alternative considered a set of standards and management actions that provided a very low level of protection for both the Frontcountry and Wilderness Zones. The indicators, such as time audible, noise free interval, sound level, speech interference, and sleep interruption provided low levels of protection of the acoustic environment and allowed for more noise intrusions on the park soundscape. Meeting the standards under this alternative would have provided less protection of the acoustic environment for wildlife, wilderness, and visitor experience. The alternative does not fully protect the acoustic experience for park visitors or ensure that natural sounds play an important role in the enjoyment of park resources and values. The alternative also failed to protect acoustic conditions for wildlife or the role of the soundscape in ensuring a healthy and dynamic ecosystem as expressed in the purpose and need. It also failed to address comments and concerns received during public scoping (Refer to *Public Involvement Summary*). As a result this alternative was dismissed from further analysis.

ALTERNATIVE SUMMARIES

Table 7 summarizes the major components of Alternative A and B, and compares the ability of the alternatives to meet the plan objectives, as identified in the *Purpose and Need*. As shown in the following table Alternative B fully meets each of the objectives, while Alternative A does not address all of the objectives.

Table 7: Summary of Alternatives and How Each Meets Objectives		
	Alternative A: No Action	**Alternative B: Preferred Alternative**
	This alternative continues current management direction or level of management intensity and involves continuing with the present course of action expressed in existing park management documents. The GMP, completed in 2001, provides details on strategies and actions to address resource problems and research needs.	This alternative includes the development of a Soundscape Management Plan (SMP) for Zion National Park. The alternative describes appropriate and inappropriate sound sources, soundscape objectives, soundscape indicators and standards, monitoring approaches and protocols, and methods for modifying the SMP using an adaptive management approach.
Plan Objectives	**Meets Plan Objectives?**	**Meets Plan Objectives?**
Protect the acoustic experience of park visitors and ensure that natural sounds continue to play an important role in the enjoyment of park resources and values.	While implementation of actions identified in the 2001 GMP have helped mitigate the adverse effects of human-caused sound on visitor experience, it does not provide a strategy for monitoring the success of failure of such mitigation. Alternative A only partially meets this objective.	The acoustic experience for visitors would be protected under the preferred alternative. Visitors would have opportunities to experience natural sounds in both the frontcountry and wilderness. The management actions identified in this alternative provide ways to mitigate effects of human-cause sound. The indicators and standards and monitoring strategy outline a mechanism to determine if objectives are being met and if the soundscape is being protected. The preferred alternative fully meets this objective.
Protect acoustic conditions for wildlife and the role of the soundscape in ensuring healthy and dynamic ecosystems.	The actions identified in the 2001 GMP have minimally mitigated the adverse effects of human-caused sound on wildlife. The GMP does not provide specific management strategies to protect wildlife from human-caused noise. As wildlife are exposed to increasing human-caused noise we could expect a decline in populations due to their decreased ability to escape prey, find food and mates, and rear and protect young. Alternative A only minimally meets this objective.	The preferred alternative identifies acoustic objectives, standards and implementation measures to monitor and protect acoustic conditions. Wildlife would be exposed to reduced levels of noise and have greater opportunities to experience important sounds related to communication, predator prey relationships, mate selection, territory establishment and other functions. The preferred alternative fully meets this objective.
Provide an approach to managing the acoustic environment that is consistent with NPS policy.	The no action alternative does not provide a systematic approach to managing or protecting the acoustic environment of the park. This alternative does not meet this objective.	The preferred alternative identifies acoustic objectives, standards and implementation measures to monitor and protect acoustic conditions consistent with NPS policy. The preferred alternative fully meets this objective.

Table 8 summarizes the anticipated environmental impacts for each alternative. Only those impact topics that have been carried forward for further analysis are included in this table. The *Environmental Consequences* section provides a more detailed explanation of these impacts.

Table 8: Environmental Impact Summary by Alternative		
Impact Topic	**Alternative A: No Action**	**Alternative B: Preferred Alternative**
Soundscapes	Effects to the acoustic environment could go unnoticed until impacts to other resources were detected such as changes in wildlife distributions or increases in the number of visitor complaints about noise. Similarly, the effectiveness of management actions to protect the soundscape resource could not be determined without clearly articulated acoustic objectives and standards and a systematic monitoring program. Therefore, Alternative A would result in moderate long-term adverse impacts to park soundscapes.	Because there is variation in natural ambient levels and acoustic conditions throughout the park, the intensity of the beneficial impact would vary. In Frontcountry areas like the Pine Creek site, where existing noise levels are higher the effect would be greater. In areas with lower natural ambient levels and fewer noise events, the intensity of beneficial impacts would be less. Overall, implementing the plan would result in long-term moderate beneficial effects to the soundscape resource.
Visitor Use & Experience	Visitors could be exposed to increased levels of human-caused noise, which would decrease their opportunities to experience natural sounds. Overall, changes in acoustic conditions would move the resource away from the desired condition leading to long-term, minor to moderate adverse impacts to visitor experience.	Because there is variation in natural ambient levels and acoustic conditions throughout the park, the intensity of the beneficial impacts would vary. In areas where existing noise levels are higher (near the river) the effect would be greater. In areas with lower natural ambient levels and fewer noise events, the intensity of beneficial impacts would be less. Overall, changes in acoustic conditions would move the resource toward a desired condition and help achieve acoustic objectives leading to long-term, moderate beneficial impacts to visitor experience.
Park Operations	Under the no-action alternative the NPS would continue current approaches to park operations. Park staff would continue to use existing motorized equipment and power tools. The number of staff required to complete maintenance tasks, and park fire and resource management tasks would not change. As a result, Alternative A would have negligible impact on park operations.	Management actions identified in the preferred alternative could affect park and concessionaire operations. Implementing the preferred alternative would have beneficial effects on park operations by minimizing staff exposure to noise. Overall, the effects of implementing Alternative B would result in minor short-term adverse impacts to park operations however benefits to soundscapes, visitor experience, and wildlife from reduced noise levels would help to offset any adverse impacts to park operations.
Wildlife, Threatened, Endangered Animal Species & Animal Species of Concern	Under the no-action alternative wildlife would be exposed to increasing human-caused levels of noise, which could interfere with the natural sounds they need for communication, predator prey relationships, mate selection, territory establishment and other functions. Overall, changes in acoustic conditions would move the soundscape resource away from the desired condition leading to long-term, moderate adverse impacts to wildlife.	Under the preferred alternative the NPS would adopt acoustic objectives and standards and implement measures to monitor and protect acoustic conditions. Wildlife would be exposed to reduced levels of noise and have greater opportunities to experience important sounds related to communication, predator prey relationships, mate selection, territory establishment and other functions. Overall, changes in acoustic conditions would move the soundscape resource toward the desired condition leading to long-term, moderate beneficial impacts to wildlife.

Table 8: Environmental Impact Summary by Alternative		
Impact Topic	**Alternative A: No Action**	**Alternative B: Preferred Alternative**
Wilderness	Under the no-action alternative the NPS would continue current approaches to protecting the acoustic environment. The park would continue to try to mitigate impacts to the soundscape in wilderness by using the minimum requirement procedures for proposed activities using motorized tools or aircraft. Overall, changes in acoustic conditions would move the soundscape resource away from the desired condition leading to long-term, moderate adverse impacts to wilderness characteristics and values.	The amount of time that human-caused sound could be heard would decrease with the implementation of preferred alternative. As a result wilderness characteristics and values would be enhanced. Overall, changes in acoustic conditions would move the soundscape resource toward the desired condition leading to long-term, moderate beneficial impacts to wilderness characteristics and values.

ENVIRONMENTALLY PREFERRED ALTERNATIVE

In accordance with DO-12, the NPS is required to identify the "environmentally preferred alternative" in all environmental documents, including environmental assessments. The environmentally preferred alternative is determined by applying the criteria suggested in NEPA, which is guided by the CEQ. The CEQ provides direction the "the environmentally preferred alternative is the alternative that will promote the national environmental policy as expressed in Section 101 of NEPA, which considered:

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

Simply put, *this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources* (Question 6a in CEQ 1981). In the NPS, the No Action Alternative may also be considered in identifying the environmentally preferred alternative.

Alternative A (No Action) does not meet, only minimally meets, or has no relationship to the above six evaluation factors for the following reasons.

- The actions identified in Alternative A do not fulfill our responsibility as trustee of the environment to current and future generations of park visitors or ensure all Americans safe, healthful, and esthetically pleasing surroundings because the Alternative does not fully protect park soundscapes. Human-caused noise interferes with visitor's enjoyment of the park by masking the sounds of nature. In the future, as visitation increases and development outside the

park increases, the ability of visitors to experience the natural environment will diminish under Alternative A.

- The actions identified in Alternative A could have undesirable or unintended consequences on the environment and the natural aspects of our national heritage would not be fully protected because the alternative does not identify specific mechanisms for protecting park soundscapes, other than the minimal desired conditions and management actions from the 2001 GMP. Over time human-caused sounds would likely increase, decreasing the visitor's ability the experience natural sounds. The increase in human-caused sound could have undesirable effects on wildlife, making it harder for them to hear and find prey or to flee from danger; find mates; and perform basic communication.
- Alternative A neither adds to or takes away from the NPS's ability to achieve balance between population and resource use or enhance the quality of renewable resources.

Alternative B (Proposed Action) is the environmentally preferred alternative because it best addresses the six evaluation factors for the following reasons.

- It fulfills the responsibilities of each generation as trustee of the environment for succeeding generations and ensures for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings by proactively monitoring the park soundscape to determine if standards identified in Alternative B to protect the soundscape are being met. Alternative B also identifies management actions that could be implemented to meet the goal of protecting the park soundscape.
- Alternative B attains the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences by identifying human-caused sound sources that are appropriate to the management of the park. Alternative B also identifies potential management actions to mitigate any undesirable or unintended consequences of those sound sources.
- Alternative B preserves the important historic, cultural, and natural aspects of our national heritage though the actions identified to protect the park soundscape.
- Alternative B achieves a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities by identifying human-caused sound sources appropriate for the management and enjoyment of the park and identifying actions to mitigate any unwanted adverse effects of those sounds.
- Alternative B neither adds, to or takes away from the NPS's ability to achieve balance between population and resource use or enhance the quality of renewable resources.

No new information came forward from the public during scoping or consultation with other agencies to necessitate the development of any new alternatives, other than those described and evaluated in this document. Because it meets the purpose and need for the plan, the plan objectives, and is the environmentally preferred alternative, Alternative B is also recommended as the NPS preferred alternative. For the remainder of this document, Alternative B will be referred to as the Preferred Alternative.

Affected Environment

DESCRIPTION OF PARK

Located in Washington, Iron, and Kane Counties in southwestern Utah, Zion National Park encompasses some of the most scenic canyon country in the United States. The park is characterized by high plateaus, a maze of narrow, deep, sandstone canyons, and striking rock towers and mesas. Zion Canyon is the largest and most visited canyon in the park. The North Fork of the Virgin River has carved a spectacular gorge

here, with canyon walls in most places rising 2,000 to 3,000 feet above the canyon floor. The southern part of the park is a lower desert area, with colorful mesas bordered by rocky canyons and washes. The northern sections of the park are higher plateaus covered by forests.

Zion is one of the earliest additions to the national park system. On July 31, 1909, President Taft issued a proclamation setting aside 15,200 acres as the Mukuntuweap National Monument. In 1918 another presidential proclamation enlarged the monument to 76,800 acres and changed its name to Zion National Monument. Congress established the area as a national park in 1919. A second Zion National Monument (now called the Kolob Canyons) was established by presidential proclamation in 1937. Congress added the Kolob Canyons to Zion National Park in 1956.

The park currently encompasses 148,733 acres. Within the park boundary there are 3,490 acres of private inholdings, mostly in the Kolob Terrace area, (The inholding acreage and all of the other park acreage figures included in this document are based on geographic information system (GIS) calculations. These figures may not correspond with legal description acreages.) Zion is part of the Southwest's "Grand Circle" of national parks, monuments, historical areas, and recreational areas. Visitors reach the park via Interstate 15, Utah State Route 9, and Highway 89. Zion is 160 miles northeast of Las Vegas and 320 miles southwest of Salt Lake City. The town of Springdale is adjacent to the park's south entrance. Other nearby towns include: Kanab (41 miles from the Zion Canyon Visitor Center), St. George (43 miles), and Cedar City (60 miles).

SOUNDSCAPES

Over the past decade, several soundscape monitoring efforts have taken place at Zion. In 2000 and 2001, Wyle Laboratories established 12 monitoring sites within the park, and produced a report that summarized their findings (Hobbs & Downing 2003). During the summer of 2008, the Natural Sounds Program (NSP) established two additional monitoring sites. After working with the NSP, ZNP acquired several monitoring systems, and monitoring efforts are continuing at the sites established in 2008, and at some of the Wyle sites. Sandhill Company collected concurrent measurements at several of the Wyle sites in 2001, but these data are not summarized in this report.

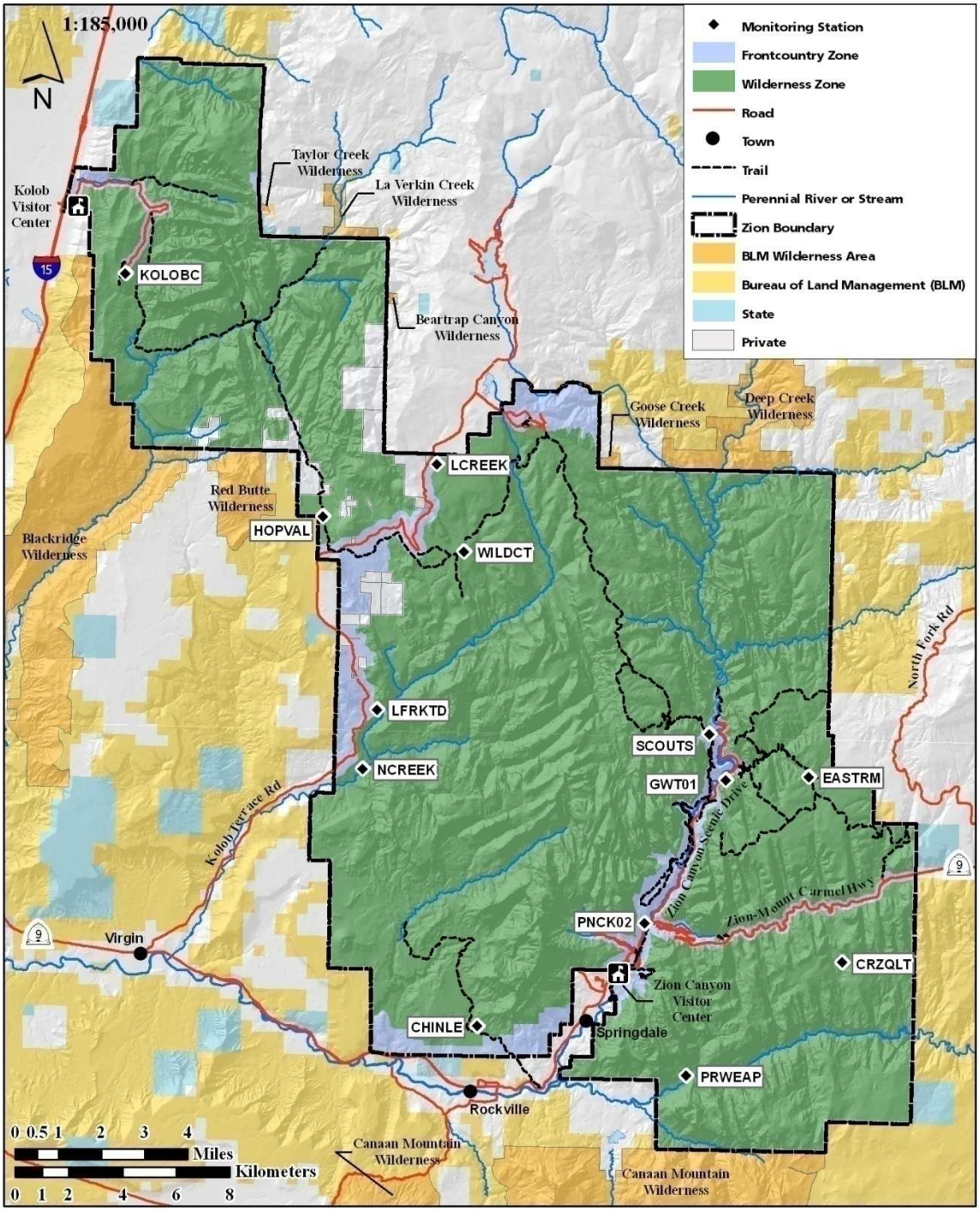
Several types of data were collected in 2000-2001, as described in the Wyle report (Hobbs & Downing 2003). At 11 of the 12 Wyle sites, data were collected for 33, ⅓-octave bands. The analysis of this type of data has evolved rapidly over the past decade, and this analysis includes updated results and graphical presentations from the Wyle sites where ⅓-octave data were available. The Lava Point site was abandoned because of early fall snow, so adequate data were not collected. Data from this site was not included in this document.

Starting in 2008, data were collected in accordance with the NPS Natural Sounds Program guidelines for soundscape monitoring (NSP, 2008). ZNP staff received training on these protocols, and will be conducting additional analyses of data collected during the summer of 2008. The 2008 sites each ran for over 3-weeks in July and August, and preliminary results from these sites are included in this EA. These results provide a quantitative description of the acoustical environment at ZNP. For a more detailed description of the results of previous analyses see *Zion National Park Acoustical Monitoring Summary Report* (2010). Table 9 lists the sites monitored by Wyle in 2000-2001and the park in 2008. Figure 7 illustrates the locations of these sites.

Table 9: Acoustic Monitoring Sites				
Site ID	**Site Name**	**Days of data**	**Vegetation**	**Elevation (in meters)**
CHINLE	Chinle Trail Mesa	58.6	Desert scrub	1281
CRZQLT	Crazy Quilt Mesa	46.6	Slick rock	1748
EASTRM	East Rim Mesa	3.7	Mountain brush	1949
HOPVAL	Hop Valley Trail	17.5	Desert scrub	1930
KOLOBC	Kolob Canyon	23.5	Pinyon/ juniper	1874
LCREEK	Upper Kolob Terrace	50.6	Pinyon/ juniper	2365
LFRKTD	Left Fork/ North Creek	21.1	Mountain brush	1563
NCREEK	Right Fork/ Kolob Terrace	19.2	Riparian	1273
PRWEAP	Parunuweap Canyon	9.0	Riparian	1227
SCOUTS	Scout's Lookout	19.4	Slick rock	1769
WILDCT	Wildcat Trail	20.9	Conifer forest	2127
GWT/01	Great White Throne (2008)	23.5	Near riparian area	1328
PNCK/02	Pine Creek (2008)	21.1	Riparian	1240

Figure 7: Acoustic Monitoring Sites

National Park Service
U.S. Department of the Interior
Zion National Park



It is important to understand existing conditions when characterizing the acoustic environment and assessing impacts to soundscape resources. The NPS calculates the existing ambient and natural ambient for soundscape studies. The existing ambient (L_{50}) is the median sound level recorded at a site and includes sound energy from all natural and anthropogenic or human-caused sources. The natural ambient (L_{nat}) is an estimate of what the median ambient level for a site would be if all anthropogenic sources were removed. Because conditions vary based on time of day, existing and natural ambient are calculated for both day and night.

The median existing ambient sound pressure level (L_{50}) and the median natural ambient sound pressure levels (L_{nat}) can be seen in Table 10 and Table 11. The L_{nat} values are based on 8-days of sound source identification (with the exception of EASTRM, where only 2-days were available for analysis). The median L_{50} values are calculated using all of the available data for the site.

Table10: Median Day and Night L_{50} and L_{nat} for Wyle Sites

Site ID	Days of available data	Median Existing Ambient (L_{50}) in dBA		Median Natural Ambient (L_{nat}) in dBA	
		Day	Night	Day	Night
CHINLE	58.6	24.1	20.2	21.9	19.3
CRZQLT	46.6	26.4	19.0	23.3	18.3
EASTRM	3.7	25.8	18.6	24.0	18.3
HOPVAL	17.5	28.5	20.2	25.8	19.4
KOLOBC	23.5	31.0	29.0	29.0	28.0
LCREEK	50.6	26.4	19.8	23.6	19.0
LFRKTD	21.1	27.0	26.1	24.5	25.1
NCREEK	19.2	37.0	38.0	37.0	38.0
PRWEAP	9.0	42.0	43.0	--	--
SCOUTS	19.4	26.9	24.8	24.3	24.0
WILDCT	20.9	28.1	27.9	25.1	26.5

Table 11: Median Day and Night L_{50} and L_{nat} for 2008 Sites

Site ID	Days of available data	Median Existing Ambient (L_{50}) in dBA		Median Natural Ambient (L_{nat}) in dBA	
		Day	Night	Day	Night
GWT/01	23.5	38.8	39.8	37.4	39.6
PNCK/02	21.1	42.9	42.8	37.7	41.8

The data show that the daytime natural ambient levels in the Wilderness Zone range from approximately 22 dBA to 37 dBA with most of the sites below 30 dBA. Nighttime natural ambient levels range from 18 dBA to 38 dBA with many sites below 20 dBA. Existing ambient levels at sites located in the Wilderness Zone range from approximately 24 dBA to 42 dBA during daytime hours and from 18 dBA to 43dBA during nighttime hours.

At Frontcountry Zone sites, natural ambient levels are approximately 37 dBA during the day and 40 dBA to 42 dBA at night. The higher natural ambient levels at these sites are mainly due to proximity to moving

water in the Virgin River. Existing ambient levels at frontcountry sites ranged from 39 dBA to 43 dBA during the day and 40 dBA to 43 dBA during the night.

In determining the current conditions of an acoustic environment, it is important to examine how often sound pressure levels exceed certain values. Table 12 and Table 13 report the percent of time that measured levels were above four key values. These exeedence values were calculated from the existing sound pressure levels (SPL) during the full duration of data collection, and include intrinsic (natural sound) and extrinsic (human-caused) sound sources.

The first threshold, 35 dBA, is designed to address the health effects of sleep interruption. Recent studies suggest that sound events as low as 35 dBA can cause increases in blood pressure and heart rate while sleeping (Haralabidis et al. 2008). The second threshold addresses the World Health Organization's (WHO) recommendations that noise levels inside bedrooms remain below 45 dBA (Berglund et al. 1999). The third threshold, 52 dBA, is based on the EPA's speech interference threshold for speaking in a raised voice to an audience at 10-meters. This threshold addresses the effects of sound on interpretive presentations in parks. The final threshold, 60 dBA, provides a basis for estimating impacts on normal voice communications at 2-meters. Hikers and visitors viewing scenic vistas in the park would likely be conducting such conversations.

Table 12: Percent Time Above Metrics for Wyle Wilderness Zone[1] Sites Monitored in 2000-2001

Site ID	Days of available data	% Time above sound level: Day				% Time above sound level: Night			
		35 dBA	45 dBA	52 dBA	60 dBA	35 dBA	45 dBA	52 dBA	60 dBA
CHINLE	58.6	13.92	1.18	0.15	0.01	4.09	0.33	0.03	0.00
CRZQLT	46.6	18.58	1.83	0.20	0.00	4.52	0.33	0.04	0.00
EASTRM	3.7	8.71	2.17	0.28	0.05	3.03	0.21	0.01	0.00
HOPVAL	17.5	22.82	3.79	0.64	0.03	6.60	1.99	0.64	0.01
KOLOBC	23.5	35.26	3.40	0.34	0.04	19.24	1.65	0.13	0.01
LCREEK	50.6	16.23	1.66	0.18	0.02	3.46	0.30	0.03	0.00
LFRKTD	21.1	14.68	2.04	0.37	0.02	17.39	2.79	0.18	0.01
NCREEK	19.2	99.69	1.71	0.32	0.02	100.00	0.79	0.11	0.00
PRWEAP	9.0	100.00	4.71	0.61	0.00	100.00	10.81	0.10	0.00
SCOUTS	19.4	11.99	1.57	0.38	0.02	5.62	0.65	0.14	0.01
WILDCT	20.9	22.70	2.95	0.47	0.07	34.89	1.28	0.14	0.00

[1]LFRKTD is not within the Wilderness Zone, but is directly adjacent to the zone.

Table 13: Percent Time Above Metrics for Frontcountry Zone Sites Monitored in Summer 2008

Site ID	Days of available data	% Time above sound level: Day				% Time above sound level: Night			
		35 dBA	45 dBA	52 dBA	60 dBA	35 dBA	45 dBA	52 dBA	60 dBA
GWT/01	23.5	99.53	13.07	3.58	0.02	100.00	3.12	0.83	0.00
PNCK/02	21.1	99.84	34.57	1.67	0.04	100.00	32.80	2.92	0.00

At most of the sites located in the Wilderness Zone, sound levels exceeded 35 dBA less than 10 percent of the night. During the times when levels exceed 35 dBA, visitors could experience increases in blood pressure and heart rate. Sound levels at wilderness sites generally exceeded 45 dBA, WHO guidelines for noise inside bedrooms, for less than 2 percent of the night. At most of the sites located in the Wilderness Zone, sound levels exceeded 52 dBA less than 1 percent of the day and night. During the times when

levels exceed 52 dBA, visitors could experience difficulty in hearing interpretive programs. Sound levels at wilderness sites rarely exceeded the 60 dBA threshold for speech interference.

At Frontcountry Zone sites, sound levels exceeded 35 dBA for almost 100 percent of the night. This result is due to nighttime natural ambient sound levels at the frontcountry sites that exceed the 35 dBA threshold. Sound levels at frontcountry sites generally exceeded 45 dBA, WHO guidelines for noise inside bedrooms, for 3 percent of the night at the Great White Throne site and 33 percent of the night at Pine Creek site. The higher percentages at the Pine Creek site are likely due to the nighttime natural ambient levels of 41.8 dBA due mainly to sound energy from the nearby Virgin River. In the frontcountry sites, sound levels exceeded 52 dBA from 1.7 percent to 3.6 percent of the day and 1 percent to 3 percent of the night. Sound levels at frontcountry sites rarely exceeded the 60 dBA threshold for speech interference.

Audibility

Table 14 shows the percent of time that aircraft and other extrinsic sounds are audible for the Wyle sites. Sound source identification was not collected for the PRWEAP site, due to windy conditions. Table 15 displays the 2008 aircraft and total non-natural sound source results. At both of the 2008 sites, vehicle noise was the most pervasive non-natural sound source.

At most of the sites located in the Wilderness Zone, aircraft were the most common source of noise. The amount of time that aircraft were audible ranged from 20 percent to 42 percent. At Frontcountry Zone sites human-caused sounds were audible 44 percent to 65 percent of the time.

Table 14: Mean Percent Time Audible – Wilderness Zone Sites – Wyle 2000-2001

Site ID	Days analyzed	Mean % time audible	
		All Extrinsic	Aircraft Noise
CHINLE	8	32.5	32.5
CRZQLT	8	30.9	30.9
EASTRM	2	40.5	33.1
HOPVAL	8	28.0	28.0
KOLOBC	8	25.0	20.5
LCREEK	8	33.2	33.2
LFRKTD	8	41.9	41.9
NCREEK	8	24.5	24.5
SCOUTS	8	54.6	29.4
WILDCT	8	34.3	31.0

Table 15: Mean Percent Time Audible – Frontcountry Zone Sites – Summer 2008

Site ID	Days analyzed	Mean % time audible	
		All Extrinsic	Aircraft
GWT/01	8	43.9	15.0
PNCK/02	8	65.9	6.6

VISITOR USE AND EXPERIENCE

Visitation to ZNP has steadily increased over time. In 2009 over 2.7 million people visited the park. Over 264,600 of these people spent at least one night at Zion Lodge or in one the park campgrounds. Most visitors come to the park in private vehicles. Visitors also come to the park as part of tour on a passenger bus. Over 923,000 vehicles entered the park in 2009 (NPS Statistics, 2009).

Zion offers a variety of activities for visitors that are consistent with the park's purposes and significance. The most common visitor activities include sightseeing, scenic drives, hiking, backpacking, canyoneering, rock climbing, and photography. Visitors can also add to their experience by taking advantage of interpretive programs, museum exhibits, and information at the visitor centers.

As in other national parks, visitors to Zion enjoy the sounds of nature: bird songs, the rustling of leaves, the sound of the river, or wind through the trees. These sounds can have a calming or relaxing effect. Or they can trigger memories of a pleasant past experience.

Zion has made several steps to increase opportunities for visitors to experience the sounds of nature in the Frontcountry. In 2000, the park implemented a mandatory free shuttle system to access Zion Canyon. Shuttles run from April through October. When visitors are in the canyon, even near the road, in between shuttle passes, they can hear the sound of the river, birds calling, and the wind in the trees. The park has also installed electric hookups in the Watchman Campground so that visitors don't have to use generators.

In the Wilderness Zone, the park has instigated group size limits and day use limits in certain areas to ensure that visitors have opportunities to experience solitude. Designated campsites are also located out of sight and sound of other campsites whenever possible. Over 39,000 people visited Zion's backcountry in 2009, with over 10,000 spending at least one night in the backcountry.

PARK OPERATIONS

Park operations refer to the maintenance of infrastructure by park staff to protect and preserve vital natural and cultural resources and provide for a quality visitor experience. Other park operations include activities performed by law enforcement, search and rescue, resource management, interpretation of park resources, fire management, administrative and concession activities.

Park staff must maintain, repair and sometimes build new facilities in order to provide a positive and safe visitor experience, while protecting park resources for present and future generations. Currently Zion has 3 campgrounds, 2 visitor centers, 1 museum, 21 public restrooms, 1 lodge with 124 hotel and cabin units, 120 miles of maintained trail, 92 administrative/public use buildings, 35 housing facilities, 51 miles of paved road, 6 miles of graded roads, and 30 shuttle busses, with 21 trailers.

In order to maintain and repair this infrastructure in the Frontcountry Zone, park staff use a variety of tools. Many of the tools needed to accomplish these tasks are motorized or produce human-caused noise such as:

- road grader, snow plow, backhoe, dynamite, etc. for roads;
- gas-powered rock hammers, chainsaws, etc. for trails;
- gas-powered lawn mowers, leaf blowers, gas-powered weed whips, etc. for landscaping;
- gas-powered weed whips, chain saws for noxious weed control, etc.;
- fire management: chainsaws, helicopters, other aircraft, etc.; and
- aircraft for search and rescue, sirens for law enforcement, etc.

In the Wilderness Zone the use of mechanical and motorized tools must go through the minimum requirement procedures. The analysis determines whether the activity is necessary in wilderness and whether the methods and techniques (tools) chosen to accomplish the task are appropriate. The types of human-caused sound related to park operations in the wilderness could include: aircraft, chainsaws, gas-powered rock hammers, or gas-powered weed whips.

WILDLIFE, THREATENED AND ENDANGERED ANIMAL SPECIES AND ANIMAL SPECIES OF CONCERN

Many animals, insects and birds decipher sounds to find desirable habitat and mates, avoid predators and protect young, establish territories and to meet other basic survival needs. Scientific studies have shown that wildlife can be adversely affected by sounds and sound characteristics that intrude on their habitats. Although the severity of the impacts varies depending on the species, research has found that wildlife can suffer adverse physiological and behavioral changes from intrusive sounds and other human disturbance.

Zion is home to 6 species of amphibians, 28 species of reptiles, 79 mammal species, 289 bird species, and 7 fish species. Many species of birds and some mammal species, such as bats, are migratory. Consequently, the number of species and the size of populations vary considerably from season to season.

Several threatened and endangered animals and animal species of concern either occur in or have the potential to occur within ZNP. They are described below.

The **Mexican spotted owl** (*Strix occidentalis lucida*) was listed as a threatened species in 1993. In 1995 the Mexican Spotted Owl Recovery Plan was completed and provided a basis for management actions undertaken by land management agencies to remove recognized threats and to recover the spotted owl. The Recovery Plan divided spotted owl habitat geographically into six recovery units in the United States. ZNP is within the Colorado Plateau Recovery Unit (USFWS, 1995). The park has 26 historical Mexican spotted owl territories, which are widely distributed. A spotted owl monitoring program for the park was initiated in 1995 and continues today.

All of ZNP was designated as critical habitat for spotted owl in August 2004 (USFWS, 2004). The identification of critical habitat is based on data available at the time of designation. The focus for critical habitat is on the physical and biological features essential to the conservation of the species, referred to the primary constituent elements, that are within areas occupied by the species at the time of listing, and that may require special management considerations and protection. The primary constituent elements necessary to ensure the conservation of Mexican spotted owl include: the presence of water; abundance of canyon walls with crevices, caves, and ledges; clumps or stringers of mixed conifer, pine-oak, pinyon-juniper, or riparian vegetation; and a high percentage of ground litter and woody debris.

A nonessential, experimental population (Section 10(j) of the ESA) of the federally endangered **California condor** *(Gymnogyps californianus)* was reintroduced into northern Arizona in 1996 (USFWS, 1996). The condor must be treated as a listed threatened species under the 10(j) designation on National Park lands. During the summer of 2009, up to 59 condors were sighted in the area north of the park and were known to venture regularly into the park during that time. Condors are now observed in the main canyon year-round. The condors appear to be expanding their range farther to the north and may be expected to visit ZNP more frequently in the future.

The **western yellow-billed cuckoo** *(Coccyzus americanus occidentalis)* has candidate species status and is considered a rare summer resident and migrant in the park (Wauer, 1997). Their primary breeding habitat is an overstory of cottonwood canopy that is present in the park although not in abundance.

Western yellow-billed cuckoos are not known to breed or nest in the park (Wauer, 1997). The park has conducted surveys for western yellow-billed cuckoo for the past 2 years. No birds have been located. For the purpose of this document we will assume that any actions resulting from the implementation of the SMP will have no effect on the cuckoo.

The federally endangered **southwestern willow flycatcher** (*Empidonax traillii extimus*) nests primarily in mid-to-low elevation riparian habitat along rivers, streams, or other wetlands where a dense growth of willows or other plants are present. There was one confirmed sighting of this neotropical migrant in the park in 1994 along the East Fork of the Virgin River. A 1998 survey of the park's riparian habitat that seemed capable of supporting flycatchers found no birds. One bird was located in the Birch Creek survey area in 1999 but apparently was a migrant. The park has conducted surveys for southwestern willow flycatcher for the past 2 years. No birds have been located. For the purpose of this document we will assume that any actions resulting from the implementation of the SMP will have no effect on the flycatcher.

A small population of federally threatened **desert tortoises** (*Gopherus agassizii*) occurs in one small area of the park. A study was completed in 2003 using line distance sampling techniques, which resulted in an average of 14 individuals, with a 95 percent confidence interval from 12 to 26 individuals (P. Stephen Corn, personal communication). The Upper Virgin River Recovery Plan unit for the tortoise does not encompass lands within the park, and there is no critical habitat designated within the park (UDWR, 2000). Actions outlined in this plan would likely have a beneficial effect on tortoise by protecting their ability to hear predators approaching.

The endangered **Virgin River chub** (*Gila seminude*) and **woundfin** (*Plagopterus argentissimus*) are not known to occur in ZNP. They are both known to occur downstream from the park in the Virgin River below the town of LaVerkin.

The following wildlife species are either under conservation agreements or are listed as a Utah sensitive species.

The **peregrine falcon** *(Falco peregrinus anatum)* was removed from the federal list of endangered and threatened species in 1999 due to its successful recovery. In ZNP peregrine falcons were a regular, but uncommon sight in Zion Canyon from the late 1920s through the late 1940s. The first report of nesting falcons was in about 1933. Peregrine falcons were added to the checklist of birds of ZION in 1935. Beginning in the early 1960s the NPS documented, although not regularly, peregrine observations until the mid-1980s. In the mid-1980s surveys and monitoring studies began and continue today. Currently ZNP hosts a high concentration of breeding peregrines that nest on steep cliffs throughout the park. The park is known to have 18 historic falcon breeding territories.

The **bald eagle** (*Haliaeetus leucocephalus*) was removed from the endangered species list on July 9, 2007 due to its successful recovery. The bald eagle winters in the vicinity of the park, especially in the Sevier River Valley east of the park. Although they are commonly observed near the Blue Creek Reservoir to the north, only a few bald eagles are observed each year in the park during the winter and early spring months. Birds that occasionally enter the park perch along the North Fork of the Virgin River in the main canyon. Bald eagle use in the park is sporadic, uncommon, and unpredictable. Large congregations of the birds do not occur, and there are no known, regularly used, winter perch sites or known roost sites within the park.

A survey conducted in 1999 found three active **northern goshawks** *(Accipiter gentilis)* nests in the park (NPS, 1999). Two of the nests are not near any trails, routes, or visitor attractions. The third site is near a

designated trail that does not receive much use. These birds inhabit higher elevations in the park. They prefer coniferous forests, but will also inhabit mixed forests.

The **Virgin spinedace** (*Lepidomeda mollispinis mollispinis*) and **flannelmouth sucker** (*Catostomus latipinnis*) are both managed under Conservation Agreements in lieu of listing as a threatened or endangered species. Both fish have similar ranges in the park and are found in the North Fork and East Fork of the Virgin River and several short tributaries within Zion and Parunuweap Canyons. They are found downstream of the park in North Creek and LaVerkin Creek. Since 1994, the Utah Division of Wildlife Resources (UDWR) has been monitoring these fish at two park locations (UDWR, 2003). Monitoring will continue annually.

WILDERNESS

The Omnibus Public Land Management Act of 2009 (Public Law 111-11) designated 124,462 acres, 84 percent of the park, within Zion National Park as wilderness. Another 9,047 acres, 6 percent of the park, are recommended for wilderness designation. This means that 90 percent of the park is managed as wilderness, as per NPS policy.

The Wilderness Act of 1964 states that: *A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain….with the imprint of man's work substantially unnoticeable…*

Management Policies 2006 states that: *…in evaluating environmental impacts, the NPS will take into account (1) wilderness characteristics and values, including the primeval character and influence of wilderness; (2) the preservation of natural conditions (including the lack of man-made noise); and (3) assurances that there will be outstanding opportunities for solitude, that the public will be provided with a primitive and unconfined type of recreational experience, and that wilderness will be preserved and used in an unimpaired condition.*

The GMP completed in 2001 stated the following desired condition: *All of the lands within recommended wilderness areas retain their wilderness characteristics and values. Visitors continue to find opportunities for solitude and primitive, unconfined recreation. Signs of people remain substantially unnoticeable. The area continues to be affected primarily by the forces of nature*.

The opportunities for park visitors to experience the sounds of nature are an important component the wilderness experience.

ENVIRONMENTAL CONSEQUENCES

This section describes the potential environmental consequences that would occur as a result of implementing each of the alternatives. Topics analyzed in this section include: soundscapes, visitor use and experience, park operations, wildlife, threatened and endangered animal species and animal species of concern, and wilderness.

Direct, indirect, and cumulative effects are analyzed for each impact topic carried forward. Potential impacts are described in terms of type, context, duration, and intensity. General definitions are defined as follows, while more specific impact thresholds are given for soundscapes, visitor use and experience, park operations, wildlife, threatened and endangered animal species and animal species of concern, and wilderness later in this section.

- **Type** describes the classification of the impact as either beneficial or adverse, direct or indirect:
    - Beneficial: A positive change in the condition or appearance of the resource or a change that moves the resource towards a desired condition.
    - Adverse: A change that moves the resources away from a desired condition or detracts from its appearance or condition.
    - Direct: An effect that is caused by an action and occurs in the same time and place. **All impacts identified in this document are "direct" unless otherwise stated.**
    - Indirect: An effect that is caused by an action but is later in time and farther removed in distance, but is still reasonably foreseeable.
- **Context** describes the area or location in which the impact will occur; site-specific, local, regional, or even broader.
- **Duration** describes the length of time an effect will occur, either short-term or long-term. Because definitions of duration can differ by topic, definitions are provided separately for each impact topic.
- **Intensity** describes the degree, level, or strength of an impact. For this analysis, intensity has been categorized as negligible, minor, moderate, and major. Because definitions of intensity vary by topic, intensity definitions are provided separately for each impact topic.

CUMULATIVE IMPACT SCENARIO

The CEQ regulations, which implement NEPA (42 U.S.C. 4321 et seq.), require assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as *the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions* (40 CFR 1508.7). Cumulative impacts are considered for both the no-action and preferred alternatives.

Cumulative impacts were determined by combining the impacts of the alternatives with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other past, ongoing or reasonably foreseeable future projects at ZNP. The geographic scope for this analysis includes actions within and adjacent to the park boundaries, while the temporal scope includes projects within a range of approximately ten years. Given this, the following projects were identified for the purpose of conducting the cumulative effects analysis:

Fire management activities – Fire management activities fall into one of two categories: planned/prescribed fire or wildland fire. The 5-Year Fuels Treatment Plan outlines proposed treatments (prescribed fire, mechanical treatments, and herbicide treatments) from 2010 through 2014. All of the treatments proposed may not be completed. The Minimum Requirement Procedures would be required for any treatment proposing the use of power tools or aerial support within wilderness. For the purposes of the cumulative analysis for this EA, it is assumed that the following planned/prescribed activities would occur:

- 2010 – Broadcast burn on up to 2,360 acres; mechanical treatments with some burning on 80 acres.
- 2011 – Broadcast burn on up to 865 acres; mechanical treatments with some burning on 60 acres.
- 2012 – Broadcast burn on up to 565 acres; mechanical treatments with some burning on 70 acres.
- 2013 – Broadcast burn on up to 90 acres; mechanical treatments with some burning on 20 acres.
- 2014 – Broadcast burn on up to 1,305 acres.

Development on private lands bordering the park – Lands on the boundary and near the park are being developed at an increasing rate. Over 35 percent of the park is bordered by private lands. Historically, these lands have been used largely for agricultural purposes. However, these lands are being developed to accommodate the demand for rural, primary and secondary homes. This development pattern is most prevalent along the east, north, and southwest boundaries of ZNP.

Between 1990 and 2000 Utah's population grew by almost 30 percent, ranking it 4th (by percentage of growth) in the United States. Washington County, with an estimated population of 90,354 (U.S. Census Bureau, 2000) has experienced tremendous growth, expanding by more than 42,000 people (nearly 86 percent) between 1990 and 2000 (U.S. Census Bureau, 2000). Kane County has an estimated population of 6,046 (U.S. Census Bureau, 2000) and has experienced a 17 percent increase in population from 1990 to 2000. Iron County has a population estimate of 34,400 (U.S. Census Bureau, 2000) and experienced a population growth of 62 percent between 1990 and 2000 (U.S. Census Bureau, 2000).

For the purposes of the cumulative analysis for this EA, it is assumed that the rate of development of open land near ZION to accommodate the demand for primary and secondary homes would increase. This demand is fueled by a steady increase in population, the proximity of ZNP to expanding urban areas (e.g., St. George), and a growing trend of rural development in surrounding counties and adjacent states.

Exotic plant monitoring and control – In the frontcountry and wilderness, park staff conduct exotic plant monitoring each year. The monitoring assists in early detection so that targeted plants can be eradicated before they spread. In an average year, park staff would monitor and provide control on over 30-acres in the frontcountry and 100-acres in wilderness. Methods of control included hand tools, herbicides, and motorized tools (with approval through the Minimum Requirement Procedures). For the purposes of the cumulative analysis for this EA, it is assumed that both monitoring and control of exotic plants would continue at a rate of 130-acres per year.

Planned road work – In June 2010, the park will begin a project to rehabilitate and improve the 9.5-mile Zion Mt. Carmel Highway. The road is the only access into the park from the east. The project is estimated to take at least 6 months. The work would include removing the existing pavement and replacing it with new, improving the grade in certain areas, improving drainage, rehabilitating guard walls, and reconfiguring pullouts and parking areas. The equipment needed to accomplish this project would create more human-caused noise that would normally occur in the area.

A similar project is proposed for 9.8 miles of the Kolob Terrace Road and could begin as early as 2011. This road provides access to Lava Point, a small campground, many backcountry hiking areas, and to large tracts of private lands that are currently being developed for residential and vacation use.

Development of an Air Tour Management Plan – The National Parks Air Tour Management Act of 2000 requires the NPS and the Federal Aviation Administration to work together to develop an Air Tour Management Plan (ATMP) for all parks with commercial air tours. The purpose of the ATMP is to provide acceptable and effective measures to mitigate or prevent the significant adverse impacts of commercial air tour operations on natural and cultural resources and visitor experience in the park. The act states that ATMPs may prohibit commercial air tour operations in whole or part; establish conditions for the conduct of commercial air tour operations, including routes, minimum or maximum altitudes, time-of-day restrictions, restrictions for particular events, and maximum number of flights per unit of time. Currently these are 14 authorized operators providing a total of 742 air tours per year over Zion.

Increase in Aviation Activity – Projected increases in aviation activity over ZNP are not available. However, based on FAA estimates (FAA 2007), commercial aircraft operations (the sum of air carrier and commuter/air taxi) at all U.S. airports, towered and non-towered, are projected to increase from 28.3

million in 2006 to 37.3 million in 2020. These forecasts imply an average annual growth rate of 2.0 percent for both the intermediate and extended forecast periods, respectively. The number of general aviation operations at towered and non-towered airports is forecast to increase from 80.9 million in 2006 to 92.1 million in 2020. These forecasts imply an average annual growth rate of 0.9 percent over both the intermediate and extended forecast periods. Much of the growth is the result of increased use of the turbine fleet for business/corporate related flying. For the purposes of the cumulative analysis for this EA, it is assumed that changes in aviation activity over ZNP will be consistent with those at the national level. [Federal Aviation Administration (2007) FAA Long-range Aerospace Forecasts Fiscal Years 2020, 2025 and 2030]

SOUNDSCAPES

NPS *Management Policies* (2006) identify soundscapes as a resource like air, water, and wildlife with inherent value. Analyses of proposed actions must consider the effects of the action on the acoustic environment in a park without regard to how they are perceived by humans and wildlife. Thresholds for identifying impacts to the soundscape resource are defined as follows:

Soundscapes	
Impact Intensity	**Intensity Definition**
Negligible	The action would rarely cause a change in existing ambient sound conditions, and/or there would be little or no change in periods of time between noise events. The amount of time that noise is audible would change very little from existing conditions. The action would rarely result in a change to any noise metric that is more than a very small increment from existing levels in the same area.
Minor	The action would occasionally cause a change in existing ambient sound conditions, and/or there would a small change in periods of time between noise events. The amount of time that noise is audible would change a small amount from existing conditions. The action would occasionally result in a change to any noise metric that is more than a small increment from existing levels in the same area.
Moderate	The action would cause a change in existing ambient sound conditions for an intermediate amount of the day, and/or there would an intermediate change in periods of time between noise events. The amount of time that noise is audible would change an intermediate amount from existing conditions. The action would occasionally result in a value for a noise metric that is an intermediate increment from existing levels in the same area.
Major	The action would cause a change in existing ambient sound conditions for a large amount of the day, and/or there would be more than an intermediate change in periods of time between noise events. The amount of time that noise is audible would change more than an intermediate amount from existing conditions. The action would occasionally result in a value for any noise metric that is more than an intermediate increment from existing levels in the same area.
Duration	Short-term – The impact would generally last the life of the project or activity or up to one year.
	Long-term – The impact would last longer than one year.

Impacts of Alternative A – No Action

Under the no-action alternative the NPS would continue present approaches to protecting the acoustic environment. Acoustic objectives and standards would not be developed and an acoustic monitoring program would not be implemented. Continued development inside the park and adjacent to park boundaries could continue to affect the acoustic environment. Increases in visitor use, and vehicle access, modifications to park operations and other changes could affect acoustic resources but the park would not have specific acoustic objectives against which to measure potential effects or a systematic approach for monitoring changes to the soundscape resources.

Effects to the acoustic environment could go unnoticed until impacts to other resources were detected such as changes in wildlife distributions or increases in the number of visitor complaints about noise. Similarly, the effectiveness of management actions to protect the soundscape resource could not be determined without clearly articulated acoustic objectives and standards and a systematic monitoring program. Therefore, Alternative A would result in moderate long-term adverse impacts to park soundscapes.

Impacts of Alternative B – Preferred Alternative
Implementation of Alternative B would help the park meet acoustic resource objectives. In areas where they are not currently being met, the standards would help identify locations that need management action to reduce noise levels. In areas where noise is increasing, the standards would identify the need for management action to ensure that conditions remain consistent with resource protection and management goals. In particular, the deviation from natural ambient, Lmax, and noise free interval standards for the Frontcountry would promote the objective that natural sounds are audible and discernable, with common noise intrusions by visitors and park operations that are concentrated at locations near roads and heavily developed areas. In the Wilderness Zone the standards would help meet the objective that only natural sounds are audible and discernable, except for short duration, infrequent human-caused sounds.

Because there is variation in natural ambient levels and acoustic conditions throughout the park, the intensity of the beneficial impact would vary. In Frontcountry areas like the Pine Creek site, where existing noise levels are higher the effect would be greater. In areas with lower natural ambient levels and fewer noise events, the intensity of beneficial impacts would be less. Overall, implementing the plan would result in long-term moderate beneficial effects to the soundscape resource.

Cumulative Impacts
Other past, present and planned future actions within the park have the potential to affect the natural soundscape resource. Adverse impacts may result from increases in visitation, including increased vehicle traffic. Increased vehicle traffic and visitor presence would potentially increase the ambient sound environment. Planned road work to rehabilitate and improve the Zion Mt. Carmel Highway and the Kolob Terrace Road could cause short-term adverse impacts from construction equipment. Fire management activities could cause short-term adverse impacts through the increased use of power tools and aircraft overflight support. These actions are likely to create short-term, minor to moderate adverse impacts on the acoustic environment of the park. Development on private lands bordering the park could create minor to moderate, long-term adverse impacts. There would be a long-term beneficial effect on the acoustic environment by effectively managing the location and number of air tours over the park through the development of an air tour management plan. It is assumed that an increase in any air traffic over the park, whether they are high-altitude air carrier/commercial or general aviation, would add to the human-caused noise in the park. The noise levels, amount of time audible, and the number of noise events these aircraft would produce would be a component of the data collected through the park acoustic monitoring program. This data would be included in the analysis process to determine if standards are being met. As identified in the management actions, the park would collaborate with the Department of Defense to address soundscape issues with military overflights and with FAA, state and local government, and other parties in developing plans for new or expanded airport facilities, or altered flight routes, that can potentially affect the park. This and other mitigation identified in the plan would partially mitigate these effects which would long-term beneficial and minor.

The moderate long-term beneficial impacts associated with the implementation of Alternative B would reduce the potential adverse impacts from actions described above. As a result cumulative effects from implementation of Alternative B would result in long-term minor to moderate beneficial impacts to the park soundscape resource.

Conclusion
Alternative A would result in long-term moderate adverse impacts because the park would not have the means to address noise issues in a comprehensive and systematic manner. Alternative B would have long-term moderate beneficial effects to the soundscape resource. The incremental effect of Alternative B on the effects of past, present and reasonably foreseeable future actions would be long-term, moderate and beneficial.

VISITOR USE AND EXPERIENCE

In numerous NPS surveys more than 90 percent of respondents have identified hearing the sounds of nature as an important reason for visiting national parks (Haas and Wakefield, 1998). The acoustic environment has an important effect on the quality of park visitor experience. Research has indicated that visitors appreciate opportunities to hear the sounds of nature and consistently rate sounds such as streams, bird songs, and other natural sounds as pleasing. The same research also found that visitors consistently rate human-caused sounds such as vehicles, cell phones, and loud talking as annoying (Pilcher, Newman and Manning, 2008). This section addresses the effects on visitor experience. Thresholds for identifying impacts to visitor use and experience are defined as follows:

Visitor Use and Experience	
Impact Intensity	**Intensity Definition**
Negligible	Visitors would not be affected, or changes in visitor use and/or experience would be below or at the level of detection. The visitor would not likely be aware of the effects associated with the alternative.
Minor	Changes in visitor use and/or experience would be detectable, although the changes would be slight. The visitor would be aware of the effects associated with the alternative, but the effects would be slight.
Moderate	Changes in visitor use and/or experience would be readily apparent. The visitor would be aware of the effects associated with the alternative and would likely be able to express an opinion about the changes.
Major	Changes in visitor use and/or experience would be readily apparent and would have important consequences. The visitor would be aware of the effects associated with the alternative and would likely express a strong opinion about the changes.
Duration	Short-term – The impact would generally last the life of the project or activity or up to one year.
	Long-term – The impact would last longer than one year.

Impacts of Alternative A – No Action
Under the no-action alternative the NPS would continue current approaches to protecting the acoustic environment. Acoustic objectives and standards would not be developed and an acoustic monitoring program would not be implemented.

Visitation is expected to continue to increase. More visitors to the park would bring additional vehicle traffic and would increase maintenance on infrastructure used by visitors. Development on private lands near the park is expected to increase over time; which could increase human-caused noise levels within park boundaries.

Because of this, the amount of time that human-caused sound could be heard by visitors would increase. Maximum and median noise free intervals would decrease; considerably in some areas. As a result opportunities for visitors to experience the sounds of nature would be diminished. Deviation from natural ambient would be the same as current levels in some areas. In other areas there would be a noticeable

increase over time leading to a decrease in listening area and alerting distance. This means that visitors would have to be closer to birds and other natural sounds before hearing them and would have less time to react to sounds like thunder, rock falls, and approaching flash floods. The amount of time that visitors would be exposed to noise levels that could interfere with speech among visitors and park staff involved in general conversations, interpretive programs, rock climbing and canyoneering would increase, as would noise levels that could interrupt sleep or cause visitors in campgrounds and park lodging to wake up during the night.

Visitors could be exposed to increased levels of human-caused noise, which would decrease their opportunities to experience natural sounds and would adversely impact their visitor experience. Overall, changes in acoustic conditions would move the resource away from the desired condition leading to long-term, minor to moderate adverse impacts to visitor experience.

Impacts of Alternative B – Preferred Alternative

Implementation of Alternative B would help the park meet acoustic resource objectives which are designed in part to protect the acoustic environment for current and future generations of park visitors. In areas where noise is increasing or soundscape objectives are not being met, the standards identified in Alternative B provide management actions needed to ensure that acoustic conditions are consistent with resource protection and management goals.

In particular, the standards identified for deviation from natural ambient and noise free interval for the Frontcountry Zone would help achieve the soundscape objective that natural sounds are audible and discernable. And that common noise intrusions made by visitors and park operations are concentrated at locations near roads and heavily developed areas. In the Wilderness Zone the standards would help meet the objective that only natural sounds are audible and discernable, except for short duration, infrequent human-caused sounds.

In most areas, the amount of time that human-caused sound could be heard would decrease due to a reduction in noise levels in the park. Maximum and median noise free intervals would increase. As a result, opportunities to experience the sounds of nature would increase for most visitors. Deviation from natural ambient would decrease over time leading to an increase listening area and alerting distance. This means that visitors would be able to hear birds and other natural sounds from a greater distance and would have more time to react to sounds like approaching thunderstorms, rock falls, and flash floods.

The amount of time that visitors would be exposed to noise levels that could interfere with speech would decrease. Visitors and park staff involved in general conversations, interpretive programs, rock climbing and canyoneering would be interrupted by noise less often. Noise levels that could interrupt sleep or cause visitors in campgrounds and park lodging to wake up during the night would rarely occur. Visitors could experience minor inconvenience from possible management actions designed specifically to protect acoustic conditions such as expanding quiet hours in campgrounds, limiting the use of generators, or requests to turn off cell phone ringers and other electronic sound-emitting devices.

Because there is variation in natural ambient levels and acoustic conditions throughout the park, the intensity of the beneficial impacts would vary. In areas where existing noise levels are higher (near the river) the effect would be greater. In areas with lower natural ambient levels and fewer noise events, the intensity of beneficial impacts would be less. Overall, changes in acoustic conditions would move the resource toward a desired condition and help achieve acoustic objectives leading to long-term, moderate beneficial impacts to visitor experience.

Cumulative
Other past, present and planned future actions have the potential to affect visitor use and experience. Adverse impacts to visitor experience may result from increased visitation (increased vehicles) and park operations. Increased vehicle traffic and visitor presence would potentially increase the ambient sound environment. Planned road work to rehabilitate the Zion Mt. Carmel Highway and the Kolob Terrace Road could cause short-term adverse impacts to visitor experience from noise generated by construction equipment. Fire management activities could cause short-term adverse impacts through the increased use of power tools and aircraft overflight support. These actions are likely to create short-term, minor to moderate adverse impacts on the acoustic environment of the park which would adversely affect visitor experience. Development on private lands bordering the park could permanently change acoustic conditions in the park and create minor to moderate, long-term adverse impacts. By effectively managing the location and number of air tours over the park, development of an air tour management plan would diminish the acoustic effects of air tours resulting in long-term beneficial impacts to visitor experience. It is assumed that an increase in any air traffic over the park, whether they are high-altitude air carrier/commercial or general aviation, would add to the human-caused noise in the park. The noise levels, amount of time audible, and the number of noise events these aircraft would produce would be a component of the data collected through the park acoustic monitoring program. This data would be included in the analysis process to determine if standards are being met. As identified in the management actions, the park would collaborate with the Department of Defense to address soundscape issues with military overflights and with FAA, state and local government, and other parties in developing plans for new or expanded airport facilities, or altered flight routes, that can potentially affect the park. This and other mitigation identified in the plan would partially mitigate these effects which would long-term beneficial and minor.

The moderate long-term beneficial impacts associated with the implementation of Alternative B would reduce the potential adverse impacts from actions described above. As a result, cumulative effects from implementation of Alternative B would be long-term, moderate, and beneficial impacts to visitor experience.

Conclusion
Alternative A would result in long-term minor to moderate adverse impacts to visitor experience because noise levels in the park could increase over time and the park would not have the means to address noise issues in a comprehensive and systematic manner. Alternative B would have long-term moderate beneficial effects to visitor experience because standards have been identified to protect the soundscape. Alternative B also identifies a mechanism to monitor the acoustic environment and management actions to mitigate adverse impacts from human-caused noise on the park soundscape. The incremental effect of Alternative B on the effects of past, present and reasonably foreseeable future actions would be long-term, moderate and beneficial.

PARK OPERATIONS

For the purposes of this analysis, park operations refers to the quality and effectiveness of park and concession staff to maintain and administer park resources and provide for an appropriate visitor experience. This includes an analysis of the projected need for staff time and materials in relationship to soundscape management under each of the alternatives. The analysis also considers trade-offs for staff time or the budgetary needs required to accomplish the implementation of the alternatives. Thresholds for identifying impacts to park operations are defined as follows:

Park Operations	
Impact Intensity	**Intensity Definition**
Negligible	Park operations would not be affected or change in operations that is not measurable or perceptible.
Minor	The change in operations that is slight and localized with few measurable consequences.
Moderate	Readily apparent changes to park operations with measurable consequences.
Major	The change is severely adverse or exceptionally beneficial in park operations.
Duration	Short-term – The impact would generally last the life of the project or activity or up to one year.
	Long-term – The impact would last longer than one year.

Impacts of Alternative A – No Action

Under the no-action alternative the NPS would continue current approaches to park operations. The park would continue operating the shuttle system and eventually phase out tour buses in Zion Canyon above Canyon Junction to reduce noise levels and eliminate the greatest source of noise in the canyon (GMP) and would continue to require bus tour companies to comply with regulations that reduce noise levels (e.g., turning off engines when buses are parked). Park staff would continue to use existing motorized equipment and power tools including road graders, snow plows, backhoes, gas-powered rock hammers, chainsaws, gas-powered lawn mowers, leaf blowers, and gas-powered weed whips. The number of staff required to complete park and concession maintenance tasks, and park fire and resource management tasks would not change. There would be no change in the amount of time necessary to complete park and concession operations. As a result, Alternative A would have a negligible, short- and long-term impact on park operations.

Impacts of Alternative B – Preferred Alternative

In order to meet the soundscape objectives outlined in Alternative B, the park would implement management actions that could affect park and concessionaire operations. These measures include limiting the use of motorized equipment before 9:00 am and after 5:00 pm; minimizing the use of leaf blowers, chainsaws, and other mechanical equipment; considering other products that accomplish the same task (handheld non-power tools, brooms, rakes, electric powered mowers or trimmers, etc.); and considering quiet technology when replacing equipment. Implementing Alternative B could increase demands on staff in the short-term while performing park operations. Park operations in the Wilderness and Frontcountry Zones may require changes in the equipment used and/or the time of day that operations could occur. In order to achieve proposed acoustical standards, crews may need to consider acoustic impacts in selecting equipment used for trail maintenance and other park operations and activities. In wilderness, park staff would be required to analyze the effects of the use of motorized equipment through the minimum requirement procedures. The Wilderness Committee assists with, and reviews the analysis and makes recommendations to the Superintendent. Initially, it may take park staff longer to complete tasks using quieter equipment. As quiet technology equipment is acquired and staff become more proficient with the use of this equipment, demands on staff time would diminish.

Park staff would collect and analyze acoustic data and implement monitoring protocols to determine levels of compliance with standards. Implementing Alternative B would have beneficial effects on park operations by minimizing staff exposure to noise. Overall, the effects of implementing Alternative B would result in minor short-term adverse impacts to park operations however benefits to soundscapes, visitor experience, wildlife, and park and concession employees from reduced noise levels would help to offset any adverse impacts to park operations.

Cumulative Impacts
Other past, present and planned future actions have the potential to affect park operations. Adverse impacts to park operations may result from increased visitation. Increased vehicle traffic and visitor presence would potentially increase the demands on park operations. Planned road work to rehabilitate and improve the Zion Mt. Carmel Highway and the Kolob Terrace Road could cause short-term adverse impacts to park operations as park staff and resources are diverted to the projects. Park staffing levels may not be appropriate to cover increasing demands from these activities. The minor short-term adverse impacts associated with the implementation of Alternative B would add slightly to the potential adverse impacts from actions described above. As a result, cumulative effects from implementation of Alternative B would result in short-term, minor, adverse impacts to park operations. However benefits to soundscapes, visitor experience, wildlife, and park and concession employees from reduced noise levels would help to offset any adverse impacts to park operations. It is assumed that an increase in any air traffic over the park, whether they are high-altitude air carrier/commercial or general aviation, would add to the human-caused noise in the park. The noise levels, amount of time audible, and the number of noise events these aircraft would produce would be a component of the data collected through the park acoustic monitoring program. This data would be included in the analysis process to determine if standards are being met. As identified in the management actions, the park would collaborate with the Department of Defense to address soundscape issues with military overflights and with FAA, state and local government, and other parties in developing plans for new or expanded airport facilities, or altered flight routes, that can potentially affect the park. This and other mitigation identified in the plan would partially mitigate these effects which would long-term beneficial and minor.

Conclusion
Alternative A would result in negligible impacts to park operations. Overall, the effects of implementing Alternative B would result in minor short-term adverse impacts to park operations however benefits to soundscapes, visitor experience, wildlife, and park and concession employees from reduced noise levels would help to offset any adverse impacts to park operations. The incremental effect of Alternative B on the effects of past, present and reasonably foreseeable future actions would be short-term, minor and adverse.

WILDLIFE, THREATENED AND ENDANGERED ANIMAL SPECIES AND ANIMAL SPECIES OF CONCERN

Recent studies have indicated that wildlife can be adversely affected by noise (Barber, Fristrup, Crooks, 2010). Research has documented substantial changes in foraging and anti-predator behavior, reproductive success, density and community structure in response to noise. This section addresses the effects on wildlife from actions identified in this EA. Thresholds for identifying impacts to wildlife are defined as follows:

Wildlife, Threatened and Endangered Animal Species and Animal Species of Concern	
Impact Intensity	**Intensity Definition**
Negligible	No animal species including federally listed species or sensitive species would be affected, or the alternative would affect an individual of a species, its critical habitat, or sensitive species, but the change would be so small that it would not be of any measurable or perceptible consequence to the protected individual or its population.
Minor	The alternative would affect an individual(s) animal or a listed species, its critical habitat, or sensitive species, but the change would be small.
Moderate	An individual or population of animals or a listed species, its critical habitat, or sensitive species would be noticeably affected. The effect would have some consequence to the individual, population, or habitat.
Major	An individual or population of animals or a listed species, its critical habitat, or sensitive species would be noticeably affected with a vital consequence to the individual, population, or habitat.
Duration	Short-term – The impact would generally last the life of the project or activity or up to one year.
	Long-term – The impact would last longer than one year.

Impacts of Alternative A – No Action
Under the no-action alternative the NPS would continue current approaches to protecting the acoustic environment. Acoustic objectives and standards would not be developed and an acoustic monitoring program would not be implemented. Wildlife would be exposed to increasing human-caused levels of noise, which could interfere with the natural sounds they need for communication, predator prey relationships, mate selection, territory establishment and other functions.

In most areas, the amount of time that human-caused sound could be heard would increase due to increased noise levels in the park. Maximum and median noise free intervals would decrease. Increases in audible human-caused noise have been shown to decrease the density and diversity of some bird species (Frances, 2009; Bayne 2008) and have been associated with decreased use or abandonment of affected habitats (Doherty 2008; Sawyer 2006).

Another important study analyzed time budgets for desert bighorn sheep in the presence and absence of helicopter overflights at Grand Canyon National Park to determine the extent to which food intake may be impaired. The results showed that bighorn sheep exposed to helicopter overflights experienced a 43 percent reduction in foraging efficiency during winter months (Stockwell and Bateman, 1991).

Research has also shown differences in parental behavior of peregrine falcons exposed to aircraft noise. Although a direct relationship between behavior and the number of overflights or recorded sound level was not observed, the researchers found that during the incubation and brooding stages of the nesting cycle, males attended the nest ledge less when overflights occurred than did males from reference nests (with few overflights). Females attended the nest ledge more during overflown periods compared to females from reference nests. The study also showed that while females were still brooding nestlings, they were less likely to be absent from the nest area during periods when overflights occurred than females from reference nests (Palmer et.al., 2003).

Reductions in noise free intervals could limit noise free recovery time for sensitive species. Deviation from natural ambient would likely increase over time leading to a decrease in listening area and alerting distance. A decrease in listening area could affect the predator prey relationship making it more difficult for some predator species to locate prey using auditory cues. Decreases in alerting distance could make it more difficult for prey species to elude predators.

Noise levels that could interrupt sleep in humans would stay the same or increase slightly. Although few studies address sleep disturbance in animals, similarities in hearing thresholds make humans an appropriate proxy for other vertebrate species and models of sleep interruption for humans can be useful in predicting sleep disturbances in wildlife. Therefore increases in noise levels that could interrupt sleep in humans could have similar effects on wildlife. Overall, changes in acoustic conditions would move the soundscape resource away from the desired condition leading to long-term, moderate adverse impacts to wildlife.

Impacts of Alternative B – Preferred Alternative
Under the Alternative B the NPS would develop acoustic objectives and standards and implement measures to monitor and protect acoustic conditions. As Alternative B is implemented, wildlife would be exposed to reduced levels of noise and have greater opportunities to experience important sounds related to communication, predator prey relationships, mate selection, territory establishment and other functions.

In most areas, the amount of time that human-caused sound would be audible to wildlife would be reduced. Maximum and median noise free intervals would increase. Reductions in audible human-caused noise could lead to an increase in the density and diversity of some bird species (Frances, 2009; Bayne 2008) and more efficient and productive use of important habitats (Doherty 2008; Sawyer 2006). Studies also indicate that songbirds shift their calls to higher frequencies in response to ambient noise levels. Reducing noise levels and audibility mitigate that effect. Increases in noise free intervals could increase noise free recovery time for sensitive species. Deviation from natural ambient would decrease, leading to an increase in listening area and alerting distance. An increase in listening area could affect the predator prey relationship making easier for some predator species to locate prey using auditory cues. Increases in alerting distance could make it easier for prey species to elude predators.

Noise levels that could interrupt sleep in humans would likely decrease as a result of Alternative B. Although few studies address sleep disturbance in animals, similarities in hearing thresholds make humans an appropriate proxy for other vertebrate species and models of sleep interruption for humans can be useful in predicting sleep disturbances in wildlife. Therefore decreases in noise levels that could interrupt sleep in humans could have similar effects on wildlife. Overall, changes in acoustic conditions would move the soundscape resource toward the desired condition leading to long-term, moderate beneficial impacts to wildlife.

Cumulative Impacts
Other past, present and planned future actions have the potential to adversely affect wildlife. Adverse impacts to wildlife may result from increases in vehicle traffic and increased visitor use. Several important wildlife species have been shown to avoid habitat near roadways and areas with high levels of human activity. Increased vehicle traffic and visitor presence would also increase the ambient sound environment. Planned road work to rehabilitate and improve the Zion Mt. Carmel Highway and the Kolob Terrace Road could cause short-term adverse impacts to wildlife from noise generated by construction equipment. Fire management activities could cause short-term adverse impacts through the increased use of power tools and aircraft overflight support. These actions would be partially mitigated by the management actions identified in Alternative B. This would likely create short-term, minor adverse impacts on the acoustic environment of the park and wildlife. Development on private lands bordering the park could permanently change acoustic conditions in the park and create minor to moderate, long-term adverse impacts. By effectively managing the location and number of air tours over the park, development of an air tour management plan would diminish the acoustic effects of air tours resulting in long-term beneficial impacts to wildlife resources. It is assumed that an increase in any air traffic over the park, whether they are high-altitude air carrier/commercial or general aviation, would add to the human-caused noise in the park. The noise levels, amount of time audible, and the number of noise events these aircraft would produce would be a component of the data collected through the park acoustic monitoring

program. This data would be included in the analysis process to determine if standards are being met. As identified in the management actions, the park would collaborate with the Department of Defense to address soundscape issues with military overflights and with FAA, state and local government, and other parties in developing plans for new or expanded airport facilities, or altered flight routes, that can potentially affect the park. This and other mitigation identified in the plan would partially mitigate these effects which would long-term beneficial and minor.

The moderate long-term beneficial impacts associated with the implementation of Alternative B would reduce the potential adverse impacts from actions described above. As a result, cumulative effects from implementation of Alternative B would result in short-term, minor, adverse impacts and long-term, moderate, and beneficial impacts to wildlife resources.

Conclusion
Alternative A would result in long-term moderate adverse impacts to wildlife because the park would not have the means to address noise issues in a comprehensive and systematic manner. Alternative B would have long-term moderate beneficial effects to the wildlife. The incremental effect of Alternative B on the effects of past, present and reasonably foreseeable future actions would be short-term minor and adverse and long-term, moderate and beneficial.

WILDERNESS

Zion contains 124,462 acres of designated wilderness and 9,047 acres of recommended wilderness. This means that 90 percent of the park is managed as wilderness, as per NPS policy. In managing these areas, the Wilderness Act and NPS policy requires that the characteristics and values associated with wilderness be protected and preserved. Thresholds for identifying impacts to wilderness character and values are defined as follows:

Wilderness	
Impact Intensity	**Intensity Definition**
Negligible	A change in the wilderness character could occur, but it would be so small that it would not be of any measurable or perceptible consequence.
Minor	A change in the wilderness character and associated values would occur, but it would be small and, if measurable, would be highly localized.
Moderate	A change in the wilderness character and associated values would occur. It would be measurable but localized.
Major	A noticeable change in the wilderness character and associated values would occur. It would be measurable and would have a substantial or possibly permanent consequence.
Duration	Short-term – The impact would generally last the life of the project or activity or up to one year.
	Long-term – The impact would last longer than one year.

Impacts of Alternative A – No Action
Under the no-action alternative the NPS would continue current approaches to protecting the acoustic environment. Acoustic objectives and standards would not be developed and an acoustic monitoring program would not be implemented. The park would continue to try to mitigate impacts to the soundscape in wilderness by using the minimum requirement procedures for proposed activities using motorized tools or aircraft.

In wilderness, the amount of time that human-caused sound could be heard could increase due to increased noise levels in the park. Maximum and median noise free intervals would decrease. Deviation from natural ambient would increase over time. As a result wilderness characteristics and values would be

diminished. The wilderness would be less *untrammeled by man*, and the *the imprint of man's work* would be more apparent and noticeable. An increase in noise would diminish *the primeval character and influence of wilderness; the preservation of natural conditions (including the lack of man-made noise); and outstanding opportunities for solitude and a primitive and unconfined type of recreational experience*.

Overall, changes in acoustic conditions would move the soundscape resource away from the desired condition leading to long-term, moderate adverse impacts to wilderness characteristics and values.

Impacts of Alternative B – Preferred Alternative
The amount of time that human-caused sound could be heard would decrease with the implementation of Alternative B. Maximum and median noise free intervals would increase and deviation from natural ambient would be reduced. As a result wilderness characteristics and values would be enhanced by Alternative B. Wilderness would be more *untrammeled by man*, and *the imprint of man's work* would be less apparent and noticeable. A decrease in noise would enhance *the primeval character and influence of wilderness; the preservation of natural conditions (including the lack of man-made noise); and outstanding opportunities for solitude and a primitive and unconfined type of recreational experience.*

Overall, changes in acoustic conditions would move the soundscape resource toward the desired condition leading to long-term, moderate beneficial impacts to wilderness characteristics and values.

Cumulative Impacts
Other past, present and planned future actions have the potential to adversely affect wilderness. Adverse impacts to wilderness may result from increases park visitation. Increased visitor presence would also increase the ambient sound environment. Planned road work to rehabilitate and improve the Zion Mt. Carmel Highway and the Kolob Terrace Road could cause short-term adverse impacts to wilderness from noise generated by construction equipment. Fire management activities could cause short-term adverse impacts through the increased use of power tools and aircraft overflight support. These actions are likely to create short-term, minor adverse impacts on the acoustic environment of the wilderness. Development on private lands bordering the park could permanently change acoustic conditions in the park and create minor to moderate, long-term adverse impacts. By effectively managing the location and number of air tours over the park, development of an air tour management plan would diminish the acoustic effects of air tours resulting in long-term beneficial impacts to wilderness characteristics and values. It is assumed that an increase in any air traffic over the park, whether they are high-altitude air carrier/commercial or general aviation, would add to the human-caused noise in the park. The noise levels, amount of time audible, and the number of noise events these aircraft would produce would be a component of the data collected through the park acoustic monitoring program. This data would be included in the analysis process to determine if standards are being met. As identified in the management actions, the park would collaborate with the Department of Defense to address soundscape issues with military overflights and with FAA, state and local government, and other parties in developing plans for new or expanded airport facilities, or altered flight routes, that can potentially affect the park. This and other mitigation identified in the plan would partially mitigate these effects which would long-term beneficial and minor.

The moderate long-term beneficial impacts associated with the implementation of Alternative B would reduce the potential adverse impacts from actions described above. As a result, cumulative effects from implementation of Alternative B would result in long-term, moderate, and beneficial impacts to wilderness characteristics and values.

Conclusion
Alternative A would result in long-term moderate adverse impacts to wilderness because the park would not have the means to address noise issues in a comprehensive and systematic manner. Alternative B

would have long-term moderate beneficial effects to the wilderness. The incremental effect of Alternative B on the effects of past, present and reasonably foreseeable future actions would result in long-term moderate and beneficial impacts.

CONSULTATION AND COORDINATION

PUBLIC INVOLVEMENT SUMMARY

Public participation is an important part of any planning process. For this EA process, ZNP used several strategies to involve the public. External scoping was initiated in March 2010. To facilitate public scoping the park:

- Distributed over 120 scoping newsletters to individuals, organizations, and government agencies. The newsletter outlined the proposed action and described the process for public involvement.
- Distributed press releases describing the proposed action and how to become involved in the EA process to local newspapers.
- Information posted on NPS Planning, Environment, and Public Communication website and on the park website.
- Held two scoping workshops – one in Kanab, UT and one in Springdale, UT.

The park received 19 scoping comment letters. The concerns from the comment letters and the sections of the document where those concerns are addressed are summarized below.

- Consider regulating times of the delivery, service and maintenance vehicles operate in park. [Refer to *Alternative B* section of the document (*Tables 1 and 5*).]
- Loud motorcycles should not be allowed in park. [Refer to *Alternative B* section of the document (*Tables 1 and 5*).]
- Soundscape would be improved by limiting overflights or changing traffic patterns. [Refer to *Alternative B* section of the document (*Tables 1, 2, 3*).]
- Suggest campaign against human-caused noise such as shouting, yelling, etc. [Refer to *Alternative B* section of the document (*Tables 1, 2, 5, 6*).]
- Keep policies reasonable. [Refer to the *Purpose and Need and Alternative B* sections of the document.]
- Suggest area of park be designated as quiet zone – possibly Upper Emerald Pools. [Refer to *Alternative B* section of the document (*Table 1*).]
- Concerned about the potential of sound limitations within the park impacting adjacent non-park areas. [Refer to *Alternative B* section of the document (*Table 3*).]
- Concerned about limiting aircraft use for wildlife management. [Refer to *Alternative B* section of the document (*Tables 1, 2, 5, 6*).]
- Audible noise associated with motors and machines not appropriate for wilderness. [Refer to *Alternative B* section of the document (*Tables 2 and 6*).]
- Why does the soundscape need a management plan? [Refer to the *Purpose and Need* section of the document.]
- All vehicles should pass a decibel meter test before entering park. [Refer to *Alternative B* section of the document (*Tables 1 and 5*).]
- Acceptable and Unacceptable Sound Sources and Management Actions to mitigate impacts from those sources, as identified at the public meeting can be found in *Tables 1, 2, and 3*.

Coordination with Native American Indian Tribes, SHPO, and USFWS

National Historic Preservation Act. In accordance with the National Historic Preservation Act, letters requesting tribal consultation were mailed in March 2010 to the following tribes: Hopi Tribe, Navajo Nation, Kaibab Paiute Tribe, Moapa Band Paiute Tribe, Paiute Indian Tribe of Utah, Las Vegas Paiute Tribe, Skull Valley Goshute Tribe, Goshute Tribe, Northern Ute Tribe, and Pueblo of Zuni. No comments were received.

State Historic Preservation Officer. A scoping letter was sent to the SHPO on March 11, 2010 requesting input on the proposed action. In a telephone conversation with Sarah Horton (ZNP Cultural Resource Program Manager) on May 5, 2010, the SHPO stated that they deemed the scoping letter informational and did not see the potential for adverse affect to cultural resources from the proposal as described, so they would not be sending an official written response. [as per telephone conversation between Barbara Murphy, Deputy State Historic Preservation Officer, and Sarah Horton documented by email dated 5/5/2010] We will consult with the SHPO on the determinations made in this document.

U.S. Fish and Wildlife Service. In accordance with Section 7 of the Endangered Species Act of 1973, park staff contacted the USFWS by telephone on March 4, 2010. We described the proposed action and asked if they would like us to initiate formal consultation. Laura Romin, Utah Field Office of USFWS, stated that we did not need to send a letter at this time. If we determined through the preparation of the EA and analysis of the alternatives that the proposed action could have an adverse affect on protected species or critical habitat that we would contact them at that time [telephone conversation documented in memo to file dated March 11, 2010]. We will consult will the USFWS on the determinations made in this document.

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REFERENCES

Barber, J.R., Crooks, K.R., and Fristrup, K.M., 2010. "The costs of chronic noise exposure for terrestrial organisms." Trends in Ecology and Evolution, 25 (3) 180-189.

Bayne, E.M. et al. 2008. Impacts of chronic anthropogenic noise from energy-sector activity on abundance of songbirds in the boreal forest. Conservation Biology 22, 1186–1193

Berglund, B., Lindvall, T., Schwela, D.H. (Eds.). 1999. Guidelines for Community Noise. World Health Organization, Geneva.

Doherty, K.E. et al. 2008. Greater sage-grouse winter habitat selection and energy development. Journal of Wildlife Management. 72, 187–195

Environmental Protection Agency (EPA). 1974. Information on Levels of Noise Requisite to Protect the Public Health and Welfare with an Adequate Margin of Safety.

Federal Aviation Administration. 2007. FAA Long-range Aerospace Forecasts Fiscal Years 2020, 2025 and 2030.

Federal Interagency Committee on Aviation Noise (FICAN). 1997. Effects of Aviation Noise on Awakenings from Sleep.

Francis, C.D. et al. 2009. Noise pollution changes avian communities and species interactions. Curr. Biol. 19, 1415–1419

Haas, G.E. and Wakefield, T., 1998. "National Parks and the American Public." *National Parks and Conservation Association*, Washington, D.C

Haralabidis Alexandros S.,et. al. 2008. "Acute effects of night-time noise exposure on blood pressure in populations living near airports" *European Heart Journal Advance Access* published online on February 12, 2008 http://eurheartj.oxfordjournals.org/cgi/content/full/ehn013v1?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=1&andorexacttitle=and&titleabstract=airport&andorexacttitleabs=and&andorexactfulltext=and&searchid=1&FIRSTINDEX=0&sortspec=relevance&resourcetype=HWCIT

Hobbs, C., Downing, M., Wyle Laboratories. 2003. Wyle Report-WR 03-08: The Soundscape in Zion National Park. Wyle Acoustics Group, Arlington, VA.

National Park Service (NPS). 1995. Report to Congress, Report on Effects of Aircraft Overflights on the National Park System. United States Department of Interior, Washington, DC.

National Park Service (NPS). 2001. Zion National Park. Peregrine falcon management and monitoring information.

National Park Service (NPS). 2006. Management Policies. United States Department of Interior, Washington, DC. View source at: *http://www.nps.gov/policy/mp/Index2006.htm*

Palmer, Angela G., Nordmeyer, Dana L., Roby, Daniel D. 2003. Effects of jet aircraft Overflights on parental care of peregrine falcons. Wildlife Society Bulletin. 31 (2). 499-509.

Pilcher, E., Newman, P. and Manning, R., 2009. "Understanding and Managing Experiential Aspects of Soundscapes at Muir Woods National Monument" *Journal of Environmental Management*, 43(3)

Sawyer, H. et al. 2006. Winter habitat selection of mule deer before and during development of a natural gas field. Journal of Wildlife Management. 70, 396–403

Stockwell, Craig A. and Gary C. Bateman. 1991. Conflicts in National Parks: A Case Study of Helicopters and Bighorn Sheep time Budgets at the Grand Canyon. Biological Conservation Vol. 56, pp.317-328.

United States Department of Commerce. Economics and Statistics Administration. 2000. U.S. Census Bureau 2000.

United States Fish and Wildlife Service (USFWS). 1995. Recovery Plan for the Mexican Spotted Owl: Vol. 1. Albuquerque, New Mexico.

United States Fish and Wildlife Service (USFWS). 1996. Endangered and Threatened Wildlife and Plants; Establishment of a Nonessential Experimental Population of California Condors in Northern Arizona; Final Rule; 50 CFR Part 17, October 16, 1996.

United States Fish and Wildlife Service (USFWS). 2004. Endangered and Threatened Wildlife and Plants; Final Designation of Critical Habitat for Mexican Spotted Owl; Final Rule; 50 CFR Part 17, August 31, 2004.

Utah Division of Wildlife Resources (UDWR). 2000. Desert Tortoise (Gopherus agassizii) Distribution Survey, Zion National Park. Publication Number 00-36.

Utah Division of Wildlife Resources (UDWR). 2003. Baseline Virgin Spinedace (Lepidomeda mollispinis mollispinis) Population Demographics in an Area Proposed for Floodplain Restoration and a Reference Reach, North Fork of the Virgin River, Zion National Park, Fall 2002.

Wauer, Roland. 1997. Birds of Zion National Park and Vicinity. Utah State University. Logan, Utah.

GLOSSARY

Acoustic Zone	Areas with similar vegetation, terrain, animals, and weather likely have similar acoustic characteristics, including sound sources and sound attenuation characteristics. These areas are referred to as "acoustic zones" and may be helpful in describing acoustic conditions in areas with similar characteristics.
Acoustic Environment	The composite of all sounds, regardless of audibility, at a particular location.
Acoustic Resources	Sound sources (wildlife, waterfalls, wind, precipitation, historic and cultural sounds), factors that modify sound transmission (vegetation, topography, and atmospheric conditions), and the soundscape perceived by park visitors.
Ambient Sound Conditions	Many different soundscapes occur in national parks. In some areas, natural sounds predominate, while in others, both natural and non-natural sounds occur. In order to understand and manage soundscapes, ambient conditions for different soundscapes need to be acoustically described. Definitions of common ambient sound conditions are provided below.
Ambient Sound, Existing	All sounds in a given area (includes all natural and non-natural sounds). The Volpe Center has used the term "Existing" to describe existing ambient sound conditions.
Ambient Sound, Less Source of Interest	All sounds in a given area excluding a specific sound of interest. For example, when assessing the potential impacts of air tour aircraft, the "ambient sound level less source of interest" would be all sources of sound except air tour aircraft.
Ambient Sound, Natural	All natural sounds associated with a given environment, including all sounds of nature and excluding all non-natural sounds. The natural ambient sound of a given environment is comprised of all natural sounds that occur in the absence of mechanical, electrical, and other non-natural sounds. Natural ambient sound is considered synonymous with the term "natural quiet," although "natural ambient sound" is more appropriate because nature is not always quiet.
Ambient Sound, Non-natural	The ambient sound attributable to human activities. The conditions associated with these sounds are usually composed of many human-caused sounds, near and far, which may be heard individually or as a composite. In a national park setting these sounds may be associated with activities that are essential to the park's purpose, they may be a by-product of park management activities, or they may come from outside the park. These sound conditions need to be defined, measured and evaluated in park planning processes to determine whether or not they are consistent with soundscape management objectives.
Amplitude	The instantaneous magnitude of an oscillating quantity such as sound pressure. The peak amplitude is the maximum value.
Appropriate Sounds	Natural sounds are appropriate in national parks. Other appropriate sounds, not natural in origin, are those types of sounds which are generated by activities directly related to the purposes of a park, including resource protection, maintenance, and visitor services. Appropriate sounds may also be associated with cultural, religious or historical celebrations or interpretive demonstrations that are intended to convey park purposes or use park resources in accordance with its establishment legislation. Natural sounds are not only appropriate, but are considered part of the park's resource base to be protected and enjoyed by the visiting public.

Appropriate Sound Conditions	The appropriate sound conditions in a given area of a park is a determination by the park superintendent or authorized decision-maker about the level and nature of sound that is consistent with or mandated by Organic Act principles, establishment legislation, or other laws pertinent to the specific purposes and values associated with the park. This determination may take the form of management zone objectives for soundscape, as well as measurable indicators and standards for sound.
Audibility	The ability of animals with normal hearing, including humans, to hear a given sound. Audibility is affected by the hearing ability of the animal, the masking effects of other sound sources, and by the frequency content and amplitude of the sound.
Change in Exposure	Difference between the average sound level and the natural ambient condition. This metric reports the difference between the 12-hour energy-averaged sound level (L_{Aeq}) and the ambient (L_{50}). This metric does not provide information on event duration or timing, nor does it mean that human caused sounds levels cannot be heard at or below the ambient. It simply means that the sound levels produced by the human sources are above the natural ambient sound level.
Hertz	A measure of frequency, or the number of pressure variations per second. A person with normal hearing can hear between 20 Hz and 20,000 Hz.
Impact	For environmental analysis, an impact is defined as a change in a receptor that is caused by a stimulus, or an action. In accordance with the CEQ regulations (40 CFR Parts 1500-1508), direct and indirect impacts (environmental consequences) are to be described in an environmental document by assessing their type, magnitude, intensity and duration. The significance of an impact is to be determined specifically in view of criteria provided in 40 CFR 1508.27, based on the outcome of these assessments. An assessment will take account of the short or long term nature of the impact, the extent to which it is either beneficial or adverse, whether it is irreversible or irretrievable, and, finally, its geographic and societal extent. Lastly, a resource impact is put in the context of all other past, present or reasonably foreseeable actions which affect the same resource, and its contribution to the total cumulative effect is to be disclosed. Under CEQ regulations, the term "impact" is synonymous with "effect" (40 CFR 1508.8).
dBA	A-weighted decibel. A-Weighted sum of sound energy across the range of human hearing. Humans do not hear well at very low or very high frequencies. Weighting adjusts for this.
Decibel (dB)	A logarithmic measure of acoustic or electrical signals. The formula for computing decibels is: 10(Log 10 (sound level/reference sound level). 0 dBA represents the lowest sound level that can be perceived by a human with healthy hearing. Conversational speech is about 65 dBA.
Extrinsic Sound	Any sound not forming an essential part of the park unit, or a sound originating from outside the park boundary.
Frequency	The number of times per second that the sine wave of sound repeats itself. It can be expressed in cycles per second, or Hertz (Hz). Frequency equals Speed of Sound/ Wavelength.
Human-Caused Sound	Any sound that is attributable to a human source.

Intrinsic Sound	A sound which belongs to a park by its very nature, based on the park unit purposes, values, and establishing legislation. The term "intrinsic sounds" has replaced "natural sounds" in order to incorporate both cultural and historic sounds as part of the acoustic environment of a park.
L_{eq} or Energy Equivalent Sound Level	The level of a constant sound over a specific time period that has the same sound energy as the actual (unsteady) sound over the same period.
Masking	The process by which the threshold of audibility for a sound is raised by the presence of another sound.
Maximum Sound Level (Lmax)	Lmax is the loudest sound level in dBA generated in an area. Change in exposure is calculated from sound pressure data collected at the park.
Natural Soundscape	The natural sound environment consists of sounds associated with wind, water flow, rain, surf, wildlife, thermal activity, lava flows, or other sounds not generated by non-natural means.
Noise	Traditionally, noise has been defined as unwanted, undesired, or unpleasant sound. This makes noise a subjective term. Sounds that may be unwanted and undesired by some may be desirable to others. Noise is sound, as defined in this document: a pressure variation, etc. In order to keep terms used in soundscape management as objective as possible, it is more suitable to label all sounds as either appropriate sounds or inappropriate sounds, rather than as "sound" vs "noise." The appropriateness of any sound in a given area of a park will depend on a variety of factors, including the management objectives of that area.
Noise Free Interval	The period of time between noise events (not silence).
Off-site Listening	The systematic identification of sound sources using digital recordings previously collected in the field.
On-site Listening	The systematic identification of sound sources at a specific monitoring site using a personal digital assistant (PDA). Custom PDA software records begin and end times of audible sound sources. These sessions often last for one hour.
Sound	Sound is a wave motion in air, water, or other media. It is the rapid oscillatory compressional changes in a medium that propagate to distant points. It is characterized by changes in density, pressure, motion, and temperature as well as other physical properties. Not all rapid changes in the medium are sound (wind distortion on a microphone diaphragm). Basic analytical parameters of sound include frequency, amplitude, and duration.
Soundscape	Soundscape refers to the total acoustic environment associated with a given area. In a national park setting, the soundscape can be composed primarily of natural sounds, or it can be composed of both natural and human-caused sounds.
Soundscape Management Objective	The appropriate acoustic conditions for a given area of a park as mandated by Organic Act principles, establishment legislation, or other laws pertinent to the specific purposes and values associated with the park. This determination takes the form of management zone objectives for soundscape, as well as measurable indicators and standards for sound.

Sound Conditions	A number of descriptors may be used when describing ambient sound conditions. These include: • Source of sound • Audibility and percent time audible • Number of sound events/time • Sound level of events • Frequency content of events • Duration of events • Median and log mean sound levels • Minimum and maximum sound levels • Calculated L_{eq}, L_{50}, L_{90}, L_x, etc., for different time periods (hour, day, month, or season). Acoustic data from rural or park-like settings are rarely normally distributed (mostly quiet with a few loud events). Therefore, except in certain situations, the most appropriate measure of central tendency is the median rather than the arithmetic mean. If data are normally distributed, then the mean and median will be very close. In some national parks, sound levels can be very low, often lower than some acoustic systems can measure. It such cases, electrical sounds associated with the measurement device can be higher than ambient. Investigations should always report the lowest levels their instruments can measure, and report, when appropriate, that actual sound levels may be lower than the instruments are capable of measuring.
Sound Impacts	With reference to the definition of sound, sound impacts are effects on a receptor caused by the physical attributes of sound emissions. In the context of national parks, human-generated sound represents an impact on the natural soundscape because it causes physical changes in the soundscape that can be detected and measured. The fact that an impact can be measured does not equate immediately to whether the impact is adverse, inconsequential, or beneficial, or whether there are adverse secondary impacts on wildlife, cultural values, or visitors. Based on statistically valid characterizations of the natural soundscape and the total ambient soundscape, levels of impact and impact significance are policy determinations.
Sound Level	Sound level is usually conveyed by expressing the *weighted* sound pressure level obtained by frequency weighting, generally A- or C-weighted. The weighting used must be clearly stated: For L_{Aeq}, "A" denotes that A-weighting was used, and "eq" indicates that an equivalent level has been calculated. Hence, L_{Aeq} is the A-weighted, energy-equivalent sound level. The most commonly used scale, A-weighting, adjusts the sound levels across the frequency spectrum to those that are audible to humans.
Sound Pressure, Sound Pressure Level	Sound pressure is the instantaneous difference between the actual pressure produced by a sound wave and the average barometric pressure at a given point in space. Sound pressure level is the logarithmic form of sound pressure
Time Audible	The amount of time that a sound source is audible to an animal with normal hearing.

ACRONYMS

Acronym	Full Name
CEQ	Council of Environmental Quality
CFR	Code of Federal Regulations
dBA	Decibel – A-weighted
DO	Director's Order
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FICAN	Federal Interagency Committee on Aviation Noise
GMP	General Management Plan
Hz	Hertz
Leq	Equivalent Sound Level
Lmax	Maximum Sound Level
NEPA	National Environmental Policy Act
NFI	Noise Free Interval
NHPA	National Historic Preservation Act
NPS	National Park Service
NSP	Natural Sounds Program
OHV	Off-Highway Vehicle
PDA	Personal Digital Assistant
SHPO	State Historic Preservation Office
SMP	Soundscape Management Plan
SPL	Sound Pressure Level
TA	Time Audible
UDWR	Utah Division of Wildlife Resources
USC	United States Code
USDI	United States Department of the Interior
USFWS	United States Fish and Wildlife Service
WHO	World Health Organization
ZNP	Zion National Park

APPENDIX 1: IMPAIRMENT

National Park Service's *Management Policies*, 2006 require analysis of potential effects to determine whether or not actions would impair park resources. The fundamental purpose of the national park system, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. National Park Service (NPS) managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adversely impacting park resources and values.

However, the laws do give the NPS the management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the NPS the management discretion to allow certain impacts within park, that discretion is limited by the statutory requirement that the NPS must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values. An impact to any park resource or value may, but does not necessarily, constitute impairment, but an impact would be more likely to constitute impairment when there is a major or severe adverse effect upon a resource or value whose conservation is:

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

An impact would be less likely to constitute impairment if it is an unavoidable result of an action necessary to pursue or restore the integrity of park resources or values and it cannot be further mitigated.

The park resources and values that are subject to the no-impairment standard include:

- the park's scenery, natural and historic objects, and wildlife, and the processes and conditions that sustain them, including, to the extent present in the park: the ecological, biological, and physical processes that created the park and continue to act upon it; scenic features; natural visibility, both in daytime and at night; natural landscapes; natural soundscapes and smells; water and air resources; soils; geological resources; paleontological resources; archeological resources; cultural landscapes; ethnographic resources; historic and prehistoric sites, structures, and objects; museum collections; and native plants and animals;
- appropriate opportunities to experience enjoyment of the above resources, to the extent that can be done without impairing them;
- the park's role in contributing to the national dignity, the high public value and integrity, and the superlative environmental quality of the national park system, and the benefit and inspiration provided to the American people by the national park system; and
- any additional attributes encompassed by the specific values and purposes for which the park was established.

Impairment findings are not necessary for visitor use and experience, socioeconomics, public health and safety, environmental justice, land use, and park operations, because impairment findings related back to park resources and values, and these impact areas are not generally considered park resources or values

according to the Organic Act, and cannot be impaired in the same way that an action can impair park resources and values.

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 NPS's threshold for considering whether there could be impairment is based on whether an action would have major (or significant) effects. The following analysis evaluates whether or not the applicable resources carried forward in this document would be impaired by the preferred alternative.

- **Soundscapes** – Sounds play an important role in maintaining healthy and diverse ecosystems in Zion National Park. Properly functioning soundscapes are important for animal communication, territory establishment, predator and prey relationships, mating behaviors, nurturing young and effective use of habitat. Visitors to Zion appreciate and value natural sounds and a soundscape management program will help ensure that the soundscape resource is preserved in an unimpaired condition for future generations. Appropriate sounds and sound levels are essential to ensuring an authentic experience of cultural and traditional landscapes, resources, and values. This Soundscape Management Plan (SMP) outlines an approach to manage and protect the acoustic environment for visitor enjoyment and for wildlife needs. Using the above criteria, soundscapes are not necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park; they are key to the natural integrity of the park; and they are identified as a goal in the park's general management plan or other relevant NPS planning documents. For these reasons, and because the preferred alternative would result in changes to acoustic conditions that would move the soundscape resource toward the desired condition leading to long-term moderate beneficial effects to the soundscape resource, there would be no impairment to park soundscapes.

- **Wildlife, Threatened and Endangered Animal Species and Animal Species of Concern** – Many animals, insects and birds decipher sounds to find desirable habitat and mates, avoid predators and protect young, establish territories and to meet other basic survival needs. Scientific studies have shown that wildlife can be adversely affected by sounds and sound characteristics that intrude on their habitats. Zion is home to 6 species of amphibians, 28 species of reptiles, 79 mammal species, 289 bird species, and 7 fish species. Several threatened and endangered animals and animal species of concern either occur within ZNP including: Mexican spotted owl, California condor, and peregrine falcon. The SMP outlines a strategy to protect acoustic conditions for wildlife and the role of the soundscape in ensuring healthy and dynamic ecosystems. As the preferred alternative is implemented, wildlife would be exposed to reduced levels of noise and have greater opportunities to experience important sounds related to communication, predator prey relationships, mate selection, territory establishment and other functions. Using the above criteria, wildlife, including threatened, endangered and sensitive animals are not necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park; they are key to the natural integrity of the park; and they are identified as a goal in the park's general management plan or other relevant NPS planning documents. For these reasons, and because the preferred alternative would result in changes to acoustic conditions that would move the soundscape resource toward the desired condition leading to long-term, moderate beneficial impacts to wildlife, there would be no impairment to wildlife.

- **Wilderness** – Zion has 124,462 acres of designated wilderness and 9,047 acres of recommended wilderness. This means that 90 percent of the park is managed as wilderness, as per NPS policy. In managing these areas, the Wilderness Act and NPS policy requires that the characteristics and values associated with wilderness be protected and preserved. This SMP outlines an approach to manage and protect the acoustic environment in wilderness. As the preferred alternative is

implemented the amount of time that human-caused sound could be heard would decrease. Maximum and median noise free intervals would increase and deviation from natural ambient would be reduced. As a result wilderness characteristics and values would be enhanced. Wilderness would be *untrammeled by man*, and *the imprint of man's work* would be less apparent and noticeable. A decrease in noise would enhance *the primeval character and influence of wilderness; the preservation of natural conditions (including the lack of man-made noise); and outstanding opportunities for solitude and a primitive and unconfined type of recreational experience*. Overall, changes in acoustic conditions would move the soundscape resource toward the desired condition leading to long-term, moderate beneficial impacts to wilderness characteristics and values.

In addition, mitigation measures as described in Alternative B – Proposed Action/Preferred Alternative, would further lessen the degree of impact to and help promote the protection of these resources.
In conclusion, as guided by this analysis, good science and scholarship, advice from subject matter experts and others who have relevant knowledge and experience, and the results of public involvement activities, it is the Superintendent's professional judgment that there would be no impairment of park resources and values from implementation of the preferred alternative.

APPENDIX 2: LEGAL AUTHORITIES

The management of the national park system is guided by the Constitution, public laws, treaties proclamations, Executive Orders, regulations, and directives of the Secretary of the Interior and the Assistant Secretary for Fish, Wildlife and Parks. The following authorities are invoked as a basis for soundscape management, in addition to those listed in the park General Management Plan (GMP).

National Park Service Organic Act (16 USC 1, 2-4)
This act establishes and authorizes the National Park Service (NPS) “to conserve the scenery and the national and historic objects ant the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.”

Wilderness Act of 1964 (PL 88-577, 78 Stat.890, USC §§1131-1136)
This Act describes those lands designated or eligible to be included in the National Wilderness Preservation System (NWPS). The NWPS was to contain those lands, already owned by the American people, that were "untrammeled by man." They were to be managed "for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness..." No roads or structures were to be built. Vehicles and other mechanical equipment were not to be used. The minimum size was set at 5,000 acres, with certain exceptions. The Wilderness Act put 9.1 million acres of national forest land into the new system. A process was created for congressional designation of future acreage in the national forests, parks, and wildlife refuges. In 1976, the Federal Land Policy and Management Act set forth a process for adding Bureau of Land Management areas to the NWPS. These four sets of public lands total 623 million acres, about 26 percent of our country.

National Environmental Policy Act (NEPA) of 1969, as amended
This Act is landmark environmental legislation establishing as a goal for federal decision-making a balance between use and preservation of natural and cultural resources. NEPA requires all federal agencies to: (1) Prepare in-depth studies of the impacts of and alternatives to propose “major federal actions”; (2) use the information contained in such studies in deciding whether to proceed with the actions; and (3) diligently attempt to involve the interested and affected public before any decision affecting the environment is made.

General Authorities Act (1970, 16 USC 1a-1through 1a-8)
The purpose of this act is to include all areas administered by the NPS in one National Park System and to clarify the authorities applicable to the system. The act states areas of the National Park System, "though distinct in character, are united through their inter-related purposes and resources into one national park system as cumulative expressions of a single national heritage; that, individually and collectively, these areas derive increased national dignity and recognition of their superb environmental quality through their inclusion jointly with each other in one national park system preserved and managed for the benefit and inspiration of all people of the United States..."

Airport and Airway Development Act of 1970 (PL 91-258, 84 Stat.226, 49 USC §2208)
Requires airport development projects to provide for the protection and enhancement of the natural resources and environmental quality and limits the secretary of transportation in circumventing this purpose. No airports can be authorized with adverse environmental impacts unless it is determined in writing that no feasible and prudent alternatives exist and steps have been taken to minimize adverse effects. Relationship is identical to §4(f) of Department of Transportation Act. This Act also placed the Federal Aviation Administration (FAA) in charge of a new airport aid program funded by a special aviation trust fund.

Noise Control Act of 1972, as amended (PL 92-574, 42 USC §4901 et seq.)
This Act establishes a national policy to promote an environment for all Americans free from noise that jeopardizes their health and welfare. To accomplish this, the Act establishes a means for the coordination of Federal research and activities in noise control, authorizes the establishment of Federal noise emissions standards for products distributed in commerce, and provides information to the public respecting the noise emission and noise reduction characteristics of such products (42 USC 4901). The Act authorizes and directs that Federal agencies, to the fullest extent consistent with their authority under Federal laws administered by them, carry out the programs within their control in such a manner as to further the policy declared in 42 USC 4901. Each department, agency, or instrumentality of the executive, legislative and judicial branches of the Federal Government having jurisdiction over any property or facility or engaged in any activity resulting, or which may result in, the emission of noise shall comply with Federal, State, interstate, and local requirements respecting control and abatement of environmental noise.

Grand Canyon National Park Enlargement Act (1975, PL 93-620 §8)
Section 8 recognized "natural quiet as a value or resource in its own right to be protected from significant adverse effect." In addition, it specifically addressed the potential for helicopter operations to cause a significant adverse effect on natural quiet and experience of the park.

The Redwood Act (March 27, 1978, PL 95-250, 92 Stat. 163, 16 USC 1a-1)
This Act affirms the basic tenets of the Organic Act and provides additional guidance on national park system management: "the authorization of activities shall be construed and the protection management and administration of these areas shall be conducted in light of the high public value and integrity of the national park system and shall not be exercised in derogation of the values and purposes for which theses various areas have been established…"

The restatement of the principles of park management is intended to serve as the basis for any judicial resolution of competing private and public values and interests in the national park system (Senate Report No. 95-528 on S. 1976 pg.7). The establishment legislation of each park area provides the authority and direction for management of each park area within the national park system. Purposes stated in the parks establishing legislation or proclamation as the resources and values of a park whose conservation is essential to the purposes for which the area was included in the national park system.

National Parks Air Tour Management Act of 2000 (PL 106-181, Title VIII)
This act prohibits a commercial air tour operator from conducting commercial air tour operations over a national park or tribal lands, except in accordance with the act, conditions prescribed for that operator by the FAA Administrator and any commercial air tour management plan for the park or tribal lands. The act sets forth specific requirements with respect to: 1) granting authority to commercial air tour operators to conduct air tour operations over national parks or abutting tribal lands with specified exemptions; and 2) establishment of commercial air tour management plans (ATMPs). The Act requires the FAA, in cooperation with the NPS, to develop an ATMP for each unit of the National Park System to provide acceptable and effective measures to mitigate or prevent the significant adverse impacts, if any, of commercial air tour operations upon natural and cultural resources and visitor experiences.
Executive Orders

Executive Order 11644 Off Road Vehicles on Public Lands, as amended by EO 11989
This Act established policies and procedures to ensure that the use of off-road vehicles on public lands will be controlled and directed so as to protect the resources of those lands, to promote the safety of all users of those lands, and to minimize conflicts among the various uses of those lands. Each respective agency head shall develop and issue regulations and administrative instructions to provide for administrative designation of the specific areas and trails on public lands on which use of off-road vehicles may be permitted, and areas in which the use of off-road vehicles may not be permitted.

Director's Order-12: Conservation Planning, Environmental Impact Analysis & Decision-Making
The purpose of this Director's Order (DO) is to provide the policies and procedures by which the National Park Service carries out its responsibilities under NEPA. DO-12 discusses the NPS approach to environmental analysis, public involvement, and resource-based decision making. The following recommendations are incorporated into DO-12:

- Use of interdisciplinary approaches and principles in decision-making;
- Decisions based on technical and scientific information;
- Establishment of benchmarks demonstrating best management processes (such as resource councils and project review teams) in development, analysis, and review of projects;
- Use of alternative dispute resolution and other processes to resolve internal and external disputes;
- Peer review panels to address conflicts among resource specialists regarding validity and interpretation of data and resource information;
- Analysis of impairment to resources as part of the environmental impact analysis process; and
- Post-litigation review and analysis of decision-making for potential improvements to resource-based decisions.

DO-47: Soundscape Preservation and Noise Management
The purpose of the DO is to articulate National Park Service operational policies that will require, to the fullest extent practicable, the protection, maintenance, or restoration of the natural soundscape resource in a condition unimpaired by inappropriate or excessive noise sources. The necessity for the order is based on the recognition that natural sounds are intrinsic to resource conditions in national parks and to their enjoyment by the visiting public. The necessity is further based on the recognition that human caused noise, in terms of type, loudness, frequency, duration, and area extent, can disrupt both natural ecological processes in parks and visitor experiences. It is recognized that certain individual types or sources of noise have impacts, and that human caused sound in general may cumulatively impact park resources or visitor enjoyment.

DO-47 describes the following components of a soundscape management plan: "Superintendents will address the preservation of natural soundscapes and the elimination, mitigation, or minimization of inappropriate noise sources through NPS planning processes (see DO-2: Park Planning) and operations policies. Soundscape preservation and noise management can be addressed in appropriate sections of General Management Plans or through a variety of park implementation plans. If needed to deal with the complexity or urgency of a noise issue, a separate implementation plan will be developed. These park planning efforts will (1) describe the baseline natural ambient sound environment in qualitative and quantitative terms; (2) identify sound sources and sound levels consistent with park legislation and purposes; (3) identify the level, nature and origin of internal and external noise sources; (4) articulate desired future soundscape conditions; and (5) recommend the approaches or actions that will be taken to achieve those conditions or otherwise mitigate noise impacts."

36 CFR § 2.12 Audio disturbances
The following are prohibited:

(1) Operating motorized equipment or machinery such as an electric generating plant, motor vehicle, motorized toy, or and audio device such as a radio, television set, tape deck or musical instrument in a manner: (i) That exceeds a noise level of 60 decibels measured on the A-weighted scale at 50 feet or, if below that level, nevertheless, (ii) makes noise which is unreasonable, considering the nature and purpose of the actors conduct location time of day or night, purpose for which the area was established, impact on park users, and other factors that should govern the conduct of a reasonably prudent person under the circumstances.
(2) In developed areas, operating a power saw, except pursuant to the terms and conditions of a permit.

(3) In non-developed areas, operating any type of portable motor or engine, except pursuant to the terms and conditions of a permit. This paragraph does not apply to vessels in areas where motor boating is allowed.
(4) Operating a public address system, except in connection with a public gathering or special event for which a permit has been issued pursuant to §2.50 or §2.51.

36 CFR § 2.17 Aircraft and air delivery
Under this regulation the following are prohibited:
(1) Operating or using aircraft on lands or waters other than at locations designated pursuant to special regulations.
(2) Where a water surface is designated pursuant to paragraph (a)(1) of this section, operating or using aircraft under power on the water within 500 feet of locations designated as swimming beaches, boat docks, piers, or ramps, except as otherwise designate.
(3) Delivering or retrieving a person or object by parachute, helicopter, or other airborne means, except in emergencies involving public safety or serious property loss, or pursuant to the terms and conditions of a permit.

36 CFR § 2.18 Snowmobiles
Under this regulation the following is prohibited: Operating a snowmobile that makes excessive noise. Excessive noise for snowmobiles manufactured, after July 1, 1975 is a level of total snowmobile noise that exceeds 78 decibels measured on the A-weighted scale at 50 feet. Snowmobiles manufactured between July 1, 1973 and July 1, 1975 shall not register more than 82 decibels on the A-weighted scale of 50 feet. All decibel measurements shall be based on snowmobile operation at or near full throttle.

NPS Management Policies 2006: 4.9 Soundscape Management
The Management Policies for 4.9. Soundscape Management states:

The NPS will preserve, to the greatest extent possible, the natural soundscapes of parks. Natural soundscapes exist in the absence of human- caused sound. The natural soundscape is the aggregate of all the natural sounds that occur in parks, together with the physical capacity for transmitting natural sounds. Natural sounds occur within and beyond the range of sounds that humans can perceive, and can be transmitted through air, water, or solid materials.

Some natural sounds in the natural soundscape are also part of the biological or other physical resource components of the park. Examples of such natural sounds include:
- Sounds produced by birds, frogs, or katydids to define territories or aid in attracting mates;
- Sounds produced by bats or porpoises to locate prey or navigate;
- Sounds received by mice or deer to detect and avoid predators or other danger; and
- Sounds produced by physical processes, such as wind in the trees, claps of thunder, or falling water.

The service will restore degraded soundscapes to the natural condition wherever possible, and will protect natural soundscapes from degradation due to noise (undesirable human-caused sound). Using appropriate management planning, superintendents will identify what levels of human- caused sound can be accepted within the management purposes of parks. The frequencies, magnitudes, and durations of human-caused sound considered acceptable will vary throughout the park, being generally greater in developed areas and generally lesser in undeveloped areas. In and adjacent to parks, the Service will monitor human activities that generate noise that adversely affects park soundscapes, including noise caused by mechanical or electronic devices. The Service will 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. (See Use of Motorized Equipment 8.2.3; Overflights and Aviation Uses 8.4)

NPS Management Policies 2006: 5.3.1.7 Cultural Soundscape Management
Culturally appropriate sounds are important elements of the national park experience in many parks. The Service will preserve soundscape resources and values of the parks to the greatest extent possible to protect opportunities for appropriate transmission of cultural and historic sounds that are fundamental components of the purposes and values for which the parks were established. Examples of appropriate cultural and historic sounds include native drumming, music (at New Orleans Jazz National Historical Park), and bands, marching, cannon fire, or other military demonstrations at some national battlefield parks. The Service will prevent inappropriate or excessive types and levels of sound (noise) from unacceptably impacting the ability of the soundscape to transmit the cultural and historic resource sounds associated with park purposes.

NPS Management Policies 2006: 8.2.3 Use of Motorized Equipment
The variety of motorized equipment—including visitor vehicles, concessioner equipment, and NPS administrative or staff vehicles and equipment—that operates in national parks could adversely impact park resources, including the park's natural soundscape and the flow of natural chemical information and odors that are important to many living organisms. In addition to their natural values, natural sounds (such as waves breaking on the shore, the roar of a river, and the call of a loon), form a valued part of the visitor experience. Conversely, the sounds of motor vehicle traffic, an electric generator, or loud music can greatly diminish the solemnity of a visit to a national memorial, the effectiveness of a park interpretive program, or the ability of a visitor to hear a bird singing its territorial song. Many parks that appear as they did in historical context no longer sound the way they once did.

The Service will strive to preserve or restore the natural quiet and natural sounds associated with the physical and biological resources of parks. To do this, superintendents will carefully evaluate and manage how, when, and where motorized equipment is used by all who operate equipment in the parks, including park staff. Uses and impacts associated with the use of motorized equipment will be addressed in park planning processes. Where such use is necessary and appropriate, the least impacting equipment, vehicles, and transportation systems should be used, consistent with public and employee safety. The natural ambient sound level—that is, the environment of sound that exists in the absence of human-caused noise—is the baseline condition, and the standard against which current conditions in a soundscape will be measured and evaluated.

NPS Management Policies 2006: 8.4 Overflights and Aviation Uses
A variety of aircraft, including military, commercial, general aviation, and aircraft used for NPS administrative purposes, fly in the airspace over national parks. Although there are many legitimate aviation uses, overflights can adversely affect park resources and values and interfere with visitor enjoyment. The Service will take all necessary steps to avoid or mitigate unacceptable impacts from aircraft overflights.

Because the nation's airspace is managed by the FAA, the Service will work constructively and cooperatively with the FAA and national defense and other agencies to ensure that authorized aviation activities affecting units of the national park system occur in a safe manner and do not cause unacceptable impacts on park resources and values and visitor experiences. The Service will build and maintain a cooperative and problem-solving relationship with national defense agencies to address the congressionally mandated mission of each agency and prevent or mitigate unacceptable impacts of military training or operational flights on park resources, values and the visitor experience. Cooperation is essential because the other agencies involved have statutory authorities and responsibilities that must be recognized by the Service.